Focal triphasic sharp waves and spikes in the electroencephalogram.

Status: Accepted Presentation type: Poster

Category: Technology – Clinical research/applications

Author's preference: Poster

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Objectives: There is a plethora of data in the EEG literature on the characteristics of the most prominent component of interictal epileptiform discharges (IED), namely the negative (fast) phase. Surprisingly, however, little attention has been drawn to the after-coming slow wave (ASW), and its pathological as well as clinical significance. In this paper, we will address the significance of prominent (high amplitude) ASW, giving rise to a triphasic morphology of the IED (focal triphasic sharp waves and spikes–FTSW). We will discuss this EEG pattern with respect to its clinical, neurophysiological, and neuropathological significance.

Methods: This investigation was conducted on a heterogeneous group of patients at KKH, Ha'il, KSA.

Results: Our data revealed that FTSW were rare EEG events occurring primarily in the first two decades of life. Ninety percent of the patients with FTSW had epilepsy, presenting clinically with generalized convulsive seizures, often without partial onset. The majority of these patients responded favorably to anticonvulsant monotherapy. We were surprised to find that half of the patients with FTSW had chronic and/or static CNS pathology, particularly congenital CNS anomalies.

Conclusions: Even though more than one mechanism may be involved in the pathogenesis of FTSW, we believe a deeply seated pacemaker as the source of this EEG pattern is the most compelling theory. The presence of FTSW should alert clinicians to the possibility of an underlying chronic and/or static CNS pathology, in particular congenital CNS anomalies, underscoring the significance of neuroimaging in the work-up of this population. Moreover, it is conceivable that the prominent ASW may contribute to the interictal intellectual dysfunction of these patients, justifying aggressive anticonvulsant therapy.
Positive sharp waves in the EEG of children and adults.

Status: Accepted Presentation type: Poster

Category: Technology – clinical research/applications

Author's preference: Poster

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Objectives: Interictal epileptiform discharges (IEDs) with negative polarity have been extensively studied in the EEG literature. However, little attention has been drawn to IED with positive polarity [positive sharp waves (PSWs)]. In this paper, we discuss pathophysiological, neuroimaging, and clinical correlates of this pattern in a heterogeneous group of children and adults who demonstrated PSW in their scalp EEG. We documented EEG parameters as well as demographic, clinical, and neuroimaging data.

Methods: We prospectively reviewed the EEGs of 1,250 patients from a heterogeneous population over a period of 1 year. Statistical analysis was performed to correlate the aforementioned data.

Results: Thirty-one patients had PSW in their EEG. The analysis showed that PSW is an epileptogenic pattern with localizing significance, occurring primarily in the younger age groups. Furthermore, there was a strong association of PSW with chronic and/or static CNS pathology, in particular, congenital CNS anomalies, often accompanied by psychomotor retardation. Patients with "multifocal" PSW invariably exhibited severe intellectual and motor deficits associated consistently with a variety of congenital CNS insults.

Conclusions: PSW is a rare and under-reported EEG abnormality which, similar to negative IED, signifies focal epileptogenecity. The presence of PSW should prompt neuroimaging studies to investigate an associated chronic/static CNS pathology, in particular, congenital CNS anomalies. This association is particularly strong when PSW is multifocal in which case patients present with severe intellectual and motor deficits.
Post – traumatic hemiballism treated with intrathecal baclofen therapy. Report of a case

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Baclofen, an agonist of GABA_B receptors binds to a number of spinal and cerebral sites and depresses the excitability of motor neurons. Intrathecal baclofen (ITB) infusion is a widely accepted therapy for the treatment of severe spinal spasticity. There is increasing evidence that ITB has similar effects on patients with spasticity of cerebral origin resulting from traumatic brain injury. Hemiballism is a very rare movement disorder, caused in most cases by a decrease in activity of the subthalamic nucleus of the basal ganglia, resulting in the appearance of flailing, ballistic, and undesired movements of the contralateral limbs. In the present report, we describe a rare case of hemiballism as a result of a brain injury treated successfully with an ITB pump.

Methods: A 58 – year old female sustained a diffuse axonal injury secondary to a road accident in 1992. She subsequently developed hemiballism in the left upper and lower, mainly, extremity. When the patient was admitted to our center, the ballistic movements of the limbs were severe enough to cause the patient to fall out of her chair and limit the ability to perform daily living activities safely. She had an average of five to six ballism episodes of the left limbs per hour, with the left hip flexed up to about 90°. The patient had previously received various therapies including topiramate, tetrabenazine, and botulinum toxin injection, without significant improvement.

Results: After a successful ITB 50μg trial infusion, she underwent a permanent programmable ITB pump insertion. The pump was implanted under local anesthesia and mild neuroleptoanalgesia. She received teicoplanin intravenously for prophylaxis of infection. There were no postoperative complications. The frequency of ballistic movements decreased to about two to four per day, and the left hip flexed to only 30°. The patient was also able to better isolate individual distal joint movements in the left limbs and she started a rehabilitation program. The patient currently receives 192.6 μg of baclofen per day intrathecally and continues to benefit almost two years after ITB pump implantation.

Conclusions: Hemiballism is a rare movement disorder that is caused primarily by damage in the basal ganglia. ITB therapy is a relatively easy, safe, and effective procedure widely used in the management of severe spasticity and dystonia resulting from a multitude of conditions, such as multiple sclerosis, brain and spinal cord injuries, cerebral palsy, and stroke. This case report highlights the significant role of ITB in managing movement disorders other than spastic hypertonia and dystonia. Since, in contrast to vascular causes of hemiballism, posttraumatic hemiballism seems to be more persistent with less tendency for spontaneous improvement, ITB therapy might be an interesting therapeutic alternative for treatment of the rare entity of hemiballism.
Diffuse axonal injury complicated by benedict's syndrome

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: Benedict’s syndrome, also called red nucleus syndrome, is considered among the fascicular syndromes of the third nerve. It describes an ipsilateral oculomotor nerve palsy accompanied by contralateral hemiparesis, involuntary movements, cerebellar ataxia including intention tremor, and hyperactive tendon reflexes. There may also be contralateral hyperesthesia. It is a rare but debilitating constellation of symptoms. The syndrome is caused by a lesion (infarction, hemorrhage, tumor, or tuberculosis) in the tegmentum of the midbrain. Specifically, the median zone is impaired. It is usually due to a vascular event, more frequently an infarct of a basilar or posterior cerebral artery branch. The aim of this report is to describe a rare case of a post-traumatic Benedict’s syndrome.

Methods: A 26-year old female sustained a severe head injury secondary to a car accident. She was admitted to our emergencies in a coma of a GCS = 6, with left anisocoria. Brain CT scan revealed subarachnoid hemorrhage in the interpeduncular cistern, left frontotemporal contusions, and slight midline shift (Diffuse Injury II according to Marshall classification). Upon gradually regaining consciousness, a detailed neurological examination revealed ipsilateral (left) internal and external ophthalmoplegia (mydriasis and ptosis, medial and superior rectus deficit with resulting diplopia, dizziness, and instability); on the contralateral (right) side the patient presented cerebellar hemiataxia including limb tremor, hypertonia and proprioception disturbances, mild hemiparesis, and hyperactive tendon reflexes.

Results: Brain MRI revealed a left midbrain tegmentum lesion at the level of the superior colliculi, congruent anatomo - topographically with a contusion of the red nucleus, oculomotor fascicles, superior cerebral peducle, and substantia nigra. The patient followed an intense rehabilitation program and after three months diplopia and ptosis improved. At five years, there is no mydriasis, diplopia manifests rarely, and ptosis is functionally insignificant, although an esthetic deficit is still visible. Motor and sensory deficits no longer exist. This young patient returned to work and, at present, is autonomous (Glasgow Outcome Scale = 5).

Conclusions: Midbrain lesions may give rise to the most complex eye movement disorders observed in clinical neurology. Benedict’s syndrome is a very rare neurological condition, usually due to midbrain vascular occlusion. The international literature search (PubMed) retrieved only one other case similar to ours. The number of other post – traumatic (non Benedict) oculomotor palsy was also relatively small.
Use of gelatin hemostatic matrix in surgical management of head injuries

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: Intraoperative hemostasis during cranial surgery is one of the most important aspects of the neurosurgical procedure. Hemostasis is necessary to keep a clean operative field, to prevent blood loss, and to avoid a postoperative hemorrhage. A variety of hemostatic agents are used by neurosurgeons depending on the type, source, and location of bleeding. Gelatin hemostatic matrix represents a new generation of local hemostatic agent. It is a sterile mixture of a flowable gelatin matrix and a thrombin component mixed together immediately prior to its use. In addition to their individual actions, the two components interact synergistically to facilitate the formation of a stable clot at the bleeding site. The purpose of this retrospective study was to evaluate the efficacy, safety, and control of gelatin hemostatic agents [Floseal® (Baxter) and Surgiflo® (Johnson & Johnson)] in a series of surgically treated patients with brain injury.

Methods: From 2000 to 2014, a total of 204 head-injured patients underwent an emergent craniotomy was enrolled in this study. Inclusion criteria for gelatin agents’ usage were persistent bleeding requiring more than standard techniques for hemostasis or when these methods could damage healthy nervous tissue. The target was defined as no hemorrhage in the operative field after Floseal or Surgiflo application. After complete or near complete hemostasis, we directly applied gelatin hemostatic agent over the bleeding area and the hemostatic was left in situ for approximately five minutes. Then the operating field was generously rinsed with saline to remove superfluous agent. If a bleeding persisted, hemostasis was achieved after a new application of the hemostatic. This second application was required in 9.6% of cases. In cases with bleeding from dural sinus, the hemostatic matrix was applied over a layer of oxidized cellulose to prevent migration of the agent inside the venous sinus. In all cases, time to prepare gelatin matrix did not exceed 300 seconds.

Results: All patients had a postoperative CT – scanning within 24 hours according to routine clinical practice. Successful hemostasis was achieved in all cases except twelve patients with delayed hematoma. None of the patients had any complications related to the hemostats.

Conclusions: Adequate hemostasis is a prerequisite in neurosurgery, to prevent dramatic postoperative bleedings and their consequences. In cases of refractory bleeding, Floseal and Surgiflo have been proved to be effective and safe, allowing a reduction of blood loss and operative time. Their application and removal are atraumatic, and the postoperative bleeding percentage of 5.8% in this series compares well with the reported percentages in the literature. This study does not intend to demonstrate any superiority of the gelatin hemostatic agents over other hemostatic materials but reflects our personal experience with these products in cases of difficult hemostasis.
Severe head injury complicated by neuroleptic malignant syndrome

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: Neuroleptic malignant syndrome (NMS) is an uncommon, potentially lethal, disorder that manifests with muscle rigidity, fever, autonomic instability, and altered consciousness. Olanzapine, an atypical antipsychotic, is used to treat agitation in patients with head injury. The aim of this study is to present a case of a severely head–injured patient with agitation and aggression who received olanzapine, developed NMS, and was treated successfully by stopping the antipsychotic drug and supportive symptomatic treatment.

Methods: A 38–year old male suffered a traumatic brain injury after a road accident. He was admitted to our emergencies in a coma of a GCS = 8 and was hemodynamically stable. Brain CT scan revealed small frontoparietal contusions and traumatic subarachnoid hemorrhage, with no need of surgical treatment (Diffuse Injury II according to Marshall CT classification). He underwent an intraventricular intracranial pressure (ICP) catheter measurement and ICP remained below 20 mm Hg in the whole duration of 5–days monitoring period. The patient had a favorable neurological outcome and was discharged from ICU after ten days. Upon gradually regaining consciousness, he started neurobehavioral disorders with episodes of severe agitation, aggression, and combativeness, so olanzapine therapy, in a dosage of 5 mg per orally twice daily, was started.

Results: After one week of treatment with olanzapine, the patient presented hyperpyrexia (over 39°C), tremors, tachycardia, fluctuating blood pressure, muscle rigidity, and reduced consciousness level. Laboratory data revealed leukocytosis, elevated creatinine phosphokinase, and metabolic acidosis. He was diagnosed with NMS and olanzapine was promptly discontinued. Supportive care therapy was initiated with adequate hydration, external cooling, dantrolene, and lorazepam. The patient showed a rapid improvement and subsequently experienced a full recovery.

Conclusions: NMS is a rare and severe reaction to phenothiazine antipsychotics, but may also be seen in withdrawal from antiparkinsonian drugs. This syndrome may occur in head–injured patients treated for agitation with atypical neuroleptics. The onset of new symptoms incompatible with patient’s progressive neurological improvement from primary brain injury should alert the clinician to consider other possible diagnoses. Further research and clinical data are needed in terms of risk factors, nosological issues, and treatment options of NMS.
Concussions in Youth Rugby: A Prospective Investigation of Enduring Neurocognitive and Academic Effects on Players Versus Noncontact Sports Controls

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: Oral

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Background: Information is scant concerning the enduring brain injury effects of participation in the contact sport of Rugby Union on early adolescents.

Objectives: The objective was prospectively to investigate differences between young male rugby players and noncontact sports controls on neurocognitive test performance over three years, and academic achievement over six years.

Methods: A sample of boys from the same school and grade was divided into three groups: rugby with seasonal concussions (n = 45) rugby no seasonal concussions (n = 21); noncontact sports controls (n = 30). Neurocognitive testing was conducted pre- and post-rugby season from Grades 7 to 9. Academic grades were documented for Grades 6,7,8,9 and 12.

Results: A mixed model repeated measures ANOVA used to investigate comparative neurocognitive and academic outcomes between the three subgroups revealed significantly lower scores for controls on the WISC-III Coding Immediate Recall subtest. There was a significant interaction effect on the academic measure with improved scores over time for controls that was not in evidence for either rugby group.

Conclusions: Tentatively, the outcome suggests cognitive vulnerability in association with school level participation in rugby.
Decompressive craniectomy in severe head injury: an ultima ratio measure or not?

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: Despite various conservative management strategies in the course of treating severe head injury (SHI), control of intracranial hypertension is not always possible. Although several reports have shown the benefit of decompressive craniectomy (DC), its effectiveness remains controversial due to the unsatisfactory long–term clinical results in many patients. This study analyzes the various prognostic factors in relation to the late neurological outcome in a series of patients with SHI underwent a DC to control raised intracranial pressure (ICP).

Methods: From 2004 to 2014, 155 patients (112 males and 43 females) with closed SHI (GCS ≤ 8) underwent a DC to control raised ICP. The mean age was 37.6 years (range 16 – 78 years). They all underwent a large unilateral or bilateral DC and duraplasty, either during the emergency evacuation of an extraaxial hematoma, or due to refractory increased ICP. Glasgow Outcome Scale (GOS) evaluated neurological outcome, at least one year post surgery.

Results: 35 patients passed away during hospitalization (22.5% – GOS = 1), 23 remained in a persistent vegetative state (15% – GOS = 2), and 32 suffered a heavy handicap (20.5% – GOS = 3). 65 patients (42%) presented a favorable outcome, with (GOS = 5 – 27%) or without (GOS = 4 – 15%) return to work. Patients with GOS 4 and 5 were younger, had a higher admission GCS score, better pupil reaction, and less midline shift in preoperative CT. They also demonstrated a major ICP decrease postoperatively. The more frequent complications were subdural hygroma and hydrocephalus.

Conclusions: DC is a well known technique used to be the last resort treatment to decrease ICP and avoid brain stem herniation with secondary brain ischemia. Indications for this procedure should be progressive intracranial hypertension resistant to conservative treatment in correlation with clinical, neuroradiological, and electrophysiological findings. Timing of DC is essential to prevent irreversible neurological damage. In this retrospective study, the functional outcome has been good in more than 40% of the patients that would have probably died without treatment. Hence, our results justify the use of DC. Admission GCS and age are the main variables correlated to long–term outcome. This method should be considered in selected cases, particularly the young, as it improved outcome in those patients of ours whose condition continued to deteriorate, despite maximal conservative management.
Chronic subdural hematoma in the elderly: a diagnosis not to forget

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Falls and fall-related injuries are important public health problems in an ageing society and are the most common cause of referrals to intermediate care services. Annually, 30 to 40% of elderly people living in the community fall, and function and quality of their life may deteriorate drastically. Closed brain injury is a frequent consequence of the above. Chronic subdural haematoma (CSDH) is predominantly a disease of the elderly in whom the incidence is estimated at 7.4/100,000. It usually follows a minor trauma and a history of direct trauma to the head is absent in up to half the cases. The common manifestations are altered mental state and focal neurological deficit.

Methods: A 79-year-old female hospitalized in the Department of Physical Medicine and Rehabilitation for rehabilitation after an orthopedic operation for left trochanteric fracture due to accidental fall two weeks ago. From her medical history, she was taking clopidogrel for ischemic heart disease. On 21st postoperative day the patient was able to ambulate using walking aid (Functional Independence Measure 80). After 10 days, the patient became confused and disoriented with ease of falling but no lateralized neurological deficit.

Results: She underwent a brain CT scan that revealed a left two-densities CSDH. She immediately discontinued antiplatelets and after five days a two burr-holes intervention was carried out under mild neuroleptoanalgesia and local anesthesia to evacuate hematoma. She returned in Department of Rehabilitation after one week and she was discharged on 45th day using walking aid.

Conclusions: Falls are one of the more frequent causes of disability, morbidity, and mortality among aged patients. In our patient there was no a clear history of head trauma and first neurological examination was normal. In patients suffering of more pathologies, cognitive deterioration can be the only clinical presentation of a CSDH. On the other hand, anticoagulation and antiplatelet therapy, are well known contributors to the pathogenesis of CSDH. Few neurosurgical conditions are more frequently underestimated in lifetime than the CSDH.
No Guts, No Glory: The Price They Pay to Play the Game A Study Investigating Female Vs Male Athletes Experience with Concussion

Status: Accepted Presentation type: Oral

Category: Neurotrauma – prevention and public health

Author's preference: Oral

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Objectives: American football concussions are in the news daily in the United States from former and current players, but there's rarely news about female athletes' experiences with concussions in the US or other countries. While we know female athletes experience a significant number of concussions, they seem too often overlooked when concussions are discussed in mainstream media. Mentioned in the report American Medical Society for Sports Medicine Position Statement: Concussion in Sport 2012, data suggest that in sports with similar rules female athletes sustain more concussions than their male counterparts.

Our research investigated from male and female athletes' experiences with concussions, and specifically, if they reported or hid their concussions, and the reasons why both male and female athletes continued to participate in sport after experiencing a concussion by not reporting it.

Methods: Using snowball-sampling techniques, a total of 529 women and 314 men who continued to play sport and had experienced a concussion completed an online open-ended questionnaire. Participants ranged in a variety of sports and from a number of countries including the United States, Canada, Europe, South Africa, Australia, and New Zealand. The survey consisted of 40 questions of which 16 were open-ended. Participants were asked about their experiences with head injuries while playing organized sports, if they reported/hid their injuries, and if they have any recurrent symptoms now.

Participants also indicated that they did not report concussions due to: (a) lack of perceived resources; (b) lack of perceived severity; (c) lack of awareness; and (d) conformance to sport cultural norms, which was comprised of two sub-themes: adherence to the pain principle and team allegiance.

Results: The results showed gender differences in the reasons athletes reported they hid their concussions. In addition there were several other gender differences such as in frequency of non-sports concussions after athletes retired from sports. Concussions which occur after “retirement” from sports are very much hidden in the media and from our study a significant number of males and females continued to concuss after they left their sports.

Conclusions: The results suggest that efforts to address concussion management in sport need to focus on the communicative and structural elements that privilege hegemonic masculinity and playing through pain, as they contribute to shaping behavior that may prevent athletes from advocating for their health.
Post-traumatic transverse and sigmoid sinus thrombosis: a case report

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: Dural sinus thrombosis (DST) usually involves the superior sagittal, transverse and sigmoid sinuses and is more common in women due to pregnancy, puerperium and oral contraceptives. Other etiologies include coagulopathies, infection, severe dehydration, iron deficiency anemia, systemic lupus erythematosus, and antiphospholipid antibody syndrome. Post-traumatic DST is generally rare. In this paper, we present an unusual case of transverse and sigmoid sinus thrombosis in a young man following a mild head injury.

Methods: A 37-year-old male was presented to the emergency department because of persistent headache, photophobia, nausea, and repeated vomiting after having a mild head injury two weeks ago. His GCS score on admission was 15/15. Except for the head trauma, he did not have any significant history of illness. No focal neurologic deficits were present. Plain CT scan revealed a hyperdense lesion like intracerebral hematoma on right occipital area and contiguous hyperdensity on right transverse sinus which was concerning for thrombosis. Brain MRI scan confirmed the above diagnosis and Magnetic resonance venography (MRV) demonstrated non-visualization of the right transverse and sigmoid sinuses and proximal right jugular vein, consistent with venous thrombosis.

Results: The patient was treated with low molecular weight heparin (LMWH), anticonvulsants, and antiedema agents. His complete blood count and routine electrolyte measurements were normal. All coagulative and hemostatic function studies, including protein C and S and antithrombin III, rheumatoid factor and antiphospholipid antibodies (anticardiolipin antibodies and lupus anticoagulant) were also normal, except of slightly increased levels of fibrinogen degradation products in the serum. LMWH was continued for three months. He was discharged at the eleventh day without any neurological deficit.

Conclusions: The first case of traumatic DST was reported by Ecker in 1946. DST is not classically thought of as being associated with closed head injury, even though trauma is certainly one of the etiologies. The pathogenesis of DST has not been well established yet in head injury. Various hypotheses for the occurrence of DST imply abnormal clotting mechanism, disturbance of blood flow, and endothelial injury. Although the most common symptoms are altered consciousness, headache and seizures, the signs and symptoms of DST can be extremely varied and may be nonspecific. Anticoagulation therapy is the first choice although it remains controversial in traumatic cases. Given the increasing prevalence of traumatic brain injury, head-injured patients suffering from headache or symptoms of intracranial hypertension must be analyzed on suspicion of DST. Early diagnosis can contribute to preventing morbidity or even mortality.
Isolated post – traumatic intraventricular hemorrhage after closed head injury: a case report

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: Existing data on traumatic intraventricular hemorrhage (tIVH) is very limited; most studies are restricted by their age, design, and sample sizes. Prevalence of tIVH in all head-injured patients who receive brain CT scanning ranges from 0.4% to 4%. Generally, tIVH accompanies traumatic brain contusion, intracerebral and acute subdural hematoma, and diffuse axonal injury. Several trials have suggested that isolated tIVH is associated with a favorable neurological outcome, although this entity is not well studied because it is rare. In this article, we present an adult patient with isolated tIVH after a severe closed head injury.

Methods: A 53-year-old female sustained a severe head injury secondary to a car accident. She was admitted to the emergency department in a coma of a GCS = 7, with pupils reacted bilaterally to light. Brain CT scan revealed an isolated tIVH (left occipital horn) without evidence of acute hydrocephalus and soft tissues swelling over left temporo-occipital area (Diffuse Injury II according to Marshall classification). The patient was intubated and transferred to the Intensive Care Unit. She was treated with sedation, analgesia, and antiedema agents. Complete blood count, and all coagulative and hemostatic functions were normal. Her relatives reported that she had no neurological symptoms nor history of hemorrhagic tendency prior to the accident.

Results: Forty eight hours postadmissionally the patient underwent an MR Angiography that showed no evidence of vascular abnormality. The follow-up CT scans showed a progressive improvement of the tIVH and ten days after her admission she was extubated and returned to the neurosurgical ward. She was discharged from the hospital at the twenty third day without any neurological deficit, in a Glasgow Outcome Scale of 5.

Conclusions: Isolated tIVH is an extremely rare finding and its outcome is unclear. In the absence of intraparenchymal hemorrhage, IVH is most often caused by tearing of the subependymal veins in the fornix, septum pellucidum or choroid plexus. Although our patient was admitted in a GCS < 8, she had a functional outcome without needing any surgical intervention. Traumatic IVH may not always attend with brain contusion, intracerebral/acute subdural hematoma or subarachnoid hemorrhage; neurological prognosis is determined by these associated brain injuries rather than by the tIVH itself.
An innovative multimodal and pharmacological interdisciplinary team approach to intervention with Prolonged Disorders of Consciousness.

Status: Accepted
Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Background: A single case study highlighting a novel interdisciplinary (IDT) approach to treatment of a patient with prolonged disorder of consciousness (PDOC) involving sensory, linguistic, music and motor stimuli following Zolpidem 10 mg will be presented. Management of this unique case recognized that interdisciplinary working is “not simply a multi professional provision but a unified strategy that fuses therapy-specific methods in attaining shared rehabilitation issues” (Kennelly & Brien-Elliott¹).

A 44 year old lady, ‘Emily’ one year post onset of subarachnoid haemorrhage from a basilar tip aneurysm with post surgical bilateral frontal infarcts at the time of her admission to an Irish National Rehabilitation Hospital. Multimodal assessments identified that she was in a minimally conscious state (MCS). She was dependent for all cares.

Objectives: To support her family's understanding of her condition and provide strategies to facilitate her participation. To explore Emily's potential to respond to musical, sensory, linguistic, motor and pharmacological stimuli. To enhance Emily's quality of life.

Methods: Initial Uni-disciplinary assessments included Medical, Nursing, Music Therapy, Occupational Therapy, Physiotherapy, and Speech and Language Therapy. The Coma Recovery Scale -Revised (CRS-R), Wessex Head Injury Matrix (WHIM) and the Music Therapy Assessment Tool for Awareness in Disorders of Consciousness (MATADOC) consistently identified that Emily was in a MCS. Pre-communicative behaviors included shared attention, eye contact, anticipatory awareness, inconsistent gestures, and facial expressions. Emily demonstrated a relatively intact swallow function.

A multi-modal, interdisciplinary hierarchical protocol was devised to obtain a baseline appraisal to facilitate analysis of responses to sensory and pharmacological stimuli. The protocol was applied pre and post administration of Zolpidem 10mg.

Zolpidem has been found to have paradoxical effects in raising consciousness in patients in low awareness states (Whyte & Myers²) Tools used to monitor changes in presentation included EEG, WHIM, MATADOC, CRS-R, Western Aphasia Battery (WAB), video recordings, family interviews and Visual Analogue Self Esteem Scale (VASES).

Results: Using our IDT protocol following Zolpidem 10mg revealed clinically significant responses. Our results support the findings of Whyte & Myers² rather than Singh et al (3). Emily emerged temporarily from the MCS for a period of time consistent with the expected duration of Zolpidem activity and then reverted to the MCS. Spontaneous verbalization was the most significant change observed. An ability to sing familiar songs, make choices and use familiar objects emerged. Over a six month period improved functional and communicative gains emerged pre Zolpidem, indicating possible changes in neuro-plasticity following the neuro-stimulant and intensive IDT rehabilitation.
Conclusions: An enhanced quality of life for Emily and her family was achieved resulting from the combined IDT and pharmacological approach. A new, comprehensive IDT model of working in PDOC was harnessed through this case.
Growing beyond traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: Poster

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ED DEVITT II

After graduating high school in the summer of 1998, choosing to follow a path of self destruction, Ed inevitably found himself the sole survivor of a high speed motor vehicle accident leaving him in a coma, and ultimately unable to walk, talk or function. After months of rehabilitation, though he was able to eventually regain most of his physical abilities, Ed struggled with maintaining sobriety until he was forced to acknowledge the wreckage of his past and deal with reality. Today, through his resilience and acknowledgement that a label does not define who you are or what you can be, Ed is an advocate and public speaker for empowerment and growth beyond Traumatic Brain Injury.

Objectives:

Methods:

Results:

Conclusions:
Histone Deacetylase Inhibitor SAHA Attenuates Post-Seizures Hippocampal Microglia TLR4 / MYD88 Signaling And Regulates TLR4 Gene Expression via Histone Acetylation

Status: Accepted  Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Epilepsy is a common neurological disorder characterized by recurrent unprovoked seizures. Seizures-induced TLR4/MYD88 signaling plays a critical role in releasing inflammatory cytokines, microglia activation and neuron apoptosis. Histone deacetylase inhibitor (HDACi) SAHA regulates gene expression by increasing the chromatin histone acetylation. Although numerous reports indicate that SAHA has positive protective effect in neurodegeneration and neurotrauma, fewer studies have been done to uncover the effect of SAHA in seizures. This study investigates SAHA roles in TLR4/MYD88 signaling and TLR4 gene expression histone acetylation regulation in developing rat seizures.

Methods: Intraperitoneal administration of kainic acid (KA) induced seizures in vivo and primary cultured microglia were activated by being exposed to KA in vitro, followed by treatment with SAHA. Seizure latency and seizure score were observed after KA injection. Hippocampus tissues were sampled after 2 and 6 hours; and 1, 3, and 7 days post-seizures. Microglia was collected 24 hours after KA exposure. TLR4, MYD88, NF-κB and IL-1 beta protein and mRNA were detected using Western Blot and qRT-PCR respectively. Activated microglia and apoptotic neuron were observed using CD68 and TUNEL immunohistochemical staining. Chromatin immunoprecipitation (CHIP) measured TLR4 gene H3 and H3K9 histone acetylation levels.

Results: Compared with KA treatment group, the seizure latency was prolonged and seizure score was reduced significantly by using SAHA pretreatment. The protein and mRNA levels of TLR4, MYD88, NF-κB and IL-1 beta, activated microglia and apoptosis of neurons significantly increased after KA treatment, but these effects is attenuated by adding SAHA. CHIP experiments indicated that KA reduced the acetylation levels of H3 and the effect was blocked by adding SAHA, while the acetylation levels of H3K9 was opposite trend; the relationship between the expression of TLR4 gene and the level of H3K9 acetylation were positively correlated.

Conclusions: Histone deacetylase inhibitor SAHA can suppress seizures-induced TLR4 / MYD88 signaling and reduce the expression of TLR4 gene through histone acetylation regulation. This suggests a protective effect against brain damage associated with neuroinflammation.
Social Anxiety Following Traumatic Brain Injury: An Exploration of Associated Factors

Status: Accepted Presentation type: Oral
Category: Neurorehabilitation – case reports/clinical research
Author's preference: No preference
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Objectives: Social anxiety (SA) following traumatic brain injury (TBI) has the potential to significantly affect an individual’s general psychological wellbeing and social functioning, however little research has explored factors associated with its development.

Methods: The present study used hierarchical multiple regression to investigate the demographic, clinical and psychological factors associated with SA following TBI. A sample of 85 people who have experienced TBI were recruited through social media websites and brain injury services across the North-West of England.

Results: The overall model was significant, explaining 52-54.3% of the variance in SA (across five imputations of missing data). The addition of psychological variables (self-esteem, locus of control, self-efficacy) made a significant contribution to the overall model, accounting for an additional 12.2-13% of variance in SA above that explained by demographic and clinical variables. Perceived stigma was the only significant independent predictor of SA (B = .274, p = .005).

Conclusions: The findings suggest that psychological variables are important in the development of SA following TBI and must be considered alongside clinical factors. Furthermore, the significant role of stigma highlights the need for intervention at both an individualised and societal level.
Objectives: Information processing and attention in psychiatric patients have received limited research interests among neuroscientists. This has further limited clinical interventions in neuropsychological areas of psychiatric disorders. The present study was on processing speed and visual attention in patients with remitted major depression (RMD).

Methods: Forty two participants were recruited for the study. Twenty one (21) of them were patients with RMD while the other 21 were healthy controls (HC). Four instruments were used to assess processing speed (TMT A and TMT B) and visual attention (Letter Cancellation TaskS (LCT): coloured and black-white), while the between group quasi experimental design was used.

Results: The findings of the study showed significant differences between RMD and HC on time taken to complete TMT A: F(1,35)=11.01, TMT B: F(1,35)15.50; LCT (coloured) F(1,35)=19.04, LCT (Black-white) F1(1,35)=29.65 at p<0.05 level of testing. Similarly the path model analysis showed that TMT B mediates significantly TMT A (overall processing speed) on time taken to complete LCT (Colored) : B=0.62, and LCT (Black and White): B=0.77.

Conclusions: The discussion of the study centered on the roles of the ability to shift task in visual attention search and likely tendency that visual search has common neural circuitry pathway with ability to shift task.
Objectives: In order for veterans to be directed towards optimal services to maximize their functional potential, an understanding of their current functional status is prerequisite. Determine the rate of return to productivity (RTP) in veterans of OEF/OIF that screen positive on the Veterans Affairs Comprehensive Traumatic Brain Injury Evaluation (CTBIE).

Methods: Research Design and Setting: Retrospective medical record review at the Participants: Medical records of 236 OEF/OIF Veterans who underwent a CTBIE between 2009-2013 were included in this study. Data Collection: De-identified data that were collected from the medical records included patient demographics, injury history, symptoms, TBI diagnosis, and current employment status. Data Analysis: All de-identified data were entered into an SPSS statistical spreadsheet and chi-square analysis using SPSS statistical software was used to determine significance.

Results: Of the 236 veterans, 90.7% were male, 45.3% were white, 34.7% were black, 47.9% were Non-Hispanic and 49.2% were Hispanic, with a mean age of 33.24 + 6.97 years. Most veterans had some college (46.9%). 230 veterans reported number of injuries, with 56.5% reporting one and 30.5% reporting more than one. 145 veterans reported time since most serious injury, with a mean of 48.75 + 31.76 months. 212 veterans reported cause of injuries, with 59.0% reporting blast and 24.5% reporting non-blast. Greater than 90% of veterans reported anxiousness, irritability, sleep difficulty, forgetfulness, and headaches. 95.8% reported pain in the last 30 days. 89.5% (n=219) of veterans had psychiatric symptoms. 69.1% of veterans were diagnosed with TBI. Return to productivity (part-time or full-time employment status or student) was 60.6% for the total population. Based on chi-square analysis, factors associated with return to productivity included race (p=.007) and feeling depressed (p=.017).

Conclusions: Veterans reported a substantial number of symptoms and a considerable amount of time since most serious injury. The majority of veterans were diagnosed with TBI. RTP was problematic for many of the veterans and was associated with race and feeling depressed. Further prospective study is needed to explore self-identified factors affecting RTP. There is a critical need for rehabilitation professionals to understand the unique needs of the veteran with TBI in order to provide best practice and optimal rehabilitation services.
On 16 Oct 1999, I was thrown from the backseat of a 15-passenger van. I became unconscious in the median, roughly 50 yards from where the van finally rested. Due to the severity of my skull fractures, broken bones and head injury, I remained in a coma for 15 days. Since returning home 24 Dec 1999, I have maintained ethnographically valid observations of my personal experience. Anthropology seeks to give voice to the voiceless, which is my purpose for developing the TBI Age Equivalence Spectrum (TBIÆS). Usage of the TBIÆS ought be integrated by survivors in later phases of their rehabilitation. Although, its my opinion that the realm of sociocultural discourse should be experienced before survivors begin to assess themselves in real time. Several benefits lie within this plot-style graph, which helps the survivor of severe head trauma plot their failures and successes along what I have termed, “the craniamatic line” (CL). All the while, a second line runs above in tandem with the CL, which appropriates any realized distance from whom a survivor would be/might have become absent severe head trauma. As a result of our highly mobile society, sickness and recovery are no longer borne in vacuous isolation in the home of a distant relative with a maximum of two or three physicians. In such a vacuous scenario: the patient, the caretaker, the physician, the neighbor, the colleague, the friend, etc. are each intimately acquainted with the plight, health and history of the one surviving. Recovery from severe head trauma will not eventuate successfully in isolation. TBIÆS garners the plausible outcome of helping medical professionals recreate the qualitative essence of the vacuum scenario despite sociocultural change in mobility, character, position and the survivor’s acquired homeostasis. Additionally, a survivor’s hopes, talents and their unique plans possessed pre-trauma can be discussed in specific detail with counseling professionals and those within the medical community. It has been my personal experience that when filling out continuation patient forms using the 1-10 emotional scale, a void persisted in not being able to express why I chose a specific number on a given day, which led to loneliness. I believe that patient-client satisfaction and understanding can be deepened drastically through the simple addition of TBIÆS. The concept for TBIÆS has been introduced in the book, Craniama: An Ethnography in Survival (© 2015 by Bryan Sisson). However, that which I hope to share with the International Congress is the analysis of my ethnography using the toolkit afforded by the TBIÆS, which has not yet been shared or published.
Anxiety Symptoms Significantly Influence Post-Concussion Syndrome: A Prospective Study

Objectives: Post-concussion syndrome (PCS) is a cluster of symptoms in patients with mild traumatic brain injury (mTBI). PCS usually includes a set of physical, cognitive, and emotional symptoms, and may cause widespread disturbances and affects the patients’ daily life. Although anxiety has been demonstrated as one of the most important influencing factors to contribute the presence of PCS, studies that focus on the association between anxiety and PCS are still limited. This study thus aims to prospectively uncover the relationships between the anxiety and PCS in patients following mTBI.

Methods: A total of 149 participants, including 53 healthy adults and 96 patients suffering from mTBI, were recruited. All participants were evaluated with the specific neuropsychological tests, the Checklist of Post-Concussion Symptoms (CPCS) and the self-rating scales (including the BDI-II, &BAI) for investigating emotion status. Participants were prospectively evaluated at 2 weeks, 1 month, and 3 months post-injury.

Results: Patients' PCS reporting and emotional status were significantly worse than healthy controls at 1 month post-injury, while patients' PCS and anxiety symptoms significantly improved at 3 month post-injury. Regardless of 1 month or three months post-injury, PCS and emotional status of high-anxiety patients were significantly worse than those of the low-anxiety and none-anxiety ones. Most importantly, anxiety symptoms at 3 months post-injury significantly correlated with PCS manifestations at 3 months post-injury.

Conclusions: This study prospectively demonstrates that patient's anxiety could be one of the most important contributing factors to the presence of PCS. The future research thus may further explore the related factors of anxiety symptoms after mTBI, and provide the appropriate interventions for those patients to decrease the persistent PCS.
Rehabilitation of sphincter control after traumatic brain injury

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Objectives: The goal of this study is to determine if neuropsychological rehabilitation is relevant to the rehabilitation of sphincter control in patients with traumatic brain injury and which variables associated with the autonomic nervous system determine the course and efficacy of this rehabilitation.

Methods: We carried out a retrospective study, selecting patients from the Centre for Brain Injury Rehabilitation (CRECER, Seville, Spain) who met the following criteria: severe TBI patient, Glasgow Coma Scale (GCS) score ≤8, clinically confirmed neuropsychological disorders at admission to the center and had undergone a minimum of 4 months of multidisciplinary rehabilitation. Exclusion criteria included previous TBI or stroke, history of neurological or psychiatric disorders, and substance abuse. A total of 58 patients met these criteria: 44 male, 14 female, median age 20. The median interval from brain injury to rehabilitation was 8 months. The median treatment time period was 10.5 months. Wilcoxon’s test was used for the comparative analysis of functionality index (FIM+FAM) scores at admission and discharge to ascertain the efficacy of rehabilitation.

Results: Results show that patients with TBI and poorer sphincter control tend to have longer hospital stays and require more ongoing special care at home after hospital discharge. A correlation was found between lower sphincter control and lower level of functionality in all the FIM+FAM subscales (p<0.01). This correlation was also found for self-care, mobility, type of transfer, locomotion, communication, psychosocial adjustment and cognitive functions.

Conclusions: The functional level of patients with sphincter dysfunction is insufficient for independent living. Dysfunctional sphincter control is also associated with neuropsychological disorders, especially in attention and executive functioning.
Temporal course of cognitive rehabilitation after severe traumatic brain injury

Status: Accepted  Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: To explore the course and timing of functional recovery in patients who emerged from coma after suffering a severe traumatic brain injury. In the search for TBI treatment, insurance companies, healthcare professionals, families, and patients are concerned with the duration of neurorehabilitation and whether it will be worthwhile.

Methods: Observational study on a group of patients with traumatic brain injury (TBI) recovered from coma that underwent holistic, intensive and multidisciplinary neurorehabilitation. Daily performance in long-term and short-term memory, orientation, calculation, attention, mental control, automation, and planning was clinically scored and compared at admission and discharge.

Results: The course of cognitive recovery after post-traumatic coma is not uniform, but rather a curve with many ups, downs and plateaus. To achieve a good outcome nearing normalcy, patients need over 300 h of intensive rehabilitation.

Conclusions: The course of recovery is not uniform, and it depends on which cognitive functions are impaired, and on the severity of this impairment. Successful treatment varies in terms of time and effort. The number of sessions needed to rehabilitate impaired cognitive functions differs from function to function. Planning and memory require the highest number of rehabilitation. Cognitive rehabilitation must be structured to maximize outcome. The consolidation of cognitive gain also requires time, proper training, and well-programmed therapy. Patient discharge should occur only after cognitive improvements are consolidated. This study provides an approximation to the duration of rehabilitation of patients with traumatic brain injury and may help to expand our knowledge of effective post-TBI cognitive rehabilitation.
The modified n-back task: a valid, new instrument for the neuropsychological assessment of working memory.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: To demonstrate that by adding manipulation of information as a condition to the n-back test, task complexity increases, which triggers increased activation in brain regions associated with WM. Another goal is to validate the modified n-back test by comparing its implementation and physiological activation with previous neuroimaging studies.

Methods: In this study, we employed a modified verbal n-back test which adds the manipulation of WM to the classic n-back task. This study included 20 healthy right-handed volunteers (14 female, 6 male), aged 22 to 39 (mean age = 26.6; SD = 4.15), and with a mean of 16.5 years of formal education. The subjects were recruited from the faculty and student body of the University of Seville, Spain. We used functional near-infrared spectroscopy (fNIRS) to evaluate prefrontal cortex (PFC) activation. The modified n-back requires monitoring of sequentially presented stimuli (in this case the days of the week). The target response relates to a stimulus which appears previously, from 0 to 2 items back, on the computer screen.

Results: Our data revealed that while modified and unmodified n-back activate the same regions of the left PFC, our modified 2-back version shows significantly higher activation in the left dorsolateral PFC (DLPFC) and the left frontal opercula. These results suggest that increased complexity in verbal WM tasks entail greater executive control, which would lead to an increase in cerebral blood flow to the areas associated with verbal WM. Therefore, an increase in the manipulation of WM load in verbal tasks reflects greater physiological activity in the left DLPFC and the left frontal opercula.

Conclusions: The modified n-back test, which adds an executive component to the classic version, activates the same PFC regions as the classic test, but with greater intensity. This new memory task could be incorporated into the armamentarium of valid instruments for the neuropsychological assessment of working memory.
The impact of cognitive impairment on driving ability: The role of executive functioning.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: Oral

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Objectives: The impact of cognitive impairment on driving ability is a major concern for traffic safety and a growing priority for researchers and clinicians. The introduction of the point system driver’s license in several European countries has generated a useful barometer for measuring driving performance. The point system for safe driving offers a coherent and valid framework for the identification and classification of driving ability. This is the first study to examine the functional integrity of executive functions in drivers with full points (N=86), partial points (N=84) or no points (N=100) on their driver’s license. The purpose of this study was twofold: to evaluate executive functions in each group and ascertain how age and cognitive differences between groups affect driving.

Methods: We applied cognitive subtests from the Seville Neuropsychological Test Battery (BNS) to assess attention processes, processing speed, planning, cognitive flexibility, learning and inhibitory control. Non-parametric statistical analyses were carried out. Bonferroni corrections were used to protect against Type I errors in multiple comparisons.

Results: Our results showed that drivers with the full 12 points still on their license performed better in executive control tasks than the other two groups. Age was associated with slower reaction times, but also with better planning skills.

Conclusions: Our results also suggest that an association exists between age and the integrity of executive functions. We found that reaction time increased with age in all tasks (attention, inhibitory control and planning). However, our data showed that older drivers had better task performance in planning. This suggests that slow reaction times are not necessarily an indicator of unsafe driving. Our data could be used to continue much needed research on executive functioning and safe driving. Future research should also be carried out to confirm these results and determine the benefits of training drivers in attention and executive control task execution.
Early leukocytosis after closed head injury

Objectives: Head injury is associated with increased blood levels of catecholamines and cortisol. Catecholamines release neutrophil stores, and corticosteroids cause a decrease in the egress of neutrophils from the circulation. Patients with head injury demonstrate many aspects of the acute phase response that is mediated to a major degree by increased levels of cytokines. Cytokine production is thought to be partially responsible for the brain edema and increased leukocyte adhesion seen after head injury by both a direct effect on vascular permeability and by causing leukocyte activation. To better examine this early leukocytosis, we investigated the role of white blood cells (WBC) in a population of brain-injured patients to determine if they did indeed act as an indicator of severity of injury or an additional predictor of outcome.

Methods: We prospectively studied 624 patients (441 males/183 females, mean age of 43.7 years) with severe, moderate or minor head injury who were admitted to Neurosurgical Department. Depending on the neurological examination and neuroradiological findings, patients were taken to the operating room, to the ICU, to the neurosurgical ward, to the special room for a 24 hrs observation under medical supervision, or were discharged to home with observation by a family member. Factors that might influence WBC were excluded from this study.

Results: There was a fair correlation between the WBC counts and the clinical grade at the time the patient was admitted; patients with severe head injury had significantly higher WBC counts than did those with moderate or minor injury. Among the patients with severe head injury, a significant relationship was found between WBC counts and GCS score, pupillary reaction, presence of subarachnoid hemorrhage, and outcome. Multiple logistical regression analysis, with age, GCS score, pupillary reaction, intracranial diagnosis, and WBC counts as predictors, showed that WBC counts contributed as an independent predictor of outcome.

Conclusions: There are several mechanisms through which leukocytes could correlate with cerebral damage and contribute to cerebral ischemia/reperfusion injury. One of these ways is the traumatic rupture of microvessels followed by physical occlusion. Aggregates of leukocytes adherent to each other can occlude the microcirculation, resulting in loss of vascular integrity, tissue hypoperfusion and further ischemic damage. Another way is through the release of cytotoxic mediators that lead to increased leukocyte–endothelial interactions. In response to a spectrum of stimuli, neutrophils are capable of generating and releasing a plethora of mediators such as granular enzymes, reactive oxygen metabolites, and products of membrane phospholipases. This study provides evidence for the involvement of leukocytes after severe cranial trauma. WBC counts on admission could serve as a significant parameter of severity of injury and as an additional predictor of neurological outcome in patients with severe head injury.
Background: Traumatic brain injuries (TBIs) remain one of the main public health problems in developing and developed countries. TBIs may produce severe illness resulting in significant morbidity, mortality and economic loss and, in developed countries, they are an important cause of long-term disability.

Objectives: The aim of this study is to quantify the burden of severe TBI among young children in Qatar and to examine trends in the distribution of these injuries by gender, age, severity, mechanism and to organize public health strategies to prevent TBIs.

Methods: This is a retrospective study that included subset of 65 children suffering from Severe traumatic brain injury 12 of them died within the first month of admission during the period between January 2007 to December 2013 among children aged less than 14 years. The study was conducted at the Children Rehabilitation Unit, Paediatric Department, Hamad General Hospital. Severity of TBI was assessed by Glasgow Coma Scale (GCS) Severe TBI where Glasgow Coma Scale was ≤83.

The TBI cases were obtained from the medical records and information collected included child’s age at the time of injury, gender, nationality, date of admission, date of discharge, and outcome.

The study was approved by the Hamad Medical Corporation, Research Ethics Committee.

Results: The predominant gender was males (73.8 %), Qatari form 49.2% and the highest frequency was among children 6-10 years of age. In our study predominant mechanisms of injury were road traffic accidents (84.6%), then falls (10.8%). The results revealed that only 18.2% of TBI children had good recovery and 21.5 % left with mild disability, 27.7 % of hospitalized patients discharged home with severe disability and 13.8% were still in hospital under vegetative state .

Among our patients 43.1 % had spasticity, 33.8% experienced posttraumatic epilepsy , 24.6 % had communication disorder, 26.2 % had poor cognition 24.6% had hemiplegia, 18.5 % had abnormal behavior and The mortality rate was 18.5% .

Conclusions: Traumatic brain injury is an important cause of death and disability in children in Qatar and in Arabian Gulf Countries as well. The evidence on effectiveness of child restraint systems, seat belts, and air bags in automobiles is very promising. Special efforts should be made to further reduce the motor vehicle accidents involving young people and welfare programs are needed to limit the risk of TBIs.
The impact of chronic pain on the cognitive functions of Middle Eastern adults: a comparative study

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: Poster

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Background: Several studies have reported an association between chronic pain and reduction of cognitive abilities of adults living in Western cultures. No literature could be found on the relationship between chronic pain and cognition among Middle Eastern adults.

Objectives: To compare four of the most commonly reported cognitive domains (memory, attention, processing speed, and executive functioning) among Middle Eastern adults with and without chronic pain.

Methods: This matched group comparative study included 69 community residing and functionally independent Middle Eastern adults. Forty participants had chronic pain and 29 were pain-free. We administering five standardized cognitive assessments that are independent of culture and language. The study was conducted in a rehabilitation research setting with a controlled environment.

Results: Evidence of decreased cognitive processing was found in patients with chronic pain. The chronic pain participants performed significantly worse than the pain free participants on the cognitive measures of executive functioning, processing speed, selective attention and long-term memory.

Conclusions: The effect of Middle Eastern culture on the cognitive abilities of patients with chronic pain was negligible. Despite the wide variations between Eastern and Western cultures, the performance of our Middle Eastern participants in this study was consistent with the performance of Western adults reported in previous studies.
Coping Strategies of Traumatic Brain Injury Survivors and Primary Caregivers

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: The research aimed to answer "What are the coping strategies utilized by survivors and primary caregivers to manage the effects of associated with traumatic brain injury?" The purpose was to explore the coping strategies of adult traumatic brain injury (TBI) survivors and primary caregivers and with this knowledge add to the development of theory related to rehabilitation and counseling. The five sub-questions asked were: 1. What were the coping strategies utilized by the survivor and primary caregiver to manage the effects of TBI? 2. How were these coping strategies developed? 3. What were the greatest needs for TBI survivors and primary caregivers? 4. What were the biggest obstacles that TBI survivors and primary caregivers have had to overcome? 5. How could mental health professionals utilize the knowledge of these coping strategies in developing a theory of counseling for helping the TBI survivor and primary caregiver? Participants: This study included seventeen individuals, eleven participants with brain injury and six primary caregivers, who participated in a series of semi-structured interviews aimed at identifying the coping strategies utilized in dealing with the effects of brain injury.

Methods: The study design was a qualitative phenomenological method.

Results: The study identified specific needs associated with the various deficits incurred by the injury. The adaptive coping strategies addressed the specific needs, namely short-term memory loss, fatigue, anger, and personality changes. Participants offered suggestions for mental health professionals addressing how to more effectively work with brain injury survivors and their primary caregivers.

Conclusions: Coping strategies determine the effectiveness in dealing with the deficits of brain injury. The findings indicated problem focused, emotion focused, and avoidant coping were utilized to some degree throughout the rehabilitation process.
The influence of the epidemiological and non-treatment variables on neurological outcome in severe head injury

Status: Accepted Presentation type: Poster
Category: Neurotrauma – health services and outcomes
Author's preference: Poster

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Objectives: It has long been recognized that the method of clinical management of severe head injuries often creates a remarkable difference in neurological outcome. Moreover, the development of advanced systems of emergency and primary care has minimized medical complications associated with severe traumatic brain injuries. Previous literature suggests the influence and contribution of several non-treatment factors, other than clinical protocols, on patients' outcome. This study analyzes nine prognostic epidemiological variables and their potential relationship to the late outcome in a series of patients with severe head injury.

Methods: Our study is based on 280 patients admitted to Asclepeion hospital, a regional trauma center, with severe head injury. Patients with associated major chest, abdominal or orthopedic trauma were excluded. The sample population was composed of 214 males and 66 females, with a mean age of 38 years. 16.42% of the patients had a history of alcohol intake with road traffic accident (83.21%) as the most common mode of brain injury. Over 50% of the patients were admitted to the hospital within 4 hours of injury. 47.14% of the patients were intubated within the first hour from the time of the accident. All patients underwent a CT scan as soon as possible after initial resuscitation. Only non-penetrating head injuries were included in this study. All variables were individually and simultaneously related to outcome. Neurological outcome was evaluated at six months according to Glasgow Outcome Score (GOS).

Results: Severity of injury (GCS) was the best and strongest statistical predictor of outcome. Patient's age, type of head injury according to CT scan findings, time from accident to emergency room and time from accident to intubation had also a statistically significant impact on neurological outcome. Multivariate analysis indicated an overall multiple correlation of R = 0.73, generated primarily from the confounding influence of GCS score, age and CT scan findings.

Conclusions: The type of patient most frequently encountered in this study was the young adult male, under 40 years of age, involved in a moving vehicular accident. This suggests a potential target group for any preventive measures directed at severe head injuries. In the arena of severe head trauma, where randomization and patient comparisons are frequently difficult, it is important to determine statistically whether reported differences in outcome are due to differences in patient groups, or to more effective therapy, or to other factors associated with outcome. Thus, predicting neurological outcome is an assimilative and integrative process of various pre-injury, injury and post-injury variables. These also suggest the necessity of continuing evaluative research on emergency care networks which can link together data relating to ambulances, paramedical personnel, physicians, community hospitals, and trauma centers.
Evolution of return to work, life-satisfaction and psycho-social outcome five years after the participation in a socioprofessional rehabilitation program: Comparison between brain-damaged patients included in the UEROS program in 1997 and in 2008

Status: Accepted Presentation type: Poster
Category: Neurotrauma – health services and outcomes

Author’s preference: Oral

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Background: Socio-professional reintegration of brain-injured patients is an important issue of their rehabilitation. The UEROS program reassessment was necessary because of demographic and socio-economic changes since 1997.

Objectives: To compare the 5-year outcome of brain-damaged patients included at two-time points (1997, 2008) in the Aquitaine Unit for Evaluation, Training and Social and Vocational Counselling program (UEROS), dedicated to the assessment and socio-professional reintegration.

Methods: 75 and 57 patients were recruited in 1997 and 2008, respectively. The initial socio-demographic status, lesional data and the clinical assessment obtained at the inclusion in the UEROS program were collected retrospectively. We assessed the family, medical and professional status, leisure activities, autonomy and life-satisfaction during a phone-structured interview at 5-year follow-up. A UEROS program satisfaction questionnaire was also proposed during the same interview.

Results: The 2008 patient group was significantly older than the 1997 one (mean age=34.7 years, p≤0.05), had higher educational level (p=0.01), higher variability of brain damages etiologies (p=0.01), lesser rate of traumatic brain injuries (-19%). The number of patients who were employed before the brain injury was significantly higher in 2008 than in 1997 (p=0.002). Median time since injury at UEROS program inclusion was 49 months in 1997 and 72 months in 2008. Patients included in 2008 were significantly less autonomous in daily activities (-23%, p=0.004). However, some of them had a job when being included in the program (12%). The 2008 patient group had less orthopaedic (-16%, p=0.003), sensitive (-19%, p=0.004)) and sensory (-21%, p=0.004) disabilities. They had less behavioural disorders (-16%, p=0.010), but memory and executive impairments were most common (+20%, p=0.014 and +16%, p=0.015 respectively). There was no difference in terms of autonomy and return-to-work five years later between the two groups of patients (p=0.086 and p=0.32 respectively). Patients who have participated in 2008 were mostly satisfied with their quality of life five years later (67%). Patients and their caregivers were mostly satisfied with the UEROS program (93 and 94% respectively). Caregivers’ satisfaction with the UEROS program improved significantly between 1997 and 2008 (p=0.00003).

Conclusions: The UEROS program remains efficient on brain-injured patients’ return-to-work and autonomy improvement.
The Effect of Post-Stroke Support on the Participation of Stroke Survivors in Gaborone, Botswana: a Qualitative Study

Status: Accepted  Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: No preference

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Objectives: In Botswana, very little funding is devoted to stroke in either the acute or post-acute phases, yet it is the second leading cause of death after HIV. In addition, there is little local literature to guide the development of future stroke services. The objective of this study is to investigate stroke survivors’ perception of how post-stroke support affects participation following stroke.

Methods: Data was collected through semi-structured, photo-facilitated interviews in Gaborone, Botswana. Fourteen stroke survivors aged 39-92 years were identified through either a local non-governmental organisation or a community physiotherapist. Eight of the participants were male, and most were employed prior to their stroke. Stroke survivors with speech or cognitive deficits were excluded. Participants were interviewed by a single researcher using a trained translator over a three-week period. Thematic analysis was used.

Results: All interviewees experienced considerable loss of participation post-stroke, particularly in employment, family life and social events. Lack of accessible public transport was a considerable barrier for many, with private transport financially out of reach.

Families currently provide the majority of post-stroke care, putting pressure on some family members. Infrequently, clinicians and charitable organisations gave support; however, these services were under-funded, and awareness of their availability was low.

Society’s attitudes towards disability were largely negative, and this was sometimes reflected in the families’ attitudes to their disabled members. Stroke survivors were at times perceived as “broken”, with no capacity for improvement of function. General understanding of the nature of stroke was poor, and occasionally stroke survivors were seen as cursed.

Participants suggested that improved access to employment was needed, and could be achieved using an advocate to search for work. More accessible public transport was repeatedly requested, as were subsidies for private transport. Financial aid would considerably increase interviewees’ social participation. The need for increased emotional support and wider understanding of stroke was highlighted.

Conclusions: Despite the small scale of this study, it is apparent that there is much room for improvement of services to increase the participation of stroke survivors in Botswana. Recommendations arising from this study were sent to the Ministry of Health of Botswana. These included: increase resourcing for stroke services; the development of stroke support groups with education of their leadership; delivery of patient, family and social education on stroke; provision of access to gymnasiums for continued physiotherapy; establish multi-disciplinary rehabilitation, prioritising the training of a cohort of occupational therapists.
Examination of the Effect of Mechanical Properties of Helmet Padding on the Blast-Induced Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Combat helmets, originally designed for protection against impact, are also used for protection against the blast waves. Advanced Combat Helmets (ACHs) currently used by the military members are supported by foam pads to reduce the loads transferred to the head. It is well known that the material, layout and shape of the padding system significantly affect the protection efficiency of the helmets. While there are several studies on the influence of padding materials on the mitigation efficiency of the helmets under ballistic impacts, their efficiency under blast loading is not well understood. Accordingly, in the current study a parametric finite element (FE) approach was used to examine the efficiency of ACH helmets under blast loading. A finite element model consisted of a detailed FE head model, as well as a padded helmet was used to study the dynamic response of brain under blast. Development and interaction of blast shockwaves were carried out using LS-DYNA. Subjected to a front blast wave, four different material properties were selected for the foam pads to examine the influence of the density and the stiffness of the foams on the protection capability of the helmet against blast waves. The brain response was evaluated in terms of both tissue and kinematical parameters. Moreover, to better evaluate the effectiveness of the helmets under different conditions, interaction of the blast waves from back and side directions were also studied. The primary findings suggested that pads with lower stiffness provided higher mitigation of blast induced loads as they absorbed more energy. Moreover, the helmet protection level altered as the helmeted head was subjected to blast waves from different directions. The reason was believed to pertain to the complex geometry of the head and helmet, the inhomogeneity of the head component and brain tissue, as well as the padding layout and shape. The finding of this study can contribute to the improvement of the pad material for the blast situations as well as the modular design of the combat helmet to incorporate the directionality considerations.

Objectives:

Methods:

Results:

Conclusions:
Sensitivity and Specificity of Subacute Concussion Detection May be Increased With the Addition of Balance and Visual-Vestibular Assessments

Status: Accepted Presentation type: Oral
Category: Neurotrauma – basic research
Author's preference: Oral

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Objectives: To provide preliminary data for the internal consistency of a new condensed model to assess vestibular and ocular-motor impairments following a concussion, and to examine this model’s discriminant validity in correctly identifying concussed athletes from healthy controls.

Methods: Each participant was tested in a concussion assessment protocol that consisted of the Neurocom’s Sensory Organization Test (SOT), Balance Error Scoring System (BESS) exam, and eight vestibular and ocular-motor assessments (i.e., near point convergence, horizontal eye-saccades, slow and fast smooth pursuits, optokinetic stimulation, gaze stabilization test, dynamic visual acuity, and the King-Devick Test).

Results: Of these ten assessments, only the SOT, near point convergence (NPC), and the signs and symptoms (s/s) scores collected following optokinetic stimulation (OKS), the horizontal eye-saccades test, and the gaze stabilization test (GST) were significantly correlated with health status, and were used in further analyses. Multivariate logistic regression for binary outcomes was employed and these beta weights were used to calculate the area under the receiver operating characteristic curve (AUC). The best model supported by our findings suggest that an exam consisting of the four SOT sensory ratios, NPC, and the OKS s/s score are sensitive in discriminating concussed athletes from healthy controls (accuracy = 98.6%, AUC = 0.983). However, an even more parsimonious model consisting of only OKS and GST s/ss together with the NPC measurement was found to be a sensitive model for discriminating concussed athletes from healthy controls (accuracy = 94.4%, AUC = 0.951) without the use of the expensive equipment.

Conclusions: These preliminary findings suggest that using this condensed exam consisting of the OKS s/s score, NPC, and GST s/s score is a valid measure for discriminating athletes impaired by concussion in the subacute stage from healthy controls, and eliminates the time consuming burden of performing all of the balance, vestibular, and ocular-motor tests available to athletic trainers. Although more investigation is needed, these findings will be helpful to health professionals, potentially providing them with a sensitive and specific battery of assessments for concussion management.
What are the most important outcomes of Traumatic Brain Injury vocational rehabilitation? People with TBI, Service Provider and Employer perspectives.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: Returning to work following a traumatic brain injury (TBI) is problematic. Only 41% of TBI people are in work at one and two years post injury (van Velzen et al 2009). UK vocational rehabilitation (VR) service provision is patchy and routine rehabilitation frequently fails to address work needs. As part of a feasibility trial comparing early specialist Traumatic Brain Injury vocational rehabilitation (ESTVR) to usual care, we aimed to identify the most important primary outcomes of rehabilitation targeting return to work from the perspective of people with new TBI (NTBI), people late after TBI (LTBI), service providers and employers.

Methods: People hospitalised for ≥ 48 hours with NTBI, were interviewed prior to randomisation. Employers were recruited via service providers and Occupational Health services and service providers from work conferences and special interest groups. People LTBI were recruited using social media and therapy contacts. In focus groups using Nominal Group Technique with LTBI and service providers, ESTVR was described and participants asked, 'What are the most important outcomes of this support?'

Results: Fifty-five people with NTBI were interviewed a mean of 18 days post-injury (SD 18). Thirteen service providers participated (11 occupational therapists) mean post qualification experience 20 years (SD 10), 10 of whom currently provided vocational rehabilitation. Twelve employers with experience of a TBI employee took part. Thirteen LTBI participated, mean age 41 (SD 11), time since injury 13 years (SD 11), all worked pre-injury, 9/13 were currently employed. For people with NTBI, return to work and symptom management were seen as the most important outcomes of ESTVR. Employers prioritised communication between employer, employee and health based VR services and a measure of TBI impact on workability; service providers prioritised quality of life and insight into the impact of the brain injury above return to work. People late after injury (LTBI) prioritised self-confidence and assessment of brain function.

Conclusions: A return to work mattered immediately following NTBI but priorities changed with experience. Service providers prioritised quality of life and insight over RTW. People LTBI wanted to understand the nature of the injury and its impact on them as a person. Employers wanted communication and assessment that enabled them to understand the impact of TBI on the individual's work ability. Therefore, while a return to work was considered an important outcome of vocational rehabilitation following TBI, it was not the most important outcome from the perspective of the people delivering it or people late after injury, many of whom had returned to work. Different perceptions regarding vocational rehabilitation outcomes may influence service delivery and outcomes. Future TBI vocational rehabilitation trials should consider measuring these constructs in addition to return to work.
Outcomes of Individuals with Both Spinal Cord Injury and Traumatic Brain Injury: A Pilot Study Using the NIDILRR SCI and TBI Model Systems National Databases

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: The aims of this study were to 1) determine the outcomes of people with both SCI and TBI (SCI/TBI), and 2) determine the feasibility of using both the Spinal Cord Injury Model Systems (SCIMS) and Traumatic Brain Injury Model Systems (SCIMS) national databases (NDB's) for such a study.

Methods: Retrospective cohort study. Data was gathered on participants with SCI/TBI who were in both Model Systems NDB's or in one of the NDB's supplemented by medical record review. Weighted linear regression was used to compare those with SCI/TBI vs. SCI only and vs. TBI only with respect to change in FIM™-Motor and Disability Rating Scale (DRS) respectively from rehabilitation admission to discharge.

Results: There was no significant difference in the change in FIM-Motor or DRS from admission to discharge. Among secondary outcomes, length of stay (LOS) was longer and change in FIM-Motor from admission to discharge was lower for those with SCI/TBI than for those with TBI alone. However change in FIM-motor from admission to one-year follow-up was not significantly different.

Conclusions: Patients with SCI/TBI ultimately have outcomes similar to those with SCI or TBI only despite a longer LOS for those with SCI/TBI compared with TBI alone, suggesting that the additional resources reflected in LOS are advantageous. Further study is needed due to the limited sample size. It is feasible to use the TBIMS and SCIMS NDB's to study outcomes. However in order to maximize sample size, it would also be necessary to use medical records, and most of the TBIMS' and SCIMS' would have to participate.
Developing a Globally Consistent Continuum of Care for People with Brain Injury: A Professional and Family Perspective

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – public policy and advocacy

Author's preference: Oral

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As a professional who travels around the world observing rehabilitation programs, it is clear there is no consistent approach to developing a mutually agreed upon global continuum of care. As we move to a more global economy, it makes sense that we should be working together to develop consistent continuums of care for treating brain injury based on current state of the science and available research. In many countries, emphasis is placed on hospital-based acute care with little or no attention to post-acute or transition back into the community. In other countries, there seems to be more of an emphasis on community-based post-acute services with huge holes in the acute care side of the continuum. This presentation will attempt to describe and delineate a continuum of care based on state of the science that could be adopted globally. The presentation will focus on, from a professional perspective, how we link these together to ensure that an individual may move smoothly to the level of care that is needed and provides the best outcomes. Perhaps where this inconsistent continuum of services has the most effect is on families who are attempting to find appropriate care for their loved ones. Oftentimes, these families must travel to other countries to receive services that are not available within their own home country. The second half of this presentation will trace the journey of a family member from the Netherlands who has traveled around the world to find appropriate services for his son. His presentation will identify gaps and inconsistencies in care throughout the world and highlight the areas and levels of care that have contributed to his son’s recovery. The presentation will attempt to also highlight alternative levels of care in the community such as clubhouse and other non-traditional medical services. Finally, discussion will focus on what advocacy, policy change, and additional research will be needed to move the idea of a mutually agreed upon continuum of care forward.

CONTACT: Gary R. Ulicny, PhD, President and CEO, Shepherd Center, Atlanta, GA

Objectives:

Methods:

Results:

Conclusions:
Social Disinhibition Following Severe Traumatic Brain Injury, The Role of Reversal Learning and Prediction Error Monitoring

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Social disinhibition is a common outcome of traumatic brain injury (TBI) and is associated with a range of negative outcomes for the individual, their caregiver and their close others. Evidence from a variety of neurological patient groups suggests that damage to the orbitofrontal cortex results in a disinhibition syndrome, yet little is known about what mechanism is comprised to result in this debilitating syndrome. This study tested whether impairments in the ability to update behaviour following a change in social or non-social reward contingencies was related to social disinhibition after severe TBI.

Methods: Twenty-one participants with TBI (19 males, mean age 46.9 years) and 21 control participants (18 males, mean age 45.29 years) completed two reversal learning tasks, one with non-social feedback and the other with social feedback, and were rated on their disinhibited behaviour in a videotaped interview by two independent, blind raters. Further, this study examined whether socially disinhibited participants with TBI had reduced reward prediction error signals, reflected by the feedback-related negativity (FRN), an event-related potential of the electroencephalogram occurring after feedback is provided.

Results: The TBI group made more errors on both the social and non-social reversal learning task, F(1,40)=9.54, p=.004, η2=.19, and produced smaller amplitude FRNs, F(1,39)=8.97, p=.005, η2=.19, than did controls. Further, those TBI participants who were rated as socially disinhibited made more errors than non-disinhibited participants on the social reversal learning task, F(1,21)=9.23, p=.007, η2=.34, but not on the non-social task. Although participants with TBI had reduced FRN amplitudes to negative feedback, this was not associated with disinhibited behaviour.

Conclusions: These findings suggests that an impaired ability to flexibly adjust behaviour in an environment when social reinforcement contingencies are constantly changing plays a role in disinhibited behaviour after TBI. That FRN amplitude to negative feedback was not related to disinhibition suggests that reward prediction error signals are not necessarily an indicator of behaviour change.
Evaluation of White Matter in Mild to Moderate Traumatic Brain Injury: Myelin Water Imaging and Relationship with Cognition

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: Oral

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Background: Myelin is critically important to normal neural function yet very little is known about changes in myelin following traumatic brain injury (TBI) and the relationship between myelin and cognitive function. Novel imaging techniques are now available to non-invasively detect changes in cerebral myelin and have been successful in highlighting white matter (WM) abnormalities in individuals with stroke and multiple sclerosis.

Objectives: (1) To evaluate myelin water content over whole brain using myelin water fraction (MWF) in individuals with TBI and (2) To evaluate the relationship between MWF and cognitive status in individuals with TBI.

Methods: Six adults between the ages of 18-51 years with a history of mild-moderate traumatic brain injury (between 1-28 years post injury) and five healthy age and sex matched controls participated in this study. MRI scans were completed at the UBC MRI Research Centre on a Philips Achieva 3.0 T whole body MRI scanner (Phillips Healthcare, Best, NL). A 48-echo gradient and spin echo (GRASE) sequence with TE=8ms was used for myelin water imaging (MWI) of the brain. MWF was determined for overall WM and specific white matter regions of interest and compared between controls and TBI subjects. Cognitive status was evaluated using the NIH Toolbox Cognitive Battery.

Results: In comparison with controls and after testing for multiple comparisons, MWF was significantly reduced in the TBI group in WM (p<.01) and in the following specific regions of interest: corpus callosum (CC), left inferior longitudinal fasciculus (ILF_L) and bilateral superior longitudinal fasciculus (SLF) (p<.01). Total age adjusted crystallized and fluid composite scores on the NIH Toolbox Cognitive test ranged from 84-153 in the TBI group and 129-153 in the control group. Crystallized ability was significantly correlated with ILF_L (R=.698; p=.04). In addition, Oral Reading Recognition (a measure of crystallized abilities) was significantly correlated with WM (R=.710; p=.03), SLF_R (R=.8; p=.01), CST_R (R=.790; p=.01) and ILF_L (R=.814; p=.01). Picture Sequence Memory (a measure of fluid ability) was significantly correlated with WM (R=.859; p=.01), CC (R=.81; p=.02), SLF_L (R=.78; p=.02) and SLF_R (R=.848; p=.01).

Conclusions: These results show reduced overall myelin in whole brain white matter and in specific white matter tracts that are critical for cognitive function in patients with a wide spectrum of brain injury. MWF is highly related to cognition such that decreases in MWF in specific tracts are correlated with decreases in both crystallized and fluid cognitive measures. MWF following brain trauma may be a significant predictor of severity and may be predictive of cognitive functioning.
**Children’s everyday executive function deficits and parental distress in families attending the holistic pediatric rehabilitation programme for brain-injured children**

Status: Accepted  Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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**Objectives:** Executive function (EF) deficits are common after childhood acquired brain injury (ABI) causing problems for the child and his/her family in many important areas of daily life. According to the literature, a bi-directional influence exists between brain-injured child’s behaviour and parental distress level. EF deficits affect everyday functioning of the child and thereby may increase parental distress.

The Holistic Pediatric Rehabilitation Programme for Brain-injured Children (HOPE) is a comprehensive post-acute rehabilitation model for brain-injured children and their families. The aims of the study were to examine everyday EF deficits of the brain-injured children and parental distress within the families attending the HOPE programme.

**Methods:** The study group consisted of 29 families attending the HOPE programme during years 2005-2009. Ages of the children varied between 7 and 17 years. In choosing the methods, the ecological validity of the assessment tools was emphasized. The baseline assessment included the Behavior Rating Inventory of Executive Function (BRIEF), the Head Injury Behavior Scale (HIBS) and the Wechsler Intelligence Scale for Children III. Classroom performance was evaluated by the child’s teacher. The follow-up assessment occurred one year later.

**Results:** Parents reported their brain-injured children having EF problems of clinical relevance. Positive correlations were found between the child’s EF problems and parental distress level (p < .01). Longer time since injury, younger age at injury and child’s female gender were statistically significant predictors of child’s EF problems reported by the parents. Significant predictors for parental distress were not found. Higher baseline IQ was related to positive change in EF during the rehabilitation process (p > .05).

**Conclusions:** As hypothesized children’s EF deficits correlated significantly to the parental distress level. A high number of everyday EF problems indicated a high parental distress score and vice versa. The result of the parents of the children with higher IQ reporting more positive change in EF during the rehabilitation process is interesting and should be further analyzed and considered in planning rehabilitation interventions for brain-injured children and their families.
Depression-like and anxiogenic-like Behaviour of Rats following Impact Accelerated Traumatic Brain Injury: A Model for Comorbid Anxiety and Depression

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Disruption of normal neuronal networks and neurotransmitter levels, in addition to disrupting neuronal circuits thought to be the causative for depressive/anxiogenic like behaviour following Traumatic brain injury (TBI). We investigated the incidence of post-traumatic depression/anxiety in rodents behavioural test battery. Post ten days of healing, chronic escitalopram (5-20mg/kg p.o) was administered till the second last day of behavioural test. In addition to exploratory hyperactivity in modified open field test and hyperemotionality to noxious stimuli, resembling the psychomotor agitation. TBI rats showed decreases socio-sexual interaction resembling loss of interest in depressed patient compared to sham operated rats. Psycho-pharmacological investigation showed that, TBI rats exhibited the anxiety like symptoms in social interaction and marble burying behaviour tests. The behavioural anomalies in TBI rats were significantly attenuated by chronic treatment with escitalopram (10 and 20 mg/kg), a selective serotonin re-uptake inhibitor. The present study indicated the comorbid depression with anxiety characterized by, agitation, sexual dysfunction, impaired social interaction associated with Traumatic brain injury in rats. This study highlights the early life adverse events, and demonstrates the efficiency escitalopram following TBI. However further work is required to establish the underlying deficit(s) that has led to the behavioural effects described here.

Objectives:

Methods:

Results:

Conclusions:
Decompressive Craniectomy and The Disability Paradox

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – case reports/clinical research
Author's preference: Oral

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Objectives: Many patients survive with severe disability following decompressive craniectomy for severe traumatic brain injury. The acceptability or otherwise of this outcome has yet to determined. The aim of this study was to assess quality of life and “retrospective consent” amongst patients who had survived with severe disability following a decompressive craniectomy for severe traumatic brain injury.

Methods: The patients in this study were drawn from one hundred and eighty six patients who had had a decompressive craniectomy for severe traumatic brain injury between the years 2004 and 2010. The patients who were studied were those who had been adjudged either severely disabled or in vegetative state at 18 months after surgery and on whom at least three year follow up was available.

Results: Amongst thirty nine eligible patients, seven had died and twenty patients or their next of kin consented to participate. Of those twenty patients, the five patients who were in vegetative state at 18 months remained so beyond three years and the remaining 15 patients remained severely disabled after a median follow-up period of 5 years. The patients' average daily activity (Pearson correlation coefficient \(r\) = -0.661, \(p=0.01\)) and SF-36 physical score (\(r = -0.543, p=0.037\)) were inversely correlated with the severity of TBI. The mental SF-36 scores of the patients were, however, reasonably high (median 46, interquartile range 37-52). The majority of patients and their next of kin felt that they would have provided retrospective consent for surgical decompression even if they had known their eventual outcome.

Conclusion: Substantial physical recovery beyond 18-month after decompressive craniectomy for severe TBI was not observed however, many patients appeared to have recalibrated their expectations regarding what they felt to be an acceptable quality of life.
Irisin Induces Neurite Outgrowth in Primary Cortical Neurons

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – basic research

Author's preference: No preference

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Objectives: Irisin is a 12 KD highly conserved myokine that is increased in the blood stream after exercise and has been hypothesized to be a mediator of energy/metabolic homeostasis. Irisin promotes the conversion of white adipose tissue to brown adipose tissue resulting in the dissipation of energy in the form of heat resulting in improved tissue metabolic profile and whole body energy expenditure. Exercise has also been shown to promote neurogenesis and irisin has been shown to regulate hippocampal neurogenesis. Moreover, knockdown of the precursor of Irisin, FNDC5, inhibited differentiation of mouse embryonic stem cells. We therefore, hypothesized that irisin would promote neurite outgrowth in our cell culture model of primary cortical neurons (PCNs).

Methods: PCNs (n=3) were isolated and plated at a low cell density with DMEM containing 20% FBS in poly-D-lysine coated plates for 5 hours. The media was then changed to Neurobasal medium containing 2% B27, 1% Glutamax, 1% antibiotics, and 10 μM 5-fluoro-2′-deoxyuridine. Cells were incubated with 0, 10nM, and 50nM irisin respectively for four days at 37°C. MAP2 immunostaining was performed to identify and measure neurite branch lengths and number of branches.

Results: Total length, branch lengths at level 1 and 2, and the total number of neurite branches were increased in both the 10nM and 50nM irisin treatment groups. The total lengths of neurites were 81.2±48.0μm, 153.7±67.7μm, and 141.3±51.3μm respectively while the number of branches were 3.76±1.5, 4.6±1.3, and 4.5±1.4 respectively in control, 10nM, and 50M irisin treatment groups (p<0.05). The total lengths at both levels 1 and 2 had significant differences between the treatment groups and the control group (p<0.05). The lengths at levels 1 were 73.0±41.8μm, 124.3±49.0μm and 118.3±39.9μm respectively while the lengths at level 2 were 8.1±11.9μm, 28.1±26.5μm and 22.1±20.1μm respectively in control, 10nM and 50nM irisin treatment groups.

Conclusions: Irisin treated PCNs increased both the lengths and branches of neurites. These results demonstrated that irisin could potentially act as a neurorestorative agent by promoting neurite outgrowth.
Cost effectiveness of primary titanium cranioplasty: A randomised controlled trial

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Autologous bone is usually used to reconstruct skull defects following decompressive surgery. However it is associated with a high failure rate due to infection and resorption. The aim of this study was to see whether it would be cost effective to use titanium as a primary reconstructive material.

Methods: Sixty-four patients were enrolled and randomised to receive either their own bone or a primary titanium cranioplasty. All surgical procedures were performed by the senior surgeon. Primary and secondary outcome measures were assessed at one year following cranioplasty.

Results: There were no primary infections in either arm of the trial. There was one secondary infection of a titanium cranioplasty that had replaced a resorbed autologous cranioplasty. In the titanium group no patients were considered to have partial or complete cranioplasty failure at 12 months follow-up (p=0.002) and none needed revision (p=0.053). There were two deaths unrelated to the cranioplasty, one in each arm of the trial. Amongst the thirty-one patients who had an autologous cranioplasty, seven patients (22%) had complete resorption of the autologous bone such that it was adjudged a complete failure. Partial or complete autologous bone resorption appeared to be more common among young patients than older patients (32 vs. 45 years-old, p=0.013). The total cumulative cost between the two groups was not significantly different (mean difference A$3281, 95% confidence interval: to -9869 to 3308; p=0.327).

Conclusions: Primary titanium cranioplasty should be seriously considered for young patients who require reconstruction of the skull vault following decompressive craniectomy.
Clinical improvement following cranioplasty

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: To determine whether there was a measureable change in neurological function following cranioplasty

Methods: This is a prospective single surgeon, single centre study. Fifty patients who required a cranioplasty procedure were neurologically assessed within 72 hours before and 7 days after surgery. The assessment tools were the functional independence measure (FIM) and the Cognitive assessment report (COGNISTAT). The scores for both assessments were calculated and then compared before and after surgery.

Results: FIM assessment was performed on all fifty patients and a Cognistat assessment was performed on forty seven patients. Most improvements were seen in the Cognistat scores however there appeared to be no specific areas in which there was consistent improvement. There were substantial improvements in the Cognistat assessment in nine patients. One patient had a much-improved FIM assessment (improved from 18 to 34), but a Cognistat assessment was not possible due to poor neurological function. These results suggested that improvements after cranioplasty were more likely to occur in the domain of cognitive function than motor function, although overall these results did not reach statistically significance.

Multiple linear regression analysis showed that preoperative FIM score was the most important determinant of postoperative FIM score but occurrence of surgical complications had a predictable adverse effect on postoperative FIM scores. Bifrontal (versus unilateral) cranioplasty, timing between decompression and cranioplasty and age of the patients did not appear to affect the postoperative FIM scores, after adjusting for preoperative FIM scores and surgical complications.

Conclusions: A small but significant number of patients appear to improve clinically following cranioplasty. Neurological susceptibility to a skull defect may be more common than had been previously appreciated.
Video Analysis of Concussion in the National Rugby League

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: In 2014, the National Rugby League in Australia introduced a new 'concussion interchange rule', whereby a player suspected of having sustained a concussion can be removed from play, and assessed, without an interchange being tallied against the player's team.

Methods: The video footage of all uses of the concussion interchange rule were independently reviewed by two raters. Team doctors provided a list of all players diagnosed with a concussion. Players were sorted into three groups: (i) medically diagnosed concussions (n=60); (ii) used the CIR, not returned to play, but not diagnosed with concussion (n=16); and (iii) used the CIR, not diagnosed with concussion, and returned to play in the same game (n=80). The two raters determined the presence or absence of six signs for every case (loss of consciousness, loss of muscle tone, seizures, clutching head, unsteadiness of gait, or vacant stare).

Results: The incidence rate for concussion was 8.92 (95% CI = 6.96-11.43) per 1,000 National Rugby League player match hours, or approximately one concussion every 6.48 games. The overall inter-rater reliability for the concussion signs between the two raters was κ = .60 (95% CI = 0.58-0.79), which is considered to be weak to moderate agreement. Overt loss of consciousness (LOC) was observed in 40.7% (24/59) of players. There were three (5%) players who showed signs of seizure-like activity. Loss of muscle tone was observed in 63.3% (38/60). Players clutched their heads 63.3% (38/60) of the time after impact. A vacant stare was observed in 83.3% (45/54). Gait ataxia was seen in 71.4% (35/49). Considering five signs simultaneously (loss of consciousness, loss of muscle tone, seizures, clutching head, unsteadiness of gait, or vacant stare), 42 (70%) had three or more observable signs of concussion. There was a significantly greater total number of signs observed in the concussed group compared to players that used the rule and were cleared to return to play in the same game. For the individual signs, those diagnosed with concussion were more likely to show evidence of LOC and a vacant stare. There was no significant difference between the number of observed signs between groups for loss of muscle tone, clutching the head, or gait ataxia.

Conclusions: The new concussion interchange rule has been used frequently during the first season of its implementation. There were instances on video analysis in which a player appeared to be concussed but he was not medically diagnosed as such. Understanding the value of video analysis for assisting clinical diagnosis requires more research.
The pleiotropic neuroprotective effect of Progesterone by activating Nrf2/ARE signaling pathway in an in vivo model of traumatic brain injury.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: This study was to investigate the role of Nrf2/ARE signaling pathway in the pleiotropic neuroprotective effect of Progesterone (PROG) on traumatic brain injury.

Methods: The Nrf2 knockout mice (Nrf2-/-) and C57 mice were respectively subjected to a lateral cortical impact injury caused by a free-falling object and divided randomly into three groups: sham operated, trauma and trauma + PROG treatment group. The PROG treatment group was given PROG (32 mg/kg of body weight, intraperitoneal injection) immediately after injury. A series of brain samples were obtained at 24 and 72h respectively after trauma in three groups. The cerebral edema was evaluated. IL-1β, IL-6 and TNF-α expression was measured using ELISA array. The apoptosis index was detected by TUNEL. Flow cytometry was used to detect the intracellular calcium concentration.

Results: In C57 mice with acute brain injury model, the water content of brain, the apoptosis index, the levels of IL-1β, IL-6 and TNF-α protein and the intracellular calcium ion concentration at 24 and 72 hours after injury began to decrease significantly in the trauma + PROG treatment group than in the trauma group (P < 0.05 or < 0.001). In the Nrf2-/- mice model of brain injury, there was no statistical significance between the trauma + PROG treatment group and the trauma group (P > 0.05) with the water content of brain, the apoptosis index, the levels of IL-1β, IL-6 and TNF-α protein and the intracellular calcium ion concentration at 24 and 72 hours after injury.

Conclusions: PROG reduced cerebral edema, apoptosis, inflammatory reaction and intracellular calcium ion overload effects after TBI were not in the Nrf2-/- mice model of brain injury, it is speculated that the Nrf2/ARE signal pathway may be involved in the pleiotropic neuroprotective effect of PROG on TBI.
Delivering A New, Multiple-strategy Reading Intervention During Subacute Brain Injury Rehabilitation: Treatment Development And Preliminary Findings

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: Cognitive-communication reading comprehension (CCRC) deficits may occur following acquired or traumatic brain injury. These deficits can impact participation in rehabilitation, future independence and return to work or study. Providing rehabilitation for CCRC deficits during early, subacute rehabilitation has the potential to improve not only reading comprehension, but also impact participation in rehabilitation. The current evidence base for CCRC rehabilitation is small, with limited information on subacute rehabilitation of reading. The objectives of this study were: 1) To develop an evidence-based CCRC intervention to be delivered during subacute brain injury rehabilitation 2) To investigate the effectiveness of the intervention via a series of experimental single-case studies.

Methods: 1) An emergent multi-phase mixed methodology was used to develop the CCRC intervention; utilising information from a systematic review of the literature, survey findings on Speech Pathology service delivery and management of CCRC in subacute brain injury rehabilitation in Australia, evidence-based reading interventions from other populations and external advisory group feedback. 2) An experimental single case design utilising multiple baselines was used to investigate the effectiveness of the intervention, across the three conditions of functional reading, longer factual reading and inferential reading. Quantitative and qualitative outcome data was collected pre-, post and at 2 months follow up; treatment and probe data for each phase was also collected.

Results: A multiple-strategy intervention involving visual, content and metacognitive strategies was developed. The intervention involved direct instruction of strategies via a hierarchical approach with fading cues, and utilised principles of adult learning and brain injury rehabilitation. Treatment dosage mirrored clinical practice: 3-4 sessions per week for 4-6 weeks, plus independent practice tasks. Preliminary results and data from two case studies will be presented.

Conclusions: Clinical implications including intervention effectiveness during subacute rehabilitation and timing of CCRC rehabilitation will be discussed.

Status: Accepted Presentation type: Poster

Category: Technology – clinical research/applications

Author's preference: Poster

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Objectives: Brain injuries are the No. 1 cause of death and disability in Americans under age 35, according to the U.S. Centers for Disease Control and Prevention. Traumatic brain injury is a global public health problem. Treatment of patients with traumatic brain injury should begin in the accident area. Elevated intracranial pressure (ICP) is seen in head trauma. Prompt recognition is crucial in order to intervene Appropriately. There is no non-invasive device that allows control of intracranial pressure in prehospital environment, currently published in medical literature. We present a new device, patent pending, called NEUROSAFER, easy to use, economic, practical and that can benefit people around the world who have traumatic brain injuries.

Methods: Based on previously published physiological studies, we designed a novel device using vagus nerve stimulation (VNS). Our device does not require surgery, postoperative risks or adverse effects. Several physiological studies published confirm the viability of our device to control intracranial pressure.

Conclusions: The potential use of our device for handling posttraumatic intracranial hypertension is feasible. We estimate this device could reduce intracranial pressure, providing valuable time until the patient receives neurosurgical attention. Our device should be tested in controlled studies to evaluate its effectiveness in the treatment of increased intracranial pressure in prehospital settings.
Child and family support - changing outcomes for families following childhood acquired brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

Lisa Turan
Sheffield University, Sheffield, UK

Objectives: The Child Brain Injury Trust provides emotional and practical support to thousands of families every year following childhood acquired brain injury.

Methods: Rehabilitation for children is a family affair and as such it relies on a whole family approach.

Results: Less isolation, improved self-esteem, improved educational outcomes for the family.

Conclusions: A major part of the support programme is being able to improve knowledge and understanding about acquired brain injury and this leads to an increase in confidence. This is done through the following output: one to one support, peer support, social activities, the need for a family approach is supported through academic research by carol Hawley, Katie byar, Jonaton read and Howard fine.
Parenting Post ABI: Fostering engagement with services 14 years post injury: A case study.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

Mark Holloway
Head First, Kent, UK, University of Sussex, Sussex, UK

Title: Parenting Post ABI: Fostering engagement with services 14 years post injury: A case study.

Objectives: To report upon an intervention with a brain-injured individual who became pregnant 14 years following a very severe brain injury. The intervention enabled her to parent successfully and safely, despite having regularly disengaged from rehabilitation and support services previously.

Description: The skills and abilities required to undertake the parenting role successfully are frequently challenged by sequelae that often arise as a consequence of acquired brain injury (ABI).

UK statutory child protection services are duty-bound to place the needs of a child above those of parents and, if judged necessary, to remove a child from a parent deemed unable to safely meet his/her needs. Rehabilitation services are usually inpatient-based and goal-focussed, potentially these may include the restoration of parenting ability and the creation of skills to meet the needs of a particular child at a particular window in time. These same parenting skills may not be appropriate as the child develops

Methods: P was injured at 13 years and received inpatient neuro-rehabilitation over a period of 12 months. Her family circumstances did not support consistent engagement with services. P disengaged with previously-agreed plans and was unable to maintain motivation to achieve her goals.

P became pregnant 14 years post injury. Statutory services were sufficiently concerned by her living arrangements and presentation for them to seek an Order through the UK Courts for an enforced removal of the infant at birth.

P herself was very child-focussed but unable to assess risk, independently plan or seek support when difficulties arose. P had only ‘intellectual’ awareness of her difficulties but not day-to-day insight.

An ABI specialist community team worked alongside P, her family, health and child welfare services pre-birth and subsequently. They established a planned package of support aimed at facilitating P’s parenting and ADL skills. Non-ABI specialist staff were trained and incorporated by the ABI team. Child welfare specialist staff provided training to the multi-disciplinary team (MDT) on parenting and child development. The support workers were fully incorporated into the MDT and acted consistently in accordance with training.

Results: P was initially unable to understand the reasoning behind the co-ordinated intervention but her desire to parent successfully enhanced her compliance. Over time P was supported to recognise rehabilitation gains made and the impact this had upon her child’s well-being. Her intrinsic motivation to parent well remained the stated focus of all staff intervention. P made significantly greater gains towards independence and community functioning in years 14-21 post injury than previously.

Conclusions: P’s child has reached all milestones and support has been reduced accordingly.
Investigating the Relative’s Experience of ABI and Associated Services

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

Mark Holloway

1Head First, Kent, UK, 2University of Sussex, Sussex, UK

Objectives: To ascertain and describe the experience of relatives of people with an ABI and seek their views of improvements as a result of their experiences.

Methods: An online survey was distributed across the UK which was aimed at relatives of individuals with an ABI. The survey was distributed by ABI services and charities and was designed to seek information regarding the following:

1. The nature and consequences of the injury
2. The services used
3. Changes caused by the injury
4. The relatives experience of services and information received
5. The relatives views as to how services could be improved.

The online survey also asked whether respondents would be prepared to be interviewed face-to-face.

Results: 110 completed responses to the online survey were received. 16 individuals were interviewed at length, the interviews recorded and transcribed.

Results indicate that:

- Survey respondents were heavily biased towards women (84.5%) and the majority of respondents were either parents of (35.5%) or partners of (40%) the injured party.

- Over 96% of respondents noted that their injured relative had a cognitive impairment that affected daily living compared to 56% who reported a physical impairment.

- Family members struggle to adjust to the on-going losses experienced and to the change in roles. In some instances, in hindsight family members questioned whether survival of their loved ones was the best outcome.

- Family members experience a lack of co-ordination of services. They felt the need to proactively educate themselves and advocate for input and maintained an involvement in their injured relative’s life over the very long-term.
· Support from the wider community, including from wider family, is frequently described as poor by family members who felt isolated in the role of carer.

· Services that are rated most highly are either those encountered immediately post injury or highly specialised brain injury services working with individuals over the longer term, often proactively. Families comment on the need to be involved in service provision.

· Family members comment negatively in respect to professionals lack of understanding of the impact of acquired brain injury (ABI), particularly ‘invisible’ deficits. They also comment negatively on the lack of continuity of services.

· The majority of family members do not believe that they were provided with adequate information at the time of the injury and were unprepared for its aftermath.

A thematic analysis of the transcribed interviews will be undertaken.

**Conclusions**: Family members of brain injured people in the UK report being provided with a lack of adequate information, of experiencing difficulties with service provision and of needing to continue to support their injured relative long-term. They are emotionally affected by this experience and feel unsupported personally.
Rehabilitation - A new approach using a therapy dog

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

Lisa Turan  
sheffield University, Sheffield, UK

The Child Brain Injury Trust is the leading organisation supporting the whole family following childhood acquired brain injury. This presentation will showcase the amazing work of therapy dogs supporting families and enabling them to come to terms with their new lives following ABI.

The partnership between dogs for good and CBIT is a pioneering approach to supporting families in the UK. The pilot project is now being rolled out nationally and will support 30 families per year with a therapy dog visiting families for 2-3 hours a week. This approach to rehabilitation is new and therefore the data we are collecting will be valuable to the progression of using dogs in the rehabilitation setting.
Exploring The Post-Concussed Adolescent Brain: A Graph-Theory Based Approach To Understanding The Trajectory Of Recovery In Functional Networks In The First 6 Months Post Injury.

Status: Accepted  Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Background: Sports related concussions are a growing concern, especially in child and adolescent populations. Concussions can present with a wide variety of symptoms and are known to be a complicated combination of structural and functional dysfunction within the brain tissue. Measuring the brain signals at rest has emerged as a powerful tool to map this functional connectivity of the brain in both healthy and disease/injury states. Accurate identification and tracking of recovery from concussion currently relies on symptom reporting and a variety of objectives cognitive measures. There is great interest in finding improved methods to track recovery and ensure individuals do not return to play before they are fully recovered.

Objectives: The purpose of this study was to use resting state EEG combined with tools from graph theory to evaluate changes in brain network properties in adolescents who are recovering from sports related concussion.

Methods: We assessed 10 healthy adolescent athletes and 8 adolescent athletes at 1 week, 1 month, 3 months and 6 months following concussion using the Sport Concussion Assessment Tool (SCAT3) and recorded resting state EEG. Global and local metrics of the structural properties of the graph were calculated for each group and correlated with total symptom score, as well as balance and coordination scores. Measures of functional connectivity were plotted over time to determine patterns of change over the course of recovery.

Results: We found that brain networks of both groups showed small-world topology with no significant differences in the global metrics. However, there were significant differences in clustering coefficient, a measure of functional connectivity. We noted an increase in clustering coefficient in the sensors corresponding to the (R) and (L) dorso lateral prefrontal cortex (DLPFC) at 1 week post-concussion. From 1 month to 6 months post-concussion there were two patterns of recovery: The (R) DLPFC showed an increase in connectivity over time while the (L) DLPFC showed a decrease in connectivity with values lower than baseline at 6 months.

Conclusions: Our preliminary results suggest that concussed adolescents show an intact overall organization of functional networks following injury but show altered functional connectivity in particular regions of the brain. Specifically, we noted an increase in functional connectivity in the prefrontal regions of the brain at 1 week following concussion in comparison with controls. Of particular interest is that over a 6-month period, we found increased functional connectivity in the (R) DLPFC with a parallel decrease in the (L) DLPFC. This pattern may reflect functional re-organization of brain networks and may be indicative of active recovery processes that must be investigated further.
The Body Function, Activity Limitation, and Participation Restriction of Individuals with Mild Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: No preference

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Objectives: 1. To quantify the body function (BF), activity limitation (AL), and participation restriction (PR), as described by the International Classification of Functioning, Disability and Health < ICF> as components of disablement, for individuals with mild Traumatic Brain Injury (mTBI); 2. To determine the relationship between the three ICF components; and, 3. To investigate the correlation between patient-reported outcome (PRO) scores and the AMA Guides, 6th Edition’s whole person impairment (WPI) percentage rating. Design: Retrospective cross-sectional study.

Methods: Outpatient physical medicine and rehabilitation clinic. Participants: 100 individuals completed the Self-Administered Co-Morbidity Questionnaire, and 26 subjects were found to have mTBI greater than two years. Main outcome measures: The Neurobehavioral Symptom Inventory (NSI) and Rivermead Post-concussion Questionnaire (RPC) quantified the BF component i.e. cognitive, emotional, and behavioral symptoms. The Rivermead Head Injury Follow-up Questionnaire (RHF) assessed the AL . The PROMIS-physical function (PPF) and PROMIS-satisfaction with social role (PSR) measured the PR.

Results: No gender differences were detected (Mann-Whitney tests, p>0.15). Therefore, results for all data were combined. The mean [SD] scores were: NSI 46.5 [20.87]; RPC 35.9 [14.89]; RHF 29.33 [11.71]; PPF 35.83 [5.26]; and, PSR 37.61 [7.69]. Pearson’s correlation coefficient was used for all correlations, which did not differ in terms of significance from Spearman’s: NSI correlated with PSR (r=-.576, r=.031); RPC with RHF (r=.530, p=.009); and, RHF with NSI (r=.602, p=.013), PPF (r=-.601, p=.011) and PSR (r=-.555, p=.21). WPI showed a statistically significance with PPF (r=-.491, p=.063) and PSR (r=-.656, p=.008).

Conclusions: Most subjects with mTBI greater than two years still had moderate post-concussion symptoms, extensive AL, and high PR. The study supports that the three ICF outcome components encompass a continuum of disability for an individual with mTBI and can be assessed via PROs. Yet however, the AMA Guides’ WPI system correlates best with PR. Future studies should focus on how personal and environmental factors affect the ICF components’ multi-dimensionality.
Chronic Spinal Injury and Traumatic Brain Injury: A Case Comparison Study of the Patient-Reported Outcome and its Correlation with Physical Performance Status

Objective: The aim of the study was to identify the patient-reported outcomes (PRO) - particularly functional status (FS), psychosocial status (PS), and pain-related impairment (PRI) in individuals with CSI, with and without TBI, and correlate the PRO to clinician-derived physical performance test (PPT) scores.

Methods: The study design was a retrospective case review conducted at an outpatient rehabilitation clinic. The records of 104 poly-trauma patients were reviewed after being referred for spine pain persisting for at least 2 years after injury; 21 of these patients suffered a CSI (14 females) and 21 (9 females) suffered a CSI and TBI. Patients were excluded if they had not completed clinical assessment with a full history and musculoskeletal exam. FS, PS, and PRI were quantified using the Pain Disability Questionnaire (PDQ) as the PRO measure: PDQ-FS subscale, PDQ-PS subscale, and PDQ-Total respectively. Clinician-derived PPT (Dynamic Gait Index, Berg Balance Scale, 6-Minute Walk Test) were also noted.

Results: Data were first tested for normality using the Shapiro-Wilk statistic and by examining skewness and kurtosis of the data distributions. As the data did not violate normality assumptions, parametric procedures were used. Data were then analyzed using a general linear model to test each outcome variable for potential differential effects between genders and to control for age as a covariate. A final model to test for the potential differences in the outcome variables was developed to include only PRI and the two patient groups (spine injury only and spine + brain injury).

Neither gender nor age was significant in the model (p > 0.05); however, PRI was found to be significant (p < 0.05) for all variables. No significant between-group differences were found for any variables (p>0.05). PRI was significant (p < 0.05) for PDQ, DGI, and BBS, but not for the 6MWT measures (p >0.05). After CSI, the functional outcome (moderate effect on FS and PS and moderately severe PRI) and physical performance status (moderate balance and gait deficits) were similar for both groups.

Conclusions: The presence of a TBI encountered with a CSI does not impact the functional outcome and physical performance differentially when compared to patients with only a spine injury. This study suggests the need to avoid the mislabeling of pain symptoms as attributable only to the brain injury sequelae in those with coexisting chronic spinal pain. PRO and PPT are essential in inferring how a patient is recovering by measuring the functional outcome in same manner in these two groups. Future studies on the poorly understood TBI mechanisms and its influence on CSI should be done.
Determining the Pain Impairment and Global Mental Health in Individuals with Traumatic Brain Injury >Two Years and Chronic Pain: Impact on Life Care Planning and Health Care Utilization

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: No preference

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Background: In individuals with Traumatic Brain Injury (TBI), research on the effect of anxiety, depression (AD) and chronic pain on health care utilization, which can be assessed by global health measures, is scarce.

The use of global health items permits an efficient way of: gathering general health perceptions; providing useful summary information about health; and, predicting of health care utilization and subsequent mortality.

Objectives: The study determined the pain-related impairment (PRI) using the Pain Disability Questionnaire (PDQ), a pain severity assessment from the AMA Guides to Evaluation of Permanent Impairment, 6th Ed. in individuals with TBI >two years and with chronic pain, along with their global mental health status.

Methods: A retrospective study was done in a comprehensive outpatient rehabilitation facility on 39 of 100 subjects (21 men).

Outcome measures used were: the PDQ, PROMIS-Anxiety, PROMIS-Depression, and Berg Balance Scale (BBS). PRI was categorized by the PDQ, based on Functional Status (FS) and Psychosocial Distress Status (PS). Global Mental Health (GMH) was measured using the PROMIS-Anxiety & PROMIS-Depression (AD) subscales. Physical Performance Status (PPS) was calculated using BBS.

Results: Clinical scores ranged: total PDQ 6-150 of 150 (average 92); PROMIS-Anxiety T-score 37-83 (average 60); PROMIS-Depression T-score 38-81 (average 59.2); and, BBS 8-56 out of 56 (average 42.0).

Conclusions: Subjects with TBI >2 years and with chronic pain tend to be with moderate pain-related impairment and decreased global mental health, along with fair physical performance. The study found a trend relationship of the PRI to GMH and PPS and that the health burden of TBI care to be extensive due to the clinical complexity involving both physical and psychosocial aspects. It recommends that the PDQ and PROMIS be part of the outcome measures for these difficult-to-manage subjects who needs integrated care. Further study on the correlation of the PDQ, PROMIS, & PPS scores should be done.
The Italian validation of the QOLIBRI - Proxy Version

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: The QOLIBRI (Quality of Life after Brain Injury) (von Steinbüchel et al., 2010) is a new international health-related quality of life (HRQoL) instrument developed for assessing the consequences of traumatic brain injury (TBI), recently validated also for the Italian version (Giustini et al., 2014).

The primary aim of the present study was the Italian validation of the QOLIBRI - Proxy Version. Further aims of the study were the comparison between the patients’ own HRQoL and the patients’ HRQoL as perceived by their caregivers, as well as the correlations between HRQoL with patients’ self-awareness and possible empathy deficits.

Methods: A total of 147 participants with TBI, after discharging from the Santa Lucia Foundation rehabilitation hospital in Rome, were evaluated by means of QOLIBRI, administered to both patients and their caregivers (Proxy Version) to evaluate their HRQoL. The Patient Competency Rating Scale (PCRS) (to assess self-awareness), the Empathy Quotient (EQ) (for empathy), the Glasgow Outcome Scale – Extended version (GOS-E) (for functional assessment of disability), the Hospital Anxiety and Depression Scale (for anxiety and depression) and the Short-Form 36 (for HRQoL) were also administered.

Results: The results suggest that QOLIBRI is very sensitive to assess caregivers’ HRQoL, as well as patients’ HRQoL in relation to their outcome, as measured by the GOS-E, the Hospital Anxiety and Depression Scale, and the Short-Form 36. Regardless of patients’ self-awareness, caregivers perceived the survivors’ quality of life as worse than that self-perceived by the patients.

Conclusions: The QOLIBRI – Proxy Version has been shown to be suitable in assessing caregivers’ HRQoL after TBI, as well as to verify the reliability of patients’ self-report of HRQoL. Indeed, the comparison between the self-perception of quality of life of the patients and their quality of life as perceived by the caregivers (QOLIBRI – Proxy Version) may offer interesting opportunities to evaluate the self-awareness and empathy of patients with TBI.
Estimating Concussion Incidence in College Sports: Rates, Risks, Average Per Team, and Proportion of Teams with Concussions

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author’s preference: Oral

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Objectives: Although injury rates are useful for researchers to compare the relative frequency of sport-related concussions (SRC) across groups, they may not be intuitive to policy makers, parents, or coaches in understanding the likelihood that a player will be concussed. More intuitive measures of injury in sports may be warranted. Utilizing SRC data from the National Collegiate Athletic Association Injury Surveillance Program (NCAA-ISP), we estimate the SRC rate as well as the risk, average number per team, and proportion of teams with SRC.

Methods: The NCAA-ISP utilized a convenience sample of NCAA teams with athletic trainers (ATs) present at all school-sanctioned practices and competitions. ATs reported concussions in real-time through the electronic health record application used by the team medical staff. A reportable injury in the NCAA-ISP occurred as a result of participation in an organized intercollegiate practice/competition and required attention from an AT or physician. No definition of concussion was provided, as we relied on the medical expertise of the ATs providing data. However, ATs were encouraged to follow the definition provided by the Consensus Statement on Concussion in Sport. SRC data were analyzed from 13 sports [Men’s Baseball, Basketball, (American) Football, Ice Hockey, Lacrosse, Soccer (Football), and Wrestling, and Women’s Basketball, Ice Hockey, Lacrosse, Soccer (Football), Softball, Volleyball]. Four measures were calculated: (1) concussion rates per 1000 athlete-exposures (AE); (2) concussion risk; (3) average number of concussions per team (per season); and (4) percentage of teams with at least one concussion.

Results: During the 2011/12-2014/15 academic years, 1485 concussions were sustained by 1410 student-athletes across 13 sports. Concussion rates ranged from a low of 0.09/1000AE in Men’s Baseball to a high of 0.89/1000AE in Men’s Wrestling. Concussion risk ranged from 0.74% in Men’s Baseball to 7.92% in Men’s Wrestling. The average number of concussions per team ranged from 0.25 (SD=0.43) in Men’s Baseball to 5.63 (SD=5.36) in Men’s Football. The percentage of teams with concussion ranged from 24.5% in Men’s Baseball to 80.6% in Men’s (American) Football. Among Women’s sports, Ice Hockey had the largest rate (0.78/1000AE), risk (7.9%), average number of concussions per team (1.69), and percentage of teams with concussion (55.2%).

Conclusions: Although Men’s Wrestling had a higher concussion rate and risk, Men’s (American) Football had the largest average number of concussions per team and the largest percentage of teams with at least one concussion. The risk, average number of concussions per team, and percentage of teams with concussions may be more intuitive and useful measures of incidence for decision makers. Calculating these additional measures are feasible within existing injury surveillance programs and can be applied to other injury types. Future research should consider reporting one or more of these additional measures alongside rates.
Time of Death in Adult Patients Who Sustained Severe Head Injury-Care Transition Step

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: No preference

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Objectives: The additional insult of severe head injury (SHI) might reduce chances of functional outcome. We explore the transition from acute-care by assessing post-discharge mortality. IMPACT-6-month risk model was used as benchmark and compared with actual mortality. IMPACT-score for age \( \geq 14 \) was currently an estimation.

Methods: IMPACT-6-month risk was calculated to 2396 SHI-patients treated during 13-year (2002-2014) in our service by the Core+CT model. Since the IMPACT score is based on data from clinical studies that had minimal information on children, we imputed a score as if the child was 14 years old. Type of neurosurgical care was considered either group- decompressive craniectomy, other type of evacuated mass, other neurosurgical operation and no neurosurgery. Six-month predicted mortality by IMPACT score was compared to actual mortality in each subgroup, as well as assessment of discharge oGOS and type of disposition. Specific look was taken into the fate of patients discharged in vegetative or severe disability.

Results: Overall 6-m mortality was 20% (which is 30% better than the IMPACT score). This beneficial outcome was maximal at pediatric age less than 16 (-58.6%) through midage (-39.7%) but much worse than predicted for patients older than 65 (+18.6%). Overall 486 death were within 6-month, and as median length of stay in acute care was 11 days most of the death above 1 week were outside our hospital. The survival curves for the pediatric were identical over the 2 periods with no additional death after 1 month. Whereas in midage the recent cohort shows better outcome in hospital that fades out after discharge. Elderly patients had continuously higher after discharge mortality. As the transition from the acute hospital is sensitive above pediatric age we found that disposition to rehabilitation hospital for patients with poor neurological outcome rose in older people from 39% to 63% over the 2 periods but still far less than 90% of the same status with midage group. Decompressive craniectomy was more in use recently with same rate in the 3 age groups. Yet the 6-m mortality was 30% for pediatric, 50% for midage and 70% in elderly. Gaining functional outcome in 1 year was 46%, 30% to lower rate of 16% in elderly.

Conclusions: Older population are fragile & SHI by itself creates a major threat to functional outcome. Additional to pre-injury status & anticoagulants use, we add the weak point of care-transition after acute-care to be taken into account. It affect outcome in every age-band while over time the acute management do improve. The decision for decompressive craniectomy for elderly patients needs many reasons in face of the fact that it does not translate to a meaningful recovery.
Objectives: Cranioplasty has recently demonstrated functional effects of improvement not only of motor deficits but also of neuropsychologic disorders, especially of speech disturbances. The ideal timing of cranioplasty should be 3 months, otherwise the risk of development of the “Syndrome of the Trephined (ST)” or of the “Sinking Skin Flap Syndrome” is high.

Methods: We have studied 5 cases, 4 males and one female, who underwent a decompressive craniectomy in order to control a severe post-traumatic intracranial hypertension. Two patients, who underwent cranioplasty several months after the decompression, developed a PTH and needed to be treated by means of a ventriculo-peritoneal shunting device.

Results: In all cases cranioplasty brought an immediate improvement of the neurological and neuropsychological deficits, also in patients with disorders of consciousness (DOC), together with CNS modifications as demonstrated by the tractography; in particular, an increase of the cerebral blood flow and of the cerebral blood volume in the so-called “regions of interest”, both homolateral as well as controlateral to the decompression, has been observed.

Conclusions: NMR-tractography could play an important role in suggesting the ideal timing for the cranioplasty after decompressive craniectomy in order to avoid the high risk of neurological deterioration and hydrocephalus in such patients.
Nanodrug delivery of a multimodal novel drug Cerebrolysin reduces Engineered nanoparticles induced aggravation of heat stroke induced ubiquitin expression and brain pathology

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Accumulation of ubiquitin within the brain after trauma or stress leads to neurodegenerative changes or brain pathology. However, some reports suggest that increased ubiquitin in the brain or cerebrospinal fluid (CSF) following trauma may have neuroprotective effects. Thus, alterations in ubiquitin expression and its role in brain pathology require further investigation.

Previous reports from our laboratory show that acute heat exposure simulating human populations exposed to high ambient temperatures during summer heat could lead to extensive breakdown of the blood-brain barrier (BBB) to large molecules such as serum proteins resulting in edema and cellular injury. This suggests that our military personnels engaged in combat related or peace keeping activity in summer heat in Middle East could be prone to brain dysfunction. In addition, our results demonstrate that this heat related brain injury is further aggravated by exposure to silica dust (SiO2 nanoparticles). This indicates that military personal exposed to desert heat may have greater chances of brain dysfunction or damage as compared to persons in other environments. Since ubiquitin expression is increased following ischemia or traumatic injuries to the brain or spinal cord the present investigation was undertaken to find out whether heat stress could enhance ubiquitin expression in different areas of the brain in a rat model. We investigated the relationship between neuronal damages and ubiquitin expression in heat stress and also examined the effect of cerebrolysin- a multimodal drug with pleotropic activity due to a select combination of neurotrophic factors and active peptide fragments on ubiquitin expression in these conditions. Our observations show that rats subjected to 4 h heat stress in a Biological Oxygen Demand incubator (BOD) resulted in over expression of ubiquitin in the cerebral cortex (+40%), hippocampus (+56%), cerebellum (+64%), thalamus (+33%), hypothalamus (+38%) and in brain stem (+23%) than control group kept at room temperature. Chronic SiO2 intoxication (50-60 nm, 50 mg/kg, i.p. daily for 7 days) resulted in exacerbation of ubiquitin accumulation by 150 to 260 % in the identical brain areas following heat exposure. Cerebrolysin in low doses was capable to reduce ubiquitin expression in heat stress and in high doses or TiO2 nanowired delivery of the drug (in low doses) its aggravation in SiO2 intoxicated group. The behavioral abnormalities seen in heat stressed animals with or without SiO2 intoxication was also ameliorated by nanodrug delivery of cerebrolysin. These observations are the first to suggest that ubiquitin expression in the brain following heat stress is one of the key factors in causing neuronal damages and this expression is further exacerbated by SiO2 intoxication. Our results further show that the neuroprotective effects of cerebrolysin in heat related injuries could be mediated through downregulation of ubiquitin expression, not reported earlier.
Cold Environment Exacerbates Brain Pathology and Oxidative Stress Following Traumatic Brain Injuries. Potential Therapeutic Effects of Nanowired Cerebrolysin

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: Oral

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Military personnel are the most vulnerable to TBI either during peacekeeping or combat operations at extreme hot and cold environments. Although, some reports suggest that hyperthermia following TBI is harmful, studies conducted on the effects of cold environment on the pathophysiological outcomes of TBI are still lacking. We examined the effects of cold environment on TBI in our rat model with regard to generation of oxidative stress and brain pathophysiology. In addition, effects of a potent antioxidant compound H-290/51 with or without TiO2 nanowired drug delivery on the pathophysiology of TBI in cold environment was also evaluated.

Focal TBI was inflicted under Equithesin anesthesia in Wistar Male rats over the right parietal cortex by making an incision of 2 mm deep and 4 mm long after opening of the skull bone (ca. 4 mm diameter, area 12.56 mm²). The animals were allowed to survive 48 h after TBI. Animals were exposed either at 5°C for 3 h daily for 5 weeks before injury. The control groups were maintained at normal room temperature (21±1°C). In these animals some of the key oxidative stress parameters e.g., Leucigenin (LCG), Luminol (LUM), Malondialdehyde (MDA) and Glutathione (GTH) in the brain along with blood-brain barrier (BBB) breakdown, brain edema formation and neuronal injuries were measured. TBI in animals subjected to cold environments exhibited about 80 to 190 % increase in LCG, LUM and MDA and 220 % decrease in GTH in the brain as compared to rats subjected to TBI at room temperature. The magnitude and intensity of BBB breakdown to radioiodine and Evans blue albumin, edema formation and neuronal injuries were also exacerbated in TBI group in cold environment by 120 to 280 % from the injured group at room temperature.

Nanowired delivery of Cerebrolysin (5 ml/kg, i.v.) 6 to 8 h after TBI in cold group was able to significantly thwart brain pathology and oxidative stress whereas normal delivery of Cerebrolysin require higher dose of the drug (10 ml/kg, i.v.) to achieve any comparable reduction in these animals after TBI. These observations demonstrate that (i) cold aggravates the pathophysiology of TBI and, (ii) this could be partially due to an enhanced production of oxidative stress in cold environment, not reported earlier. Nanodelivery of Cerebrolysin may have potential novel therapeutic value in treating TBI in cold environment. The findings of this investigation may have strategic significance in our military personnel involved in warfare at high altitude and/or cold environment.
Nanodelivery of cerebrolysin induces profound neuroprotection in heat stroke following chronic hypertension in combination with carbon nanoparticles induced exacerbation of brain damage

Status: Accepted Presentation type: Poster
Category: Neurotrauma – basic research
Author's preference: Oral

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Our military personals are often exposed to combat stress induced hypertension in an environment rich in various nanoparticles emanating from different sources e.g., gun powder explosion or blast injuries. Furthermore, they are also exposed to high environmental heat and silica dust. Previously, we have shown that hypertensive animals when exposed to heat stress exhibit massive brain damage and deterioration of their sensory motor dysfunctions. In this investigation we evaluated the additional effects of single walled carbon nanotubes (SWCNT) on brain pathology before heat exposure in hypertensive rats. Chronic hypertension was produced using a silver clip to constrict one renal artery leaving both the kidneys intact (2K1C). Intoxication of SWCNT (50-60 nm) was done by 50 mg/kg, i.p. dose given once daily for one week either at room temperature (21°C) or at 34° C (wind velocity 20-25 cm/sec, relative Humidity 45-47 %) for 8 days. On the 9th day their brain pathology using blood-brain barrier (BBB) breakdown to Evans blue albumin (EBA) or radioiodine ([131]I), brain edema, neuronal or glial cell damages and behavioral dysfunction employing Rota rod treadmill, grid walking and inclined plane angle tests were evaluated in a blinded fashion.

Hypertensive rats exposed to SWCNT in combination at high environmental temperature exhibited 3- to 5-fold higher increase in BBB permeability in 10 brain regions to EBA and radioiodine as compared to these rats placed at room temperature. The brain edema in 8 regions showed a 6- to 8-fold increase in SWCNT treated hypertensive rats at 34°C and neuronal and glial damages were enhanced by 4- to 6-fold that their counterparts placed at 21°C. In heat exposed hypertensive rats following SWCNT exposure also showed severe functional disturbances in behavioral tests as compared to those placed at 21°C. Interestingly, SWCNT in hypertensive animals also showed about 2-fold increase in BBB disruption, edema formation and brain pathology as compared to normotensive rats under identical conditions. Cerebrolysin treatment (5 ml or 10 ml/kg, i.v.) showed mild to moderate degree of reduction in brain pathology or behavioral disturbances in hypertensive rats with SWCNT exposure after heat stress. On the other hand TiO2 nanowired cerebrolysin (5 ml/kg) was able to markedly reduce brain pathology and behavioral dysfunction in heat exposed hypertensive rats treated with SWCNT.

These observations are the first to demonstrate that a combination of hypertension, and SWCNTs with heat aggravates brain damage and under nanodelivery of cerebrolysin is needed to induce neuroprotection and restoring the functional disturbances, not reported earlier.
Neuropsychological rehabilitation might be understood as a system of interventional methods and strategies, which helps to guarantee the possibility of patients with brain lesions to be able to fulfill day-to-day activities and cognitive tasks. When brain lesions occur in early childhood, it is necessary to take into account developmental processes. Neuropsychological rehabilitation during infancy should become not only treatment of difficulties, but also system of methods, which guarantees the positive psychological development. The objective of the study is to show results of neuropsychological assessment and intervention in a case of a female patient of preschool age. Organic early lesion was never properly detected and the girl received a diagnosis of autism. Neuropsychological assessment was applied at the age of 5 years. The method of qualitative analysis of neuropsychological syndrome permitted to conclude about functional deficit of programming and control. Developmental psychological analysis pointed out absence of communication verbal ability, absence of playing actions and concrete actions with material objects. The program for rehabilitation was applied during 2 years 3 times per week. Tasks for development of playing activity, symbolic actions, graphic representation by drawings and verbal regulation were used. The program was based on constant collaboration and guidance by neuropsychologist. Control reevaluation was performed after a period of 2 years. The results of reevaluation pointed out favorable changes. EEG study was applied before and after neuropsychological correction. Qualitative visual analysis of EEG pointed out abnormal functional stage in cortical and subcortical regions of right hemisphere. Constant observation, psychological and pedagogical support continued for next five years and showed positive developmental dynamic with normal school learning achievements. We discuss the possibility to reconsider common rehabilitation schemes in cases of severe syndromes of development difficulties in childhood. Children with complex brain lesions of subcortical-cortical level might be characterized as autistic patients with no hope for future development. We conclude that qualitative neuropsychological assessment and intervention may become a useful instrument for insure progressive development of communication and cognitive processes starting from preschool age.
Development and psychometric evaluation of the Self-Awareness in Daily Life-3 (SADL-3), a new instrument for the assessment of self-awareness in the chronic phase of acquired brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Patients with acquired brain injury (ABI) often have impaired self-awareness. They commonly experience difficulty understanding their impairments in cognition, behavior and interpersonal skills and the impact these impairments have on their functional abilities. Main objective of this study was to evaluate reliability, validity and usability of a short and simple instrument for use by professional caregivers or nurses on self-awareness across multiple daily life areas in the chronic phase after ABI.

Methods: The Self-Awareness in Daily Life-3 (SADL-3) discerns three types of patients, based on their level of self-awareness: the Passerby (has no awareness of his deficits, significant others are the ones who experience problems and who ask for help or treatment), the Searcher (agrees that brain damage is part of his life but does not fully understand the consequences of the brain damage for everyday functioning), and the Buyer (understands the fact that his brain damage affects his life, knows that he needs others to help him deal with his deficits and is willing to cooperate). Typology is assessed for seven daily life areas: family relations, friends and social contacts, intimacy and sexuality, leisure time, work and daytime activities, housing situation and living conditions, health and appearance. The scale is filled out by professional caregivers or nurses. Patients from one of three Dutch living facilities for patients with ABI participated in this study. To evaluate reliability, different nurses completed the SADL-3 twice within two weeks (test-retest reliability) and independently from each other (inter-rater reliability). To evaluate convergent validity, patients and nurses completed the Awareness Questionnaire (AQ), Patient Competency Rating Scale (PCRS) and Clinician's Rating Scale for evaluating Impaired Self-Awareness and Denial of Disability (CRS-ISA-DD). To evaluate usability, nurses completed a usability questionnaire.

Results: Eighty-nine patients participated in this study. Mean time since injury was 16.3 years. Test-retest reliability of the SADL-3 is good for the seven daily life areas (p between .78 and .89). Inter-rater reliability is sufficient for five of the seven daily life areas (ICC between .42 and .60) and insufficient for the areas family relations (ICC = .37) and friendship and social contacts (ICC = .38). Convergent validity is sufficient when compared with the PCRS (p = -.34) and the CRS-ISA-DD (p = -.59), and insufficient when compared with the AQ (p = -.11). Most nurses rated the SADL-3 as 'fairly easy' to 'very easy' to complete. Median completion time is 20 minutes.

Conclusions: The SADL-3 is usable, has good test-retest reliability and sufficient convergent validity. It can be used for the assessment of self-awareness across multiple daily life areas in the chronic phase after ABI. Because results on inter-rater reliability are mixed, it is recommended that nurses together fill out the SADL-3.
Moderate and severe TBI patients distinguish emotional stimuli unlikely to healthy adults: EEG and behavioral research

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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In our experimental research focused on the variety of responses to emotional auditory stimulation in patients at different stages after craniocerebral trauma. We suggested, patients after severe and moderate TBI have unusual brain responses to significant emotional stimuli which are on different unconsciousness levels. Our research included the EEG recording followed by the stimulation, behavioral investigation and neurological examination. The patients sampling consisted of three groups: 13 comatose patients, 14 severe TBI patients, 12 moderate TBI patients, the control group consisted of the 28 healthy adults. The subjects were stimulated with auditory stimuli containing significant sounds (coughing, laughing, crying, bird singing, barking, scraping) and control sounds (white noise) and tactile stimuli (soft brush, neurological wheel, thorny brush). We have analyzed statistically significant differences of power of the rhythmic activity registered during the presentation of different types of stimuli using Matlab. The t-test differences for each type of stimuli and background rhythmic activity were calculated as well as major ANOVA-effects. The results showed that EEG-response was based on the form of the emotional stimulus, the consciousness levels, the severity of injury and the recovery process. The TBI patients showed lower theta-rhythm power in the frontal areas to the all emotional stimuli. The alpha-activity was reduced in the TBI patients: the alpha-rhythm depression is most vividly pronounced in the control group, the alpha-rhythm acceleration in the occipital areas was found only in the moderate TBI patients and only to the emotional stimuli. The severe TBI and comatose patients showed lower response rates to the neutral stimuli and higher response rates to the unpleasant physiological stimuli.
Median nerve stimulation in children and young adults in vegetative or minimally conscious state: study protocol for a randomised controlled trial

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Background: In the Netherlands, each year 330-1000 children and young adults aged 24 years and younger are diagnosed with severe traumatic brain injury (TBI) or non traumatic brain injury (nTBI). Frequently, this results in coma. Approximately 10% is in a vegetative state of minimally conscious state one month after the injury. Severe brain injuries not only have severe effects on patients and their families, they also have major economic impact on societies.

In the Netherlands, for children and young adults aged 24 or younger an Early Intensive Neurorehabilitation Program (EINP) is, which is proven effective. One of the most promising other treatments is right median nerve stimulation (RMNS). Studies performed with RMNS at adults showed positive results on the level of consciousness that is achieved.

Objectives: To investigate the effect of RMNS, combined with EINP on the level of consciousness in children and young adults < 25 years of age, who are in a vegetative state or minimal conscious state due to a recent brain injury, compared with EINP alone. Secondary aim is to describe the relationship of the effect of RMNS with duration of recovery to conscious state, and assessment of side effects due to RMNS.

Methods: The proposed study is a randomised controlled trial comparing the two treatments for patients admitted to the EIN unit. Recruitment of 65 patients is foreseen. Therefore, the inclusion period should be 7 years and the duration of the study (i.e. incorporating one year follow up) should be 8 years Patients are randomly assigned to the usual care group (EINP) or the intervention treatment group (EINP + RMNS). In order to blind patients, their professional and informal caregivers for the treatment arm, the usual care group will receive sham RMNS. After the treatment at the EIN unit patients will be followed for 12 months.

Results: The primary outcome measure will be the Coma Recovery Scale - Revised (CRS-R). In order to allow comparison with previous research, the Post Acute Level Of Consciousness- scale (PALOCs) and the Glasgow Coma Scale (GCS) will also be administered. Personal, medical en psychosocial characteristics which can influence the primary outcome will be assessed.

Conclusions: This study is expected to provide information about the effect of additional RMNS on the on the level of consciousness in children and young adults < 25 years of age, who are in a vegetative state or minimal conscious state due to a recent brain injury. Because of the huge lifelong impact of the disease on the patients and their relatives, all efforts should be done to improve treatment in this group of patients.
Effect of Drop Foot Stimulator on Brain Plasticity in Chronic Stroke Patients

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: We assessed regional changes in cerebral metabolism using positron emission tomography (PET) one year after implanted drop foot stimulator system in chronic stroke patients.

Methods: \([18F]\)-fluorodeoxyglucose-PET was prospectively acquired in 12 stroke patients with drop foot before and one year after the activation of a 4-channel stimulator ActiGait, which selectively and directly stimulates the fibular nerve (5 women, mean age: 47±12y, time since insult: 2±1y). Data were preprocessed and analyzed by means of statistical parametric mapping (SPM8) with PET images of right-sided stroke patients being flipped.

Results: The implanted drop foot stimulator system improved walking endurance and the physiology of ankle joint kinematics. Prior to treatment, FDG-PET showed a significant decrease in metabolism in premotor and supplementary motor cortices, prefrontal cortex and left thalamus, contralateral to the paralyzed side (FEW corrected, figure 1). After one year of implanted fibular nerve stimulation, regional metabolism increased in premotor and supplementary motor cortices of ipsi- and contralateral hemisphere (0.001 uncorrected, figure 2).

Conclusions: Clinical improvement of gait after unilateral fibular nerve stimulation in chronic drop foot is paralleled by metabolic changes in the ipsi- and contralateral motor network. These results suggest a residual cortical plasticity occurring at the chronic state after a peripheral nerve stimulation.
Internalizing Disorders in Adults With A History of Childhood Traumatic Brain Injury

Objectives: There is a vast literature on the incidence of behavioural problems and psychiatric disorders in individuals following Traumatic Brain Injury (TBI). However, the focus is often on externalising disorders and symptoms, with internalising problems rarely being specifically investigated in such a sample. Further, a large proportion of research in the TBI field utilises child or older adult samples, with young adults being a relatively neglected age-group. This study explored the presence, rate and incidence of internalising behaviour problems, including anxiety, depression, somatic complaints, avoidant personality symptomatology and overall internalising behaviour problems in university students aged 18-25 years.

Methods: A conveniently selected sample of 247 university students (197 non-TBI, 47 mild TBI, 2 moderate TBI, 1 severe TBI) aged 18-25 years was utilised. Participants completed a self-report measure on behavioural functioning, the Adult Self Report (ASR), to identify internalising behaviours. The internalising scales include depression, anxiety, withdrawal, somatic complaints, avoidant personality problems and overall internalising symptoms, and clusters items into DSM-oriented scales and ASR syndromes. The Ohio State University TBI Identification Method was used as a self-report measure, which identified individuals with a history of TBI and obtains information regarding loss of consciousness and severity of injury.

Results: Due to the small group numbers (n=3), individuals with moderate and severe TBI were excluded from the analyses. Mean age of TBI was 14.80 years, and 57% of participants with TBI were injured before the age of 15 years. Raw scores were utilised and then converted to standardised T-scores to derive information on clinically significant problems. Raw scores of behaviour indicated that participants with a history of childhood TBI reported significantly higher levels of withdrawal, somatic complaints and internalising behavioural problems, than the non-TBI participants. When analysing standardised T-scores for borderline and clinically elevated ASR syndromes and DSM-oriented scales, individuals in the TBI group were significantly more likely to have higher rates of borderline anxiety, somatic complaints, avoidant personality problems and overall internalising disorders, and clinically elevated somatic complaints. Students with a history of childhood TBI were also significantly more like to report at least 1 or more DSM disorders.

Conclusions: This study sheds light on the limited knowledge regarding the profile of internalising disorders in a university sample with history of childhood mild TBI. This sample provides a snapshot of the long-term problems that may be experienced many years after a TBI event. It is concluded that students with a history of childhood mild TBI are at risk of developing long-term internalising behavioural problems, including withdrawal, somatic complaints and avoidant personality problems. This is important to consider with regards to interventions which can aim to assist such individuals who may be struggling at university due to these long-term outcomes.
The evaluation of cerebral blood flow in patients with traumatic head injury: A comparison of MRI ASL and Tc ECD SPECT

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: Tc ECD SPECT is the standard method for evaluating cerebral blood flow (CBF); however this method of examination is associated with some drawbacks, including high cost, radiation exposure and its limited availability for emergency patients. Arterial spin labeling (ASL) perfusion MRI is a method of CBF examination that does not involve the use of contrast media or radiation exposure and has become possible with the availability of 3T MRI. Because of its short image acquisition time, ASL can be performed in the course of a routine MRI examination. While CBF evaluation is known to be useful in the evaluation cerebral function in cases of traumatic head injury, ASL perfusion MRI has not been fully evaluated in head injury patients. We performed ASL perfusion MRI and Tc ECD SPECT in patients with head injury and compared the imaging findings.

Patients: A total of 21 patients (male: n=16; female: n=5; age from 18 to 90 years) were registered in this study. MRI and SPECT images were examined in 15 acute-phase (within 1 month after head injury), and 6 chronic-phase patients (more than 2 months). The final diagnoses were contusion (n=8), ASDH (n=5), CSDH (n=3), concussion (n=3), traumatic SAH (n=2), DAI (n=2).

Methods: We intravenously injected Tc99m ECD 600MBq into the right cubital vein and acquired SPECT images using an E CAM (Siemens) system. An axial image was statistically evaluated using the easy Z-score Imaging System (eZIS) software program. ASL perfusion MRI was performed using a Magnetom Skyra 3.0 Tesla (Siemens) and 3 delay times (1600, 1990 and 2400 ms). We used a turbo gradient-spin-echo pulse sequence for ASL with a 3 mm slice thickness, a TR/TE of 5000/36 ms, a matrix size of 64x64, and an FOV of 192x192 mm. The acquisition time was 2 min 5 sec for each delay time. Whole brain axial color images were visually evaluated.

Results: The patients with cerebral contusion always showed low CBF with both ASL perfusion MRI and SPECT. In the DAI cases, low CBF were compatible with functional impairment and higher brain dysfunction. In the cases with ASDH or CSDH, cerebral compression was not revealed as a CBF change; a CBF study was therefore useful to determine the surgical indication and prognosis.

Conclusions: SPECT was capable of providing quantitative and statistically-standardized evaluations. In contrast, ASL was only capable of providing qualitative images. SPECT is more useful than ASL for CBF studies. However, the time required for ASL imaging is very short, thus ASL can be performed in the course of a routine MRI examination. SPECT remains the gold standard of CBF evaluation. However, ASL is sufficient as a routine evaluation for certain head injury patients.
Development of Indicators and Outcome Measures for the Clinical Practice Guideline for the Rehabilitation of Adults with Moderate to Severe Traumatic Brain Injury in Canada

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Objectives: Clinical practice guidelines (CPGs) can help clinicians align services and make decisions based on the best available evidence. There is evidence that implementation of CPGs can result in better patient outcomes for the patients. However, there is also evidence that the process of implementation is very difficult. One tool to help promote implementation is audit of practice followed by feedback to clinicians about their adherence to best practices and outcomes. We conceptualized that there are two types of outcomes that may be of interest in evaluating implementation of guidelines: 1. Process Indicators that determine whether the best clinical practices have been followed by clinicians and organizations and 2. Patient Outcomes Measures that evaluate whether the expected outcomes/benefits were obtained from implementation of the recommendation. Unfortunately, most brain injury guideline developers have not included these types of indicators and outcomes in their guideline publications. The objective is to report on the indicators and outcome tools that accompany key recommendations of an up-to-date CPG developed in 2015 for the rehabilitation of adults with moderate to severe traumatic brain injury (TBI).

Methods: A 2-day consensus conference with interdisciplinary experts in the field of brain injury was held in Montreal, Canada on November 27 and 28, 2014 to develop the recommendations contained in the CPG. The panel of experts consisted of 60 individuals from Ontario and Quebec with a range of clinical, research, policy, management, consumer, and health system leaders to ensure relevance. Post-conference, the expert panel members were involved in prioritizing those recommendations most important to implement and then developing corresponding process indicators and outcome measurement of the high priority practices. The process indicators were derived from group discussions during and post-conference; considering existing available data and feasibility of collecting data from observation or chart audit. To derive the outcome measures, a systematic review of available tools from the Evidence Based review of Acquired Brain injury (www.abiebr.ca) was used to identify measures with good measurement properties, followed by consideration of international standards for measurement and relevance to the recommendations.

Results: A core set of process indicators and outcome measures were developed that are aligned with the key recommendations in the CPG. The process indicators and outcome measures cover the two sections of the CPG: 1. Components of the Optimal TBI Rehabilitation System, and 2. Assessment and Rehabilitation of Brain Injury Sequelae.

Conclusions: The development of indicators and outcome measures related to the CPG will assist in CPG implementation and ultimately in improving and standardizing TBI care in Canada.
Factors related to fatigue after pediatric Acquired Brain Injury (ABI)

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Objectives: To assess the degree of fatigue after pediatric traumatic and non-traumatic brain injury (TBI and NTBI) and its associations with participation and quality of life (QoL). Patients: Children with a hospital-based diagnosis of ABI, aged 4-20 years and their parents, 24-30 months after diagnosis.

Methods: Children and their parents completed the Pediatric Quality of Life Inventory™Multidimensional Fatigue Scale (PedsQL™MFS). Additional assessments included measures of family functioning, participation, sociodemographics/disease characteristics.

Results: Eighty-eight parents and 49 children (56%) completed the PedsQL™MFS. The median age was 11 years (range 5-22). Sixty-nine patients had TBI (16% moderate/severe) and 19 patients NTBI (3 (16%) moderate/severe The mean parent and children-reported PedsQL™MFS Total Fatigue scores were 76.5 (SD 16.4) (n=88) and 78.5 (12.9) (n=49), respectively (Spearman r=0.450, p=0.001; n=49). More parent-reported fatigue was associated with higher age, single parent household and pre-existent health problems (r ranging ..., p< ...), with the association with age at onset and household composition remaining statistically significant in the multivariable analysis.

Conclusions: Two years after onset of ABI, parent-reported fatigue is higher in older patients and single parent households. Clinical message: Fatigue is an often reported symptom after ABI and should be addressed in rehabilitation programs

This study was financially supported by the Revalidatiefonds, Johanna Kinder Fonds and Kinderrevalidatie Fonds Adriaan.
Recovery from mild traumatic brain injury in previously healthy adults

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: To report recovery from mild traumatic brain injury (MTBI) across multiple domains in a 12-month follow-up.

Methods: A carefully selected consecutive sample of 74 previously healthy adults with MTBI between the ages of 18 and 60 years and 40 orthopedic controls (i.e., ankle injuries) completed assessments at 1, 6, and 12 months after injury. Outcome measures included post-concussion symptoms (Rivermead Post Concussion Symptoms Questionnaire), fatigue (Barrow Neurological Institute Fatigue Scale), insomnia (Insomnia Severity Index), pain (Pain subscale of the Ruff Neurobehavioral Inventory), depression (Beck Depression Inventory- Second Edition), traumatic stress (PTSD-Checklist-Civilian Version), quality of life (Quality of Life after Brain Injury-QOLIBRI), satisfaction with life ( Satisfaction with Life Scale), resilience (Resilience Scale), and return to work. Cognition was assessed by a neuropsychological examination (including Rey Auditory Verbal Learning Test, Stroop Test, Trail Making Test, verbal fluency, Finger Tapping Test, and the following subtests from Wechsler Adult Intelligence Scale – Third Edition: Information, Digit Span, Digit-Symbol Coding, and Symbol Search).

Results: There were no significant differences between the MTBI group and controls in age, education (in years), or gender. Patients with MTBI reported more post-concussion symptoms and fatigue than the controls at the beginning of recovery, but by six months following injury, did not differ as a group from non-head injury trauma controls on cognition, fatigue, or mental health, and by 12 months their level of post-concussion symptoms and quality of life was similar to that of controls. Almost all (96%) patients with MTBI returned to work/normal activities (RTW) within the follow-up of one year. A subgroup of those with MTBIs (26.7%) and controls (17.2%) reported mild post-concussion-like symptoms at one year. A large percentage (62.5%) of the subgroup who had persistent symptoms had a modifiable psychological risk factor at one month (i.e., depression, traumatic stress, and/or low resilience), and at six months they had greater post-concussion symptoms, fatigue, insomnia, traumatic stress, and depression, and worse quality of life. All of the control subjects who had mild post-concussion-like symptoms at 12 months also had a mental health problem (i.e., depression, traumatic stress, or both).

Conclusions: These results support the favorable prognosis of MTBI in previously healthy adults. The results also illustrate the potential importance of providing evidence-supported treatment and rehabilitation services early in the recovery period because those individuals who have mild persistent long-term symptoms had more severe post-concussion symptoms at one month, and they had modifiable psychological problems throughout the first year (e.g., traumatic stress, depression, and low resilience).
Achieving consensus around a clinical practice guideline for the rehabilitation of adults with moderate to severe traumatic brain injury in Quebec and Ontario

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Objectives: There is evidence that healthcare professionals are not integrating novel traumatic brain injury (TBI) evidence into practice. Clinical practice guidelines (CPGs) are promising tools for assisting healthcare professionals and decision makers in this continuous improvement process. A CPG for the rehabilitation of adults with moderate to severe TBI has been developed. To understand the needs for optimal CPG content/format and perceived barriers to implementation, multiple stakeholders were consulted prior to initiation. The objective is to report on the consensus process results and the key recommendations generated.

Methods: A Consensus Conference was held in Montreal, Canada on November 27 and 28, 2014 involving 60 individuals from Ontario and Quebec with a range of clinical, research, policy, management, consumer, and knowledge translation expertise. Using syntheses of scientific evidence and existing guidelines about the organization of rehabilitation services and the rehabilitation of specific brain injury-related impairments, experts assembled in 6 working groups to produce a preliminary set of recommendations. Post-conference, the working groups refined the recommendations and provided additional suggestions concerning related indicators and clinical tools. Working groups in the area of “Neuropharmacological” and “Intensity and Duration of Therapy” were formed to develop recommendations in these prioritized topic areas. The project committee then adapted, refined and compiled all of the recommendations and proposed edits, as well as addressed any comments/concerns identified by the expert panel. The expert panel members individually voted using an online survey to: 1. eliminate recommendations with poor evidence or insufficient consensus support, and 2. prioritize those recommendations for implementation and development of indicators.

Results: The final set of recommendations is divided in two large sections: Section I: Components of the Optimal TBI Rehabilitation System includes 81 recommendations (28 New, 53 Existing recommendations) while Section II: Assessment and Rehabilitation of Brain Injury Sequelae includes 206 recommendations (88 New, 118 Existing recommendations) for a total of 287 recommendations. A total of 116 new recommendations were formulated - highlighting the relevancy of producing a new CPG in order to respond to the needs and context of practice in Quebec and Ontario, with an emphasis placed on informing and standardizing practice while also providing practical, implementable guideline recommendations. Key recommendations have been pinpointed by the experts and will be highlighted accordingly in the final CPG.

Conclusions: The finalized bilingual guideline will help service providers to enhance rehabilitation practice and will benefit from a provision of tools/indicators for successful implementation. This presentation will review the key practices prioritized by stakeholders.
Guidelines for the Rehabilitation and Disease Management of Adults with Moderate to Severe Traumatic Brain Injury: Methodology and PICOT Questions

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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A variety of diagnostic, treatment, preventative and other services are provided to adults with moderate-severe TBI in inpatient acute and subacute rehabilitation facilities, nursing homes, residential programs and in outpatient programs. In the USA, the network of specialized post-acute services and providers has grown since the 1970s, when the observation was made that people with moderate and severe TBI could benefit from a continuum of rehabilitation services that enable them to live in their community rather than receiving limited care in nursing homes or being confined to psychiatric and other types of institutions. Recent work has focused on the development of models for chronic disease management for TBI, which can extend the duration of life as well as the quality of life of these individuals.

Despite the outcomes achieved by these services over the last decades, of late access to comprehensive rehabilitation in the US has been increasingly limited by third-party payers. This often occurs with the justification that there is no “Class I” evidence to support the provision of these needed services, inaccurately interpreting the absence of evidence as evidence of ineffectiveness. The outcome of this discriminatory process is that individuals with TBI are unable to receive care from which they could benefit, thereby limiting their recovery and increasing the burden of care on their families and society.

In 2014 the Brain Injury Association of America funded our group to develop guidelines as to what diagnostic, treatment, preventative and other services, whether medical, social, psychological or educational, should be provided and in what setting(s) and/or phases after injury onset. The project utilizes the GRADE (Grading of Recommendations Assessment, Development, and Evaluation) methodology and incorporates evidence from studies that are less than Class I. Where the evidence is weak or lacking, consensus recommendations developed by expert panels will be included. By disseminating the guidelines to patients, families, service providers, insurers and policymakers, we aim to answer the question that has plagued the brain injury field for nearly 30 years: Who should receive what type and approximate quantity of restorative, rehabilitative, diagnostic or preventative services?

To date, five panels of about 11 stakeholders each (persons with TBI, family members, clinicians, researchers) have developed 64 PICOT (Population, Intervention, Comparator, Outcome, Time point) questions to guide the identification and selection of potential evidence, in five areas: behavioral issues; cognitive rehabilitation; functional issues; chronic medical issues; vocational-community. Screening of abstracts (using the Covidence website) has been completed for most questions, and extracting of data (using the Systematic Review Data Repository) has started.

This presentation will highlight the PICOT questions, and some of the methodological challenges created by the large number of questions and the extensive literature at least potentially relevant to them.

Status: Accepted Presentation type: Poster

Category: Technology – clinical research/applications

Author's preference: Poster

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Objectives: Arm robots are the main drivers of repetitive, intensive task-specific rehabilitation training for neurorehabilitation. High costs and inconclusive functional gains prevent their widespread adoption as standard rehabilitation therapy tools. The H-Man planar arm robot, a compact low cost table-top, end-effector arm robot with up to 30N of arm assistance or resistance was tested in a stroke rehabilitation clinic.

Methods: A single-arm study with assessor-blinding was carried out over 1 year. Inclusion criteria were poststroke arm paresis (Fugl Meyer motor (FMM) score 20-50) at 4 to 24 months post stroke without contraindications to intensive arm exercise. Research interventions included 8 sessions over 2 weeks of H-Man robot training (60 minutes) followed by standard arm therapy (30 minutes), supervised by occupational therapists. Outcome measures were measured at baseline, after 2 (end of training) and 4 weeks. These were FMM, Action Arm Research Test (ARAT), grip strength (Kgf), pain (visual analogue scale 0-100), arm spasticity of elbow, wrist and finger flexors (Modified Ashworth Scale) and subjective ratings at week 2.

Results: A total of 7 males and 2 females (age 55.4 years, 366.6 days poststroke, FMM 40.17), were recruited. At weeks 2 (completion of training), and 4, there were no significant changes compared with baseline. The was a trend of improvement at week 2 for ARAT (+2.28, SD 3.8, P = 0.068) and grip strength (+0.99 Kgf, SD 2.61, P = 0.22) ; and at week 4 (ARAT +2.67, SD 4.7 P = 0.058) and grip strength (+0.98Kgf, SD 1.98, P = 0.12). There were no adverse events and all intended sessions and subjects were completed. Significant differences were observed between 2 healthy subjects and 2 strokes for spectral arc length, smoothness and peak velocity of movements. 80% of subjects rating their H-Man training as comfortable, useful and beneficial to their paresis.

Conclusions: The H-Man arm robot was successfully deployed in this feasibility trial. Due to the short training duration, modest gains were seen in arm impairments and strength. These initial results will form the basis for organisation of training paradigms for a larger randomised controlled trial.
Preoperative trepanation and drainage for acute subdural hematoma

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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**Objectives:**
Craniotomy is frequently used for the treatment of acute subdural hematoma; however, it exhibits a high mortality rate. Preoperative trepanation and drainage in an emergency ward may reduce intracranial pressure, shorten operation time and lower patient mortality, and is thus applicable to the treatment of acute subdural hematoma.

**Methods:** The present study reports the cases of two elderly patients that benefitted from trepanation and drainage of an acute subdural hematoma.

**Results:** In each case, the family members of the patients refused to consent to a craniotomy; thus, burr-hole drainage was selected as an alternative option for relieving intracranial pressure. The risks require careful evaluation when considering whether trepanation with drainage is an option for a patient. Following treatment, the two cases were cured and discharged on days 48 and 18 after admission, respectively.

**Conclusions:** The present case studies indicate that trepanation with drainage may be a promising approach for reducing craniotomy-associated mortality and closely monitoring condition variation in elderly patients. Following trepanation with drainage, certain patients do not undergo a craniotomy.
Whole Brain CT Perfusion Imaging at the Early Stage of Aneurysmal Subarachnoid Hemorrhage

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Objectives: To investigate the characteristics of perfusion in patients with acute aneurysmal subarachnoid hemorrhage (aSAH) to predict delayed cerebral ischemia (DCI) by whole brain computed tomography perfusion Imagings (CTP).

Methods: Thirty patients with aSAH at our institute from June 2013 to January 2014 were evaluated retrospectively. All patients underwent whole brain CTP examination within 72 h after SAH onset. The cerebral blood volume (CBV), cerebral blood flow (CBF), mean transit time (MTT) and time to peak (TTP) for 32 predefined regions of interest were measured. For patients with and without DCI, we compared perfusion qualitatively, quantitatively and semiquantitatively.

Results: The qualitative result of the perfusion maps showed that the DCI group had more positive cases on the CBF maps (P < 0.05), while two groups showed no statistically significant difference in the other CTP parameters. There was no statistically significant difference between patients with and without DCI upon quantitative analysis. Global and focal perfusion asymmetry on CBF maps in the DCI group was more obvious than that in the non-DCI group. Furthermore, focal asymmetry showed a greater statistically significant difference (P < 0.01) than the global asymmetry on CBF maps. However, no significant difference was demonstrated on the rCBV, rCBF, rTTP and rMTT of the watershed area.

Conclusions: The asymmetry of the CBF map change at the acute stage is helpful to predict the occurrence of DCI. This change is more likely to be a focal hypoperfusion. Whole brain CTP can detect cerebral microcirculation change during the acute stage of aSAH and has widespread application prospects in the study of the pathogenesis of DCI.

Key words: subarachnoid hemorrhage; delayed cerebral ischemic; CT perfusion imaging; cerebral microcirculation

Acknowledgement: This study was supported, in part, by the Wenzhou Municipal Science and Technology Project (Y201400290) and Nature Science Foundation of Zhejiang Province (Project No. LQ15H180002).
Normobaric hyperoxia treatment following fluid percussion injury in striatum of mice improved locomotors activity through neuroprotection and enhancement of dopaminergic system.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Fluid percussion injury (FPI) is most substantial method to mimic closed traumatic brain injury (CTBI). Majority of accident caused CTBI which leads to increase mortality rates in developing countries. However, sustainable therapeutic approach has not been established yet. Therefore, the present study was designed to evaluate the impact of normobaric hyperoxia treatment (NBOT) on striatum associated locomotors activity and dopamine genes after FPI.

Methods: Animals were divided four groups such as Group I control (n=15), Group II sham (n=15) (only cannula implanted), Group III FPI (n=15) and Group IV FPI with NBOT (n=15). Locomotors activity has been assessed using a new computerized well recognized behavior tool called IntelliCage, which is fully automated, controlled by software operation from computer attached to the system. Briefly, IntelliCage is equipped with four corner chambers accessible through a ring antenna. In each corner, two doors controlled the access to the two water bottles. Number of visit was recorded in the corners (visit - each time a transponder is read by the circular antenna in conjunction with a presence heat sensor). Animals were habituated in IntelliCage for 4 days following transponder implanted in mice neck region on 5th day. Locomotors activity of all four groups of animals has been assessed for 5 days for 6hr (9am-3pm) before inducing FPI. On 6th day, cannula was implanted on striatum, on 7th day FPI was performed in Group III (kept in normal environment) and IV (immediately exposed to NBOT for 3hr). Locomotors activity was assessed at 1st, 7th, 14th, 21st and 28th days following FPI in IntelliCage for 6hr. At the end of the behavior experiment, neuronal morphology and dopamine receptors (D1 and D2), Dopamine transporter (DAT) and Vesicular monoamine transporter (VMAT) were also assessed.

Results: The data suggested that FPI significantly impaired locomotors activity of mice as compared to control and sham in terms of less number of visits in all four corners of IntelliCage in associated with downregulation of dopamine genes. The immediate exposure to NBOT improved locomotors activity in terms of increased number of visits in all four corners as compared to FPI and upregulated dopamine genes and minimized neuronal damage.

Conclusions: Taken together these results concluded that normobaric hyperoxia exposure could improve the locomotors activity of mice following fluid percussion injury in striatum through prevent neuronal damage and enhancement of dopaminergic neurotransmission. The present study suggested that NBO treatment could be possible therapeutic approach for improving dopaminergic neurons as well as locomotors activity following closed traumatic brain injury victims.

Key words: Fluid Percussion Injury, Normobaric Hyperoxia Treatment, IntelliCage, Locomotors activity, Striatum, Dopamine and Neuroprotection.
The Optimal Opportunity Of Antenatal Taurine Improves Neuron and Neural Stem Cell Proliferation In Fetal Rats With Intrauterine Growth Restriction

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: To explore the effects of different periods of prenatal application of taurine on expression of proliferating cell nuclear antigen (PCNA) and fatty acid binding protein 7 (FABP7) in fetal rat brains with fetal growth restriction (FGR); To explore the effect of antenatal supplement of taurine on neurons and neural stem cells proliferation, and the best time of prenatal supplement taurine to promote fetal rat brain development with FGR.

Methods: All the low protein diet is adopted to establish fetal rats model with FGR, twenty-five pregnant rats were randomly divided into five groups: control group, FGR model group, FGR with day 9th antenatal taurine supplement group (E9 group), FGR with day 11th antenatal taurine supplement group (E11 group), FGR with day 15th antenatal taurine supplement group (E15 group). PCNA, FABP7 positive cells expression in fetal rat brain tissues were detected by immunohistochemistry stains in different time points.

Results: The results showed that: (1) The birth weight of fetal rat (g): In the control group, FGR group and E9 group, E11 group and E15 group are respectively: 6.61±0.45; 4.05±0.23; 5.37±0.17; 5.74±0.21; 5.00±0.24, The difference between the five groups was statistically significant (P<0.05); (2) The PCNA positive cell count of fetal rat brain tissue in the five groups (A / high power fields): In the control group, FGR group and E9 group, E11 group and E15 group are respectively: 31.03±5.38; 46.49±4.38; 59.65±5.37; 67.76±5.84; 53.53±6.94, compared with control group, PCNA positive cells count of FGR group and supplement taurine groups were increased, The difference was statistically significant (P<0.05), PCNA positive cells count of E11 group was significantly higher than other groups, the difference is statistically significant (P<0.05). (3) The FABP7 positive cell count of fetal rat brain tissue in the five groups (Integrated option density, IOD): In the control group, FGR group and E9 group, E11 group and E15 group are respectively: 350 544.16~552 921.96; 187 052.12~227 412.15; 311 589.99~355 943.24; 336 921.13~424 373.59; 236 412.85~321 521.25, The difference was statistically significant (P<0.05). FABP7 positive cells expression of E11 group was significantly higher than other groups, the difference is statistically significant (P<0.05).

Conclusions: The result of this study show that antenatal supplementation of taurine can promote neurons and neural stem cell proliferation in fetal rat with FGR, especially, the 11 days of pregnancy complement effect is best. This work was supported by the National Natural Science Foundation of China (81471087). Address for correspondence: Prof. Dr. Jing Liu, Email: Liujjingbj@live.cn
Coping with Communication Breakdown: The Effectiveness of a New Intervention for Adults with Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Impaired communication is a well-documented and enduring consequence of traumatic brain injury (TBI). As a result of this impairment, people with TBI frequently experience communication breakdown. Everyday interactions are stressful and close others often judge communication breakdown as one of the most problematic consequences of the injury. Typically, we use communication-specific coping strategies to address communication breakdown. Productive strategies enhance communication while non-productive strategies do little to resolve problems. The aim of this research was to evaluate the effectiveness of a new treatment, Communication-specific Coping Intervention (CommCope-I), which specifically targets coping in the context of communication breakdown.

Methods: Participants were 8 men and 5 women with severe TBI (GCS scores: 3 - 8). Mean age was 35.2 years (SD 9.3) and mean time postinjury was 7.6 years (SD 5.2). The structured intervention program runs over 6-weeks and focuses on personally-relevant productive coping strategies identified collaboratively with the client. Productive coping scripts are developed and practiced through a series of graded scenarios that are evaluated with the aid of video recording. The project involved 3 phases: 1) A Control/Pre-intervention Wait Phase (6 weeks), 2) The Treatment Phase (6 weeks) and 3) The Follow-up Phase (12 weeks). Repeated measures ANOVA with planned pairwise comparisons were used to test the significance of change over time. Where the assumption of sphericity was violated, Greenhouse-Geisser correction was applied. Effect size was indexed by partial eta squared.

Results: The intervention elicited statistically significant improvements in communication-specific coping, functional communication and stress that were maintained up to 3 months post treatment. Positive changes in interpersonal communication were evident in clinician blind ratings. Clients reported significant reduction in stress at the end of treatment and 1 and 3 months later. Positive changes were perceived by close others who reported a significant increase in observed use of productive strategies following treatment that was maintained for 3 months.

Conclusions: This intervention provides a promising means of reducing communication dysfunction and its negative consequences for people with TBI.
“Nobody Wants to Know You.” Understanding the Experience of Friendship Following Severe Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: Relationships with others are the most frequently reported source of life meaning across the lifespan and have been shown to make an important contribution to well-being and the maintenance of a positive sense of self-worth. For those who sustain traumatic brain injury (TBI), life is frequently characterised by declining interpersonal relationships and increasing social isolation. The aim of this study was to understand the postinjury experience of friendship from the perspective of adults with severe TBI.

Methods: Twenty-three adults who had sustained severe TBI participated in this project. On average 10 years had elapsed since the injury and the majority of participants were between 25 and 45 years old. They all lived in the community with family or paid support. The experience of friendships, particularly their source and quality, was explored using mixed methods (quantitative measures and in-depth interviews). Qualitative analysis of interview transcripts moved through a process of data-driven open and focussed coding to reveal emergent themes and categories.

Results: Friendship was primarily characterised through three themes: the sense of loss, a lack of understanding and a desire to share. Participants nominated a mean of 3.35 (SD 2.19) friends. When paid carers and family members were not included, the mean dropped to 1.52 (SD 1.38) and 14 participants (61%) described having no friends. Only three of the 23 participants (13%) had maintained preinjury friendships. Postinjury enduring friendships had been developed during rehabilitation, through work and leisure activities and as a result of shared living arrangements.

Conclusions: Participants’ stories clearly illustrated how rehabilitation can focus on friendship by supporting already established relationships through education and facilitating access to chosen activities that bring with them new interpersonal encounters and opportunities to share experiences.
Effect Of Antenatal Taurine Supplementation On PirB Expression In Brain Fetal Rat With Intrauterine Growth Restriction

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: To explore the expression of paired immuoglobin-like receptor B (PirB) in fetal rat brain tissue with intrauterine growth restriction (IUGR) and the influence of antenatal taurine on its expression.

Methods: Eighteen pregnant rats were randomly divided into 3 groups: normal control group, IUGR models group (IUGR group) and the IUGR + antenatal taurine supplement group (taurine group) (n=6). IUGR models were induced by low protein diet throughout gestation period. Three fetal rats were randomly selected from each nest and were sacrificed to obtain the brains. The PirB positive cell counts were detected by immunohistochemistry, the PirB protein contents were detected by Western Blot and the level of mRNA expressions of PirB gene were detected by Real time-PCR.

Results: Control group, IUGR group, taurine group: 1) the PirB positive cell counts in the three groups were respectively 18.40±1.52, 66.17±3.66, 21.17±2.71; 2) the PirB protein semi-quantitative analysis results respectively 0.05, 0.31, 0.09; 3) the level of PirB mRNA 2-ΔΔCT numerical respectively 1(0.87,1.15), 0.08(0.06,0.11), 1.22(0.97,1.55). Compared control group and taurine group with IUGR group, PirB positive cell counts were lower than that of IUGR group, PirB mRNA and protein expression were lower than that of IUGR group. The differences of comparing IUGR group with taurine group were statistically significant (p<0.05).

Conclusion: The results of this study shows that the expression of PirB in fetal rat brain tissues was higher in IUGR groups than that in controls while antenatal taurine can significantly decrease its expression, which suggested that antenatal taurine may play a protecting role by inhibiting the expression of PirB in fetal brain tissues. This work was supported by the National Natural Science Foundation of China (81471087). Address for correspondence: Prof. Dr. Jing Liu, Email: Liujingbj@live.cn
Successful return to work after acquired brain injury, opportunities and barriers from a patient perspective

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Background: Acquired brain injury (ABI) is often a lifelong disability that entails a marked change in a person's life. It involves biopsychosocial levels and return to work (RTW) is one of the main goals for the person. Several of those suffering an ABI are of working age. The society and the individuals are both winners if the person could get back to work and sustain working.

Objective: The aim of this study was to increase knowledge about the opportunities and barriers for successful RTW among individuals with ABI.

Methods: Adults who have ABI and had participated in work rehabilitation were interviewed in regard to their experiences of the process. The informants (5 females, 5 males) had participated in work rehabilitation, had successfully RTW and had worked at least 50% in at least a year after the injury. The interviews were transcribed, structured and analyzed by latent content analysis with a hermeneutic approach.

Results: Three main themes that influenced RTW after ABI were identified: (i) individually adapted rehabilitation process, (ii) motivation for RTW and (iii) cognitive abilities and inabilities.

The results indicate that an individually adapted vocational rehabilitation (VR) process was an important issue. The individuals with ABI actively involved in their own rehabilitation process also required continuous support from the society, the specialists, their employers and colleagues, this support has to be designed for each individual. A moderate level of motivation for RTW was necessary for the best result to RTW in other words it was important to achieve a balance between too high and too low motivation. Finally, a comprehensive knowledge about the cognitive abilities and inabilities of the individual after ABI helped the individuals and their employers to find compensatory strategies to handle their work tasks.

One implication of the findings was the necessity of a good support system and a good VR that functions well and lasts for a longer period. When there are obstacles in the VR process, it is important to have strategies and awareness of how to proceed further.

Conclusions: Consequently the support built for a person individually, with a balanced motivation, knowledge about the cognitive abilities and awareness of how to proceed further in the process will help to build a successful and sustainable RTW.
This work aimed the development of a geometrically accurate brain model with the inclusion of the gyri and sulci, obtained by segmentation of magnetic resonance images (MRI). In order to validate the model, an impact numerical simulation was performed using finite element analysis (FEA), assigning the same material property to the whole brain model. The results were compared with the data obtained by Willinger et al. 1999 regarding the pressures at five locations: frontal, two occipital, parietal and at the posterior fossa. Different responses were observed, that may be due to the increased geometrical accuracy of the model.
Adherence to Guidelines in Adult Patients With Traumatic Brain Injury: A Systematic Review

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: Guidelines aim to improve the quality of medical care and reduce treatment variation. The extent to which guidelines are adhered to in the field of traumatic brain injury (TBI) is however unknown. The objectives of this systematic review were to (1) quantify adherence to guidelines in adult patients with TBI, (2) examine factors influencing adherence, and (3) study associations of adherence to clinical guidelines and outcome.

Methods: We searched EMBASE, MEDLINE, Cochrane Central, Pubmed, Web of Science, PsycINFO, SCOPUS, CINAHL, and grey literature in October 2014. We included studies of evidence-based (inter)national guidelines that examined the acute treatment of adult TBI patients. Two reviewers independently extracted data and assessed methodological quality of included studies. Methodological quality was assessed using the Research Triangle Institute item bank and Quality in Prognostic Studies Risk of Bias Assessment Instrument.

Results: Twenty-two retrospective and prospective observational cohort studies, reported in 25 publications, were included, describing adherence to 13 guideline recommendations. Overall, the methodological quality of studies was good, with the majority of studies judged at low risk of bias in most domains. Guideline adherence varied considerably between studies (range 18% - 100%) and was higher in guideline recommendations based on strong evidence compared to those based on lower evidence. A number of patient-related factors, including age, Glasgow Coma Scale and intracranial pathology, were associated with greater guideline adherence. Guideline adherence to Brain Trauma Foundation guidelines seemed to be associated with lower mortality.

Conclusions: Guideline adherence in TBI is suboptimal and wide variation exists between studies. Guideline adherence may be improved through the development of strong evidence for guidelines. Further research specifying hospital and management characteristics that explain variation in guideline adherence is warranted.
Predicting Major Depression and Post-traumatic Stress Disorder after Traumatic Brain Injury: A Systematic Review

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: While it is known that major depressive disorder (MDD) and posttraumatic stress disorder (PTSD) are prevalent after traumatic brain injury (TBI), little is known of factors predicting these psychiatric conditions. This knowledge could however provide physicians and patients information about prognosis and can help decide whether specialized follow-up care or early treatment might be useful. We therefore performed a systematic review of predictors and prediction models of MDD and PTSD after TBI.

Methods: We searched EMBASE, MEDLINE, Cochrane Central, PubMed, PsycINFO, and Google Scholar in January 2015. We identified studies in civilian adults with TBI reporting on predictors or prediction models of either MDD or PTSD. We only included studies using structured diagnostic interviews to diagnose MDD or PTSD, because self-reports from TBI patients may be unreliable due to the overlap between psychiatric symptoms and disorders, memory deficits associated with TBI, and evidence that TBI patients tend to underestimate their functional problems. Two independent reviewers extracted data according to the critical appraisal and data extraction for systematic reviews of prediction modelling studies (CHARMS) checklist. Methodological quality was assessed using the Quality in Prognostic Studies (QUIPS) Risk of Bias Assessment Instrument.

Results: We included 23 observational studies assessing predictors or prediction models of MDD (n = 16) and/or PTSD (n = 8). Overall methodological quality of the included studies was satisfactory, although the majority of studies that assessed the effect of single predictors did not adjust sufficiently for potential confounding factors. The included studies showed that MDD and PTSD after TBI were not predicted by demographic variables or TBI severity. MDD was strongly related to preinjury depression and some intracranial abnormalities. PTSD was predominately related to post-injury factors such as coping and early stress symptoms. Having a memory of the traumatic event also increased the likelihood on developing PTSD. Methodology of the studies that developed a prognostic model was poor; all models were at risk for overfitting, since they included too many candidate predictors given their sample size.

Conclusions: Currently available prediction studies of MDD and PTSD after TBI suffer from methodological shortcomings, but can form the basis for future development of a prediction model from a large sample of TBI patients using a limited set of predictors.
Rehabilitation After Severe Traumatic Brain Injury in Europe: A Survey Study

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – public policy and advocacy

Author's preference: Oral

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Objectives: Severe traumatic brain injury (sTBI) is a lifelong disorder and the final outcome is determined by many factors that may differ in the acute, subacute and chronic phases. As rehabilitation after sTBI is crucial to improve physical and cognitive functioning, the objective of this study was to describe structure and process characteristics of acute in-hospital rehabilitation and referral to post-acute rehabilitation centers across Europe.

Methods: Between December 2014 and August 2015, the principle investigators (PIs) of 75 hospitals from 21 European countries, participating in a prospective European multicenter study (CENTER-TBI), were approached to complete a set of questionnaires about structure and process characteristics of TBI care. All these hospitals provide acute care to TBI patients. One of the questionnaires addressed acute in-hospital rehabilitation and referral to post-acute rehabilitation centers. The questionnaire was developed based on literature and expert validation and was subsequently pilot-tested. Reliability of the total set of questionnaires was estimated by calculating concordance rates between questions that were asked twice in different questionnaires (5% of the questions).

Results: 66 (88%) hospitals completed the rehabilitation questionnaire by August 2015. Reliability was satisfactory (median concordance rate: 0.78). The included hospitals predominately represented academic hospitals (94%) with a level I or II trauma center (76%). There was variation in the structure and process of rehabilitation; e.g. 42 hospitals (65%) indicated to have rehabilitation physicians who can be consulted for TBI patients. In half of these hospitals (n=21), a multidisciplinary rehabilitation team could be consulted. Surprisingly, only 11 (18%) hospitals indicated to use guidelines for rehabilitation of TBI patients.

Age has a major influence on referral decisions in 43% of the hospitals. In these hospitals, younger patients were usually referred to specialized rehabilitation centers, while elderly patients (age ≥ 65 years) were more often referred to nursing homes or local hospitals. The waiting time for referral was usually no longer than one month and in the majority of hospitals (82%) there was structural collaboration with rehabilitation institutes in the region. Hospitals were generally satisfied with the quality of rehabilitation care, but were less satisfied with the distance to rehabilitation centers and the availability at short notice.

Conclusions: Variation exists in structural and process characteristics of in-hospital acute rehabilitation and referral to post-acute rehabilitation centers among 66 centers treating patients with acute neurotrauma across Europe. Considering the complex needs of persons with brain injury, establishing regional or national disparities in providing services within an integrated regionalized structure will assist in providing more effective access to health services for this population. Greater emphasis should be placed on creating collaborative partnerships and networking with all partners to build capacity and effective services within their regions.
Identifying cognitive impairment in TBI: a novel multivariate approach

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Background: Traumatic brain injury (TBI) often results in persistent cognitive impairment, which hampers rehabilitation and reduces well-being. Typically, cognitive impairment after TBI is defined by considering neuropsychological test results independently. However, classifying patients as cognitively impaired may be more sensitively performed by considering performance across a range of cognitive domains. Multivariate classification techniques, such as Multivariate Normative Comparison (MNC), provide a method to do this by integrating information across multiple cognitive tests. Importantly, if these cognitive impairments have underlying neuroanatomical correlates, there are implications for prognosis and future treatment decisions after TBI. Therefore, we used MNC to define cognitive impairment across multiple domains and then determine whether these patients show alterations in brain structure compared to both ‘unimpaired’ TBI patients and controls.

Objectives: To investigate the relationship between a multivariate classification of cognitive impairment and white matter damage.

Methods: 45 patients with moderate to severe traumatic brain injury (TBI) and 48 healthy controls underwent cognitive testing and diffusion tensor imaging. We assessed cognitive domains commonly affected in TBI patients such as memory, information processing and executive function. The presence of cognitive impairment was defined using two different statistical methods: a conventional univariate analysis and MNC. Agreement in classification between these approaches was then assessed. Voxel-wise statistical analysis of fractional anisotropy (FA) using Tract Based Spatial Statistics (TBSS) was applied to determine differences in white matter structure, based on either univariate or MNC classification of cognitive impairment.

Results: MNC classified 50% more TBI patients as cognitively impaired compared to the univariate method (univariate, cognitively impaired N = 10, MNC, N = 15). TBSS analysis demonstrated that TBI participants classified as impaired by MNC had significantly lower FA in multiple white matter regions, compared to unimpaired TBI participants. Significantly lower FA was also found when comparing all TBI participants to healthy controls.

Conclusions: Using MNC, our analysis classified a greater proportion of TBI patients as cognitively impaired, relative to a classification that considers neuropsychological test results independently. These MNC-defined TBI patients had global alterations in white matter, suggesting that the global impairments in cognition identified by MNC may reflect neuroanatomical changes after TBI.
BDNF Met/Met Genotype is Associated with Increased Lifetime Risk for Concussion in Active Duty Soldiers

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: Genetic risk factors for concussion in athletes, civilians, and active duty military service members are poorly understood. We recently discovered that U.S. soldiers with the brain derived neurotrophic factor (BDNF) Met/Met genotype were more likely to sustain a concussion during deployment to the Middle East than those without that genotype. Based on those results, we hypothesized that active duty service members with the BDNF Met/Met genotype would have a greater lifetime history of concussion before military deployment.

Methods: Pre-deployment genetics and self-reported concussion history data from 423 male soldiers were analyzed. Blood-serum was analyzed for the BDNF genes. 0.5 μl extracted DNA per sample was amplified at the BDNF region using 0.125 μl iTaq polymerase enzymes and 0.5 μl BDNF-specific primers (Eurofins). Primers for BDNF Val66Met were as follows: forward 5’ AAA CAT CCG AGG ACA AGG TG 3’ and reverse 5’ ACG TGT ACA AGT CTG CGT CC 3’. Reaction volume was 25 μl with 0.75 μl 50mM MgCl₂, 0.5 μl10mM dNTP mix, and 2.5 μl iTaq 10X Buffer. PCR conditions were: 5 min at 94°C, followed by thirty 30s cycles of 94°C, 60°C and 72°C. The PCR was terminated at 72°C for 10min and held at 4°C. The product of this amplification was digested with 1 μl Pml I enzyme (Biolabs) at 37°C for 16h into genotype-specific fragments, which were then separated by electrophoresis in a 3% metaphor agarose gel, stained with Ethidium Bromide.

Results: The BDNF Met/Met genotype was uncommon, occurring in only 4.3% of soldiers (18/423). For those with the BDNF Met/Met genotype, 61.1% (11/18) had a history of 1 or more prior concussions, compared to 36.8% (149/405) of those with other BDNF genotypes [χ²(1) = 4.335, p = .037, RR = 1.661, 90% CI = 1.054 – 2.205], and 38.9% (7/18) with BDNF Met/Met had 2 or more prior concussions compared to 23.0% of those with other BDNF genotypes [93/405; χ²(1) = 2.421, p = .120, RR = 1.694, 90% CI = 0.871 – 2.729].

Conclusions: The BDNF Met/Met genotype was associated with greater lifetime history of concussion in active duty soldiers. This intriguing finding requires replication.
ApoE Genotype and Lifetime Risk for Concussion in Active Duty Soldiers

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: Little is known about genetic risk factors for sustaining a concussive injury to the brain. In two past studies, college athletes with the Apolipoprotein E (ApoE) ε4 allele were statistically more likely to have a history of concussions, although a third did not show this association. Therefore, we hypothesized that active duty military service members with the ApoE ε4 allele would have a greater lifetime history of concussion than those who do not have this genotype.

Methods: Pre-deployment genetics and self-reported concussion history data from 430 male soldiers were analyzed. Blood-serum was analyzed for the APOE genes. A direct ApoE kit (EzWay Direct ApoE Genotyping Kit, Koma Biotechnology), following manufacturer’s instructions, was used for amplification and digestion of the ApoE gene from extracted DNA. Genotype-specific fragments were separated by electrophoresis in a 3% metaphor agarose gel, stained with Ethidium Bromide.

Results: For those with ε3/ε4 or ε4/ε4, 47.0% (39/83) had a history of 1 or more prior concussions, compared to 35.4% (123/347) of those who did not have these genotypes [χ²(1) = 3.800, p = .051, RR = 1.326, 90% CI = 1.027 – 1.664]. For those with ε3/ε4 or ε4/ε4, 22.9% (19/83) had a history of 2 or more prior concussions, compared to 23.9% (83/347) of those who did not have these genotypes. Comparing those with ε2/ε2 or ε2/ε3 to those with ε3/ε4 or ε4/ε4, 36.0% (18/50) of those with ε2 genotype compared to 47.0% (39/83) of those with ε4 genotype had a history of 1 or more prior concussions [χ²(1) = 1.538, p = 0.215, RR = .766, 90% CI = .504 – 1.128]. The rates of 2 or more prior concussions were very similar between those with ε2/ε2 or ε2/ε3 genotypes (12/50; 24%) and those with ε3/ε4 or ε4/ε4 genotypes (19/83; 22.9%).

Conclusions: There was a trend for soldiers with ApoE ε3/ε4 or ε4/ε4 to have a greater history of 1 or more prior concussions compared to those who did not have these genotypes. A larger study is needed to determine if there is an association between these genotypes and lifetime history of concussion.
Return to work outcomes of vocational rehabilitation after acquired brain injury: a comparison between two different approaches

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Objectives: Return to work (RTW) after acquired brain injury (ABI) is not always self-evident: about 40% of the people is able to return to work within two years after ABI. There are indications that specialist vocational rehabilitation (VR) could have a positive effect on RTW after ABI. Two existing approaches of vocational rehabilitation are the case coordination model (key components are the monitoring of the VR process by a case coordinator, integration of VR into an overall individualized rehabilitation plan, a focus on early intervention, continuity of care, and coordination of VR with other post-acute rehabilitation services) and the supported employment model (key components are a quick job placement with minimal pre-employment training, individualized training and advocacy on the worksite, and job coaching on a one-to-one basis until job competence is reached). The Early Vocational Rehabilitation (EVR) and the Late Vocational Rehabilitation (LVR) interventions are designed based on the principles of the case coordination model and the supported employment model, respectively, and are part of usual care in two different rehabilitation centers. Although with different (starts of) activities over time, both interventions aim to support people with ABI during their standard rehabilitation process to RTW. The objective of the study was to evaluate and compare the effects on RTW outcome of both interventions at 3, 6, 9, and 12 months after the start of the rehabilitation process.

Methods: A longitudinal, prospective study was performed. Thirty-three patients participated in the study: 22 patients following EVR and 11 patients following LVR. All patients started inpatient or outpatient rehabilitation between July 18th, 2011 and September 1st, 2012 because of non-progressive ABI (due to a traumatic or non-traumatic cause). Patients had paid jobs before ABI. Outcome measure was the percentage of patients who achieved RTW. Data was gathered with self-designed questionnaires. A Chi-square test was performed to detect statistical significant differences (p≤0.05) between the EVR and LVR group in %RTW at 3, 6, 9, and 12 months after the start of the rehabilitation process.

Results: In the EVR group 32%, 58%, 79%, and 88% RTW was achieved at 3, 6, 9, and 12 months after the start of the rehabilitation process. In the LVR group %RTW was 40%, 67%, 89%, and 78% RTW was achieved at 3, 6, 9, and 12 months after the start of the rehabilitation process. No statistical significant differences (p=0.48-0.66) between the groups were found.

Conclusions: In this small study, no differences in RTW outcome between both vocational rehabilitation approaches were found. More than three-quarter of the patients in both groups were able to start working within one year after the start of the rehabilitation process.
Marked variability in inpatient paediatric rehabilitation pathways in the UK: does this matter?

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: No preference

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Objectives: UK services for paediatric rehabilitation after ABI have developed reactively in an ad hoc manner. Provision is very geographically heterogeneous. A single large independent non-profit organisation provides residential paediatric rehabilitation (The Children’s Trust, TCT) in the south east of England. It is not clear whether these disparities in provision are associated with differences in severity-adjusted outcome. Futures (www.futuresrehabproject.info) is a planned national prospective cohort study intended to seek differences in severity-adjusted outcome and relate these to rehabilitation treatment delivered. In preparation for this study a review of existing patterns of service provision and referral nationally was completed.

Methods: Data were collected from an online survey completed by current service providers within the National Health Service (NHS) and independent sectors. Additionally a large NHS dataset of all UK hospital admissions (Hospital Episode Statistics, HES) that tracks all inpatient hospital episodes, including inter-hospital transfers, was searched for likely rehabilitation episodes based on the concurrence of a primary diagnosis with the potential for causing ABI such as stroke or traumatic brain injury in an under-18 year old, followed by a consolidated inpatient length-of-stay of > 28 days.

Results: Survey results confirm geographic heterogeneity in rehabilitation pathways for children in the UK with widely varying rates of referral to TCT, and varying approaches to step-down rehabilitation provision via more local district hospitals. Referral rates to TCT correlate with distance. A minority of potentially eligible children are accessing TCT.

Conclusions: There is marked variability in inpatient paediatric rehabilitation pathways in the UK. The planned cohort study will seek evidence of differences in severity-adjusted outcome attributable to differences in rehabilitation delivered. The aim of this preliminary study has been to identify candidate centres with very contrasting rehabilitation pathways for the planned cohort study.

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5 days of left prefrontal transcranial direct current stimulation improve sign of consciousness in 50% of chronic minimally conscious state.

Status: Accepted  Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Poster

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Objectives: A recent study showed that single-session anodal transcranial direct current stimulation (tDCS) applied to the left dorsolateral prefrontal cortex (LDLPF) transiently improves consciousness in 43% of patients in minimally conscious state (MCS) (1). We here test the potential effects and safety of repeated tDCS in severely brain-damaged patients with MCS.

Methods: In this double-blind cross-over sham-controlled experimental design, we delivered two sessions of repeated (5 days of stimulation) tDCS, either anodal or sham in a randomized order. We stimulated the LDLPF cortex during twenty minutes in 20 MCS patients (12 men, aged 48±16 years, time since onset 78±95 months, 12 post-traumatic). Consciousness was assessed by the French adaptation of the Coma Recovery Scale Revised (CRS-R; 2) before and after each stimulation.

Results: A treatment effect was observed for the comparison between CRS-R total scores at baseline and after 5 days of real tDCS (p<0.01). Behaviorally, 10/20 patients showed a tDCS-related improvement; 5 patients responded after the first stimulation and 5 other patients responded after 2, 3 or 4 days of stimulation. No side effect (e.g. epilepsy) was reported.

Conclusion: Our results demonstrate that repeated (5 days) anodal LDLPF tDCS is safe and might improve signs of consciousness in about half of patients in MCS. It is important to note that the first session is not predictive for a future positive effect of the efficacy of the non-invasive electrical stimulation.


Investigating Symptoms of Depression and Concussion in Adolescent Athletes Devoid of Concussive Injury.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: A number of objectives have been outlined for this study. i) investigate the prevalence and describe the relationship between self-reported symptoms of depression and concussion among adolescent athletes (in the absence of concussion injury), ii) investigate the relationship between participant sex and self-reported symptoms of concussion and depression (in the absence of concussion injury) and iii) investigate the relationship between participant medical history (i.e. history of concussion, depression, anxiety or learning disability) and ongoing self-reported symptoms of concussion and depression (in the absence of concussion injury).

Methods: Athletes enrolled within various community level sport organizations across the Greater Toronto Area will be invited to participate. Athletes participating in mandated baseline testing conducted by community-based concussion management clinics in Toronto, Ontario, are also invited to participate. Approximately 150 adolescent athletes (males and females between 13-18 years old) participating in various sports (e.g. lacrosse, soccer, hockey, rugby) and levels of competition (e.g. house league, all-star, rep, provincial and national leagues) will be sought. Primary outcome measures utilized within this investigation include The Post-Concussion Scale (PCS) and The Mood and Feelings Questionnaire (MFQ). The PCS will be used to document the presence of concussion-like symptoms (in absence of a concussive injury). Symptoms of depression will be documented via the MFQ. Demographic and medical histories will also be collected. This is a descriptive investigation. Surveys will be administered once at various points throughout an athlete's competitive season.

Results: Depression and concussion symptom scores will be described relative to participant age, sex and medical history (i.e. prior history of depression, history of concussion). Results will delineate concussion and depression symptom differences between males and females and describe athletes involved in various sport disciplines a priori, devoid of concussive injury.

Conclusions: Findings will clearly describe adolescent athlete mental health status and concussion symptoms prior to injury. Findings will be utilized to provide rationale for secondary research, investigating concussive injury incidence and the effect of proactive mental healthcare interventions specific to this population.
Predictors of inpatient (neuro) rehabilitation after acute care of severe traumatic brain injury: an epidemiological study

Status: Accepted  Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: To describe severe traumatic brain injury (sTBI) patients' discharge destination after acute care. To identify predictors associated with inpatient rehabilitation (versus discharge home) and to identify predictors associated with neurorehabilitation (versus general rehabilitation).

Methods: National, multi-centre, prospective study with adult survivors after sTBI (abbreviated injury scale head score >3) in Switzerland. Univariate and multivariate logistic regression models included patient characteristics, pre-injury conditions, initial neuro-physiological assessment, trauma mechanisms, severity of TBI, and prehospital conditions to find predictors of discharge destination.

Results: Out of the 566 included patients, 341 (60%) were referred to inpatient rehabilitation, thereof 249 (73%) to neurorehabilitation; 225 (40%) were discharged home or to a nursing home. Lower scores on the Glasgow Coma Scale at admission/at 14 days, higher injury severity scores, and older age were predictors for inpatient rehabilitation. Younger age and male gender were predictors for neurorehabilitation.

Conclusions: Patients' pathways after acute care are not only determined by the severity of their brain injury but also by their overall injury severity and socio-biological factors. More than half of the patients after sTBI are not discharged to specialized inpatient neurorehabilitation, and therefore, efforts should be taken to optimize post-acute care.
Family Protection of Emotional and Physical Safety of Patients with TBI during Hospitalization

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Background: Traumatic brain injury (TBI) is a chronic disease that has tremendous lifetime implications for patients with TBI and their families. Family members play an essential role in supporting patients with TBI during the hospitalization process, including emotional support, decision-making, and goal-planning. Yet, most literature that includes family members’ perspectives after a loved one sustains a TBI only focuses on the families’ perceived needs, emphasizing the lack of available resources. To our knowledge, no studies have focused on family experience during the hospital stay or the work that the families do during this time.

Objectives: To address these gaps in knowledge, the purpose of this study was to investigate: 1) the experience of family members while that patient with TBI is in the hospital and 2) the work that the family is engaged in during the hospital stay.

Methods: We interviewed 15 patient-family dyads during in-patient rehabilitation, and analyzed results using grounded theory, a qualitative methodology.

Results: Findings included the focus of family work during hospitalization is protecting emotional and physical safety of their injured relative during hospitalization. A primary strategy for protecting emotional safety was managing visitors who intended to see the patient while in the hospital. Families identified visitors who might pose emotional threats to the patient and also managed the number, frequency, and timing of visits. Families also assessed the motivation of visitors and discouraged some visitors from coming while encouraging others. Families reported minimal collaboration with hospital staff when managing visitors. Strategies to protect the patient’s emotional safety varied by stage of recovery, from initial post-injury care, to rehabilitation, to return home. In relation to physical safety, families worked to prevent re-injury and attempted to change care staff when they perceived assigned care staff were providing inadequate care. Participants also shared concerns about difficulty managing other outside responsibilities while the patient was hospitalized.

Conclusions: These findings have implications for how to best support family members during their loved one’s hospitalization and for education and training of healthcare providers who care for patients with TBI.
Fatigue in the First Year after Traumatic Brain Injury: Relationship with Injury Severity and Correlates

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: The objectives of this study were (1) to describe the course of subjective fatigue at three time points in the first year after traumatic brain injury (TBI) according to injury severity, and (2) to explore correlates of subjective fatigue, separately at each time point.

Methods: Participants were aged 18-65 years, had sustained a mild, moderate, or severe TBI, and were admitted to a Level I trauma centre in Québec, QC, Canada. The final sample included 210 participants (mean age = 42.2 ± 15.2 years; 23.8% women; 48.6% mild, 33.8% moderate, 17.6% severe TBI). Participants completed questionnaires at three time points: 4, 8, and 12 months post-TBI. The main outcome measure was the Multidimensional Fatigue Inventory (MFI), which includes five subscales: general fatigue, mental fatigue, physical fatigue, reduced activity, and reduced motivation. Questionnaires also included validated self-reported measures of depressive and anxiety symptoms, insomnia, pain, and cognitive functioning. For the first objective, severity X time generalized estimating equations (GEEs) were computed for each MFI subscale. For the second objective, multiple linear regressions were performed, separately for each assessment (4, 8, 12 months), with the MFI total score as the dependent variable and the following potential predictors: age, sex, TBI severity, work status, depression symptoms, anxiety symptoms, insomnia, pain, and cognitive functioning.

Results: A significant effect of TBI severity was found for mental fatigue, physical fatigue, and reduced activity, with higher fatigue after severe compared to moderate TBI. The Time effect was significant for mental fatigue, with higher scores at 12 than 8 months post-TBI. The severity X time interaction was significant for all subscales except for reduced motivation, and the general pattern was a reduction of fatigue over time after mild TBI, fairly stable fatigue after moderate TBI, and a gradual increase of fatigue after severe TBI. Results of the multiple linear regressions revealed that fatigue was significantly related to greater depression, insomnia, and cognitive symptoms at all three times, by greater pain at 4 and 8 months, and by unemployment at the 12-month assessment only.

Conclusions: Results from this longitudinal study revealed that injury severity has a significant influence on the course of subjective fatigue in the first year after TBI. Overall, fatigue levels appeared to be similar to chronically unwell individuals (Lin et al., 2009). Our findings also corroborate the literature regarding the close relationship between fatigue and depression, cognition, insomnia, and pain. In the case of pain, results suggested a diminishing influence on fatigue over time. Conversely, work status was increasingly related to fatigue with time. This research protocol is being prolonged to follow participants up to four years post-injury to document how fatigue evolves beyond the first year for the different injury severity subgroups.
Psychiatric Outcomes From Hockey Concussion: A Narrative Review

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: This narrative review aimed to examine current literature on the psychiatric symptoms after hockey related concussions and current guidelines for screening and return to play.

Methods: A systematic search in nine databases was conducted with MeSH terms that incorporate the concepts of concussion AND hockey AND mental health. The identified papers were reviewed for relevance by 3 reviewers and the resulting 21 articles were selected. Main outcome measures: Narrative review

Results: There exists a scarcity of knowledge related to psychiatric outcomes following concussion in ice hockey. There are no systematic epidemiological studies on the prevalence of psychiatric outcomes post hockey-specific concussion. Although there is mention in current guidelines of these adverse outcomes, there are no evidence based screening tools that accurately identify psychiatric symptoms, nor is there any level A evidence on how to treat these psychiatric outcomes.

Conclusion:

1. Ice hockey has a higher or equivocal rate of concussion compared to other high-risk sports.

2. There is evidence of an increased risk of depression, anxiety and suicide following concussion. However, there is currently limited research to direct development of guidelines around post-concussive psychiatric outcome assessment and management within ice hockey.

3. It is critical that research should be focused on psychiatric outcomes following ice hockey concussion. Future research in this area could inform validated clinical assessments for evaluating and managing psychiatric outcomes following ice hockey concussion.
Background: Each year in the United States, over 200,000 older adults aged 55 years or older sustain a traumatic brain injury (TBI). TBI causes significant cognitive and physical impairments, which have tremendous implications for patients and their families. Family members play an essential role in supporting patients during hospitalization, including emotional support, decision-making, and goal-planning. Literature focusing on family members during the patient’s hospital stay typically describes families’ perceived needs, emphasizing lack of available resources. To our knowledge, no studies have focused on families’ experience and the work families do during the hospital stay.

Objectives: The purpose of this study was to investigate: 1) the experience of family members during the patient’s hospitalization and 2) the work the family is engaged in during hospitalization.

Methods: We interviewed 15 patient-family dyads during in-patient rehabilitation, and analyzed results using grounded theory, a qualitative methodology.

Results: Findings showed, in contrast to caregivers of younger adults, whose focus was on emotional safety, caregivers of older adults focused on physical safety. Caregivers of younger adults had significant control over the patient’s post-discharge contacts and activities, whereas most caregivers of older adults had relationships where they couldn’t control the patient’s activities. Instead of directly controlling the older adult’s activities, caregivers found other strategies to control the environment to keep the patient physically safe.

Conclusions: Findings have implications for how to best support family members during hospitalization of an older adult and how supporting caregivers of older adults may be different than supporting caregivers of younger adults.
Nurses’ Perceptions of Caring for Patients with TBI

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: No preference

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Background: Nurses play an integral role in care of hospitalized patients with moderate or severe traumatic brain injury (TBI), including assessment, coordination of care, education, and emotional support. Patients and families are often concerned about the care they are receiving, do not know what to expect, and seek information from healthcare providers. Nurses are often in a position to provide such information. Thus, it is imperative that nurses are knowledgeable about care of patients with TBI, including current research, evidence-based practice guidelines for symptom assessment, treatment recommendations, and appropriate discharge instructions. However, research has shown knowledge gaps and practice inconsistencies in nursing care of patients with TBI.

Objectives: The purpose of this study was to investigate nurses’ perceptions about care for patients with TBI.

Methods: We conducted an exploratory study, which surveyed nurses across hospital departments.

Results: Findings showed gaps in knowledge about: 1) clinical guidelines for TBI care; 2) TBI epidemiology, characteristics, and recovery; and 3) assessment and treatment procedures specific to patients with TBI. Nurses also expressed concerns about providing care for patients with TBI and their families and needing more training.

Conclusions: These findings have practice implications for training and educating nurses who care for patients with TBI and their families.
Harnessing Neuroprotection and Regeneration in Traumatic Brain Injury: A Translational Computed Neurobiology Platform with Preclinical-Clinical Substantiation

Status: Accepted Presentation type: Poster

Category: Technology – basic research

Author's preference: No preference

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Objectives: In recent times, Traumatic Brain Injury (TBI) becomes the leading disease burden globally, after cardiac ischemia and malignant disease, and occurs mainly due to traffic accidents in developing countries (Lancet-Neurology, 11:651, 2011), with India's burden as highest. While customary clinical management are available, there is much need of newer therapeutic approaches as currently no treatment adjuncts appreciably improving neurorestoration. Hence we explore the possibility of a neuroinformatics/neuroimaging-aided computational methodology for delineating endogenous neuroprotection/cell-proliferation, under internal or external activation (growth factors), as a regenerative approach to TBI.

Methods: We particularly consider frontal lobe injuries, the commonest TBI-type. Using the Gompertz quantitative cell-growth analysis, we develop a computational formulation of intracranial cell proliferation (gliogenesis, angiogenesis, dendrite formation) based on experimental findings, in both preclinical and clinical setting, i.e. the adult rodent and adult human systems, post-injury. We analyse the histologically-demonstrated frontal migratory channel-system of stem cell generated endogenously in the subventricular zone and emanating into cerebral hemispheres, namely lateral cortical migratory channels (rodent), and medial cortical migratory channel (human). We delineate a quantitative formulation to estimate the cellular regeneration intensity with altering age.

Results: We thereby formulate a quantitative model of the progenitor cell formation rate across the channels, undergoing proliferation kinetics. We then validate the formulation using available findings from (i) MRI/neurological investigation of human TBI recovery, (ii) immunohistochemical study of rodent experimental TBI model. In the human case, the subject had a penetrating left frontal injury that destroyed 22% of right frontal white-matter, with recovery monitored weekly. In the rodent experiment, there was 24% injury of left frontal region, and the enhanced recovery was tracked under defined dose of regeneration-promoting drug, carbamylated-erythropoietin.

Conclusions: Our computational neurobiology formulation functioned as an in-silico clinical trial and correctly predicted and tracked the recovery endpoints, in both rodent and human systems, within 10% error. A neuroinformatics platform can be thus be explored for translational applicability for traumatic brain injury.
High Level Mobility Outcomes in a Neurological Population – An Observational Study Exploring a Group Exercise Intervention

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – activities and participation

Author's preference: No preference

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Objectives: The aim of this study was to profile high level mobility outcomes in a neurological population following an intensive group exercise training programme incorporating dynamic strengthening and balance activities.

Relevance: Traditionally the rehabilitation of individuals with neurological injury has focused on impairments. Once activities can be performed independently e.g. indoor walking, these individuals are often discharged from rehabilitation services. High level mobility encompasses skills beyond normal gait e.g. running and jumping and is an essential skill for sport and leisure. Achieving high level mobility has been linked to an increased likelihood of returning to employment (Lindstrom et al. 2009).

Participants: A heterogeneous group of individuals with conditions including stroke, traumatic brain injury and incomplete spinal cord injury completed an intensive group exercise training programme. This training programme was an additional therapy for all participants who were inpatients in a specialist rehabilitation centre. All participants were independently walking without aids.

Methods: This study was a pre and post interventional observational design. The training programme was delivered in a group setting, for 60 minutes, twice a week by physiotherapy assistants. Baseline and post interventional outcome measures included the High Level Mobility Assessment Tool (HiMAT), the Activities-specific Balance Confidence (ABC) scale and the 6MWT. Analysis: Descriptive statistics were used to describe pre and post outcome measures.

Results: 8 patients: 10 months post injury (± 4), age 37 (± 15), 5 males, 3 female, completed on average 6 (± 3) sessions. No adverse events were noted during the training programme. A median improvement of 5 (IQR 6.5) was shown in HiMAT scores. Perceived balance confidence also improved by a median of 6% (IQ R 10). 6MWT improved by a median of 127m (IQR 233m).

Conclusions: Preliminary results suggest that an intensive task specific strength & balance programme, delivered in a group format, is effective in improving high level mobility in an inpatient neurological population. Implications: This observational study demonstrates that neurological patients have the potential to regain running and high level mobility.

Key Words: High Level Mobility, Running, Neurological population.

Comparison of robotic-assisted treadmill therapy on walking-tests performance in subjects after traumatic brain injury and multiple sclerosis

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Structural changes of the central and peripheral nervous system is an important etiologic factor for gait abnormalities in patients after traumatic brain injury (TBI) and multiple sclerosis (MS). The key biomechanical abnormalities of gait after TBI are yet to be determined. In MS subjects, main factors for gait problems are weakness, spasticity, loss of balance, sensory deficits and fatigue. Walking impairment is one of the most commonly reported symptoms of MS and has been reported as a symptom with great impact on the quality of life. Independent gait is one of the priorities in rehabilitation in both pathologies. Very limited data is available about the influence of robotic-assisted treadmill therapy on walking and standing performance in the adult TBI and MS population. The aim of the study was to compare the effect of robotic-assisted treadmill therapy on walking performance in adult subjects after moderate and severe TBI and MS subjects.

Methods: 18 adult ambulatory subjects with gait abnormalities after TBI (GCS<13) in chronic phase (>1 year after injury, average 6.6, range 1-16 years) and 9 subjects with MS with average EDSS score of 5.3 (3.5 - 6.5) were included in the study. Each subject in both (TBI and MS) groups received 10 sessions of 30 minutes of robotic-assisted treadmill training on Lokomat (Hocoma-CH) as monotherapy. Three standardised assessments were performed before and after the therapy: 10-Meter Walking Test (10MWT), 6-Minutes Walking Test (6minWT), Get Up and Go Test (GUGT). Absolute and relative (ratio between absolute improvement and first assessment) improvements for each test in both groups were defined and analysed. Exact Wilcoxon rank sum test (EWRST) was used to compare absolute and relative improvements among both groups.

Results: On average, patients in TBI and MS group improved absolutely and relatively in all (the) performed tests. TBI group showed greater absolute and relative improvement, but differences between groups were not statistically significant at the 5% alpha-level. Relative improvement on 10MWT in TBI group was 11% (SD 19%) and in MS group 4% (SD 18%). Relative improvement on GUGT in TBI group was 21% (SD 23%) and in MS group 8% (SD 23%). Relative improvement on 6minWT in TBI group was 26% (SD 28%) and in MS group 6% (SD 52%). The difference between the two groups came close to statistical significance at the 5% alpha-level regarding relative improvement in 6minWT (p=0.089).

Conclusions: Robotic-assisted treadmill therapy seems to improve walking tests performance in adult brain injury subjects in the chronic (>1 year post-injury) period better than in MS subjects, but comparison of both groups did not show statistically significant difference. We would have probably proven improvement with p-value closer to statistical significance (5% alpha-level) if the number of patients in MS group had been larger.
Pituitary hormone changes in the acute, subacute and chronic phases of traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Neuroendocrine dysfunction is a known consequence of traumatic brain injury (TBI). The present study is to investigate the effect of acute, sub-acute and chronic phases of TBI on growth hormone (GH) and cortisol, as a measure of pituitary function.

Methods: Ninety six male patients between the ages of 18 and 40 years with verified head injury admitted within 24 hours of injury, without history of chronic ailments or morbid conditions, like penetrating head injury were recruited for the study. Endocrine functions were assessed by basal hormone concentrations. In each case, blood was collected within 24 hours, at first week and sixth week of injury between 8.00h and 10.00h. The blood samples were collected by standard venepuncture procedure in plain bottles and allowed to clot by leaving it undisturbed at room temperature for about 30 minutes and centrifuged. Serum was extracted from the resulting supernatant and stored frozen at -20°C until the samples were analyzed consecutively for GH, IGF-1, ACTH and cortisol by ELISA technique. The results obtained were compared with reference values of normal healthy adults. Severity of TBI was determined by Glasgow Coma Scale (GCS).

Results: Ninety % of the patients with moderate to severe TBI were deficient in GH and cortisol within 24 hours of injury. The deficiencies became more pronounced in the first week and remain so to the sixth week post-injury. GH deficiency was found to be associated with cortisol deficiency (P= 0.001). The remaining eleven patients with mild TBI had minimal lowering of GH but slight increase in cortisol level within 24 hours of injury. However, the GH peaked and cortisol dropped to normalcy within the first and sixth week of injury.

Conclusions: Pituitary failure may result from moderate to severe TBI. Routine assessment and timely identification of pituitary dysfunction may be critical to optimal patient recovery and improved quality of life of survivors of moderate to severe TBI.

Key words: Pituitary hormones, growth hormones, cortisol, traumatic brain injury
Analysis of Center of Mass Parameters with Segmental Method during Walking in Chronic Hemiplegic Patients

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: To estimate the displacements of Center of Mass (COM) in frontal and vertical plane during level walking in patients with chronic stroke compared with healthy adults and determine the relationships between displacements of COM and functional measurements of patients.

Methods: Patients with stroke (n=16) and sex-age matched adults (n=16) were recruited in the study. Maximum Lateral Displacement (MLD) and Maximum Lateral Velocity (MLV) of Center of Mass (COM) and Maximum Vertical Displacement (MVD) and Maximum Vertical Velocity (MVV) of COM during level walking were calculated by segmental method after three-dimensional motion analysis in both groups. The functional measurements including Lower Extremity score of Fugl-Meyer Motor Assessment (FMA-LE), Timed Up-and-Go (TUG) test, Berg Balance Scale (BBS) and the walking speed were performed in the same day in stroke patients.

Results: During level walking, MLD of COM and MLV of COM were significantly larger in stroke patients (P<0.01, P<0.05) compared with healthy adults, while MVD of COM and MVV of COM were significantly smaller in stroke patients (P<0.01, P<0.01). In analysis of correlation with functional measurements, the MLD of COM had a strong correlation with walking speed (r=-0.63, P<0.01) and BBS (r=-0.57, P<0.05) and a median negative relationship with FMA-LE (r=-0.44). However, a weak or no correlation was found between MVD, MLV and MVV of COM and the functional measurements.

Conclusions: A larger displacement and higher velocity of COM in media-lateral direction but a small displacement and lower velocity of COM in vertical direction are found in patients with chronic stroke. The MLD of COM has a strong correlation with, BBS and walking speed, a median relationship with FMA-LE.
snRPN controls ability for postinjury axonal regeneration in primate retinal ganglion cells

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: To unravel molecular mechanisms which are responsible for regenerative failure of primate retinal ganglion cell axons.

Methods: Retinas were obtained from newborn to adult monkeys (Callithrix jacchus) immediately after death, freed from surrounding tissue and used to prepare explants which were cultured in vitro. Growth of axons was monitored using phase contrast microscopy and time-lapse video cinematography. Immunohistochemistry, Western blotting, qRT-PCR, proteomics and genomics were performed to characterize molecules associated with axonal growth. Then, siRNA experiments were conducted to identify the causal involvement of selected molecules in triggering axonal growth.

Results: Primate' retinal ganglion cells (RGCs) are known to lose the ability to regenerate cut axons during postnatal maturation, but the underlying molecular mechanisms are unknown. We screened for regulated genes in monkey RGCs during axon growth in retinal explants obtained from eye cadavers on the day of birth from New World marmosets (Callithrix jacchus), and hybridized the regeneration-related mRNA with cross-reacting cDNA on human microarrays. Neuron-specific human ribonucleoprotein N (snRPN) was found to be a potential regulator of impaired axonal regeneration during neuronal maturation in these animals. In particular, up-regulation of snRPN was observed during retinal maturation, coinciding with a decline in regenerative ability. Axon regeneration was reactivated in snRPN-knockout adult monkey retinal explants. These results suggest that coordinated snRPN-driven activities within the neuron-specific ribonucleoprotein complex regulate the regenerative ability of RGCs in primates, thereby highlighting a potential new role for snRPN within neurons and the possibility of novel postinjury therapies.

Conclusions: The data show that even after maturation, the molecular mechanism for postinjury axonal growth still exist and can be reactivated to result in growth cone formation and lengthy stump extension. Understanding of the molecular mechanisms of axonal regeneration will help to develop therapeutic concepts for optic nerve injuries.
Palmitoylethanolamide chronic treatment reduces the sensorial and cognitive disfunctions associated with mild traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Traumatic brain injury (TBI) represents a major public health problem. Traumatic brain injury (TBI) initiates a neuroinflammatory cascade that contributes to neuronal damage and behavioral impairment. Cannabinoids of all classes have the ability to protect neurons from a variety of insults that are believed to underlie delayed neuronal death after traumatic brain injury (TBI), including excitotoxicity and neuroinflammation.

We investigated the anti-neuroinflammatory properties of the palmitoylethanolamide (PEA), a commercially available compound with a pleiotropic mechanism of action.

We applied a model of mild TBI that develop sensorial and cognitive disfunctions. In particular, mice developed abnormal pain sensation (allodynia) and depression associated to repetitive, obsessive-compulsive behaviours. According to the literature, we found that TBI increased the number of proinflammatory/hypertrophic microglial cells in specific areas of the brain. We observed that PEA chronic treatment (10 mg/kg i.p.), significantly ameliorate the mechanical allodynia associated with TBI. Moreover, cognitive impairment associated with TBI such as depression and aggressiveness were reduced by PEA treatment. In particular, we measured the immobility time in sham, TBI and TBI treated animals in the tail suspension test and the results revealed that, while TBI animals showed an increased immobility time, PEA chronic treatment determined a reduction of depressive-like behaviour. Finally, we found that PEA, through a genomic mechanism PPAR-α-mediated, increased the expression level of CB2 cannabinoid receptor in primary microglial cells and, hence, could be responsible of the phenotype switch from pro to an anti-inflammatory/neuroprotective microglia.

Our results show a possible use of natural compounds such as PEA together with the already used drugs for the treatment of severe brain injury. Moreover, the discovery of new mechanisms in endogenous lipid compound could represent a new pharmacological tool to develop new molecules for the treatment of chronic neurological disorders.
Pilot evaluation of a new care path in the Netherlands for people with acquired brain injury in the chronic phase after injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: Many people with acquired brain injury (ABI) experience difficulties that require chronic and specific care. However, in The Netherlands this type of care is lacking or is insufficient. Therefore several Dutch care facilities initiated the development of a new care path for patients with ABI in the chronic phase that finished rehabilitation. A pilot-study was performed to evaluate the care path. The study includes a process evaluation to investigate the feasibility of the intervention, and an outcome evaluation to investigate the effects of the intervention.

Methods: Intervention: The main goal of the intervention is for the patients and their family to become as independent as possible, to achieve personal goals and gain self-esteem. The intervention is a care path consisting of cognitive and physical group treatment modules. The cognitive modules focus on difficulties with dealing with change, energy control, and cognition and behavior. The goal of the physical module is to improve functional mobility. Together with the patient it is decided which parts of the care path will be followed. In addition patients and their family receive individual treatment at home. In these sessions a coach works with the patient and his family on specific individual treatment goals and helps them to implement aspects of the group sessions in their own daily life situation. Procedure and measurements: between September 2014 and January 2015 patients who started following the care path were recruited for participation in the study. The outcome evaluation measurements were performed at the start of treatment (T0) and one year later (T1). Primary outcome measures included the Utrecht Scale for Evaluation of Rehabilitation-Participation; a care needs questionnaire; Rosenberg Self-Esteem Scale; and Caregiver Strain Index. Secondary outcome measures included: COOP/WONCA charts (functional status); Neuropsychiatric Inventory Questionnaire and the Life Satisfaction Questionnaire-9. In addition, module specific goal attainment measurements were collected between T0 and T1. For the process evaluation information regarding the reach of the intervention, fidelity, and dose delivered (exposure) and received (satisfaction) was gathered.

Results: Ninety-five participants with ABI were included (56% male; mean age 52.8 (sd=11.6) years; time since injury 5 (sd=4.4) years). Thirty-five family members participated as well (43% male; mean age 53.4 (sd=12.2) years). Preliminary analyses revealed that patients were very satisfied about two modules, dealing with change (n=31) and the related physical module (n=11), rating them both with an 8 on a scale from 0 (not satisfied) to 10 (very satisfied). Final results of the study will be available in January 2016.

Conclusions: Preliminary data show that patients are very satisfied about a part of the care path. The final results of the pilot-study will be presented at the conference.
The residual consciousness of unconscious patients can be detected by studying the P300, a wave among event-related potentials. Previous studies have applied tones, the subject’s name and other names as stimuli. However, the results were not satisfactory. In this study, we changed the constituent order of subjects’ two-character names to create derived names. The subject’s derived names, together with tones and their own names, were used as auditory stimuli in event-related potential experiments. Healthy controls and unconscious patients were included in this study and made to listen to these auditory stimuli. In the two paradigms, a sine tone followed by the subject’s own name and the subject’s derived name followed by the subject’s own name were used as standard and deviant stimuli, respectively. The results showed that all healthy controls had the P300 using both paradigms, and that the P300 in the second paradigm had a longer latency and two peaks. All minimally conscious state patients had the P300 in the first paradigm and the majority of them had the P300 in the second paradigm. Most vegetative state patients had no P300. Patients who showed the P300 in the two paradigms had more residual consciousness, and patients with the two-peak P300 had a higher probability of awakening within a short time. Our experimental findings suggest that the P300 event-related potential could reflect the conscious state of unconscious patients.
Comparison of Traumatic Brain Injury Patients Admitted to Inpatient Rehabilitation: Canada vs. the United States

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Objectives: The aim of this study is to investigate the differences in patient demographic, clinical characteristics and in functional outcome between Traumatic Brain Injury (TBI) patients receiving inpatient rehabilitation in Canadian and U.S. facilities from admission to discharge and at 1-year follow-up.

Methods: This data were collected from TBI patients >14 consecutively enrolled in ten inpatient rehabilitation centers, one from Canada (n=149) and nine from the US (n=1971) as a part of the TBI-Practice Based Evidence (TBI-PBE) study. Patients were stratified based on admission Functional Independence Measure (FIM) cognitive score sub-groups (<15, 16-20, ≥21). Demographics, clinical characteristics and FIM score at discharge and 1-year post-injury were compared for each admission FIM cognitive category between Canada and U.S. Pooled t-test, Satterthwaite t-test, chi-square and fisher’s Exact were used for data analysis.

Results: There were no significant differences in demographics between patients in Canada and the U.S. Patients who were treated in Canada experienced longer acute care and Rehabilitation Length of Stay (RLOS) and lower Comprehensive Severity Index (CSI) score in all three cognitive sub-groups (p<.001). There were no significant differences in cognitive FIM scores for higher cognitive sub-groups at rehabilitation admission, however motor FIM scores were significantly higher in patients treated in rehabilitation in Canada in all three cognitive sub-group (p<.001). At discharge, patients in Canada showed significantly more improvement in cognitive FIM score in highest cognitive sub-groups and better motor FIM score in all cognitive sub-groups. At 1-year post-injury, patients in higher cognitive sub-groups in the U.S showed significantly more improvement in cognitive FIM scores (p<.05). However, patients from both countries showed no other significant differences in long-term results.

Conclusions: This is the first study to compare demographic, clinical characteristics, and long-term functional outcomes, between TBI patients in the U.S. and Canada who participated in inpatient rehabilitation programs. TBI patients who received post-acute rehabilitation in Canada showed greater improvement in cognitive and motor components of the FIM at discharge. However, at 1 year post-injury patients in both countries showed relatively same results in both motor and cognitive FIM components; they did not show any significant differences within each cognitive sub-group. The only exception was those in higher cognitive sub-groups in the U.S with more improvement in cognitive FIM score. Although significant differences at discharge FIM could be attributed to the lower severity of injury in TBI patients and longer RLOS in Canadian inpatient rehabilitation setting, further analysis is warranted to examine differences in treatments and their effects on functional outcome.
Pilot Retrospective Analysis of Selective Serotonin Reuptake Inhibitors (SSRIs) on Traumatic Brain Injury (TBI) Patients

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: Recent studies suggest antidepressants may be helpful in managing the neuropsychiatric and neurological defects manifesting from brain injury. This study aimed to test the capability of SSRIs as a treatment option for TBI patients in terms of physical and mental recovery.

Methods: A retrospective chart review was conducted on patients admitted to and discharged from neurotrauma and then followed up by admittance to head injury clinic at St. Michael's Hospital. Data was collected via physician records, Personal Health Questionnaire, and other measurement methods (Montreal Cognitive Assessment, Glasgow Coma Scale). Randomization was conducted by outlining groups that fell within the same criteria (egs., age group, severity level) and evaluating SSRI users vs non-users within the sample group. Comparison was done between discharge from neurotrauma, and then at time of follow up at head injury clinic. Measures evaluated included mood, sleep, eating habits, social activities, social interaction, motor activity, and mental status.

Results: Out of the 50 patients administered antidepressants: 48% of patients had overall positive effects, 20% had no overall impact. Out of the 50 control patients (no antidepressants administered): 28% (14/50) of patients had overall positive effects, 46% (23/50) of patients had overall negative effects, 26% (13/50) of patients had no overall impact. Out of the 25 patients administered SSRIs: 56% (14/25) of patients had overall positive effects, 32% (8/25) of patients had overall negative effects, 12% (3/25) of patients had no overall impact. In patients administered non-SSRI antidepressants: 40% (10/25) of patients had overall positive effects, 32% (8/25) of patients had overall negative effects, 28% (7/25) of patients had no overall impact. Among the 25 patients administered SSRIs, the following trends were observed: The greatest number of patients displayed improved mood (n=12), followed by improved mental status (n=11), improved motor function (n=9), improved social interaction (n=8), improved sleep (n=7), and improved people interaction (n=7), improved eating (n=5).

Conclusions: While past studies have examined SSRI administration and outcomes in stroke patients, this was the first pilot review that investigated SSRI outcomes in TBI patients. As suggested by the trends in the results: SSRI administration and usage has displayed overall beneficiary outcomes for post TBI mental and physical symptoms. The SSRI class of medications has a greater positive effect on TBI patients than other antidepressants. Within the sub-group of SSRI patients who took SSRIs, we further discovered its various benefits in the categories of mood, mental status, and motor function. This provides new evidence on the role of SSRIs in treating neurological and neurobehavioral symptoms post TBI.
Longitudinal changes in brain volume over the first year following traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: Studies in traumatic brain injury (TBI) have shown decreases in gray and white matter volumes following brain trauma. Despite continual volume loss, neuropsychological performance has been shown to improve over time. However, it is unclear whether volume loss is diffuse or regionally selective, if changes are related to TBI severity, and if volumetric changes relate to changes in neuropsychological function. The present study sought to address these questions using a volumetric region of interest approach. We hypothesized that brain volumes would decrease in a regionally-specific manner, and that volume loss would correspond with TBI severity. Additionally, we hypothesized that there may be an association between volume loss and neuropsychological performance.

Methods: Twenty-seven patients (15 male) with non-penetrating TBI were classified by severity: mild, complicated mild, or moderate/severe. Patients were assessed across 3 time points: sub-acute (less than 3 months), 6 months, and an evaluation at 1 year following injury. The longitudinal pipeline within the FreeSurfer software package (version 5.3) was used to quantify brain volumes. Neuropsychological assessments measured: attention, information processing speed, motor speed and fine motor dexterity, abstract reasoning and mental flexibility, whole-to-part construction and spatial reasoning, phases of memory including encoding, consolidation, and recall, and working memory. Statistical analyses were performed using SAS 9.3. Mixed effects models were used to detect brain volume changes over time, accounting for time since injury and total intracranial volume. Mixed effects models were also used to investigate changes in neuropsychological performance over time and to determine whether volumetric changes were associated with changes in neuropsychological performance. TBI severity was incorporated as a fixed effect variable. Results were corrected for multiple comparisons. The SAS Proc Mixed procedure was used to estimate correlations in the presence of repeated measures.

Results: Volumetric analyses revealed significant decreases in the bilateral caudate (left: \( p<0.0001 \); right: \( p=0.00014 \)), right putamen \( (p=0.0005) \), right thalamus \( (p=0.0009) \), right superior temporal gyrus \( (p=0.0005) \), and left superior parietal lobule \( (p=0.0004) \). Neuropsychological analyses revealed significant improvements in abstract reasoning \( (p=0.0024) \) and processing speed \( (p=0.0018) \). Volumetric changes and neuropsychological performance were not significantly related to TBI severity. No significant correlations were found between changes in brain volumes and neuropsychological performance.

Conclusions: In line with our hypothesis, brain volumes appear to decline over the first year post-injury in a regionally-specific fashion. Volumetric reductions are independent of TBI severity, indicating that even mild injuries may result in chronic loss of brain tissue. However, neuropsychological performance does not appear to be associated with volume loss. Though neuropsychological performance in the first year post-injury appears to be unrelated to volumetric changes, there may be long term implications for the development of comorbid psychiatric and neurological disorders in patients who sustain TBI and subsequent volume loss.
Recovery of Reaching and Grasping in Severe Chronic Paediatric Stroke Patients using Functional Electrical Stimulation Therapy

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author’s preference: Oral

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Objectives: To evaluate the effectiveness of 48 hours of transcutaneous functional electrical stimulation (FES) therapy for retraining voluntary reaching and grasping function in severe chronic paediatric stroke patients.

Methods: A convenience sample of four children and youth with chronic hemiparesis after a postnatal stroke

The assessments used were: Rehabilitation Engineering Laboratory Hand Function Test, Quality of Upper Extremity Skills Test, Paediatric Evaluation of Disability Inventory, and Assisting Hand Assessment. All participants improved on all measures. These results suggest that FES therapy has the potential to improve upper limb function in severe chronic paediatric stroke patients.

Results: All participants improved on all measures. The average change scores on selected Rehabilitation Engineering Laboratory Hand Function Test components were 14.5 for object manipulation (p=0.042), 0.78 Nm for instrumented cylinder (p=0.068), and 14 for wooden blocks (p=0.068). The average change score for the grasp component of Quality of Upper Extremity Skills Test was 25.93 (p=0.068). These results suggest that the Toronto Rehab’s FES therapy has the potential to improve upper limb function in severe chronic paediatric stroke patients.

Conclusions: FES appears to be an effective tool for therapy of hemiparesis in acquired brain injury stroke survivors. Further research into FES therapy for hemiparesis in children and youth post ABI deserves further clinical evaluation.
Algorithm for Symptom Attribution and Classification Following Possible Mild Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: To present a heuristic model of a Symptom Attribution and Classification Algorithm (SACA) for mild traumatic brain injury (mTBI).

Methods: US Veterans seeking treatment at three US Department of Veterans Affairs (VA) Polytrauma Network sites were enrolled into a Cross Sectional mTBI diagnostic accuracy study. The SACA was developed for this project and it includes seven clinical decisions made according to a systematic algorithm format according to specified criteria.

To determine if and how SACA decisions and corresponding criteria influence allocation of participants (n = 422) into diagnostic categories, we tested changes in the proportion of Veterans classified into one of the seven SACA diagnostic categories relative to the six diagnostic categories in the VA's Comprehensive TBI Evaluation (CTBIE). For this comparison, we computed the frequencies for each diagnostic category, the percent of the total sample [% Total Sample = Frequency/422 Veterans] and percent change from the SACA categories [% Change from SACA = (New Frequency - SACA Frequency / SACA Frequency) x100]. Using these same computations and the same SACA decision hierarchical structure, we also tested changes in the proportion of Veterans classified into one of the seven SACA categories after altering SACA decision-making criteria. To examine different methods for determining test profile validity, we used the SACA algorithm, but for each analysis we substituted different cut-scores, decision criteria and/or methods to make the same SACA decisions. The final analyses examined the value of adding the Structured TBI Diagnostic Interview (STDI), Neuropsychological tests and Mental Health tests by comparing the diagnostic distribution of the study sample using the SACA (Decision # 7) relative to using the SACA when the CTIBE #23 is substituted for the STDI and the Validity-10 cut scores (≥ 22, ≥ 13) are substituted for the STDI, Letter Memory Test (LMT) and Minnesota Multiphasic Personality Inventory (MMPI-2-RF).

Results: Compared to the SACA, the CTBIE attributes 16-500% more symptoms to mTBI, behavioral health (BH), mTBI+BH and Symptom Resolution (SR) categories. Altering the SACA criteria indicates that: (1) The CTBIE determination of cognitive impairment yields 27-110% more mTBI, mTBI+BH and SR classifications, (2) Ignoring timing of symptom onset yields 32-76% more mTBI, mTBI+BH and Other Condition classifications, (3) Proportion of sample having invalid profiles using STDI, MMPI-2-RF and LMT is 26% whereas with CTBIE item #23 and Validity-10 it is 6-26%, (4) MMPI-2-RF F-scale is the only measure identifying Veterans with PTA>24 hours as having invalid profiles.
Conclusions: The SACA enabled a systematic evaluation of the impact of decision-making criteria on symptom attribution. The MMPI-2-RF F-scale may be more precise in identifying invalid profiles, for mTBI+BH, when compared to the Validity-10 and LMT. The SACA provides a framework to inform clinical practice, resource allocation and future research.
The Selective Inhibitor of Nuclear Export (SINE) Compound, KPT-350, Exerts Neuroprotective and Anti-Inflammatory Activity in Rat Models of Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Recently, Exportin 1 (XPO1) – a nuclear export protein that regulates the trafficking of over 200 cargo proteins – has surfaced as an attractive target for the treatment of inflammatory disorders such as traumatic brain injury (TBI). A new class of molecules inhibiting this protein, termed Selective Inhibitor of Nuclear Export (SINE) compounds, have proven to be well tolerated, therapeutically active and brain penetrant in preclinical and clinical trials. This study sought to determine the effect of SINE compounds on inflammatory and neuroprotective endpoints in rodent models of TBI.

Methods: The anti-inflammatory and cytoprotective effects of the SINE compound KPT-350 were investigated in a controlled concussion injury (CCI) model of TBI. CCI rats received either KPT-350 or a vehicle compound once daily for 5 days, starting 2 hours post-injury. Cytokine levels from the fluid of the CCI-impacted area were evaluated at the end of the treatment period. To evaluate the effect of SINE treatment on blood brain barrier (BBB) permeability, rats received either a single dose or daily doses of KPT-350 for 3 days following moderate CCI. Quantitative measurements to assess the extent of extravasation were conducted 12 hours and 3 days post-CCI using the Evans Blue (EB) method. Finally, to complete our investigation of KPT-350 BBB protection, we used western blot analysis to evaluate tight junction protein levels in rats 3 days following moderate CCI.

Results: Animals dosed with KPT-350 experienced significant changes in cytokine levels relative to vehicle controls. Specifically, levels of anti-inflammatory cytokines like IL-10 and IL-13 increased by over ten-fold, while the concentrations of TNFa, IL-6, IL-1a, IL-1b and other pro-inflammatory cytokines were reduced by anywhere from four to fifty times in KPT-350 treated rats relative to the control group. Additionally, growth factors known to reverse axon damage (HDAC1) and promote neuronal longevity (HIF-1a, HDAC1, and RXRa) were measured in the treatment group at more than 10 times that of the control.

The integrity of the BBB was markedly improved in KPT-350 treated rats as compared to their vehicle-treated counterparts. Quantitative measurements of EB tissue content in brains of rats administered KPT-350 showed significantly lower extravasation as evidenced by reduced EB levels. Furthermore, EB tissue measurements showed that KPT-350 reduced BBB leakage following TBI in both the acute (12 hours post-injury) and sub-acute (3 days post-injury) phases. Western blot analysis substantiated these observations: CCI control animals were abnormally lacking in tight junction proteins, while KPT-350 treated rats expressed these integral BBB proteins at sham levels.
**Conclusions:** Together, these data suggest that KPT-350 acts by a dual mechanism of action, modulating key inflammatory mediators and neuroprotective pathways while simultaneously protecting BBB integrity following TBI.
Reintegration after chemo-therapy? My chemo-brain is letting me down

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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To recognize and acknowledge effects of chemo-therapy on the functioning of the brain, a case series.

Summary of the presentation

A case series of highly educated cancer patients (with a non-brain tumor), who were treated with chemotherapy, shows that cognitive functioning after treatment does not attain previous levels. Measurements at different moments illustrate the negative impact of chemotherapy on cognitive functioning. The complexity of the treatments and the physical burden impede objective observations. Physical and psychological support obtain priority in the initial phase. At a later stage, when the physical impact of the treatments decreases, memory- and concentration deficits become apparent. These cognitive problems come only on the table when re-integration fails. A missed opportunity!

Everyone from the described cases experiences this process as a second trauma. The feeling of powerlessness, hopelessness, doubt, the concerns that one won’t be heard and that you can’t get back into the cognitive rhythm from before the cancer diagnosis becomes their second struggle. Going back to the former job requires specific care with diagnostics and treatment by well-informed professionals. The incidence of cancer is increasing worldwide, so are the chances of survival through specific therapies. ‘Life after cancer’ becomes increasingly important. Full recovery asks for supplementary requirements on traditional treatment methods for and view on cancer resulting in optimizing as much as possible the quality of life and work. This can be managed through focused targeting on specific aspects which are interfering with re-integration. Cognitive revalidation in all its aspects is also applicable in this situation. Due to the fragmentation in health care secondary cognitive limitations, as a part of cancer treatments, hardly get any attention. Powerlessness/impotence and a lack of knowledge are often the cause. Recognition and acknowledgement of this complex matter are essential in facilitating return to society. Occupational therapists certified in cognitive rehabilitation have both the knowledge and the possibilities to recognize these limitations, to raise the subject within different disciplines and to monitor it. This is the challenge...
Concussion Incidence in US High School and Collegiate Basketball

Status: Accepted Presentation type: Oral

Category: Neurotrauma – prevention and public health

Author's preference: No preference

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Objectives: Basketball is a physically demanding contact sport. Despite this, there remains a paucity of research on concussion incidence and characteristics in high school and college basketball. This study will 1) describe the incidence of concussions in US high school and college settings, 2) compare concussion rates between setting and sex, 3) describe the mechanism of injury among concussions, and 4) describe concussion symptomatology.

Methods: This study reports concussion data from existing injury surveillance programs: the National Athletic Treatment, Injury and Outcomes Network (NATION) during the 2011/12-2013/14 academic years; and the National Collegiate Athletic Association Injury Surveillance Program (NCAA-ISP) during the 2009/10-2014/15 academic years. Medical professionals (athletic trainers) collecting the injury data diagnosed concussions in accordance with their local and state requirements, but in lieu of regulation, were encouraged to follow the definition provided by the Consensus Statement on Concussion in Sport. When concussions occurred, concussed student-athletes answered a 17-item symptom checklist. Concussion injury rates (IRs) per 10,000 athlete-exposures (AEs), injury rate ratios (IRRs), and 95% confidence intervals (CIs) were calculated in strata of setting, sex, and mechanism of injury.

Results: At the high school level, there were 97 and 138 concussions in males and females, equating to IRs of 2.66/10,000 AEs and 4.78/10,000 AEs respectively. At the collegiate level, there were 106 and 136 concussions in males and females, equating to IRs of 3.66/10,000 AEs and 5.45/10,000 AEs respectively. Concussions occurred at higher rates in female than male athletes in high school (IRR=1.80, 95%CI: 1.39, 2.33) and college (IRR=1.49, 95%CI: 1.15, 1.92). In high school and collegiate settings, concussions occurred at higher rates in competition than practice (high school IRR=4.32, 95%CI: 3.33, 5.61; college IRR=2.12, 95%CI: 1.63, 2.74), although the number of concussions in competition and practice were similar (n=233 and n=244 respectively). Across all settings and sexes, player contact was the most common mechanism of injury (65.0%), followed by surface contact (23.3%) and ball contact (5.5%). The average number of reported symptoms per concussion was 5.24 (SD: 2.66) and 5.47 (SD: 2.94) for high school boys and girls respectively, and 5.92 (SD: 3.08) and 5.51 (SD 2.57) for college men and women respectively. There were no differences among the average number of reported symptoms (P=0.38). Common symptoms included headache (97.7%), dizziness (75.9%), and difficulty concentrating (62.5%).

Conclusions: Concussions occur routinely in basketball and place student-athletes at risk. At the both the high school and collegiate level, concussions occurred at higher rates among females versus males, although symptomatology did not differ by setting or sex. As basketball-related concussion research is limited, future research should examine methods to reduce the incidence of concussion, while reducing disparities in incidence related to setting and sex.
Bringing indigenous knowledge forward. Whakawhiti kōrero, a method for identifying and correcting problems with assessment tool development for young Māori with TBI and their whānau

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author’s preference: Oral

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Background: The importance of tools for the measurement of outcomes and needs in traumatic brain injury is well recognised. The development of tools for these injuries in indigenous communities has been limited despite the well-documented disparity of brain injury. Ideally, development of such tools requires processes that can withstand critique from both Te Ao Māori (the Māori world) and Western Science.

Objectives: The wairua theory of traumatic brain injury (TBI) in Māori proposes that a culturally defined injury occurs at the same time as the physical injury. This means a cultural response, defined by and originating from Te Ao Māori is indicated. This research investigates a Rangahau Kaupapa Māori method (research by Māori, for Māori, with Māori) used in the development of a cultural needs assessment tool designed to further examine needs associated with the culturally determined injury and in preparation for formal validation.

Methods: Whakawhiti kōrero is a term from Te Ao Māori that expresses discussion and negotiation. This method was used to develop culturally defined statements in the development of the assessment tool. Three wānanga (traditional fora) were held in Te Tai Tokerau (Northland), with community health and education workers. One wānanga with whānau (extended family) with experience of traumatic brain injury was also held.

Results: The approach was well received by participants. A final version, Te Waka Kuaka, is now ready for validation.

Conclusions: Whakawhiti kōrero is an indigenous research method that has been utilised in the development of a cultural needs assessment tool in Māori traumatic brain injury. This method may have wider applicability in other fields, such as Mental Health and Addictions services to ensure robust process of outcome measure and needs assessment development.

Acknowledgement: This research is made possible by the Eru Pomare Post Doctoral Fellowship from the Health Research Council of New Zealand
The distribution of positive work and power generation amongst the lower-limb joints during walking normalises following recovery from traumatic brain injury.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: To determine whether better walking performance following recovery from traumatic brain injury (TBI) is attributable to an accentuation of compensatory strategies or an improvement in the way positive work is done and power is generated by the lower-limb joints.

Methods: A large metropolitan rehabilitation hospital. Participants: Thirty-five ambulant people with extremely-severe TBI who were attending physiotherapy for mobility limitations, and a comparative sample of 25 healthy controls (HC). Design: Cross-sectional cohort study with six month follow-up. Main Measures: Positive work done and average power (i.e. over time) generation by the hip, knee and ankle during stance as well as self-selected gait velocity.

Results: In comparison to HCs, TBI participants walked at baseline with a significantly ($p < .01$) reduced contribution from the ankle to total lower-limb average power generation (and positive work done) during stance, and a significantly ($p = .03$) greater contribution from the hip. However, this compensatory strategy resolved over time such that at six month follow-up no significant differences in the relative contributions from the ankle and hip were identified for the TBI participants when compared to HCs.

Conclusions: Better walking performance following recovery from TBI is attributable to an improvement in the way positive work is done and power is generated by the lower-limb joints rather than an accentuation of compensatory strategies.
Distribution and Severity of Lower Limb Spasticity Does Not Influence Mobility Outcome Following Traumatic Brain Injury: An Observational Study

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: 1) To examine the effect of lower limb spasticity on mobility limitations following traumatic brain injury (TBI) and determine the influence of spasticity distribution on mobility outcomes following TBI. 2) To determine whether the severity of lower limb spasticity had a differential effect on mobility following traumatic brain injury (TBI), and to investigate whether the distribution of lower limb spasticity influenced compensation strategies when walking.

Methods: A large metropolitan rehabilitation hospital. Participants: Ninety-three ambulant people with TBI who were attending physiotherapy for mobility limitations. Design: Cross-sectional cohort study. Main Measures: The High-Level Mobility Assessment Tool (HiMAT), gait velocity, modified Tardieu scale and three dimensional gait analysis was used to measure power generation.

Results: Lower limb spasticity was common following TBI, with a distal distribution being the most prevalent. Participants with spasticity had significantly greater mobility limitations compared to participants without spasticity. However, the distribution of lower limb spasticity and the presence of unilateral or bilateral spasticity had no additional impact on mobility outcomes. There was no significant difference in mobility outcomes at the six month follow up for people with spasticity, indicating that individuals have equivalent ability to improve their mobility over time despite the presence of spasticity. No significant relationship was found between the severity of lower limb spasticity and mobility limitations. There was a strong relationship between ankle power generation and mobility performance. Proximal compensation strategies did not vary significantly between groups with different distributions of lower limb spasticity. There was a strong relationship between ankle power generation and mobility performance. Proximal compensation strategies did not vary significantly between groups with different distributions of lower limb spasticity.

Conclusions: Following TBI, people with lower limb spasticity have significantly greater mobility limitations than those without spasticity, yet the distribution of spasticity does not appear to impact mobility outcomes. Although spasticity was prevalent, the severity and distribution did not appear to impact mobility outcomes. Proximal compensation strategies were not influenced by the distribution of lower limb spasticity following TBI. There is long term potential to improve mobility despite the presence of spasticity.
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Cognitive-Motor Interference in Mobility Function Among People with Chronic Stroke

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – activities and participation

Author's preference: No preference

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Objectives: Functional ambulation necessitates the ability of dividing attention to maintain walking balance while engaging in a cognitive task (i.e. dual-task condition). However, attention has a finite capacity. Performing the mobility and cognitive tasks simultaneously may result in deterioration of performance in one or both tasks, compared with the performance when each task is performed separately. This phenomenon is called cognitive-motor interference (CMI). Mounting evidence has shown that CMI is more compromised in people after stroke. The objective of this study was to examine how the nature and complexity level of the motor and cognitive tasks influenced the CMI patterns in different dual-task conditions among people with chronic stroke.

Methods: Sixty-one people with chronic stroke (15 women and 46 men, mean age: 62.9±7.8 years) participated in the study. Subjects performed three different walking tasks with increasing level of difficulty (walking forward with comfortable speed, obstacle course, and backward walking with comfortable speed). Two domains of cognitive tasks (verbal fluency, and mental tracking: serial-3-subtractions, serial-7-subtractions) were performed simultaneously while performing the walking tasks to examine the interaction effect of dual-tasking. The sequence of tests was randomized to minimize order effect. The outcomes were walking time (in seconds) and correct response rate (CRR) of the cognitive task in all conditions. Two-way repeated measures analysis of variance (within-subject factors: 1. Task condition (single Vs dual), 2. Level of difficulty of mobility task or cognitive task) was conducted to compare the walking time and CRR in different conditions.

Results: Regardless of the type and difficulty level of the cognitive tasks used, the walking time was increased if a cognitive task was added, compared to the walking time under the corresponding single-task condition. A significant interaction effect was observed, indicating that increase in walking time was dependent on the difficulty level of the mobility task and cognitive task used (mental tracking task, F= 15.51, p<0.001, partial eta²=0.205; verbal fluency task, F= 22.76, P<0.001, partial eta²=0.275). The increase in walking time was more apparent when a more difficult mobility task (i.e., backward walking) and cognitive task (serial-7-subtraction) was used. For CRR, adding the walking task led to a significant decline in its performance and the decrement in CRR was increased with increasing level of difficulty of the mobility task (mental tracking task, F=4.73, P=0.012, partial eta²=0.073; verbal fluency task, F=6.87, p=0.003, partial eta²=0.103). By examining the effect sizes (partial eta²), it was found that the verbal fluency task had more effect on CMI compared with the mental tracking task.

Conclusions: The nature and level of difficulty of the walking task and cognitive task interact to determine the CMI in dual-task conditions among people with chronic stroke.
The Lived Experience of Behaviours of Concern after Traumatic Brain Injury: A Qualitative Study

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Behaviours of Concern (BoC), such as aggression, are a debilitating and distressing consequence of Traumatic Brain Injury (TBI). The perspectives of clinicians and family members on BoC have been previously explored, but few qualitative studies have included the perspectives of the individuals with TBI. The aim of this study was to explore the lived experience of BoC and treatment history in individuals with TBI, and their family members and/or clinicians.

Methods: Primary participants were clients of a no-fault accident compensation scheme (the Transport Accident Commission - TAC), in Victoria, Australia, who had sustained a TBI and were identified as having BoC based on TAC records and a telephone survey with a close other. Semi-structured qualitative interviews were conducted with 13 participants (5 TBI individuals, 4 family or care workers, and 4 clinicians), which were coded and analysed using a six-stage thematic process as described by Braun and Clarke (2006). Rigour was ensured through member checking with participants and inter-rater coding checks.

Results: Participants with TBI and their informants described frequent and persistent BoC, particularly physical and verbal aggression and socially inappropriate behaviour, even many years post-injury. Five key themes emerged from the interviews relating to i) the behaviours, ii) the journey of managing BoC over time, iii) self-identity, iv) social relationships, and v) meaningful participation. The latter three themes represented the impact of and contributors to BoC in the context of the person as a whole, and had bidirectional relationships with each other and the former themes. The impact of BoC on relationships and employment was highlighted, leading to social isolation, a loss of sense of self, anger, depression, further frustration, and in turn, aggressive behaviours. TBI related changes, including reduced insight and rigid thinking, underpinned BoC but were also barriers to intervention for BoC according to clinicians. Conversely, ongoing therapy support and the establishment of a sense of purpose through engagement in hobbies were linked with improved adjustment and reduced BoC.

Conclusions: This study demonstrates the benefit of including TBI individuals in qualitative studies and provides greater understanding of the complex factors contributing to and impacted by BoC. The framework developed in this study will inform future interventions designed to reduce BoC and ultimately maximise the quality of life in individuals with TBI and their families.
Multiple Mild Traumatic Brain Injury Sustained In Childhood Is Not Associated With Cognitive Deficits In Adulthood.

Status: Accepted  Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Mild traumatic brain injury (mTBI) occurs frequently during childhood, particularly in the context of sporting events. Some researchers have found a ‘prolonged effect’ associated with multiple mTBI for adult populations and have suggested a potential ‘cumulative effect’. The possibility of cumulative effect creates a dilemma when considering management of children and young people who experience multiple mTBI. However, most research uses the terms prolonged and cumulative outcome interchangeably, and there is very little research regarding the outcomes of multiple mTBI, particularly for children. Further, extant research has measured outcomes during the same developmental age as when the injuries occurred, with no information regarding whether any deficits emerge or, alternatively, resolve over time. The aim of the present study was to assess whether multiple mTBI sustained during childhood was associated with increased cognitive deficits in adulthood and whether age at first injury influenced any outcomes.

Methods: Individuals who had experienced a mTBI (<18 years of age), who were now between 18-30 years of age and were more than 5 years post-injury, were invited to take part in the study. Participants were recruited via hospital and neurosurgical files (n=59). Participants were then divided according to whether they had experienced a single mTBI (n=31) or multiple mTBI events (n=28). A battery of tests assessing 4 cognitive domains (memory, working memory, visuospatial ability, and executive function) was administered to each participant.

Results: There were no significant differences between the groups on any of the demographic variables, age at first injury, or years post injury (p>0.20). Statistical analysis revealed no significant differences between those with 1 mTBI compared with those with 2 or more TBI on any of the cognitive domains. However, there was a trend towards significance for the domain of working memory (p=0.06). Hierarchical multiple regression analysis indicated that number of mTBI and age at first injury were not significant predictors of cognitive outcomes in adulthood. Based on the adjusted $R^2$, the predictors explained only approximately 3% of the variance in the cognitive outcomes.

Conclusions: There has been increasing concern regarding whether multiple mTBI might be associated with cumulative deficits. However, the terms ‘prolonged’ and ‘cumulative’ tend to be used interchangeably despite these implying very different outcomes. Further, there is little information regarding the long-term and adult outcomes for injuries that occurred during childhood. Our results suggest that there are no cumulative cognitive deficits associated with multiple mTBI that occurred in childhood that can be detected in adulthood.
Mild Traumatic Brain Injury: The Impact of Early Intervention on Job Satisfaction

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: To investigate job satisfaction and post-concussion symptoms (PCS) after mild traumatic brain injury (MTBI) using a randomized, controlled study. The primary objective was to determine whether there is a correlation between job satisfaction and PCS one year after MTBI, and to determine the degree of persistent PCS. A secondary objective was to establish whether there are differences between the intervention and control groups.

Research design: A randomized, controlled trial with one year follow-up.

Patients: 180 patients aged between 20 and 60 who met the inclusion criteria were recruited from 1,719 consecutive individuals with MTBI.

Methods: The control group received standard care. The intervention group was examined and problems in daily activities related to PCS were identified. Personalised, tailored treatment was given.

Results: A significant correlation was found between a higher incidence of symptoms and low job satisfaction for the intervention group. Both the intervention group and the controls experienced more PCS one year after MTBI. With regard to job satisfaction there was no statistically significant difference between the groups at one-year follow-up.

Conclusions: Early individual intervention by a rehabilitation team does not appear to impact job satisfaction for individuals with symptoms related to MTBI.
Accuracy Of Self-Report As A Method Of Screening For Life-Time Occurrence Of Traumatic Brain Injury Events That Resulted In Hospitalization.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Traumatic brain injury (TBI) occurs frequently during child and early adulthood, and has been associated with a number of negative outcomes including increased drug abuse, disorders of mental health and criminal offending. Identification of previous TBI in at risk populations is important for effective rehabilitation, but frequently relies on self-report. Unfortunately, there is little information regarding the accuracy of self-report. This study examined the accuracy of adult self-report for TBI events requiring hospitalization and the factors that enhance recall for these TBI events.

Method: The Christchurch Health and Development Study (CHDS) is a birth cohort of all children born in the Christchurch region of New Zealand initiated in 1977, originally comprising of 1276 children. A history of TBI events was constructed using prospectively gathered information at each of the follow-up periods (yearly intervals 0-16, 18, 21, 25 years) using a combination of parental/self-report which were verified using hospital records. At 25 years of age participants were asked to recall if they had ever visited a doctor or been hospitalized as a result of a head injury, if so, had they ever been diagnosed as having a concussion, brain injury or facture to their skull and for details of each incident.

Results: At the 25 year follow-up 1003 cohort members were available to participate. Approximately 10% of these individuals had experienced a TBI that required hospitalization (101/1003). A total of 58/101 (57%) of all hospitalized TBI events were recalled. Recall varied depending on the age at injury, with only 25% of TBI occurring over 0-4 years being recalled compared to 43% over 5-9 years, 42 % over 10-14 years and 73% and 95% for the 15-19 and 20-24 year age groups. Eleven of the injuries were classified as moderate/severe, and 10/11 of these were recalled (91%). There were 59 cases where there was a recorded loss of consciousness (LOC) 40/59 (67.8%) of these were recalled, and 42 cases were there was no LOC, 19/42 (45.2%) were recalled. There was a significant association between the recorded LOC and recall for TBI events χ² (1, n = 101) = 4.253, p <0.05, phi = -.230. Logistic regression analysis using two factors (age and LOC) indicated that the model could accurately classify over 74% of cases, but only age at injury made a statistically significant contribution to the model.

Conclusions: Information regarding previous TBI events is important in rehabilitation for at risk populations. This research demonstrates that age at injury and a LOC increase TBI recall, however, injuries that occur in early childhood are unlikely to be recalled in adulthood. Therefore, accurate screening for TBI may require a combination of self-report and review of hospital files to ensure that all cases are identified.
Hyperbaric oxygen therapy as a treatment for traumatic brain injury in mice

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Objectives: Traumatic brain injury is a common health problem with significant effect on quality of life. Hence, TBI is a major social problem and economic burden. The major causes are motor vehicle crashes, falls, and violence. Mild traumatic brain injury (TBI) accounts for 80-90% of total brain injuries. mTBI may lead to short- and long-term cognitive, emotional, and behavioral deficits. As yet, there is no effective treatment or cure for patients with mTBI. Hyperbaric oxygen therapy (HBOT) is a treatment by which 100% oxygen is administered at a pressure greater than atmospheric pressure at sea level (one atmosphere absolute, ATA). This involves placing the patient in an airtight vessel, increasing the pressure within that vessel, and administering 100% oxygen for respiration. In this way, it is possible to deliver a greatly increased partial pressure of oxygen to the tissues. HBOT has been shown to decrease cerebral edema, normalize water content in the brain, decrease the severity of brain infarction, and maintain blood-brain barrier integrity.

Methods: Mice were subjected to closed head weight-drop injury with 70 g weight. Mice were treated with hyperbaric oxygen for 1 hour at 2 ATA for 4 consecutive days starting from 3 hours post injury. 7 days post injury mice were assessed in 2 behavioral paradigms: Y-Maze and Novel Object Recognition test.

Results: Mice exhibited a lower learning ability following mTBI in both the Y-Maze and Novel Object Recognition test. All cognitive impairments were ameliorated in mice treated with HBOT. Brains (from another group) were remove 72 hours post last HBO treatment. mTBI group had decrease in myelin basic protein. Moreover, we found increase in neuronal loss and in astrocyte reactivity post brain injury. These changes were abolished in mice that were treated with HBOT.

Conclusions: These findings may suggest a new therapeutic strategy to treat damages induced by mTBI. The mechanisms underlie this improvement may be related to reducing inflammation and preventing de-meyelinization.
The Experience of Relationship Continuity and Discontinuity in Partners of People with an Acquired Brain Injury

Status: Accepted
Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: Spouses/partners of those with an acquired brain injury often report low levels of relationship satisfaction, and separation and divorce are common. It is important to understand why this happens: Such relationships are intrinsically valuable to those involved, and they also have an impact on the general psychological well-being of both parties, and on the rehabilitation outcomes for the person with the ABI because of the important role the partner plays in helping the person achieve those outcomes.

Methods: A better understanding of these issues may be gained by a more detailed exploration of how the partner experiences the relationship as it responds to the challenges presented by the brain injury. Focusing on this experience provides an opportunity to explore how it impacts on satisfaction with the relationship and on the psychological well-being of the partner; and how it impacts on the quality of care and support provided by the partner.

Results: In dementia, the notion of 'relationship continuity' has been used to gain a better understanding of how partners experience the relationship. Relationship continuity refers to whether the partner experiences the relationship as a continuation of the pre-morbid relationship (continuity), or as essentially changed and radically different (discontinuity). There are five dimensions of relationship continuity, each dimension providing a contrast between continuity and discontinuity: Relationship redefined; same/different person; same/different feelings; couplehood and loss. Evidence from dementia research indicates that these five dimensions are closely connected and that someone experiencing discontinuity on one dimension is likely to experience it on the other dimensions as well. Evidence also indicates that the experience of continuity or discontinuity is connected with the emotional well-being of the spouse/partner and how they provide care and support.

Conclusions: This presentation describes two qualitative studies that explored 'relationship continuity' in understanding the experience of partners of people with a brain injury. Findings suggested that it may provide a useful way of conceptualising this experience. The narratives of the participants provided much material that mapped onto the five dimensions, and participants who showed continuity (or discontinuity) on one dimension tended to show continuity (or discontinuity) on the other dimensions. This framework, and the hypothesised connections between dimensions, may provide the basis for a richer understanding of partner experience. The findings also suggested that the experience of continuity or discontinuity has implications for the partner's emotional well-being, their commitment to remaining within the relationship, and the kind of care and support they provide. Those who experience discontinuity may be more likely to draw on medical models for making sense of their partner and to be less proactive in managing changes in their partner; they may experience greater subjective burden; and they may be more likely to have doubts about remaining within the relationship.
Various Patterns Of Recovery In Patients With Disorders Of Consciousness?

Status: Accepted Presentation type: Oral

Category: Technology – clinical research/applications

Author's preference: Oral

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Objectives: Diagnosing disorders of consciousness (DOC) in patients with severe non acquired brain damage is a difficult task. Moreover, it has been increasingly evident that clinical assessment of unresponsive patients using behavioral observation methods alone can lead to misdiagnoses, as this merely quantifies the (absence of) behavioral reactions to environmental input. To get more insight in how DOC patients process external information, we focused on how different physiological measures were related to their recovery. To this end, we longitudinally examined autonomic nervous system (ANS) reactivity, Evoked Potentials (EPs), and Event Related Potentials (ERPs), together with behaviour.

Methods: Patients were children and young adults in Vegetative State Unresponsive/ Wakefulness Syndrome (VS/UWS) or in Minimally Conscious State (MCS), after non-acquired brain injury. They were involved in an Early Intensive Neurorehabilitation Programme. Two-weekly longitudinal measurements were performed involving clinical observation during auditory, visual, tactile, and olfactory stimulation. Additionally, electrodermal reactivity and heart rate variability (indices of ANS), EPs (brainstem auditory, somatosensory, visual evoked potentials), and auditory ERPs (mismatch negativity, MMN; and P300) were registered.

Results: With recovery to consciousness, patients’ sympathetic reactivity to environmental stimulation linearly increased, and parasympathetic reactivity linearly decreased. These changes in reactivity were also seen after each stimulation protocol. EPs were present in all patients. Only visual evoked potentials differed between recovered patients and those who did not recover. Mismatch negativity increased before patients recovered into MCS, and was initially different (> .01 µV) when comparing recovered patients to those who did not recover. The P300 randomly appeared, and was more often seen in the eventually recovered patients.

Conclusions: Different physiological indices of information processing showed different patterns: reactivity was either generally present (EPs), changed linearly (ANS), changed discontinuously (MMN), or appeared randomly (P300), during recovery to consciousness. Changes in ANS responses and brain activity appeared before changes in behaviour could be observed. This is important to take into account when diagnosing DOC patients only by behavioural observation. The meaning of these different patterns in information processing during recovery and how they relate to recovery of consciousness will be discussed.
Effects of the stem cells therapy on neuronal integrity in brain of children with long-term effects of severe traumatic brain injury. 1H-MRS study.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: Marker of neuronal integrity N-acetylaspartate (NAA) was measured in different loci of brain in children with long-term effects of severe traumatic brain injury (TBI) before stem cells therapy and after it using single voxel 1H MRS.

Methods: Patients (in age of 8 - 17 years) with severe neurological deficit (Glasgow Coma Scale score 3) were treated in 6 - 23 months after severe TBI with injections of the cord/placental blood cells suspension. The cells (in the dose of 5×10^6 per 1 kilo of weight) were injected twice with time interval of 14 days. Brain metabolites were measured at the 45th and 15th day before the treatment and up to the 15th, 45th, and 150th day after the end of therapy. Philips Achieva 3T scanner was used. Localisation of spectroscopic voxel (the volume was 3cm^3) was achieved by PRESS (echo time TE = 35 ms, repetition time TR = 2000 ms). The spectra were obtained in normal appearing white matter of temporal and frontal lobes, as well as in the frontal cortex and in hippocampus.

Results: According to the data of statistical analysis of signal intensities of NAA, glutamine+glutamate, choline containing compounds, creatine+creatine phosphate, mioinositol normalised to unsuppressed water signal intensity, the levels of above mentioned metabolites were stable before the treatment. After stem cells therapy NAA increased reliably at the 45th day and remained at the same level up to the 150th day in cortex and in white matter of temporal lobe.

Conclusions: NAA increase reflects an increase of neuronal integrity in temporal lobe cause by stem cells therapy. This effect is probably due to neurotropic factors penetrated through blood brain barrier in contrast to the cells. The raise of neuronal integrity coincided with positive dynamic in improvement of cognitive and motor functions.
Compensatory processes in normal-appearing children brain cortex in acute period of severe TBI.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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**Objectives:** The aim of this study is to reveal and characterize compensatory processes in normal-appearing cortex in acute and subacute period of traumatic brain injury (TBI).

**Methods:** 34 patients were studied in age from 5 to 16 years (mean age - 12.7 y.). Group of patients consisted of 18 children with severe brain injury (volume of injured tissue was 30-50 ml). 16 age-matched healthy volunteers comprised control group. Phillips Achieva 3.0T scanner was used. MRS-studies were conducted in acute and subacute period of trauma. The area of interest in intact frontal - parietal cortex (volume = 3 cm3) was studied using PRESS (TE = 35 ms, TR = 2000 ms, NSA = 32). The intensities of resonances in each spectrum were normalized to the signal of unsuppressed water. Statistical processing of spectral data was performed using software package Statistica 6.0.

**Results:** In comparison with control group significant decrease of NAA, increase of Cho, ml and Cr+PCr was found in patients. A direct statistically significant correlation (p<0.05) between NAA, Cr+PCr and Cho was revealed in both groups: in control group - RNAA-Cr = 0.65, RNAA-Cho = 0.64, RCr-Cho = 0.61; in patients group - RNAA-Cr = 0.82, RNAA-Cho = 0.53, RCr-Cho = 0.66

**Conclusions:** Increase of Cr+Pcr, Cho signal intensities (in absence of changes in its relaxation characteristics) indicates activation of compensatory processes of choline and creatine synthesis in brain cells. At the same time NAA level is reduced. Existing of NAA-Cr and NAA-Cho correlations and Cr and Cho increase could mean that activation of Cr and Cho synthesis causes the NAA decrease. The scheme of metabolism which is implemented in neurons and explains NAA, Cr, Cho level changes in TBI is proposed. It follows from the scheme that enhancement of compensatory processes activity requires activation of Krebs cycle.
The VA/DOD Chronic Effects of Neurotrauma Consortium: An Overview at Year 1

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: No preference

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Abstract: Increasing evidence supports the linkage between both concussions and combat related trauma with chronic traumatic encephalopathy (CTE), which results in progressive cognitive and behavioral decline in sub-populations 5 to 50 years out from repeated or cumulative mTBI exposures. The possibility of a link between mTBI, persistent symptoms, and early dementia has widespread implications for SMs and Veterans; however, these chronic and late-life effects of mTBI are poorly understood. The Chronic Effects of Neurotrauma Consortium (https://CENC.RTI.ORG) is a federally funded research project devised to address the long-term effects of mild traumatic brain injury in military service members (SMs) and Veterans. Announced by President Barack Obama on August 20, 2013, the CENC is one of two major initiatives developed in response to injuries incurred by U.S. service personnel during Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) as part of the National Research Action Plan. CENC is a collaboration between more than 30 universities, non-profit research organizations, VA medical centers, and military medical centers. It is made up of a leadership core, five infrastructure cores, eleven active studies, a data safety monitoring committee, a Consumer Advisory Board, a Scientific Advisory Board, and an independent granting mechanism to foster additional research in the area of chronic effects after mTBI. An overview of the Consortium and a progress update on the 11 studies will be presented.
Mechanisms of Concussion While Heading in Women’s and Men’s High School and College Soccer

Status: Accepted Presentation type: Oral

Category: Neurotrauma – prevention and public health

Author's preference: No preference

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Objectives: The mechanisms of concussion during the act of heading in soccer have been debated relative to sex. Neck strength and biomechanics have been identified as potential factors. However, the incidence of concussion mechanisms across sexes during the act of heading in soccer practices and matches has not been well documented. Two ongoing injury surveillance programs: the National Athletic Treatment, Injury and Outcomes Network (NATION) and the National Collegiate Athletic Association Injury Surveillance Program (NCAA-ISP) provide the opportunity to compare mechanisms of injury in women’s and men’s high school (HS) and college soccer players using identical methodology.

Methods: This study uses data from existing injury surveillance programs: the National Athletic Treatment, Injury and Outcomes Network (NATION) during the 2011/12-2013/14 academic years; and the National Collegiate Athletic Association Injury Surveillance Program (NCAA-ISP) during the 2009/10-2014/15 academic years. A reportable injury occurred as a result of participation in an organized practice/competition and required attention from an AT or physician. In lieu of a legislated definition, ATs were encouraged to follow the definition provided by the Consensus Statement on Concussion in Sport. Concussion data were analyzed from 101 women’s and 102 men’s high school team-seasons and 141 women’s and 82 men’s college team-seasons. Concussion injury rates (IR) per 1,000 athlete-exposures (AE) and injury rate ratios (IRR) were calculated, and 95% confidence intervals (CI) reported.

Results: There were 200 and 195 concussions reported by high school and college teams, respectively. Women’s teams reported higher overall IRs ([high school IR=0.66; CI: 0.54, 0.78] and [college IR=0.63; CI: 0.53, 0.73]) compared to men’s teams ([high school IR=0.41; CI: 0.33, 0.50] and [college IR=0.33; CI: 0.24, 0.42]). Except for college practices, all IRs were higher for women’s teams (overall women’s IRR=1.69 (CI: 1.38, 2.08). The mechanisms of injury in women's players included player-to-player contact (46.1%), contact with the ball (36.0%), and contact with the surface (13.6%). In men's teams, mechanisms included player-to-player contact (69.3%), contact with the ball (16.1%), and contact with the surface (13.1%). During the act of heading, player-to-player contact accounted for 56.9% and 74.1% of the concussions in women's and men's players while contact with the ball accounted for 37.5% and 18.5% of the concussions in women's and men's players, respectively. During heading, concussion due to contact with the ball was higher in women (IRR=2.43; CI: 1.18, 5.02).

Conclusions: Women’s soccer players have overall higher concussion injury rates than men’s players. Women’s players have a higher proportion and rate of concussions that occur from player-to-ball contact during the act of heading. This may support the hypothesis that women’s soccer players are at increased risk of concussion from ball contact. Future research should consider sex-differences related to neck strength, ball weight, and skill education.
Bicycle-related severe head injury in Japan

In comparison with the other developed countries, bicycle is widely used for transportation in all ages in Japan. In 2013, the number of death caused by bicycle related injury in Japan was worst among the member of Organisation for Economic Co-operation and Development (OECD). In our country, 12.4% of all cases of head injury was in bicycle related accidents. The purpose of this study is to clarify the features of bicycle related severe head injury in Japan. One thousand and one hundred one cases had been registered in the Japan Neurotrauma Data Bank (JNTDB) from 2004 to 2005 [Project 2004]. And one thousand and ninety one cases had been registered in JNTDB from 2009 to 2011 [Project 2009]. We enrolled 1016 cases (46.4%) of head injury by traffic accident. These cases were divided to Bicycle related head injury group (BR group) and the others (non-BR group). The number of BR group was 271 cases (26.7%), and the number of non-BR group was 745 cases (73.3%). Only 9 cases (3.3%) had put on helmet in BR group. The ratio of alcohol intake in BR group was lower (11.4%) than that of non-BR group (16.0%). The female ratio and the mean age of BR group were higher than that of non-BR group. The proportion over 65 years of age in BR group was higher (32.1%) than that of non-BR group (25.1%). The average of Glasgow Coma Scale (GCS) score in BR group is higher in comparison to non-BR group. The number of cases with lucid interval was higher as compared to non-BR group. Though the average of Injury Severity Score (ISS) was low in BR group, there was no statistical significance in the mortality rate among the two groups. This discrepancy was caused by elderly patients of BR group. And then there is a large number of elderly patients with bicycle related injury in Japan. This might have been caused by the rapid increase in aging society and decrease in birth rate. The results of our study provide the important information for taking preventive countermeasures against bicycle related head injury such as safety education, helmet and other campaigns not only for youngsters but also for elderly cyclist in Japan.
Tension pneumocranium as a fatal complication of paediatric traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: Tension pneumocranium occurs when air enters the cranium but cannot exit, most likely secondary to a one-way valve mechanism. The valve is usually a piece of dura which behaves like a flap. The result is increased intracranial pressure. We report a case of fatal tension pneumocranium in a young child after a motor vehicle crash.

Methods: A young boy with a serious closed head injury was resuscitated in the emergency room and underwent CT scan of the head and orbits.

Results: Fine cuts on computed tomography (CT) scan of the brain without contrast revealed a left parietal skull fracture, a left sphenoidal wing and an orbital roof fracture. It also demonstrated an extensive bifrontal pneumocranium, with air visible in the right middle cranial fossa and orbits bilaterally.

Conclusions: Suspicion for tension pneumocephalus is required in patients with severe head injuries presenting with periorbital swelling and peri-ocular trauma. Immediate resuscitation and urgent CT scan and neurosurgical intervention are required to avoid sudden death.
Acquired Brain Injury Ireland launched its political advocacy campaign in September 2015. This is the first ever national advocacy campaign for people with acquired brain injury in Ireland. The theme of the campaign is ‘Don’t Save Me, Then Leave Me. Rehabilitation is a Right, Not a Request’. The aim of the campaign is to raise the profile of acquired brain injury in Ireland and to lobby the Government to develop and implement public policy and invest in ABI services. The core message of the campaign is that essentially people are being saved and are surviving brain injury because of advances in medicine and technology but due to the lack of services, survivors are left to exist.

The core messages of the campaign were developed using a number of techniques in terms of stakeholder engagement:

1. Using on-line survey to engage with a range of stakeholders (people with ABI, families, ABI Ireland staff, healthcare professionals and supporters). Over 200 people responded and the data analysed.

2. Forming a Campaign Task Group involving senior management, board members, project staff, a doctor in rehabilitation medicine and a person with ABI.

3. Utilising 15 years of grassroots experience of developing and delivering community based neuro-rehabilitation services across the country.

As a result, ABI Ireland developed an ABI Manifesto. The manifesto sets out and explains the theme, indicates the core campaign asks and gives a summary of the key policy issues/context for the work.

The campaign is calling on Government to introduce a dedicated programme of investment for people with ABI over three years. The programme of investment must have three key elements:

1. Develop ABI rehabilitation services in the community to enable timely post-acute discharge with a transition period of intensive rehabilitation

2. Develop longer term ABI community based supports that enable people to live meaningful lives in the community

3. Support the acute hospitals with early rehab assessment and reduce the significant waiting times to access specialist post-acute neuro-rehab services by developing appropriate community response and regional in patient rehab units

A full suite of printed, download and social media campaigning tools was developed. These include the ABI Manifesto, postcards, posters and social media banners.
Political engagement (national and grassroots) and national and local media profile as well as engaging in social media activity were the critical campaigning tools used. In this way, it was possible to raise the profile of ABI in general, create a better understanding of the issues in the public policy discourse and provided the opportunity for people with ABI and their families to have their voice heard. Sixty staff, people with ABI and family members were trained in advocacy and media skills to engage in campaigning.
Detection of residual awareness function in the vegetative state patients

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: The vegetative state (VS) is characterized by preserved arousal, but in the absence of behavioral signs of awareness. Exploration of new ways in detecting the capacity of awareness is very important and valuable in both basic and clinical study.

Methods: At two referral centers in Beijing, China, we performed a study involving 8 patients in vegetative state by clinical assessment. We used functional magnetic resonance imaging (fMRI) to get the patients’ structural brain and test the blood-oxygenation-level-dependent (BOLD) responding signals by two established tasks (visual and auditory stimulations). At the same time, we used a special bedside electroencephalogram (EEG) technique to test the residual awareness signals by auditory mismatch negativity (MMN) task.

Results: In the fMRI study, 3 patients showed the differential functional signals by the tasks of relatives photo-flashing and relatives calling. However, some of the signals were located below the threshold range. In the EEG study, we found response signals in 4 patients but different with the typical MMN waveform by the classical MMN methods (auditory stimuli).

Conclusions: These primary results show that a proportion of patients in a vegetative state have brain response signals reflecting some awareness and cognition probably. The special techniques of fMRI and EEG may be useful in establishing a new cognitive testing method although the clinical significance is still unclear.
Support needs of survivors of ABI and their families.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

Patty Belle van Charosa, Waddinxveen, The Netherlands

Objective: The evidence based Support After Brain Injury (SABI) publication was developed 15 years ago with and for persons with ABI, their family and caregivers, to support people with ABI in rebuilding their lives. It helps to understand their wishes and needs and is designed to help them map out their past, present and future. The current study was done to assess the needs for support of people with ABI and their families and compare and contrast to the needs assessed 15 years ago. The SABI was also examined relative to its current relevancy and need. Finally people were asked about their suggestions for improvement.

Methods: Structured interviews were conducted to 48 persons in the network of ABI in the Netherlands and Belgium with a response of 50%. The interviews were transcribed and encoded by two persons. This qualitative study reveals the needs of people with ABI from three perspectives: 1) persons with ABI and their family, 2) professionals and 3) coordinators in the network of ABI in the Netherlands and Belgium. The answers of all three groups were compared with each other to validate the results.

Results: The most significant study finding was that persons with ABI are faced with an evolving set of challenges and issues as the move through life post-injury. They point out that this is due to new phases in life and change of circumstances (life-events such as birth, death, relocation), people get stuck in their lives and do not know where to get help. Another finding of the study was the persistent difficulty of non-recognition of ABI by professionals. The persons who work with the SABI-program are enthusiastic and see it as an effective program for all professionals and persons with ABI.

We believe, based on these results that the person with ABI, as well as their support network continues to need support services. All groups stress that there still is a need for better information and connection in transfers to other organisations. They suggest an annual follow-up, education in ABI for professionals, and measuring the effects of interventions. This should be assessed and tested in further research.

Conclusions: This study explored the needs of people with ABI, their families and caretakers who were followed in the post-acute setting in the Netherlands and Belgium. The professionals and coordinators see the SABI-program as relevant for life-long support and effective in the different phases of life. The study of the Free University of Amsterdam in 2004 confirms these findings.

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All That “Tightness” is Not Spasticity: A Novel Use of Gabapentin for the Relief of Tightness Sensation in Addition to Spasticity

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Background: Spasticity is a common phenomenon following spinal cord injury (SCI). Patients with cervical SCI often describe spasticity as tightness in their arms and legs. Baclofen, whether administered orally or intrathecally, is the preferred agent for treating SCI-induced spasticity (Rabchevsky). Gabapentin has also been shown to be effective, though usually used as an adjunct medication, in treating spasticity following spinal cord injury (Gruental, Priebe). The efficacy of treatment of spasticity has been traditionally measured by objective scales, such as the modified Ashworth (mAS) scales, and not by subjective reports of “tightness.”

Objectives: Case description of a patient, despite having an intrathecal baclofen therapy, who reported significant improvement of tightness in his legs after starting oral gabapentin.

Methods: Case report, with literature review.

Results: This is a case of a 42-year old man with a 4-year history of C6 spinal cord injury, American Spinal Injury Association Impairment Scale of D. He responded well to oral baclofen, but he was unable to tolerate higher doses due to sedation. He decided to undergo intrathecal baclofen (ITB) therapy. Initially, he responded very well to the slow titration of ITB dosage. Despite the improvement in modified Ashworth scale (mAS), he still reported persistent sensation of tightness in his legs. Despite the reduction of objective findings of spasticity and improved mobility, patient continued to report that the sensation of tightness was very bothersome to him.

His ITB dosage was titrated up to as high as 700 mcg/day. His legs’ mAS was 0 at all joints (hips, knees, and ankles) starting at about 150 mcg/day. Despite the wide ranges of dosages from 150 mcg/day to 700 mcg/day, he still reported the same degree of tightness in his legs. It is important to note that higher doses of ITB (> 300 mcg/day) caused urinary retention and erectile dysfunction. Thus, clinically, he was receiving ITB therapy.

Patient was trialed on gabapentin, started at 100mg three times a day (TID) and slowly titrated up to 600mg TID. He reported significant improvement in the sensation of tightness at 600mg TID. The ITB dosage was titrated down to 215 mcg/day and had been maintained at that dose for over a year.

Conclusions: Gabapentin has been shown to be effective in treating neuropathic pain in patients with spinal cord injury (Hagen). With the understanding that gabapentin inhibits the spinal release of glutamate to reduce neuropathic pain (Coderre), and that sensation of tightness is likely to be carried by the lateral spinothalamic tracts that carry pain and temperature sensation, gabapentin is hypothesized to help decrease the sensation of tightness in patients with SCI. This case demonstrates that gabapentin was effective, and should be considered, in treating patients with subjective tightness due to SCI.
Traumatic Brain Injury, Aggression, and Suicide: A Heuristic for Clinical and Medicolegal Assessment

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Background: Aggressive behavior, including violence directed at others and self-directed violence, is strongly associated with traumatic brain injury (TBI). Effective clinical management of aggression necessitates understanding the relationship between TBI and subsequent aggressive behaviors, while remaining mindful of other contributory factors. Likewise, medicolegal formulations often require determinations regarding the relative contributions of neurotrauma versus other neuropsychiatric factors to any specific act of violence. A coherent conceptual framework for analyzing aggressive behavior in relation to TBI may facilitate both clinical decision making and medicolegal formulations.

Objectives: To explore the relationship between TBI and aggression, and to identify the crucial elements informing formulations about potential relationships.

Methods: A PubMed search for "TBI" AND ["aggression" OR "suicide"] was performed. Investigations reporting epidemiological, neuroanatomical, and/or clinical relationships between TBI and externally-directed or self-directed violence were reviewed.

Results: The medical literature indicates a relationship between TBI and aggression that is influenced by injury parameters (i.e., injury severity), as well as pre-injury and post-injury factors. The nature of and context for any violent act, including the purposefullness and instrumentality of the specific violent act, are necessary components of cogent clinical formulations and/or medicolegal opinions regarding relative contributions from TBI.

Conclusions: The authors offer a three-dimensional heuristic which facilitates determinations regarding the relative contributions from TBI to any given act of aggression. Additional studies, critiques, and conceptualizations of this subject matter are warranted to further evaluate the utility of this heuristic to clinical decisions and medicolegal formulations regarding TBI and its role in externally-directed or self-directed violence.
Determinants of Disease Specific Health Related Quality of Life in Turkish Stroke Survivors

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: To identify determinants affecting disease specific health related quality of life in Turkish stroke survivors.

Methods: 114 consecutive patients who experienced a stroke at least 6 months prior were studied. Health related quality of life was measured using Stroke-specific Quality of Life (SS-QoL) that is a disease specific scale with 12 domains. Demographic and clinical data including age, gender, marital status, education period, time since stroke, whether the patient received rehabilitation prior to admission, stroke etiology, whether dominant hand was affected or not, presence of vision defect, neglect, aphasia and dysarthria were collected. The subjects were assessed with Functional Independence Measure (FIM) and Mini-Mental State Examination (MMSE). Multiple linear regression analysis was conducted using stepwise method to determine the predictors of domains and total score of the SS-QoL.

Results: The FIM total score were significantly associated with the six domains and total score of the SS-QoL (p<0.05). The other factors that significantly affected SS-QoL were age, MMSE, received rehabilitation, education period, male gender, the FIM motor score, affected dominant hand, presence of aphasia, dysarthria, and vision defect (p<0.05).

Conclusions: The functional independence, age, cognitive status and receiving a rehabilitation program seemed as the primary determinants of the SS-QoL.
Jobelyn, a potent neuroprotective agent in a binge alcohol rat model of alcohol use disorder

Status: Accepted  Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: The overall objective of this study was to examine if Jobelyn®, a nutraceutical, could protect the prefrontal cortex, cerebellar cortex, and hippocampus from neurodegeneration in a binge alcohol rat model of alcohol use disorders. Jobelyn is GRAS-certified by the Food and Drug Agency of USA. This is critical because conventional drugs that manage alcohol use disorders (AUDs) do not have prevention of neurodegeneration as part of their pharmacological repertoire. Multimodal neuroprotective therapeutic agents have been hypothesized to have high therapeutic utility for the treatment of CNS. Nutraceuticals by nature are multimodal in mechanism.

Methods: Two groups of rats were intragastrically fed thrice daily with 5 g/kg ethanol (25% w/v), and 5 g/kg ethanol (25% w/v) plus Jobelyn (4mg/kg body weight) respectively in diluted nutritionally complete diet (50% v/v). Control rats were correspondingly fed a nutritionally complete diet (50% v/v) made isocaloric with glucose. Cytoarchitectural consistencies of the prefrontal cortex, cerebellar cortex, and hippocampus were examined with H&E. Immunohistochemistry studies for p53, NF, GFAP, NSE and Ki-67 proteins were done by the ABC method.

Results: After 4 days of binge alcohol treatment, results showed that Jobelyn supplementation significantly lower the levels of histologic and biochemical indices of degenerative changes. Animals treated with Jobelyn exhibited improved neurodegenerative scores, reduced tissue destruction, and decreased neuronal apoptosis and necrotic cell death. Immunohistochemical studies showed that in the prefrontal cortex, Jobelyn inhibited p53-dependent apoptotic signalling pathway through increased expression of p53 protein in the cortical neurons. In comparison with the alcohol group, Jobelyn also significantly reduced the expressions of GFAP, NSE and NF proteins. In the hippocampus, Jobelyn inhibited p53-dependent apoptotic signalling pathway by increased expression of p53 protein in areas CA1 and CA3, and by decreased expression in the DG. This was also a significant overexpression of NF proteins in the CA1 area. In addition, Jobelyn significantly reduce the levels of GFAP expression and prevented astrocyte reduction in the hippocampus, compared with the alcohol group. Jobelyn also significantly reduced alcohol-induced inhibition of neurogenesis in the SGZ of the dentate gyrus. In the cerebellar cortex, Jobelyn suppressed neuronal death by a reduction in number of p53 positive neurons.

Conclusions: Taken together, the results of this study have repurposed Jobelyn as a good ameliorative agent in alcohol abuse and alcohol dependent rats. Jobelyn supplementation ameliorate cytoarchitectural deficit in the prefrontal cortex, cerebellar cortex, and hippocampus of AUD rats by alleviating oxidative stress and reducing neuronal apoptotic and necrotic death.
Effect of Lesion Burden on Recovery and on Response to Amantadine in Patients with Disorders of Consciousness after Traumatic Brain Injury

Status: Accepted Presentation type: Oral
Category: Neurorehabilitation – case reports/clinical research
Author's preference: No preference

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Objectives: To assess the effect of lesion burden by CT on recovery and response to amantadine treatment in patients with prolonged traumatic disorders of consciousness (DoC). Amantadine improves the pace and quality of recovery after traumatic DoC but it is uncertain how injury characteristics such as lesion burden affect recovery and the benefit of amantadine.

Methods: Retrospective analysis of a randomized controlled trial dataset on 184 patients (87 amantadine; 97 placebo) with non-penetrating post-traumatic DoC, 4-16 weeks post-injury from 11 neurorehabilitation centers (USA, Denmark, and Germany). CT scans were visually coded against standard templates in 117 cortical and subcortical regions. Outcome measures: Disability Rating Scale (DRS) and Coma Recovery Scale-Revised (CRS-R) scores, 4 and 6 weeks post-randomization.

RESULTS: In the placebo group, higher lesion burden was significantly associated with worse outcome at 6 weeks post-randomization (cortical: n=89, DRS P=.0124, CRS-R P=.0324; subcortical: n=91, DRS P=.0067, CRS-R P=.0256).

Results: Follow-up regional analyses, controlling for time post-injury and initial level of consciousness, demonstrated a strong relationship of lesion burden to outcome in thalamus, striatum, medial prefrontal, dorsolateral prefrontal, parahippocampal, sensorimotor, auditory and temporoparietal association areas but not in precuneus/posterior cingulate, visual or brainstem areas. There was no significant interaction of lesion burden and treatment group (amantadine or placebo) at 4 weeks, however, inspection of the 4wk slope of recovery suggested that amantadine-treated patients with highest lesion burden recovered more slowly, similar to the placebo group, while patients in the placebo group with lowest lesion burden recovered faster, similar to the amantadine group.

Conclusions: Higher lesion burden on routine CT imaging is associated with worse recovery in patients with traumatic DoC, but does not conclusively limit the response to amantadine treatment. Damage in specific regions of interest was associated with functional outcome although the influence of regional versus global lesion burden remains unclear.
The outcome of Level of consciousness after early intensive neurorehabilitation programme (EINP)

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Background: Brain injury in children and young adults, leading to diminished consciousness, can have a huge lifelong impact on the patients and their relatives. Treatment programmes have been developed aimed at restoring consciousness, besides treatment and prevention of medical complications. Most of these treatment programmes are based on principles of recovery of brain function by regulated stimulation of the senses. In The Netherlands, a comprehensive early intensive neurorehabilitation programme (EINP) for children in a vegetative state or minimal conscious state was developed in 1987. Of the participants, included between 1987 and 2001, almost 2/3 reached full consciousness. Traumatic patients and patients with a small interval since injury had a better outcome than non-traumatic patients and patients with a longer interval since injury.

Objectives: To reassess the outcome in consciousness after treatment of children and young adults in a vegetative state or minimal conscious state, following the EINP in the period 2010-2014. Secondary aim was to describe its relationships with cause of brain injury (traumatic versus non-traumatic) and time interval since injury. Design: Historic cohort study. Patients: Children and young adults < 25 years of age, in a vegetative state or minimal conscious state due to a recent brain injury (n = 71).

Methods: Consciousness was measured during the EINP with the Post-Acute Level Of Consciousness scale (PALOC-s), at admission and at discharge.

Results: Patients in vegetative state diminished from 42% to 14%, and in minimal conscious state from 33% to 21%, so 65% of the patients was conscious at discharge. Of the patients with traumatic brain injury 67% became conscious, versus 59% of the non-traumatic ones. Of the patients admitted within 3 months of injury (n = 66), 70% became conscious, whereas none of the patients admitted more than 3 months of injury (n = 5) did.

Conclusions: Children and young adults < 25 years of age, in a vegetative state or minimal conscious state due to a recent brain injury can benefit from an early intensive neurorehabilitation programme. Compared with an earlier study, a little bit more patients became conscious (65% versus 62%), especially in the non-traumatic brain injury group (59% versus 41%). The reason for this is not studied, but might be due to advanced medical treatment and prevention of complications. It is recommended to study this specific group in more detail, regarding personal, medical en psychosocial characteristics in relation to outcome of consciousness. A randomized controlled trial should be best but is ethically hardly feasible.
Behavioural, Blood, and Advanced Magnetic Resonance Imaging Biomarkers of Experimental Concussion

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: No preference

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Objectives: Repetitive concussions may result in cumulative and chronic neurological consequences, and these effects may be due to the subsequent concussions occurring while the brain is in a period of increased vulnerability after the initial insult. Thus, the identification of markers that indicate when the brain is no longer in a state of increased vulnerability might allow them to be used to guide medical decisions, so as to reduce the effects of repeated concussion. The current clinical management of concussion is based on assessing for the resolution of symptoms, which can be highly subjective and may not accurately indicate when the brain has recovered. Alternatively, advanced magnetic resonance imaging (MRI) and blood-based biomarkers represent objective methods that may be more sensitive to the subtle pathophysiological changes that occur in the concussed brain. Therefore, here we assessed the ability of multi-modal MRI, blood proteomics, and behavioural outcomes to detect changes and estimate recovery after an experimental concussion.

Methods: Adult male Long-Evans rats were given either a sham injury or a mild fluid percussion injury (mFPI), and serial MRI, blood collection, and behavioural testing was performed at 1, 3, 5, 7, and 30 days post-injury. Serum and plasma was analyzed using reverse phase protein arrays to assess markers sensitive to neuronal and glial cell loss, metabolic abnormalities, neuroinflammation, axonal injury, and other pathophysiological mechanisms associated with concussion. In vivo MRI data was acquired using a 4.7T Bruker pre-clinical scanner, and analyses included structural, diffusion tensor imaging (DTI), tractography, and magnetic resonance spectroscopy (MRS). Behavioral analyses involved measures of cognition, sensorimotor function, anxiety, and depression.

Results: A mFPI resulted in transient cognitive abnormalities that persisted for 3 days post-injury, and sensorimotor impairments that persisted for 1 day post-injury. In contrast, MRI (i.e. DTI, tractography and MRS) and blood biomarkers detected brain abnormalities that remained after the resolution of behavioral symptoms, some of which were still present a day 30 day post-injury.

Conclusions: These findings indicate that MRI, blood proteomic, and behavioral methods can all detect changes induced by a mFPI. However, advanced MRI and blood biomarkers may be more sensitive than symptom-based approaches, and should continue to be pursued as objective biomarkers of concussion.
Activities and participation in children and adolescents after mild traumatic brain injury and the effectiveness of an early intervention: design of the Brains Ahead! study

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Objectives: After mild traumatic brain injury (MTBI), up to 20% of children and adolescents may experience unrecognized long-term consequences. These include cognitive problems, posttraumatic stress symptoms and reduced load-bearing capacity. The underestimation and belated recognition of these long-term consequences may lead to chronic and disruptive problems, such as participation problems in school and in social relationships. This study aims to examine the level of activities and participation in children and adolescents up to six months after MTBI and possible predictors for outcome. Furthermore, the study aims to investigate the effectiveness of an early psychoeducational intervention compared to the usual care.

Methods: The Brains Ahead! study is a nested randomized controlled trial (RCT) (n=140) within a multicentre longitudinal prospective cohort study (n=500). The main inclusion criteria are children and adolescents aged 6-18 years with an MTBI within the last two weeks. An MTBI in this study is defined as a Glasgow Coma Scale score of 13-15 and one or more of the following: (1) confusion or disorientation, (2) loss of consciousness for 30 minutes or less, (3) posttraumatic amnesia for less than 24 hours, (4) other transient neurologic abnormalities such as focal signs, seizure and intracranial lesion not requiring surgery. Among the exclusion criteria are insufficient knowledge of Dutch language and previous objectified head trauma or previous neurological problems. Participants in de RCT are randomly assigned to either the psychoeducational intervention group or the usual care control group. The psychoeducational intervention consists of one face-to-face session with the interventionist, during which the consequences on MTBI and advice on coping with these consequences in order to prevent long-term problems are addressed, one telephonically follow-up session, and optional - i.e. depending on the needs of the patient or caregiver - follow-up sessions by telephone. Information is provided both verbally and written. The interventionist is a professional experienced and educated in child rehabilitation. Measurements are performed at two weeks, three months and six months post MTBI. The primary outcome measure is activities and participation in children and adolescents after MTBI, measured with the Child and Adolescent Scale of Participation-Dutch language version (CASP-DLV). Possible predictors of activities and participation are injury related and non-injury related factors, as well as pre-injury family functioning (FAD-GF) and behaviour (CBCL), degree of fatigue (PedsQL-fatigue), quality of life (PedsQL-QoL), sensory processing (SP/AASP), post concussive symptoms in the physical, cognitive, emotional and behavioural field (HBI), post-traumatic stress (IES), and participation on after-school activities (CAPE).

Conclusions: The results of this study will provide insight into which children with MTBI are at risk for long-term participation problems and may benefit from a psychoeducational intervention.
Delayed Presentation Head Injuries: Which Patients Presenting After twenty-four Hours Need a Scan? An observational study.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: The NICE guidelines used to triage the 1.4 million patients attending the ED with head injury in England and Wales annually for CT imaging are based on research conducted in populations presenting within twenty-four hours of injury. We therefore postulated that they might not apply to those presenting later in the same way. The three specific aims of this study were to:

1) Estimate what proportion of adult head-trauma CT scans were performed for patients presenting after twenty-four hours of injury

2) To compare the incidence of traumatic intra-cranial CT findings in head-injury patients presenting within and after twenty-four hours of injury

3) To compare the use and sensitivity of the NICE guidelines in head-injury patients presenting within and after twenty-four hours of injury.

Methods: Emergency Department (ED) trauma Computed Tomography (CT) head scan requests from Hull Royal Infirmary, over a period of 6 months, were matched to ED records. Data was extracted on: time to presentation after injury; the presence of a NICE indication for a CT head scan; whether there was a significant traumatic finding; and demographic data.

Results: 650 CT head scans matched to case records were available for analysis. Overall, 8.6% showed a traumatic abnormality; 1.2% required neurosurgery and 0.3% died. Of this sample, 15.5% of CT head scans were for patients presenting after 24 hours. The CT abnormality rate was 8.4% for those presenting within, and 9.9% for those presenting after 24 hours. The sensitivity of the NICE guidelines for intracranial injuries was 98% in those presenting within 24 hours and 70% in those presenting after 24 hours of injury.

The presence of a NICE indication was found to be statistically predictive of significant traumatic pathology and this was unaffected by time of presentation

Conclusions: Head injury patients presenting after twenty-four hours of injury are a clinically significant population. NICE guidelines were less sensitive in this group. A different approach for such patients may be required.
Return to Work after Severe Traumatic Brain Injury is low in Denmark: A Nationwide follow-up Study

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: To explore return to work (RTW) and stability of labor market attachment (LMA) after severe traumatic brain injury (TBI) and to compare long-term LMA with the general population. Further, to assess the association between LMA and Quality of life (QOL) after severe TBI.

Methods: The national population of persons aged 18-64 years, who received highly specialized neurorehabilitation after severe TBI between 2004 and 2012 (n=637, approximately 84% of all persons surviving severe TBI in Denmark) were matched to general population controls on age, sex, pre-injury employment status, educational level, and residence (n=2497)

Data on RTW and LMA were retrieved from a nationwide transfer payments register. Three different measures of RTW and LMA were defined by including different types of transfer payments as measures of RTW and LMA. Stable LMA was defined as weeks with LMA≥75%. LMA among persons with TBI and controls were compared using multivariable conditional logistic regression. QOL between persons with LMA and persons with no LMA after severe TBI were compared using Wilcoxon Rank Sum test.

Results: Thirty to 52% attempted RTW and 16-31% achieved stable LMA within the first 2 years after severe TBI. LMA prevalence proportions decreased from 2½% years post-injury. LMA including tax-financed activities temporally increased between 3 and 4 years post-injury, but decreased to 30% at 5 years post-injury. Post-injury QOL was significantly higher for persons with LMA compared to persons with no LMA.

Adjusted odds ratios were 0.05 and 0.06 for LMA at 1 and 2 years post-injury and 0.07 for stable LMA for persons with severe TBI compared to the general population.

Conclusions: The chances of RTW and long-term LMA after severe TBI were low in Denmark when compared with the general population and when compared with other countries.
Neurophysiological and Neurocognitive Mechanisms underlying Daily Life Problems of Children with TBI: Results from the Dutch TBI Project

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: The Dutch TBI Project is a multicenter research collaboration between academic trauma level 1 medical centers and rehabilitation centers throughout the Netherlands, aiming to elucidate the neurophysiological and neurocognitive mechanisms underlying daily life problems of children with TBI. This presentation will provide recent project findings, discuss clinical implications and reveal the latest findings of the magnetic resonance imaging (MRI) follow-up.

Methods: Children aged 6-13 diagnosed with TBI (n=113; M=1.7 years post-injury) were compared to children with traumatic control (TC) injury (n=53). TBI severity was defined as mild TBI without or with risk factors for complicated TBI (mildRF−TBI: n=24 and mildRF+TBI: n=52, respectively) or moderate/severe TBI (n=37). A neurocognitive test battery assessed: (1) attention function using the Attention Network Test in combination with ex-Gaussian modeling; (2) learning from increasingly inconsistent feedback using the Probabilistic Learning Test; and (3) sensory integration using experimental paradigms for visual integration and multisensory integration combined with diffusion modeling. Behavioral functioning was measured using parent and teacher questionnaires and general neurocognitive functioning was estimated using a Wechsler short form estimation of IQ. In a follow-up on a subset of children (n=64), 3 Tesla MRI was performed, including high-resolution anatomical imaging, diffusion tensor imaging and (resting-state and active-state) functional MRI (fMRI).

Results: Analyses in the domain of attention revealed that TBI did not affect alerting, orienting or executive attention (Ps≥.55). Instead, the children with mildRF+TBI or moderate/severe TBI had lapses of attention (P=.002, Cohen's d=0.52) that explained the negative relation between IQ and parent rated attention problems in the TBI group (P=.02). Results in the learning domain revealed that children with TBI had unaffected ability to learn from increasingly inconsistent feedback, but that moderate/severe TBI affects the ability to generalize learning from feedback to novel contexts (P=.03, d=-0.51). Interestingly, poorer generalization of learning predicted more externalizing problems in children with TBI (P=.03, β=-.21). Analyses of sensory integration after pediatric TBI showed that children with mildRF+ or moderate/severe TBI have impaired efficiency of visual integration and multisensory integration (Ps<.001, ds<-.63), which were both related to poorer IQ. Ongoing analyses on MRI data investigate the prognostic value of white matter integrity and brain connectivity for clinically important impairments after pediatric TBI.

Conclusions: The first results from the Dutch TBI Project indicate that children with TBI are at risk of: (1) lapses of attention that relate to daily life attention problems observed by parents; (2) impaired generalization of learning that relates to externalizing problems; and (3) impaired efficiency of visual and
multisensory integration, both relating to poorer general neurocognitive functioning. The results further reveal chronic effects of mild TBI on functioning (even in absence of intracranial injury), supporting routine follow-up children with mild TBI.
Family Impact of Acquired Brain Injury in children and youth

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: To determine the impact of paediatric TBI and NTBI on families in the Netherlands, 24-30 months after diagnosis, using the Pediatric Quality of Life Inventory Family Impact Module (PedsQL™FIM) and to determine associations between family impact and socio demographic characteristics, ABI characteristics and current physical and mental functioning.

Methods: This follow-up study was part of a larger study on the incidence and consequences of ABI in The Netherlands. In a sample of parents of non referred children and youth, with a hospital based diagnosis of ABI made in 2008 or 2009, family impact and functioning were measured with the PedsQL™FIM. The 36-item PedsQL™FIM yields Summary Scores on Parent Health Related Quality of Life and Family Functioning, as well as Communication and Worry Subscale Scores. Additional assessments included the PedsQL General Core and Multiple Fatigue scales, the Paediatric Stroke Outcome Measure (PSOM) and the Child & Family Follow-up Survey (CFFS). Correlations among the three subscales of the FIM were computed using Spearman Rank Correlation Coefficients. To explore the association between the FIM and measures of the patients' and parents' health status we used linear regression models.

Results: The parents of 108 patients participated in the study. The median age of the patients was 13 years (range 6-22), 60 patients (56%) were male. The cause of ABI was traumatic in 81 patients (75%) and at the time of diagnosis 84 (78%) were classified as mild and 24 (22%) as moderate or severe. The mean Total PedsQL™FIM Scores were 81.8 (95% CI 78.3 - 85.3) and 75.6 (95% CI 65.8-84.9), in the mild and moderate/severe groups, respectively (p<0.01). In a multivariable regression analysis the severity and type of injury and the presence of child or family health problems before the ABI were found to be associated with lower FIM scores (more family impact).

Conclusions: In a hospital based cohort of children and youth with ABI, its impact on the family, as measured by the PedsQL™ FIM, was considerable. The extent of family impact was associated with characteristics of ABI as well as the health status of the child before ABI. The results of this study support the importance of the systematic monitoring of family impact to enable tailor-made psycho-education, follow-up and support for parents, brothers and sisters.


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Cognitive gaming after stroke: a randomised controlled trial

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: To determine the effect of a computer-based cognitive rehabilitation (CBCR) brain training program on cognitive functioning, quality of life (QoL) and self-efficacy compared to only information provision on brain and cognition in stroke patients.

Methods: Randomized comparison of an 8-week computer-based game training program (Lumosity Inc.®) to be used ≥5 days per week for 15–20 minutes with the provision of general information about the brain weekly. Inclusion of patients aged 45–75 years, 12–36 months after a first stroke, with self-perceived cognitive impairments. Assessments (0, 8 and 16 weeks) consisted of neuropsychological tests (Trail Making Test, Block and Digit Span, Eriksen Flanker Task and Raven Standard Progressive Matrices) and the Cognitive Failure Questionnaire, Stroke Specific Quality of Life Scale and General Self-Efficacy Scale.

Results: 53 patients were randomized to the intervention and 57 to the control group. Significantly better results in favor of the intervention were seen for working memory (Block Span, items correct forward, mean difference 0.7, 95% CI 0.25,1.10), speed (Eriksen Flanker, reaction time incongruent, mean difference -63, 95% CI -118.9,-7.4) and self-efficacy (GSES, mean difference 1.0 , 95% CI 0.31;2.23) at 8 weeks. Between 8 and 16 weeks no changes within or differences between groups were seen. Patients in the intervention group improved significantly on trained computer task (games) at all cognitive domains (attention, memory, speed, flexibility and problem solving), but these results did not translate into cognitive functioning as measured with neuropsychological tests and measures of subjective cognitive functioning or QoL.

Conclusions: The effect of the computer-based gaming program on some aspects of memory and self-efficacy warrants the need for further research into the value of CBCR to improve cognitive functioning in patients after stroke.

Acknowledgements: This study was supported by the Fonds Nuts Ohra (grant number 1202-006) and Revalidatiefonds ( 2011184). Lumosity Inc. provided the computer games for free.
The Effect of CPAP Treatment on Rehabilitation Outcome of Stroke Patients with Obstructive Sleep Apnea

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Obstructive sleep apnea (OSA) in stroke patients is associated with worse functional and cognitive status during inpatient rehabilitation. The effect of continuous positive airway pressure (CPAP) treatment on stroke recovery however is still unclear. The aim of this study is to investigate whether a four-week period of CPAP treatment would improve cognitive and functional outcomes of stroke patients during rehabilitation.

Methods: Thirty-six stroke patients admitted to a neurorehabilitation unit were randomized to rehabilitation treatment CPAP treatment (CPAP group) or to treatment as usual (control group). Primary outcomes were cognitive status measured by neuropsychological examination, and functional status measured by two neurological scales and a measure of activities of daily living (ADL). Secondary measures included sleepiness, sleep quality, fatigue and mood. Tests were performed at baseline and after the 4-week intervention period.

Results: Twenty patients were randomized to the CPAP group and 16 patients to the control group. The average CPAP compliance was 2.5 hours per night. Patients in the CPAP group showed significantly greater improvement in the cognitive domains of attention and executive functioning than the control group. CPAP did not result in measurable improvement on measures of neurological status or ADL, or on any of the secondary measures.

Conclusions: Our study indicates that CPAP treatment improves cognitive functioning of stroke patients with OSA during inpatient rehabilitation. These findings offer a preliminary evidence base for the use of this treatment as part of a rehabilitation program for stroke patients.
Free mobile app about acquired brain injury. Needs of caregivers and effects on anxiety and self-efficacy

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: The rising accessibility to the Internet have favored the increase of searches about health and wellbeing. In 2010, 49% of the European population used the Internet to search for health-related information. However, Internet can be a source of misinformation that cause anxiety due to difference in testimonials and reviews, or increase the expectations and demands of patients regarding new treatments or therapies. All these factors led us to interview patients, relatives, and caregivers to know their preferences when searching information about acquired brain injury (ABI), and to develop the first mobile app about ABI. The objective of this study was twofold: first, to describe the results of the survey, and second, to determine the clinical efficacy of the app.

Methods: A total sample of 116 subjects (81 men and 35 women), 43.5±23.9 years old, participated in the survey. A total of 82.8% of the participants were related to subjects with a chronicity from 1 to 6 months, 16.3% were related to subjects with greater chronicity, and only 0.9% were related to subjects with a chronicity fewer than one month. All of them completed a 9-item questionnaire that assessed their motivation, frequency of use, interests, and preferred devices and social networks. Clinical efficacy: Twenty-five subjects (9 men and 16 women), 53.9±8.9 years old, participated in a longitudinal study to assess the clinical efficacy of the app. Subjects freely used the app for 12 weeks. The app (NeuroRHB, Spain) requires users to complete a survey to provide customized information and recommendations for each user about mobility, cognition, behavior/emotion, communication, feeding, activities of daily living, environment adaptation, health care, social resources, and family. Participants were assessed before and after the study with the Generalised Anxiety Disorder Assessment (GAD-7) and the Revised Scale for Caregiving Self-Efficacy (RSCSE).

Results: Most of the participants (84.2%) used the Internet to get information about ABI, and almost all of them (98.2%) used mobile devices. A total of 68.8% of the participants were interested in receiving recommendations about ABI and 58% of them searched for websites with specific information for clarification. Participants preferred Wikipedia (61.7%) over Youtube (42.3%), Facebook (31.6%), and Twitter (4.5%). Clinical efficacy: After using the app, participants showed a significant decrease (-2.7±3.5) in the anxiety level (t=-3.8, p=0.01), a decrease (-2.8±5.1) in the caregiver burden (t=2.7, p=0.012), and an improvement (7.3±4.9) in the efficacy of caregiving (Wilcoxon-z=-4.3, p<0.001).

Conclusions: Mobile technology has contributed to Internet accessibility, which is also reflected in the number of searches related to health. Mobile apps with specific reliable information about ABI could help patients, relatives, and caregivers to decrease their anxiety and improve their self-perfection of caregiving. Users can freely download the app searching for NeuroRHB on Google Play or Apple Store.
Head Injuries in Young Children; The Forgotten Pandemic

Status: Accepted Presentation type: Oral

Category: Neurotrauma – prevention and public health

Author's preference: Oral

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Objectives: To describe the profile of childhood head injury patients treated in a Paediatric Trauma Unit over a 25 years period.

Methods: A retrospective record-based study was performed at the Trauma Unit of the Red Cross War Memorial Children's Hospital in Cape Town, South Africa. The Childsafe South Africa Childhood Injury Surveillance System was data-mined for the information. Inclusion criteria were children under the age of 13 years and presenting with a head injury during the period between January 1991 and July 2025.

Results: 10205 children presented after sustaining a head injury. There were 6457 boys and 3745 girls. In 281 (2.75%) of cases the children were injured as a result of physical violence. The majority of children presented with superficial lacerations and abrasions, mostly affecting the scalp and skull. Injuries were mainly caused by falls from a variety of heights or were traffic-related. Almost two-thirds of traffic-related injuries involved children as victims of a motor vehicle crash. The majority of head injuries in young children occurred in the vicinity or within the child's own home. In 56 cases the severity of the injury was not recorded. From the remaining 10146, 6864 (67.3%) were classified as minor; 2918 (28.6 %) as moderate; 225 (2.2%) as severe and 135 (1.3%) children died within 24 hours after admission.

Conclusions: Head injuries are a significant and ongoing cause of morbidity in particular of young children and represent the most important component of childhood injuries. Protection of young children, especially in their own home and on the streets requires urgent attention.
Body schema plasticity after stroke. Insights from the Rubber Hand Illusion on spastic subjects

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Poster

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Objectives: Body-ownership can be defined as the sense that the body that one inhabits is his/her own. Agency refers to the sense that one can move and control his/her body. The Rubber Hand Illusion (RHI) experiment has been used to study body-ownership mechanisms in different conditions, mainly in phantom limb pain after amputation. However, little is known about the effects on stroke. The objective of this study is to determine the effects of RHI in stroke survivors in comparison with healthy individuals.

Methods: Individuals post-stroke and healthy subjects were recruited. Inclusion criteria in the stroke group were 1) age ≥ 50 and ≤ 80 years old; 2) chronicity > 6 months; 3) Modified Ashworth Scale > 1 and ≤ 3; 4) Mini-Mental State Examination > 23; and 5) Mississippi Aphasia Screening Test ≥ 45. Individuals were excluded if they had 1) peripheral nerve damage; 2) orthopedic alterations or pain syndrome; 3) joint stiffness that prevented arm positioning; 4) unilateral spatial neglect. Individuals were included in the healthy group if they were 50 to 80 years old and had no motor or cognitive impairment. Twenty subjects (59.5±8.9 years old) participated in the study and presented an ischemic stroke (n=11) or hemorrhagic stroke (n=9). Twenty-one healthy subjects (59.9±7.5 years old men) were also recruited. The classic RHI experiment was conducted. Participants were asked to look at the rubber hand and "sense the rubber hand as theirs". Then, both hands (the real and the rubber hand) were synchronously stroked with a brush during two minutes. Immediately thereafter, the experimenter hit the rubber hand with a hummer, and the experiment concluded. After that, participants filled in a 10-item questionnaire about embodiment. Items evaluated body-ownership, location, and agency.

Results: Individuals with stroke felt a significantly stronger sense of body ownership (p=0.009) and agency (p=0.046) than healthy individuals. Expressed in terms of number of participants, while only 13 healthy participants (61.9%) felt the sense of body-ownership, all the participants with stroke but one (95%) reported to have felt this effect (p=0.010). Similarly, only nine healthy participants (42.9%) felt agency over the rubber hand in contrast to 16 participants with stroke (80%) (p=0.015). This could have been facilitated by an alteration in their body schema derived from the injury and its resulting motor limitations. This premorbid condition could have allowed the external limb to be incorporated (thus promoting a reconfiguration of the body schema) more easily.

Conclusions: The RHI experiment could evidence an alteration on the body schema in spastic subjects after stroke, which can promote the ownership of alien limbs. Future studies should address this hypothesis.

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Validity and reliability of an open access Wii Balance Board-based posturography.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Posturography systems incorporate force plates to objectively and reliably measure balance and postural control of individuals while also assessing sensory integration. The off-the-shelf Nintendo® Wii Balance Board (WBB) is an inexpensive and portable force platform that has proved to have similar performance to those used in laboratory grade posturography systems. We have developed a web-based tool that would create a clinical posturography system based on the WBB (www.posturography.labhuman.com). The aim of this study was to determine the psychometric properties of this experimental assessment tool and to characterize a cohort of stroke individuals with respect to a sample of age-matched healthy subjects.

Methods: A total of 144 healthy individuals (43.34±18.59 years old) and 53 individuals with stroke (52.11±13.70 years old) were enrolled in this study. Individuals with stroke presented ischemic (n=24) or hemorrhagic (n=29) etiology, and a chronicity of 788.75±692.15 days. Inclusion criteria were ability to stand unassisted for 30 seconds and to understand instructions (Mini-Mental State Examination>23). Subjects with severe aphasia (Mississippi Aphasia Screening Test<45), arthritic or orthopedic conditions affecting the lower limbs, or severe hemispatial neglect were excluded. All participants were assessed on the WBB-based system, which consisted of three standardized tests: the modified Clinical Test of Sensory Interaction on Balance (mCTSIB), the Limits of Stability, and the Rhythmic Weight Shift. To determine concurrent validity of WBB-based posturography, individuals with stroke were also assessed with the laboratory grade NedSVE/IBV posturography system (IBV, Spain), and with a battery of clinical scales (Berg Balance Scale, Functional Reach Test, Step Test, 30-Second Chair-to-Stand Test, Timed “Up-and-go” Test, Timed Up-and-Down Stair Test, and 10-Meter Walking Test). In addition, a group of ten subjects were assessed twice in the same day by the same physical therapist and another ten subjects by two different physical therapists to determine intra and inter-rater reliability, respectively. Reliability was assessed using the intra-class correlation coefficient (ICC).

Results: The WBB-based system successfully ranked individuals with stroke according to the severity of their symptoms, characterizing individuals with stroke in comparison to healthy population. The system demonstrated high to excellent concurrent validity with the NedSVE/IBV system for sway velocity (r=0.911;p<0.01) and for maximum displacements in both medial-lateral (r=0.708;p<0.01) and anterior-posterior planes (r=0.873;p<0.01) during the mCTSIB; and high validity for limits of stability (r=0.649;p<0.01). Responses to the other clinical scales trended in the expected direction, but correlations with WBB results were not strong. All measures other than directional control exhibited excellent inter and intra-rater reliability (ICC>0.8;p<0.01).

Conclusions: The open access WBB-based posturography showed comparable psychometric properties to laboratory grade system, with the advantage of its low-cost and higher availability and portability, which suggests that the system can be relied upon to assess changes in the balance abilities of individuals following a stroke.
The prediction of neurobehavioral problems in acquired brain injury with a Dutch version of an ecologically-valid assessment of executive functions

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Acquired brain injury (ABI) is strongly related to cognitive dysfunction and changes in behavior. Particularly, damage to the frontal cortex may lead to changes in behavior as well as executive dysfunctions. Literature shows that some patients who have behavioral problems may nonetheless perform flawlessly on standardized tests of executive function. One explanation might be that many executive functions tests lack ecological validity, as during the traditional administration of neuropsychological tests the examiner provides structure, organization, guidance, planning and monitoring necessary for optimal performance, which therefore fail to induce executive behavioral deficits usually seen in daily live. The use of Virtual Reality (VR) seems to be a good alternative to address the lack of ecological validity in traditional neuropsychological tests. The Jansari assessment of Executive Functions (JEF©) is such a VR test and has been demonstrated to be a sensitive measure regarding different clinical and non-clinical populations (Jansari and colleagues, 2010, 2011, 2012, 2013, 2014).

In this study we investigated whether the correlation between a Dutch translation of JEF© and behavioural measures was stronger than that between classical neuropsychological executive tests and the same behavioral measures, in patients with focal brain damage. Patients entering a mental health institute for brain injury (Vesalius, The Netherlands) who had frontal brain damage were included in the study. The results show that Dutch JEF© predicts daily-life executive problems better than standard executive tests. This suggests that JEF©, could be used as a new assessment of executive function, improving the process of treatment/rehabilitation and hopefully make re-entry into society more easy.
Specialised Brain Injury Rehabilitation: An Ethical Framework for staff to plan discharge for cognitively impaired brain injury survivors.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Title: Specialised Brain Injury Rehabilitation: An Ethical Framework for staff to plan discharge for cognitively impaired brain injury survivors.

Background: The incidence of acquired brain injury (ABI) in the United Kingdom was 544 per 1,000,000 between 2013-14. With frontal lobe involvement, cognitive deficits can vary greatly and health care professionals are often faced with legal and ethical dilemmas. They may often feel unsure on how to proceed with complex decision making around discharge. Conflicts of opinion can occur between health care professionals, the patient, his or her family and peripheral services. Although these difficulties are identified, the current frameworks used do not support the legal and ethical decisions.

Objectives: To identify whether the use of an ethical framework would be beneficial in supporting health care professionals in specialised rehabilitation, when considering difficult dilemmas in decision making around discharge planning.

Methods: Review of current research in ethical and legal considerations around decision making in complex discharge planning

Results: Ethical considerations include: autonomy, non-maleficience; beneficence and justice. Legal consideration; Acts of Parliament, relevant case law. Professional considerations and codes of conduct.

Autonomy and mental capacity are common themes running through complex decision-making and dilemmas in practice around discharge planning. Mental capacity is needed to exercise autonomy; however mental capacity is not always clear for consent and decision making, when there are cognitive difficulties with understanding, processing and retaining information. This ability can also fluctuate. Often a patient's wishes for discharge from hospital could put them at risk. They can be perceived by health care professionals as bad choices, leaving them unsure on how to proceed. Healthcare professionals have to refrain from coercing patients into a decision that they feel more comfortable with. This could be difficult for professionals, who are in a position where they should be reducing risk and preventing harm for patients. Consideration of ethical and legal aspects can be time-consuming and there are often conflicts between the ethical principles and legal duties. An ethical framework by Seedhouse provides support with decision making; it considers the individuals involved their duties and roles, the consequences and external consideration and can support efficiency, but it should not replace personal judgement.

Conclusions: Following the identification of the difficulties in decision-making concerning complex discharge planning in people with cognitive deficits following ABI, the use of an ethical frame work can a) help staff to allay feeling unsure on how to proceed with care and b) support staff to consider all aspects linked to that decision making. Healthcare professionals can practise care that ensures that they are working both ethically and within the law, when proceeding with difficult decisions around discharge.
Objectives: This study aimed to estimate the prevalence of TBI in a French prison population of female offenders, to study variables known to be associated with TBI and to compare our results with results among male offenders from a previous study. Participants: All female offenders (adults and juveniles) admitted consecutively to Fleury-Mérogis prison over a period of 3 months were included in the study.

Methods: During the admission procedure, female offenders were interviewed by healthcare staff using a self-reported questionnaire.

Results: In all, 100 female offenders were included. The rate of self-reported TBI was high, with a prevalence of 21%. The first cause of TBI was violence related outcomes (35%) and a majority of female offenders with a history of TBI reported more than one TBI. Epilepsy, psychiatric care, anxiolytic and antidepressant treatment, use of alcohol were all higher among female offenders with a history of TBI.

Conclusions: These results provide further evidence that specific measures need to be developed for female offenders who sustained a TBI.
The cost of crime: a health economic analysis of the impact of traumatic brain injury on crime

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: Across various studies, in different jurisdictions internationally it has been shown that survivors of childhood or adolescent Traumatic Brain Injury (TBI) are at much greater risk of offending compared to the general population. And, indeed, compared to their own siblings. Analysis of costs to the UK criminal justice system of young offenders - who may often have TBIs - are substantial. With estimates that each serious young offender costs $45,000 per annum to society over a ten year period.

Methods: We present a review of health economic data on the cost of crime that may be due to TBI.

Conclusions: It would therefore appear that initiatives to reduce the likelihood of TBI and/or the consequences of TBI (such as behavioural problems and impulsivity) may offer routes for reducing costs associated with crime. Indeed, even if interventions are only moderately effective in reducing re-offending, they are still likely to be good value for money and so should be provided.
High Level Mobility Task Performance After Military Mild Traumatic Brain Injury Identifies Subtle Motor Control Impairments

Status: Accepted
Presentation type: Oral
Category: Technology – clinical research/applications
Author's preference: No preference

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Background: Recent advances in medical science have highlighted the need for effective methods for quantifying the effects of mild TBI. Clinical neurological examinations, neuropsychological testing, and self-reporting of post-concussive symptoms have limitations and vulnerabilities. Quantitative evaluation of performance on motor tests, on the other hand, can be both practical and objective, with potential to be highly sensitive to even subtle neural abnormalities associated with mild brain injury.

Objectives: In this study we investigated whether two components of the Assessment of Military Multitask Performance, the Illinois Agility Test (IAT) and Run-Roll-Aim (RRA) task identified movement differences associated with mTBI.

Methods: The IAT, requires running of a series of short distances while navigating obstacles, with multiple turns, acceleration and deceleration. In the RRA test, a service member runs while carrying a simulated weapon on a course that includes running with obstacle avoidance, rapid transition to prone, combat rolls, rapid lateral movement, transition back to standing, and running backwards. The IAT was administered to 18 healthy control subjects and 18 subjects diagnosed with mTBI with persistent symptom complaints, while the RRA test was administered to 37 healthy control and 37 mTBI subjects, all active duty soldiers. Subjects were outfitted with inertial sensors (tri-axial accelerometers and gyroscopes), one attached to a headband and another at the lumbar area of the torso. Time series values outputted continuously by each of the 12 sensors quantified performance during each task.

Results: In the RRA test, the power spectrum of each subject's time series was computed separately for each sensor using Fast Fourier Transform (FFT). Using the leave-one-out cross-validation approach, the 300 most significant frequencies were used as the input to a linear Support Vector Machine (SVM), trained to distinguish between control and mTBI subjects. The SVM correctly classified 23 out of 37 control subjects (62%) and 31 out of 37 mTBI subjects (83.7%). The area under the ROC curve based on the roll component of the task was most sensitive at 0.804.

In IAT, only the accelerometry data were used. To reduce the dimensionality of the data, Principal Component Analysis was implemented and first 2 principal components were used in FFT analysis. The 190 most dominant frequencies were used as the input to a linear SVM. Cross-validation was conducted using the leave-one-out approach. The SVM correctly classified 14 out of 18 control subjects (77.7%) and 17 out of 18 mTBI subjects (94.4%). The area under ROC curve was 0.817.

Conclusions: These results indicate that movement during RRA and IAT performance are affected by mTBI and, once further optimized on a more comprehensive sample, may be sensitive measures of movement dysfunction.
A feasibility study investigating the use of project-based treatment to improve communication skills and quality of life (QOL) in people with ABI

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Communication impairments are common following ABI. These impairments have a significant impact on a person’s QOL post-injury. Few communication treatments have been able to show improvement post-treatment on communication, and QOL. Project-based treatment is an alternative treatment that could have an impact on both these areas for people who are a long-term post-injury. This treatment is embedded in a context of meaningful activities chosen by people with ABI, whereby, as a group, they work collaboratively to achieve a tangible end product. This paper reports the findings of a quasi-randomised controlled trial that aimed to determine the feasibility of project-based treatment for improving communication skills and QOL for people with ABI.

Methods: Twenty-one people with ABI (X age: 46 years; X time post-injury: 12 years), with evidence of a social communication disorder were recruited to participate in the group-based treatment, which comprised 10 sessions over six weeks (20 hours). Participants were recruited in groups, and alternately allocated to either the TREATMENT group (n=12) or WAITLIST control group (n=11). Participants were required to work towards achieving a project that helps others, in a group context that facilitated communicative interaction. Treatment was evaluated by measures of conversation and QOL. Conversations were videotaped of each person with ABI at three time points: pre-treatment, post-treatment, and at follow-up. The conversations were rated blindly on the Measure of Participation of Conversation (MPC), which has two scales (Interaction and Transaction). In addition, participants completed two QOL questionnaires: Quality of Life in Brain Injury Questionnaire (QOLIBRI) and Satisfaction With Life Scale (SWLS). Participants in the WAITLIST group were assessed twice pre-treatment, each separated by six-weeks. Mixed ANOVAs compared the TREATMENT with the WAITLIST group on the measures, and repeated measures ANOVA detected change over time for both groups.

Results: All people with ABI received the treatment as allocated, with no dropouts. No significant difference between groups was detected at baseline for any measures. Interaction effects revealed a significant difference between the TREATMENT and WAITLIST group post-treatment on the MPC Interaction scale (p=0.04), but not the Transaction scale (p=0.28), SWLS (p=0.147) or QOLIBRI (p=0.438). Change over time comparisons revealed a significant difference for the QOLIBRI (p=0.05), a trend towards significance for the SWLS (p=0.06), but no significant difference for MPC Interaction (p=0.19), or Transaction (p=0.18).

Conclusions: The results of the trial demonstrate that project-based treatment is feasible for people with ABI. Modest improvements in both communication skills post-treatment, and in QOL at follow-up were found. Lack of further change may reflect low participant numbers and the responsiveness to change of measures from a relatively short treatment period. Positive feasibility results and evidence of some communicative and QOL benefit suggest that project-based treatment merits further research for this population.
Development of a Pediatric Brain Model of the Six-Year Old Human

Status: Accepted Presentation type: Poster

Category: Technology – basic research

Author's preference: No preference

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Objectives: The objective of this research was to develop a finite element model of the pre-adolescent 6-year-old human brain and skull, and demonstrate the usefulness of that model in predicting brain deformation during rapid rotation reconstructions.

Methods: We developed a finite element model of the 6 year old pediatric human brain and skull based upon 26 individual MRI scans of 6 year olds from the NIH MRI Study of Normal Brain Development database. We used an MRI averaging process and extracted the surface geometry of the 6 year old human brain from this average. Then, we developed a human 6 year old finite element model with distinct regions of gray and white matter and integrated the brain with a skull model of the 6 year old human based upon published geometric data. We then demonstrated the usefulness of the model in predicting brain deformation during rapid rotation reconstructions.

Results: For the rapid rotation reconstructions, the FE brain model was rotated in each of the three anatomical planes. In sagittal rotations, the head was rotated approximately 75 degrees in the ventral-to-dorsal direction. In axial rotations, the head was rotated right-to-left approximately 75 degrees. In coronal rotations, the head was rotated 75 degrees from left-to-right. We found the highest strains in the sagittal (1.748 mm/mm) and axial rotation (1.711 mm/mm) directions and the lowest strains in the coronal rotation (1.371 mm/mm) direction when comparing the maximum principal strain cumulative population distribution curves across all three rotation directions. Also, that the sagittal rotation direction had the highest strain rate (371.9 mm/mm/s), when comparing the maximum principal strain rate cumulative population distribution curves to the axial (292.6 mm/mm/s) and coronal (268.9 mm/mm/s) rotation directions.

Conclusions: This project delivers a pre-adolescent finite element brain model to the research and engineering community, and this model is based upon a validated relationship between brain deformation and injury (diffuse axonal injury) established in published porcine animal studies. Through reconstructions, we have demonstrated the robustness and utility of the model as a research and engineering design tool. Stemming from this demonstration, there are limitless uses of the model by other researchers to design and evaluate safety systems for the pre-adolescent age range. Projects could include assessment of brain injury potential in pedestrian crash tests, validation of model TBI thresholds via youth sport, design of novel helmets that reduce angular and linear head acceleration, design of side curtain airbags for children, tuning of foam padding in booster seat wings, and many others. The long term goal of this line of research is to elucidate the biomechanics of pediatric traumatic brain injury, and improve capability and accuracy of the ATD, injury assessment, and computer modeling tools available to the engineering community.
Active rehabilitation for youth who are slow to recover from concussion

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Background: No evidence-based guidelines exist for treatment and rehabilitation services for children and adolescents who are slow to recover following a concussion. Fortunately, most children who sustain concussions appear to recover, functionally, within the first few weeks post injury. For children with persisting symptoms, four options are available for ongoing management: (i) encourage continued rest and avoid vigorous activity, (ii) allow the child to engage in limited activities under parental supervision, (iii) provide symptomatic treatment, or (iv) implement active rehabilitation. There is a dearth of direct scientific evidence that active rehabilitation with children who are slow to recover after mTBI is time-effective, cost-effective, or clinically efficacious. There simply has been very little clinical research in this area, reaffirming that this intervention needs to be formally evaluated.

Objectives: The specific aims of this study were to: (i) determine the impact of providing children and youth ages 6 to 17 years who are slow to recover following a concussion with a well-developed active rehabilitation intervention on post-concussion symptoms at 2 and 6 weeks after the initiation of intervention, and (ii) investigate functional recovery (cognitive, motor, and psychosocial) and return to activities in children receiving the active rehabilitation intervention 6 weeks post-initiation of the intervention.

Methods: Participants (n=50) with post-concussion symptoms lasting more than 1 month were assessed on three different occasions: pre-intervention (T0), as well as 2 weeks (T2) and 6 weeks (T6) post-initiation of intervention. The Post-Concussion Symptom Inventory was used to document the symptoms of children and adolescents at each visit (primary outcome). Secondary outcomes (assessed at T0 and T6 only) included: (i) quality of life, (ii) energy level, (iii) and balance. To address specific aim 1 comparing post-concussion symptoms after the initiation of intervention, univariate ANOVA with repeated measures on the time factor was performed. Similar analyses were used to address specific aim 2.

Results: Preliminary results show significant improvement of post-concussion symptoms after participation in the active rehabilitation intervention (F=22.8; p<0.001). The participants' total symptom score decreased over time (T1: x 33.11; SD 23.14), (T2: x 23.55; SD 21.24), and (T6: x 14.82; SD 16.59). Participants improved both their quality of life (p=0.004) and energy level (p<0.001), but not their balance (p=0.145) over the follow-up period.

Conclusions: This study provides further evidence towards the effectiveness of implementing an active rehabilitation intervention for children and adolescents who recover more slowly from their injury. The intervention could be directly implemented in concussion clinics and mild traumatic brain injury programs to reduce impairments, activity limitations, and participation restrictions in this population.
Interhemispheric EEG coherence: analysis of the structural and functional determinacy in patients with consciousness depression after severe traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Previous electrophysiological studies have shown informative parameters of interhemispheric EEG coherence (ICohEEG) for assessing the human brain functional activity of healthy persons and unconsciousness patients after severe traumatic brain injury (TBI) [Grindel, 1980, 2002; Dobronravova, 1996; Boldyreva et al.; 2007; Sharova et al. 1997, 2008]. Recent diffusion tensor imaging studies [Zakharova et al., 2014] revealed significant correlations between the damage grade of the corpus callosum (CC) and conscious level, and outcome of patients with severe TBI.

The present study focuses on the evaluation of ICohEEG determinacy by CC condition, as well as features of the patient’s clinical status after severe TBI.

Nine healthy volunteers and 24 patients with severe TBI were entered this study. Each person was carried out multi-channel EEG recording with calculation of the coherence between symmetrical occipital, parietal, central, frontal and temporal regions - integral (0.5 - 20 Hz) and alpha range (8-12 Hz). The same day diffusion-tensor MRI was acquired by 3.0 Tesla scanners. First for TBI we used differential topographic approach for estimating fractional anisotropy (FA) parameters in 7 CC regions from splenium to rostrum, chosen in a sagittal slice [Witelson, 1989; Tkachenko et al., 2014]. The patients were evaluated by clinical scales of the current state and consciousness level, motor defect (hemiparesis) and clinical outcome 1 year after injury. Spearman correlations (p<0.05) were evaluated between regional ICohEEG, tractography CC indicators and quantitative characteristics of the state in all persons.

High correlations (0.53-0.83) were revealed between ICohEEG and clinical data, especially in frontal and parietal regions. Integral ICohEEG values of correlation were slightly higher than for alpha band. Specific to the motor sphere was a higher conjugation with hemiparesis of central cortical areas ICohEEG (R = 0.79), for the current level of consciousness - of frontal (R = 0.77-0.79). The most correlation with the clinical outcome showed ICohEEG of the frontal lobes (R = 0.77). The regional ICohEEG correlations with FA CC (0.36-0.76) were slightly lower than with clinic. They were minimal.
and unreliable in isthmus and posterior midbody CC areas. The most structural and topographic accordance found between the integral ICohEEG of central regions and FA anterior midbody CC (R = 0.76), the frontal ICohEEG alpha range and FA in rostrum (R = 0.68).

These data confirm and objectifies highly informative of ICohEEG parameter in severe TBI.

Sleep Function and Behaviours Before and After Mild Traumatic Brain Injury: Pre- and Post-Injury Comparisons

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: This study investigated the effects of work-related mild traumatic brain injury (mTBI) on the function of sleep and sleep behaviours.

Methods: Forty-seven working-age persons (53% male; 63% ≥45 y.o.a.) diagnosed with mTBI reported on the presence of pre- and post-injury sleep disturbance, satisfaction with sleep function, sleep-wake behaviours, and utilization of sleep medication aids.

Results: Approximately half of the workers (49%) performed some type of shift work aside from morning shift at the time of injury. Females more often performed fast-rotating shifts, while males - slow-rotating shifts. The major mechanisms of injury were: being struck by an object (39%), falls (34%), and being struck by a person (15%). Pre-injury ‘refreshing sleep most of the time’ was reported by 86% of males and 67% of females. Ability to fall asleep/maintain sleep was reported to deteriorate post-injury: ‘refreshing sleep most of the time’ post injury was reported by just 5% of both males and females. Thirty percent reported taking sleeping pills post-injury compared to 12% pre-injury, with males being more prone to use medications to aid with sleep (76% and 42% for males and females, respectively). Fifty percent of men and 65% of women reported taking naps post-injury, compared to 15% and 5%, respectively, pre-injury. At the time of investigation, a majority of the participants (67%) were working, while the remainder was receiving disability benefits.

Conclusion: These preliminary results outline changes in sleep function and behaviours after a mTBI. The function of sleep is inextricably linked to the waking state and behaviours. Thus, investment into the clinical understanding of biological processes differentially shared between sleep and wakefulness states, in a manner that optimizes energy utilization and ensures safe return to work, is vital.
Resilience in families of adolescents with traumatic brain injuries: development of a support intervention

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Background: Family life with an adolescent has its share of challenges. The adolescent's emotional rollercoasters can make relationships tense and difficult within the family unit, and even outside of it. By virtue of its unexpected character, the occurrence of traumatic brain injury (TBI) in an adolescent can undermine the family dynamics even further. Additionally, the myriad of impacts caused by a TBI forces the family to alter its plans for the future by committing themselves together to rebuild them. Resilience to trauma does not manifest itself in the same way for all families. Some manage to effect positive changes, while others are unable to do so, or experience more difficulties. In light of this, it appears relevant to develop family-centred care approaches fostering the recognition of elements that can support the family's resilience process through hardships and, ultimately, help reconstruct its plans for the future.

Objectives: Using the humanist model of nursing care as a disciplinary perspective, this study led to the co-construction of the building blocks for an intervention program to support family resilience in conjunction with families with an adolescent suffering from moderate or severe TBI and rehabilitation professionals.

Methods: A qualitative and inductive study, supported by a collaborative research approach, was used. The complex intervention design and validation model inspired a three-stage data collection process. The first stage consisted in identifying the building blocks of the intervention program in the eyes of families (n=6) and rehabilitation professionals (n=5). The prioritization and validation of these building blocks, respectively the second and third stages, were conducted with the same families (n=6 for stage 2 and n=4 for stage 3) and rehabilitation professionals (n=5 for stages 2 and 3).

Results: The data analysis process identified five encompassing themes, considered to be the building blocks of an intervention program to support family resilience following moderate to severe TBI in adolescents. They are: 1) family characteristics and its influences; 2) positive family strategies; 3) family and social support; 4) management of occupational aspects; 5) contribution of the community and health professionals.

Conclusions: The results of this co-construction process established a strong matrix that is flexible enough to adapt to the various contexts in which families and rehabilitation professionals live and work. This study also offers promising avenues for practitioners, administrators and researchers in nursing and other fields with respect to the implementation of concrete strategies to support the resilience process of families facing particularly difficult times in their lives.
Conceptualizing Concussion: Exploring Key Stakeholder Reactions to Youth-Produced Drawings of Concussion

Objectives: To date, quantitative data and scientist perspectives have dominated the field of youth concussion. As a result, the youth perspective is largely absent from the youth concussion literature. Specifically, youth conceptualizations of concussion are unexplored, leaving those who interact with youth to rely on speculation to understand how youth think and feel about this common health phenomenon. If speculation is integrated into parents’ or professionals’ interactions with youth, it may lead to misinformed advice, education, or treatment. With the intent of informing the direction of education, treatment, and research, the current study translated youth conceptualizations of concussion, as expressed through drawing, to key stakeholders in the area of youth concussion.

Methods: This critical arts-based research study aims to explore key stakeholder reactions to youth-produced drawings of concussion. Drawings were produced by youth (5-19 years of age) in a related study exploring how youth think and feel about concussion. Drawings were then displayed in a public art installation viewed by an international audience of key stakeholders in the area of youth concussion (e.g., clinicians, researchers, parents, teachers, policy-makers, coaches, and other youth). Data was collected via two methods: audio recording and drawing. First, each stakeholder audio recorded his or her reactions (i.e., thoughts and reflections) while walking through the art installation. Then, each stakeholder produced his or her own drawing depicting his or her understanding of youth concussion as a result of viewing the art installation. Each stakeholder then audio recorded the meaning of the drawing (e.g., the message communicated, the intended audience) and if he or she envisioned a change in practice or research as a result of viewing the art installation. Each drawing and accompanying audio recording will be analyzed using an adapted critical visual methodology and thematic analysis. Analysis across the data set will then be conducted using the same method. Preliminary analysis will be presented.

Results: It is expected that the youth conceptualizations of concussion presented through the art installation will be integrated into key stakeholders’ existing ways of conceptualizing youth concussion. These varied and evolving ways of understanding youth concussion will be reflected in themes emerging from this study.

Conclusions: This study is the first of its kind to present the youth perspective to key stakeholders in decision-making positions in the area of youth concussion. Data collection methods were intentionally chosen as they required key stakeholders to actively consider and reflect on the youth perspective regarding youth concussion; thereby, creating the potential to influence the direction of youth concussion research and practice. Additionally, this study demonstrates the potential of innovative qualitative research methods in yielding novel findings and promoting translation of that knowledge in an area where traditional quantitative data have dominated to date.
Patterns of Psychotropic Use in Medicare Beneficiaries Before and After Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Background: Neuropsychiatric symptoms/syndromes (NPS) are the most common problems in the chronic stages (i.e., > 3 months) of traumatic brain injury (TBI)1. There are no Food and Drug Administration (FDA) approved drugs for the treatment of TBI associated NPS. Even though TBI is a significant public health problem in the elderly with worse functional outcomes compared with younger patients2, there is a dearth of NPS treatment studies.

Objectives: Analyzing current patterns of pharmacological treatment of TBI NPS in the elderly can provide an understanding of commonly used psychotropics and serve as a platform for comparing various pharmacologic treatment strategies. It is with this background that we conducted a retrospective analysis with 2 Specific Aims: (1) Characterize use of psychotropic medications among Medicare beneficiaries pre and post-TBI and (2) Assess differences in psychotropic use pre and post TBI.

Methods: We conducted a retrospective analysis of Medicare administrative data obtained from the Centers for Medicare & Medicaid Services (CMS) Chronic Condition Data Warehouse (CCW). All Medicare beneficiaries with a hospital discharge diagnosis of TBI between 1/1/2007 and 12/31/2009, aged 65 or older, with continuous Medicare Parts A, B, D with no Part C coverage for at least 12 months pre- and post-TBI who did not die in the hospital were included in the study. Psychotropic drug claims were obtained from Medicare Part D prescription drug event files.

Results: The total sample size was 60,276. The average prevalence of psychotropic medication use was greater during the 12 months post-TBI compared with the 12 months pre-TBI (41.8% vs. 47.8%, p<0.001). The use of selective serotonin re-uptake inhibitors (21.0% vs. 23.4%, p<0.001), serotonin norepinephrine reuptake inhibitors (4.2% vs. 4.6%, p<0.001), and other antidepressants (6.1% vs. 8.2%, p<0.001) was significantly greater post-TBI compared with the pre-TBI period. However, use of tricyclic antidepressants (3.8% vs. 2.8%, p<0.001) decreased significantly. Use of antipsychotics (7.1% vs. 9.9%, p<0.001) and mood stabilizers (10.3% vs. 14.0, p<0.001) also increased following TBI. Sertraline, escitalopram, zolpidem, gabapentin and citalopram were the most commonly used psychotropic medications among Medicare beneficiaries with TBI. Average prevalence of use increased significantly during the 12 months post-TBI for all five, with the greatest increase for citalopram (4.1% vs. 5.8%, p<0.001). Quetiapine was the most commonly used antipsychotic, and average monthly prevalence of use increased significantly following TBI (2.8% vs. 4.4%, p<0.001).

Conclusions: This is the first study to compare prevalence of psychotropic medication use in Medicare beneficiaries pre- and post-TBI. We observed a significant increase in psychotropic medication use post-TBI. Results from this study can be used in the future to conduct comparative studies on the most clinically and cost effective psychotropics in this fragile population.
Risk Factors for New Onset Depression after Traumatic Brain Injury

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Background: Depression is the most common neuropsychiatric sequela of traumatic brain injury (TBI). The pathophysiology of TBI depression involves an interplay of pre-TBI, TBI and post-TBI factors. However, there is minimal literature on risk factors associated with development of new onset depression (NOD). Understanding and treating early risk factors (<3 months of TBI) can help minimize or prevent development of depression in the later stages.

Objectives: The overarching goal was to determine pre-TBI, TBI and post-TBI factors associated with development of NOD in the first year after TBI (NOD_1year). The 2 specific aims included: (a) To test the hypothesis that executive dysfunction as assessed by neuropsychological testing and frontal/temporal lesions as determined by computerized tomography (CT) head scans are risk factors for development of NOD_1year; (2) To test the hypothesis that impaired social ties and social function in the pre-TBI and early TBI period are risk factors for development of NOD_1year.

Methods: Subjects will all severities of TBI were followed for 1 year. Subjects were assessed using semi-structured psychiatric interviews, and had follow-up evaluations, <2 weeks, 3, 6, and 12 months after injury. All subjects had computerized tomography (CT) head scans soon after injury. Executive dysfunction was determined by creating a composite variable of the scores on neuropsychological tests done within 3 months of TBI. Social impairment was assessed using 2 scales: Social Functioning Exam (SFE) and Social Ties Checklist (STC).

Results: Of the 103, subjects enrolled in the study, the frequency of new onset major depression in the first year after TBI was 15.3%. There was statistically no significant relationship between executive function scores and NOD_1year. Similarly, there was no statistically significant association between fronto-temporal lesions, scores on the STC and SFE in the pre-or early TBI period and NOD_1year. However, there was statistical significant relationship between scores on SFE in the early (<3 months) TBI period and NOD_1year. This association remained statistically significant even after controlling for age, gender, severity of TBI and medical comorbidity.

Conclusions: Poor social functioning soon after TBI is a significant risk factor for NOD_1year. Psychosocial stabilization in the early TBI period has the potential to reduce or minimize development of NOD.
The Impact of Physical Therapy on Spasticity and Pain in Chronic Disorders of Consciousness

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Background: Spasticity is a frequent complication after severe brain injury, which may prevent the rehabilitation process and worsen the patients' quality of life.

Objectives: In this study, we investigate the correlation between spasticity, joint fixation and pain with the frequency of physical therapy (PT) in chronic patients with disorders of consciousness (DOC).

Methods: 110 patients with chronic (>3months post insult) disorders of consciousness (Unresponsive wakefulness syndrome - UWS; minimally conscious state - MCS; emergence from MCS - EMCS) were included in this retrospective study (39 women; mean age: 40±13y; 60 with traumatic etiology: 35 UWS, 68 MCS, 6 EMCS and 1 locked-in syndrome; time since insult: 39±42months). Frequency of PT varied between 0 to 6 times per week and consisted of 20 to 30 minutes of conventional stretching. Spasticity was measured with the Modified Ashworth Scale (MAS, ranging from 0 to 5) on every segment for both upper and lower limbs (UL & LL). The median for left and right upper limbs and for the left and right lower limbs were used for analyses. Pain was assessed using the Nociception Coma Scale-Revised (NCS-R) during nursing cares.

Results: We identified a negative correlation between the frequency of PT per week and MAS scores for both UL and LL (p<0.001 & 0.003 respectively - figure 1). We also observed a negative correlation between PT and the presence of joint fixation (p=0.004). A positive correlation between NCS-R and MAS scores was found (UL&LL: p=0.004 & p=0.020), but no correlation was identified between NCS-R and the frequency of PT.

Conclusions: Our results highlight the positive effects of PT on patients' spasticity in chronic patients with DOC. Indeed, it seems that patients who receive more PT are less spastic and have less joint fixation, or on the other hand, that patients who receive less PT are more spastic and suffer from joint fixation more frequently. Even if no correlation have been observed between the frequency of PT and pain, we recommend remaining daily PT session for chronic patients with DOC, as we know than spasticity and joint fixation may increase pain in this population.
Background: Individuals with traumatic brain injury (TBI) face many challenges when attempting to return-to-work (RTW). Vocational evaluation (VE) is a systematic process that involves assessment and appraisal of an individual’s current work-related characteristics and abilities.

Objectives: The aims of this study are to: (1) examine demographic and employment characteristics of vocational rehabilitation providers (VRP), (2) identify the specific evaluation methods that are used in the VE of individuals with TBI, and (3) examine the differences in assessment method practices based upon evaluator assessment preferences.

Methods: This exploratory case study used a forty-six item online survey which was distributed to a small cohort of VRP practicing in the state of Florida.

Results: One hundred and nine VRPs accessed the survey. Of these, 74 completed the survey. A majority of respondents were female (79.7%), Caucasian (71.6%), held a Master’s degree (74.3%), and more than half (56.8%) were employed as state vocational rehabilitation counselors (VRCs). In addition, over two thirds (67.6%) were Certified Rehabilitation Counselors (CRC). Respondents reported using several specific tools and assessments during the VE process.

Conclusions: Study findings reveal differences in use of and rationales for specific assessments amongst VRP. Understanding VRP assessment practices and use of an evidenced-base framework for VE following TBI may inform and improve VE practice.
**Clinical Management of Mild Traumatic Brain Injury Patients – Place of Magnetic Resonance Imaging in the Acute Phase**

**Objectives:** Increasing incidence of patients with mild traumatic brain injury (mTBI) is a fact that all involved medical professionals have to respect. Mostly applied diagnostic tool is computed tomography (CT) which cannot show small brain lesions that can be detected on magnetic resonance imaging (MRI). The aim of this study was to establish criteria for early MRI examination in patients with mTBI and improve diagnostic algorithm and clinical management of these patients.

**Methods:** From June 1st, 2012 to May 31st 2015 we prospectively collected clinical data and obtained early MRI for 34 patients with mTBI who had normal CT scan. MRI has been performed in first 72 hours and T1, T2, FLAIR, T2* and SWI sequence has been used for morphological imaging and DTI sequence for assessing structural integrity of white matter.

**Results:** 23 male and 11 female patients with mTBI, mean age 33.4 (+/-14.4), mean GCS score of 14.4 were examined. Major number of patients had headache (76%) and vegetative disturbances (56%). All patients had amnesia (76% anterograde and 82% retrograde). Most of patients were injured in traffic accidents (56%), fall from heights (18%) and assaults (12%). In analyzed group we found lesion on MRI examination in 41% of patients, most of them were on SWI sequence, less on T2* and FLAIR respectively.

**Conclusions:** MRI examination of patients with mTBI in the acute phase can clearly show presence of small brain lesions. Unfortunately this is not possible in routine clinical practice because of high costs and unavailability of MRI facility. Further clinical studies are needed to show which group of patient can have most benefit from early MR imaging.
Predictors of delayed discharge from acute care among survivors with hypoxic-ischemic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Objectives: To describe key demographic and acute care characteristics of the understudied population of patients admitted with a hypoxic-ischemic brain injury (HIBI) diagnosis and investigate determinants of delayed discharge among HIBI survivors.

Methods: Population-based cohort study comprising adult patients entering inpatient hospitalization with diagnoses indicative of HIBI across Ontario, Canada from fiscal years 2002 through 2010. HIBI cases were identified using International Classification of Diseases (ICD-10) coding and were enumerated from Ontario administrative health databases. Delayed discharge was captured as number of Alternate Level of Care (ALC) days: days spent in acute care where the attending physician deems acute care services are no longer required. Main analyses, identifying predictors of delayed discharge from acute care, were conducted using zero-inflated negative binomial multivariable regression.

Results: Almost 80% of HIBI acute care patients died in hospital. Of those who died, only 3% had any ALC days. HIBI survivors tended to be younger, to live in an area of lower socioeconomic status by income, to have less comorbidity burden and have a higher likelihood of an accompanying psychological comorbidity than those who died. We did not observe an increase in the proportion of HIBI patients who survived their acute care episode year over year (linear trend across fiscal year categories: p = 0.36), however, there was a strong increasing trend in the proportion of HIBI patients who died with age (p < 0.001). Of the survivors, 41.6% had at least one ALC day and among those who had any, the median number of ALC days was 19 (IQR: 8-40). Discharge destination was most strongly predictive of having any ALC days. The odds of having no ALC days for HIBI survivors with a home discharge designation was 6 fold higher than for those waiting for transfer to long-term or palliative care (OR: 6.11; 95% CI: 3.25-11.5). Having a psychological or behavioral comorbid condition was also significantly associated with this outcome. Of those likely to have any ALC, 20-34 year olds had higher rates of ALC days relative to length of stay (LOS) compared to those 65-79 (RR=1.44; 95% CI=1.05-1.97). Time spent in special care (e.g., ICU, CCU) and later year of acute care episode was also inversely associated with rates of ALC days.

Conclusions: Patients who survive HIBI tend to be younger, have psychiatric comorbidities and are high users of ALC days. This suggests that a great deal of work is required to determine the optimal pathway of care for these individuals and that the status quo for inpatient hospital care inadequately meets their needs.
Rehospitalization After Moderate-severe TBI: Primary Reasons and Trajectories of Rehospitalization Risk 1-10 Years Post-injury

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: A growing body of research on post traumatic brain injury (TBI) health and functioning suggests moderate-severe TBI should be characterized as a chronic disease process. Readmission to an acute care hospital in the years following inpatient TBI rehabilitation not only reflects ongoing health challenges, but may create financial burden, disrupt community integration, and impose additional health risks. The objectives of this study are to: (1) describe the rates and causes for rehospitalization in the years following moderate-severe TBI, and (2) characterize factors associated with rehospitalization 1-10 years after injury by modeling the probability of rehospitalization at the individual level over time.

Methods: Participants included individuals 16 years and older with a primary diagnosis of TBI who were enrolled in the TBI Model Systems National Database which is a multicenter prospective longitudinal study of TBI outcomes funded by the National Institute on Disability, Independent Living, and Rehabilitation Research. Part 1 of this study used a cross sectional cohort design to describe the rates and most common reasons for rehospitalization among TBI survivors at 1, 2, 5, and 10 years post-injury. Part 2 used a longitudinal cohort design to describe the probability of rehospitalization over time using Generalized Linear Mixed Modeling and individual growth curve (IGC) analysis. Covariates of interest were entered into the model to explain individual variability in rehospitalization over time.

Results: Sample size ranged from 2,377-7,573 depending on the data required for each analysis; on average, participants were 73% male, 70% White, and aged 38 (±17) years. The greatest number of rehospitalizations occurred in the first year post-injury (27.8% of the sample), and the rates of rehospitalization remained largely stable (22-23.4%) at 2, 5 and 10 years post-injury. Orthopedic and reconstructive surgeries accounted for the majority (17.1%) of rehospitalizations in Year 1 and declined steadily thereafter. General Health Maintenance was the most common reason for rehospitalization at Years 2, 5, and 10, and rates increased (18.7-23.7%) at each follow-up. Seizures and Infection were also common reasons for rehospitalization. Results of longitudinal analyses indicate that age, race, education, pre-injury employment status, primary payor, discharge residence, FIM™ scores at rehabilitation discharge, and rehabilitation length of stay were associated with the probability of rehospitalization over time. Each unique combination of these factors represents a unique risk trajectory, which is best demonstrated through an interactive tool that allows users to impute covariate values and observe individual-level trajectories of the probability of rehospitalization over time.

Conclusions: After TBI, rehospitalization is common and results from conditions which may be preventable. This IGC analysis elucidates constellations of individual-level factors associated with rehospitalization risk over time, which could allow for targeted and appropriately timed interventions for high-risk subgroups to improve health and longevity after TBI.
Predicting Mortality and One Year Functional Outcome in Elderly and Very Old Patients with Severe Traumatic Brain Injuries

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: The aim of the present study was to evaluate mortality and outcome in old and very old patients with severe traumatic brain injury (TBI) compared to the predicted outcome according to the CRASH model (based on the Corticosteroid Randomization After Significant Head injury, from the Medical Research Council (MRC)).

Methods: Prospective, national multicenter study including subjects with severe TBI ≥65 years. Predicted mortality and outcome according to the CRASH algorithm was calculated based on clinical information (age, GCS score, pupil reactivity to light), as well as with additional CT findings. Observed 14 days mortality and favorable/unfavorable outcome according to the Glasgow Outcome Scale (GOSE) (unfavorable outcome <5) at one year was compared to the predicted outcome according to the CRASH model. Two proportion tests (NCSS version 2007, Kaysville, Utah, USA) were used to compare the differences between the observed and CRASH predicted outcome. In addition, Kappa values were calculated between the observed and predicted mortality.

Results: 97 patients, mean age 75 (SD 7), 64% men, were included. Two subjects were lost to follow up, 48 died within 14 days. The observed mortality was 50 %, whereas the predicted mortality was 64% based on clinical findings and 81% if CT findings were added (p<0.001). Unfavorable outcome (GOSE < 5) was observed at one year follow up in 72% and predicted in 85% and 92% based on clinical and additional CT findings respectively (p<0.001). The agreement between the observed and predicted mortality was low; k=0.42 when including clinical information and k=0.22 with additional CT information.

Conclusions: The CRASH model overestimated mortality and unfavorable outcome in old Norwegian patients with severe TBI, and the agreement was low. Using such a model in clinical practice may possibly bias treatment decisions in old patients.
Outcome after severe TBI - the influence of ApoE in a Norwegian cohort

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Apolipoprotein E (ApoE) is a multifunctional circulating lipoprotein. Three common isoforms of the protein are identified as ApoE 2, ApoE 3 and ApoE E. In traumatic brain injury he ApoE ε4 allele is suggested to be associated with worse outcome, although the evidence is diverging (Lawrence et al 2015). Hence, the aim of the present study was to assess the relationship between ApoE alleles and functional outcome 12 months after severe TBI in a Norwegian cohort.

Methods: Adults age 16 years and above sustaining severe TBI in 2009-2011, from the north, middle and east part of Norway surviving at one year follow-up were included. Genomic DNA was extracted from peripheral white blood cell by MagNApure LC (Roche, Switzerland). Primers were designed by Primer3 program (http://primer3.sourceforge.net/) spanning the polymorphic site in the first part of exon 4 in the ApoE gene (RefSeq DNA NM_000041). Haplotypes for ApoE 2, 3 and 4 were determined from base c.388 in codon 130 (T/C) and c.526 in codon 176 (T/C).

Results: Of 201 patients 129 agreed to ApoE typing, without significant differences in age, gender or injury severity between subjects typed or not. However, GOSE at 12 months was significantly lower among non ApoE typed subjects (p<0.001). Mean age of ApoE typed subjects was 40 (SD 18) years, and 81% were males. The ApoEε4 frequency was 17%. There were no significant differences (p=0.90) in functional outcome at 12 months between carriers of ApoEε4 and not (GOSE 6.18 (SD 1.35) and 6.21 (SD 1.21) respectively.

Conclusions: The present study did not support adverse effects of ApoEε4 on 12 months functional outcome in severe TBI. However, the strongest evidence for an influence of ApoEε4 has been on dementia-related outcomes. Due to the ethical approval of the present project, only survivors of severe TBI consenting to genotyping were included. ApoE type may thus have influenced mortality and outcome among the patients nonconsenting. Larger sample sizes with longer follow is needed.
The risk of a bleed after delayed head injury presentation to the ED: A systematic review.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: There are approximately 1.4 million ED head injury attendances in England and Wales every year. Not all patients present immediately after injury. There is evidence that clinical deterioration following injury usually occurs within 24 hours. It is unclear whether this means that head injury patients with a delayed presentation are at lower risk of clinical deterioration and significant pathology.

The aim was to systematically identify and evaluate studies in delayed ED presentation head injury populations to determine whether or not the prevalence of intracranial pathology was lower in this group.

Methods: An electronic search strategy and systematic review protocol was designed in accordance with PRISMA guidelines. Two independent researchers assessed retrieved studies against pre-determined inclusion criteria. Studies had to be conducted in ED head injury populations presenting in a delayed manner, and report a measure of incidence of traumatic CT abnormality as an outcome.

Results: Three studies were eligible for inclusion. They were all of poor methodological quality, and heterogeneity prevented meta-analysis. The reported incidence of traumatic intracranial injury on CT was between 2.2% and 6.3%. This is lower than reported in the literature for non-delayed presentation head injury populations.

Conclusions: There is little evidence, of poor quality, about delayed ED presentation head injury patients. The evidence that is available suggests that patients presenting in a delayed fashion may be a lower risk sub-population, but this is insufficient to guide clinical practice. Further research is required to characterise the delayed presentation ED head injury population and establish the extent and associated risk factors of significant intracranial injury in this group.
An exploration of the knowledge of concussion amongst adults who play or have played American football in the UK

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: Oral

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Objectives: Concussion is a common injury in contact sports, and can lead to a range transient and more prolonged neurological deficits. It is important that a player who suffers concussion is immediately removed from play to avoid secondary injury. American Football (AF) is becoming popular in the UK and there are an increasing number of teams. Many of these teams are made up of amateurs who do not receive training on the potential dangers of concussion injuries. Consequently there is a risk of significant injury through lack of awareness. The aims of this project are to identify:

1. the awareness and knowledge of concussion and head injury among team players and coaches.
2. the extent of training received by players and coaches about dealing with concussions and head injuries during matches or training sessions.
3. the guidance and protocols teams use to deal with head injuries sustained by players.
4. the type of injuries received and the prevalence of concussion among players.

Methods: Participants are aged 18+ and registered with the British American Football National League as a registered player or coach. They are recruited from AF teams in the UK Midlands. Methods are: a) Questionnaire survey of players and coaches of American Football in the UK to collect qualitative and quantitative data on injury history, knowledge of concussion, awareness of guidelines on head injury and concussion, and details of any training received regarding concussion. b) Focus groups with players and coaches to collect qualitative data on knowledge and attitudes regarding concussion injuries.

Results: The focus groups revealed that players and coaches have limited knowledge about concussion or head injury. Many players had experienced a concussion themselves, but had usually returned to play within the same game. Few respondents were aware of guidelines and none had received specific training on concussion or head injury. UK American Football teams are unlikely to have a resident medical expert on hand during training sessions. Recruitment to the study is ongoing, and full results of the questionnaire survey will be available early 2016.

Conclusions: The results so far suggest that there is limited knowledge about concussion or head injury and that after a concussion, play normally continues. If this is proven to be the case following completion of the questionnaire survey, the next stage of the research will be to develop training packages for teams and distribute concussion check-lists for use on the field.
Does early decompression in traumatic brain injury improve patients' outcome? A clinical study

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: In 10% to 15% of patients after severe traumatic brain injury (STBI), the intracranial pressure rises significantly and does not react to conservative treatment or to external ventricular drainage. Patients with intracranial pressure (ICP) higher than 20mmHg, not responding to intensive care measurements, show higher morbidity and mortality. In such cases, decompressive craniectomy (DC) may be employed for lowering the elevated ICP. This reduction of ICP after DC is thought to improve recovery. Our experience with DC is presented.

Methods: In the retrospective study, 27 patients with STBI were included (GCS rated from 3 to 8) in whom DC was performed due to a rise in ICP that was not responsive to conservative measurements. A classical, mostly unilateral DC of 10cm to 15cm in diameter was performed. The influence of patient age, initial GCS score, time of surgery, pupillary light reflex, associated injuries, concomitant intracranial procedures and treatment outcomes were studied. For every patient, the effect of treatment was scored by GOSE score (Glasgow Outcome Scale Extended) at discharge and during follow-up. Student's t-test was used for statistical evaluation.

Results: From 2005 to 2010, 243 patients with severe brain injury were treated at our centre. DC was employed in 27 patients. A favourable treatment outcome was achieved in 38% of patients, 44% died, 12% remained in persistent vegetative state and 6% severely disabled. Rated by GOSE score (GOSE 1 to 4), poor treatment outcome was observed in 63% (average GOSE 1.4) and favourable in 37% (average GOSE 6.5). Before and after DC, the average ICP has fallen from $(48 \pm 19)$ mmHg to $(16 \pm 12)$ mmHg, respectively ($p=0.003$). Patients younger than 50 years, those treated by DC later than 24 hours after injury and those with GCS rated from 6 to 8 ($p=0.0038$) had a better treatment outcome.

Conclusions: DC effectively reduces the rise in ICP following STBI. Patients with less significant neurological dysfunction as well as patients younger than 50 years of age benefit the most. These results are thus comparable to those reported in other retrospective studies, although a straightforward comparison among DC studies is not possible due to the various parameters they considered. However, they all demonstrated a successful treatment outcome on patients' survival after DC, ranging from 16% to 69%.
Transdisciplinary Individualized Patient Protocols – A Pilot Study in Inpatient Neurorehabilitation

**Status:** Accepted  **Presentation type:** Poster

**Category:** Neurorehabilitation – case reports/clinical research

**Author's preference:** Poster

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**Objectives:** Patients with severe acquired brain injury often experience significant impairments in the area of arousal, orientation and functional communication. Rehabilitation assessments rely on observations and subjective reports in these areas. We found discipline specific measures were being performed, but not in a systematic manner and with limited ability to track progress in an objective approach. A pilot study was initiated, occurring in acute inpatient neurorehabilitation, which attempts to develop a systematic transdisciplinary approach to assess and treat cognitive-perceptual-behavioral impairments for patients with severe acquired brain injury by development of individualized protocols to target specific goals in a unified way to improve patient's overall functional status. In addition these protocols assist in tracking responses to tasks in patients with marked limitations. Using this technique allows for clinical monitoring to be individualized, stimuli and response criteria to be specific and well defined.

**Methods:** Interventions included the primary therapists (PT/OT/SLP) administering specific outcome measures, such as the Orientation Log (O-log); Agitation Behavior Scale (ABS), Coma Recovery Scale-Revised (CRS-R). Then the rehab team members meet weekly and analyze the assessment measures and behavioral reports to guide the development of specific individualized protocols. The protocols have included monitoring and treating of impairments in arousal, orientation as seen in confusional states and functional basic communication via Yes/No responses. All therapists then administer the protocol during each session for a total of three trials daily until protocol is terminated or modified. Data is compiled and discussed with the medical team each week, which guides addition of and changes to pharmacological treatments as well as adjustments in therapeutic interventions.

**Results:** To date 56 Patients have participated in the program. Data has shown that patients receiving orientation protocol which is based on use of errorless learning and spaced retrieval improved on average 30% in responses and recall of orientation information and those patient receiving a protocol targeting functional communication via yes/no responses improved on average 20%.

**Conclusions:** There are limited standardized objective measures developed to track progress in significantly cognitively impaired patients. These protocols have allowed us to capture progress and recovery patterns in this specific patient population. Overall changes in the areas of arousal, orientation and consistency of accuracy in yes/no response are well documented and tracked. Participants in this program receive a streamlined transdisciplinary treatment plan that is derived from objective data. This program has facilitated improved patient management via timelier transdisciplinary discussion.
0219

**Compressor tube explosion causing severe craniocerebral trauma: a case report**

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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**Objectives:** Traumatic brain injury is frequently encountered in neurosurgical practice. Although penetrating trauma is less common than closed injuries, it is more often lethal. Cavitation effect, vascular and neuronal damage, secondary brain injury and infection are the main causes of poor outcome.

**Methods:** Clinical presentation of a 35-year old patient is described, who suffered explosion head injury. During the explosion of a construction machine, a foreign body (a part of high-pressure compressor air tube, 6cm in length, made of steel wires and plastic mantle) penetrated the basal parts of frontal lobes through maxilla, medial orbit and ethmoid. It was embedded in the vessels of the anterior communicating complex, elevating it to the lower falx. At the admission, GCS was rated at 14. No paresis was evident.

**Results:** Through the interhemispheric approach, the foreign body was removed, debridement and reconstruction were done and all vessels were spared. The initial recovery was good and sedation was gradually discontinued. However, patient’s clinical condition deteriorated after one week due to vasospasm induced brain infarction and meningitis and he died of infection and multiorgan failure.

**Conclusions:** Penetrating injury to the brain has a poor prognosis and high disability among the survivors. Minimising secondary insults to the brain tissue, strict adherence to the brain trauma guidelines and infection prevention are imperative. The deterioration may appear also late in the treatment course, after initial promising recovery.
Isolation of astrocytes from human brain

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: To study mechanisms of neurotrauma and neurodegeneration, in vitro organ culture systems with live neural cells are highly appealing. Astrocytes are especially a focus in research. Mostly, these cells are isolated from animal tissue. We established a relatively quick and easy protocol for isolation of astrocytes from the brain biopsies with a high yield and low risk for contamination.

Methods: Human astrocytes can be obtained following cranial operations, especially in neurotrauma patients after brain necrectomy. In sterile conditions, fragments of viable tissue that was removed during the operation were collected. The tissue was cut, grinded and seeded through mesh system. After sequential centrifugation and separation, sediment was harvested and cells seeded in suspension, supplemented with special media (DMEM Advanced) containing high nutrient level (FBS) and antibiotics (streptomycin, penicillin). Characterization was made and sub-isolation cells followed.

Results: In appropriate environment, isolated cells retained viability and proliferated quickly. Attachment was observed after 8 to 10 hours and proliferation after 5 days. Time to confluence was 21 days. Cell proliferation, apoptosis and cell senescence were examined after 21 days in culture. The cells were stable. Under standard culture conditions, cell proliferation and cluster formation was observed. Cell viability was 90%. GFAP and DAPI immunohistology was made for characterisation and the cells were highly positive, confirming the astrocyte markers.

Conclusions: The demonstrated isolation process is simple, quick and economical, allowing viable long-term primary cell culture. The availability of such system will permit the study of cell properties, biochemical aspects and the potential of therapeutic candidates for traumatic and neurodegenerative disorders in a well-controlled environment on a human astrocyte cell culture.
Depression Following Traumatic Brain Injury: The Contribution of Pain, Comorbidities, and Injuries to Other Parts of the Body

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: The objectives of this study were to: (1) compare rates of depression at 4, 8, and 12 months after traumatic brain injury (TBI) according to the presence/absence of injuries to different parts of the body, and to the presence/absence of significant pain, migraine headaches, use of analgesic medication, and presence of health comorbidities; and (2) explore the contribution of health-related variables to the presence of depression in the first year post-TBI, while taking into account sociodemographic variables and premorbid history of depression.

Methods: Participants were adults aged 18-65 years hospitalized in a Level I trauma centre in Québec, QC, Canada evaluated at 4, 8, and 12 months after incurring a TBI (mild to severe). The final sample consisted of 236 participants (76.3% men; mean age: 41.55±15.13; 50.8% mild, 32.6% moderate, 16.5% severe TBI). Depression was assessed with a semi-structured interview for DSM-IV diagnoses (MINI) and the Hospital Anxiety and Depression scale (HADS-D). Injuries and comorbidities were documented through interviews and pain was measured with the SF-36 pain subscale. Chi-square analyses were used to compare subgroups of interest at each time point (Objective 1), and a logistic regression was carried out (Objective 2) with sex, premorbid history of depression, and health variables measured at 4 months as potential predictors, and the presence or absence of depression at any time point in the first year post-injury as the outcome.

Results: Individuals with injuries to the lower limbs at the time of their TBI were more likely to report significant depressive symptoms (HADS-D) at 4 and 8 months post-TBI, but there was no significant association with the presence of major depression (MINI). Participants reporting significant pain and those using analgesic medication were also more frequently depressed (HADS-D) at all time points, and also received more diagnoses of major depression (MINI; at 8 and 12 months for those with pain, at 12 months for those using analgesics). Migraines were linked to the presence of depression (both MINI and HADS-D) at 12 months, as were comorbid health conditions (HADS-D only). The logistic regression model explained 18.6% of the variance of the presence of depression on the MINI or HADS-D in the first year post-TBI, with sex and premorbid history of depression accounting for 10.5% of the variance and lower limb injury, and presence of pain, migraines, comorbid health condition, and use of analgesics at 4 months post-TBI for 8.1%. Only one predictor was significant however, premorbid history of depression (OR = 4.91).

Conclusions: These results demonstrate the importance of careful follow-up for depression in persons with TBI populations who suffer from pain, migraines and specific concomitant injuries. A better understanding of the impact of these factors may optimize rehabilitation and recovery.
Factors Associated with Dizziness and Balance Problems Following Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: Dizziness and balance problems are common following traumatic brain injury (prevalence: 30-80%), and might cause functional limitations, psychological distress, and have a negative impact on quality of life. The purpose of this study was to describe and explore socio-demographic, injury related and post-injury functioning factors associated with dizziness and balance problems in a TBI population.

Methods: In an ongoing RCT we performed baseline assessment of 57 patients admitted to Oslo University Hospital 3.6 months (range 1.5-10) after a TBI. Thirty-nine (68.4%) were women. Mean age was 39.7 (SD: 13.3) (range: 16-60) years.

Socio-demographic factors (age, gender, social status, educational level, sick-leave status), injury related factors (GCS, PTA, LOS, CT/MRI, neck pain) and outcome measures covering all dimensions of the ICF were used for the assessments: Rivermead post-concussion symptoms questionnaire - RPQ, Vertigo symptom scale-short form-VSS-sf, Quality of life after brain injury-QOLIBRI, Hospital anxiety and depression scale-HADS, Balance error scoring system-BESS, High mobility assessment tool for TBI-HiMAT. Main outcome measure was the Dizziness Handicap Inventory (DHI). Regression analyses were performed to explore the associations between self-reported functioning and dizziness measured with the DHI.

Results: 65% were married/cohabiting, 68.4 % had higher education (>12 years), and 80% were on complete/partial sick-leave. Causes of injury were falls 63.2%, traffic accidents 15.8%, violence 10.5% and other 10.5%. PTA and LOC were positive in 61.4% and 58% respectively. The patients had mild/moderate TBI (Mean GCS: 14.5 range: 11-15), CT/MRI scans for intracranial lesion were positive in 47%. Results are presented in mean (SD). The patients reported moderate to severe complaints of dizziness: DHI 45.3 (17.9), VSS-sf 18.9 (10.24), a considerable burden of post-concussion symptoms: RPQ 30.8 (11.3), some psychological distress: HADS 15.6 (8.2). Quality of life on the QOLIBRI was 53.5 (17.5). Performance based scores on balance and mobility were below norms: BESS: 29.2 (10.5) and HiMAT 40 (11.0). Work status and neck pain were the only socio-demographic and injury related factors that showed a significant (p < 0.05) association with DHI (Beta 0.28, p=0.035 and Beta 0.32, p=0.02 respectively). All outcome measures showed significant associations with DHI: VSS-sf (Beta 0.63, p<0.001), RPQ (Beta 0.53, p= <0.001), HADS (Beta 0.46, p<0.001), QOLIBRI (Beta 0.53, p= <0.001) BESS (Beta 0.46, p<0.001) and HiMAT (Beta 0.42, p=0.001).

Conclusions: Almost 50% of the patients had a moderate or complicated mild TBI with positive CT/MRI. At baseline dizziness reported on the DHI was associated with neck-pain, sick-leave, psychological distress, post-concussion symptoms and self-reported and performance based measures of dizziness and balance/mobility. Further analyses are needed, but clinicians should pay attention to complaints of dizziness and their associations to work status and sick-leave, psychological distress and quality of life.

Trial registration: Clinical Trials # NCT01695577
The effects of severe traumatic brain injury management by early or postponed decompressive craniectomy on the patients time spent in ICU and outcome

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: Although decompressive craniectomy is performed in the treatment of cerebral edema after traumatic brain injury, beneficial effect of the procedure remains controversial. There is no consensus on if and when to proceed with the surgery or will there be improvement of outcome after surgery has been performed. The aim of this study is to determine whether the decompressive craniectomy performed within or after 36 hours post trauma has any effect on time spent in ICU and outcome.

Methods: Retrospective study was conducted involving 50 patients treated in Clinical Centre of Vojvodina from 1th August 2010 to 31th July 2015. Patients were divided into the group treated within the first 36 hours post trauma, and the second group - patients treated 36 hours after trauma.

Results: 73% patients were male and 23% were female. Almost half of the patients (49%) were transferred from another hospital. Patients suffered trauma after car or motorcycle accident (22%), bicycle accident (11%), pedestrian accident (5%), fall accident (29%) and fall from the height (22%). Median Glasgow Coma Scale on admission was 6. 86% of patients underwent surgery in the first 36 hours, and 14% after 36 hours. No significant statistical difference was observed (t-test) in the time spent in ICU (7.6 and 7.9 days respectively) or in the outcome between the two groups. Patients underwent craniectomy within the 36 hours had mortality of 56%, 15% were in vegetative state, 15% had severe disability, 11% mild disability, and 3% of the patients had good recovery on Glasgow Outcome Score. In the group of patients who had craniectomy after 36 hours mortality was 33%, 17% of patients were in vegetative state, 33% had severe disability, 17% of patients mild disability and no patients in this group had good recovery.

Conclusions: Time of decompressive craniectomy performance has no effect on time spent in ICU or patient outcome.
**Prevalence differences of patients in vegetative state in the Netherlands and Vienna, Austria: a comparison of values and ethics**

Status: Accepted  Presentation type: Poster

Category: Neurorehabilitation – public policy and advocacy

Author's preference: No preference

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**Objectives:** Little is known about prevalence of persistent vegetative state (new nomenclature unresponsive wakefulness syndrome) and comparisons between countries. The aim was to explore reasons for the comparable count of patients in vegetative state found in prevalence studies in nursing homes in one European country (Netherlands; 32 patients in 2003) compared to one single European city (Vienna, Austria; 32 patients in 2001).

**Methods:** This study is based on a literature review of vegetative state in the Netherlands and Vienna during December 2007 - April 2008, using Pubmed and Medline, national policy guidelines, textbooks and national websites concerning this patient category. This in the context of population characteristics and definitions, guidelines and interactions with families and physicians of patients in vegetative state. Additionally, families and physicians were interviewed in both settings to illustrate the prevailing views.

**Results:** The population characteristics and the definition of and criteria for vegetative state are comparable between the two settings. A difference is found in the development of authoritative policy-guidelines concerning treatment and the possibility of withdrawal of medical treatment of patients in vegetative state. In the Netherlands these guidelines were developed after public debates and jurisdiction concerning two patients in this condition. In Vienna/Austria however, such public debate, jurisdiction and/or guidelines, did not exist at the time. Moreover there seem to be different societal values concerning rehabilitation and end-of-life decisions for these patients. In the Netherlands, life prolonging medical treatment, including artificial nutrition and hydration, is considered futile if there is no prospect of recovery and can be withdrawn according to the guidelines. In Vienna, however, patients in vegetative state are regarded as severely disabled and in need of long term rehabilitation and social reintegration. There is no end-of-life discussion in this context.

**Conclusions:** The most important explanation for the vegetative state prevalence differences between the Netherlands and Vienna can be found in the different societal values and (non)existence of guidelines about patients in vegetative state concerning their treatment, rehabilitation and medical-ethical dilemmas.


doi: 10.1097/HTR.0000000000000058
Markers of brain injury and reparation under different severity and outcomes of brain trauma in children Scientific Center of Children Health, Children and Research Institute of Emergency Children Surgery and Trauma, Moscow, Russia

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author’s preference: No preference

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Objectives: Among second brain injury (BI) after brain trauma (BT) hypoxia and inflammation are the leading factors. We also can’t exclude the reparation processes. The aim of this study was to value the significance of different brain markers in blood in prognosis and outcomes of BT.

Methods: The severity of BT valued according GCS and outcomes after BT - by GOS (complete recovery, moderate disability, high disability, vegetative status and fatal outcome). Blood levels of BI markers such as S100b, NSE, nitrotyrosine (NT), autoantibodies (aAbs) to NMDA receptors (NR2 Rcs) and to S100b, erythropoietine (EPO), TNF and BDNF were measured in blood serum/plasma of 120 children with different severity and outcomes of BT from the 1st to 60th days after BT.

Results: Children with favourable recovery had positive dynamics of BDNF, the elevated levels of aAb to NR2 Rcs on the 1st day after BT, the absence of NT and the decreasing dynamics of S100b and NSE to the 3d day after BT. 2) Negative outcomes of BT were in connection with low level of aAb to NR2 Rcs on the 1st day after BT, high extending increase of NSE and S100b and very high level of EPO; 3) During vegetative status the wavy increased concentration of aAb to S100b and NR2 Rcs against a background of very low S100b and NSE was discovered.

Conclusions: The revealed character of brain markers dynamics under different outcomes of BT may contribute to new aspects of pathophysiology and prognosis of BT in children.

Acknowledgement: Supported by RHF grant.
Trajectory of Disability and Quality of life in Non-geriatric and Geriatric Survivors between 3 and 12 Months after Severe Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: The objective was to investigate disability and health-related quality of life (HRQOL) 3, 6, and 12 months after traumatic brain injury (TBI) in non-geriatric (≤65 years) and geriatric patients (>65 years).

Methods: Patients ≥16 years who sustained a severe TBI (Abbreviated Injury Scale of the head region >3) were included in this prospective, multi-center study. Outcome measures: Glasgow Outcome Scale Extended (GOSE; disability), SF-12 (HRQOL). Mixed linear model analyses were performed.

Results: 351 patients (median age 49.8 years; interquartile range (IQR) 27.0-66.7) were included; 73.2% were male and 27.6% were geriatric patients (>65 years). Median GOSE at 3, 6 and 12 months was 5 (IQR 3-7), 6 (IQR 4-8) and 7 (IQR 5-8); this increase (slope(time) = 0.22, p < 0.0001) were age dependent (slope(age*time) = -0.06, p = 0.003). Median SF-12 physical component scale score at 3, 6 and 12 months was 42.1 (IQR 33.6-50.7), 46.6 (IQR 37.4-53.9) and 50.4 (IQR 39.2-55.1); this increase (slope(time) = 1.52, p < 0.0001) was not age dependent (slope(age*time) = -0.30, p = 0.083). SF-12 mental component scale scores were unchanged.

Conclusions: Disability decreased and HRQOL improved after TBI between 3 and 12 months. Functional improvement was not significant for geriatric patients.
A Systematic Review of Genetic Risk Factors for Concussion and Mild Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: This systematic review examined the literature on the association between genetics and risk for sustaining a traumatic brain injury (TBI) in athletes, civilians, active duty military service members, and veterans.

Methods: Articles were retrieved via online database searching, hand-searching reference lists, and by performing cited reference searches. All articles published in English from 1980 to September 2015 pertaining to genetic risk and TBI were examined. The online databases of PubMed, PsycINFO®, MEDLINE®, EMBASE, and Web of Science were searched, using the key search terms: genotype, genetics, apolipoproteins E, ApoE, ApoE4, E4 allele, brain-derived neurotrophic factor, BDNF, Dopamine receptors, D2, DRD2, met genotype, met; in combination with injury terms: craniocerebral trauma, brain injuries, brain concussion, concuss*, TBI, mTBI; in combination with risk-related terms: risk, risk*, risk factors, risk reduction behavior, risk assessment. All eligible articles were independently assessed for quality using a standardized quality assessment checklist selected for its generic comprehensiveness and currency.

Results: A total of 5,163 articles were identified. After reviewing the titles and abstracts of all identified citations, 62 were retrieved for full-text screening, and three were eventually included in this review. All three studies were conducted in collegiate athletics, with a total of 709 athletes involved. All three studies examined the risk of concussion associated with ApoE genotypes, two studies also considered the ApoE promoter polymorphisms, and one study also studied tau genotype. Results were varied; Terrell and colleagues (2008) found a three-fold increase in self-reported concussion history in those subjects with the ApoE promoter G-219T polymorphism (OR=2.8 [95% CI=1.1 – 6.9]), but no association with ApoE4 allele or tau genotype. Tierney and colleagues (2008) found an association of the ApoE promoter G-219T polymorphism and a history of ≥ 2 concussions (Wald x²=3.96; p=.04; OR=8.4), and athletes with E2/E4 genotype who also carried the G-219T promoter had a greater number of self-reported concussions (based only on analyses of 3 or more concussions, Wald x²=3.82; p=.05; OR=9.8). Kristman et al., in the only prospective study, found no increased risk in those athletes with an ApoE4 allele, with an adjusted hazard ratio of 1.06 (95% CI=0.41–2.72).

Conclusions: There are very few studies considering genetic risk factors for TBI. All studies that met criteria for inclusion in this systematic review were conducted with collegiate athletes and considered concussions. These three studies do not demonstrate an increased risk of concussion in ApoE4 allele carriers. However, the ApoE promoter G-219T polymorphism was significantly associated with concussion risk based on the two studies that examined this relationship. More research is needed to determine the extent to which there are genetic risk factors for sustaining a mild TBI.
Effect of early rehabilitation on functional outcome one year after aneurismal subarachnoid hemorrhage

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Objectives: Early rehabilitation improves outcome in stroke and traumatic brain injury but is not established as part of treatment guidelines after aneurysmal subarachnoid hemorrhage (aSAH). Some studies concluded that early rehabilitation after aSAH is safe and feasible. The more long-term consequences of early rehabilitation, however, have to our knowledge not been assessed.

The aim of this study was to assess the impact of early rehabilitation on global functional outcome one year after aSAH.

Methods: Controlled interventional study comparing two one year cohorts of adult aSAH patients, admitted to the neuro-intermediate ward (NIW) after repair of a ruptured aneurysm. Exclusion criteria: previous SAH, traumatic brain injury or neurodegenerative disorder. The Control group (N=76) was treated in accordance with our institutional guidelines. The intervention group, hereafter denoted Early Rehab group (N=92) was treated identically but received in addition early rehabilitation and mobilization. Clinical and radiological aSAH characteristics, progression in mobilization and treatment variables were registered. Clinical status before initiating early rehabilitation was assessed by World Federation of Neurosurgery scale (WFNS) and for analysis purposes patients were dichotomized into good (WFNS 1 and 2) and poor grade (WFNS 3,4,5).

Global functioning was evaluated one year after aSAH by Modified Rankin Scale which for analysis was categorized into four categories.

Results: Clinical and radiological aSAH characteristics at baseline and global functioning at one year follow-up were similar between the groups. Early rehabilitation was initiated median 1.4 days (range 0-23 days) after aneurysm repair. The Early Rehab group was mobilized significantly quicker and to a higher mobilization level (p<0.001). Assessment of functional level one year after aSAH was later in the Control group than the Early Rehab group (median 413 days versus median 384 days, p<0.001). Therefore, the adjacent category logistic regression analysis including all patients (N=168) was used to analyze the effect of early rehabilitation on modified Rankin score at one year follow-up. Neither the unadjusted nor adjusted model showed an effect of early rehabilitation. Increasing age and poor clinical status (assessed by Hunt and Hess at baseline) reduced the probability of better outcome. However, when analyzing effect of early rehabilitation in poor grade patients (N=60) and good grade patients (N=108) separately, a statistically significant effect of early rehabilitation was found among poor grade patients, with adjusted OR=2.33 (CI 1.04-5.2, p=0.039) for a favorable outcome. Among patients in good clinical grade (WFNS 1 and 2), age was the sole predictor of functional outcome.

Conclusions: Early rehabilitation increased the chance of good outcome in poor grade aSAH patients. A corresponding effect could not be found in good grade aSAH patients.
The efficacy of a smartphone reminder app with unsolicited prompts (UPs) for people with memory impairments after ABI: A single-case-experimental-design study.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Smartphone reminding apps can help people with acquired brain injury (ABI) to compensate for poor prospective memory functioning. In the absence of a caregiver, users must enter reminders into the device themselves. Poor memory or apathy associated with ABI can result in failure to initiate reminder-setting behaviour, which may prevent reminding technology from being effective. We developed a reminding app (ForgetMeNot) which addresses this problem by periodically prompting the user to enter reminders with unsolicited prompts (UPs).

Methods: We present an A-B1-A-B2-A single case experimental design study evaluating the effect of the app on everyday prospective memory tasks compared to baseline (A - B comparison), and with and without UPs (B1 - B2 comparison). The app was used by three people with severe ABI living in a post-acute rehabilitation hospital over seven weeks (one week per baseline ‘A’ phase and two weeks per intervention ‘B’ phase). Non-overlap of all pairs (NAP) analysis was used to analyse the difference in prospective memory task performance observed between phases.

Results: Six UPs at random times through the day from ForgetMeNot increased daily reminder-setting behaviour for all participants compared to using the same app without any UPs. The everyday memory performance of two participants was better when using the app with UPs compared to the same app without UPs; NAP (B1 vs B2) = 0.71 (medium effect) for one participant and NAP (B1 vs B2) = 0.64 (small effect) for the other. For all three participants, memory performance improved in both intervention phases (when the app was in use) compared to baseline levels; combined A phase vs combined B phase NAP scores were > 0.66 for each participant indicating a medium effect of the technology on memory performance. Weekly ratings of the system’s usability showed a no clear overall trends although two participants stated that they found the UPs annoying.

Conclusions: UPs could be an effective addition to a reminder app for people who may otherwise fail to set reminders independently. Future investigations of UPs could build on neuropsychological rehabilitation and human computing interaction literatures by investigating which modalities are most effective, what content is most acceptable, and by developing and testing software which predicts the best times to prompt users.
The Neural Correlates of Consciousness in Patients Emerging from Minimally Conscious State

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: No preference

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Objectives: Between severely impaired consciousness, as in disorders of consciousness (i.e. vegetative state/ unresponsive wakefulness syndrom –UWS- and minimally conscious state -MCS) and normal consciousness (healthy controls) there is a scarcely researched transition zone belonging to those patient who regained capacity for functional communication and/or object use, refereed to as patients who emerged from MCS (EMCS). We here investigate the neural correlates of consciousness in EMCS patients.

Methods: We acquired resting state functional and structural MRI in 58 patients (23 UWS, 21 MCS, 14 EMCS) and 35 healthy controls. Positron emission tomography data (FDG-PET) were acquired in 44 patients. We applied seed-based correlation analysis to investigate default mode network (DMN) positive connectivity (i.e., within network correlations) and DMN negative connectivity (i.e., between-network anticorrelations). We next correlated FDG-PET brain metabolism with fMRI connectivity. Voxel-based morphometry tested the influence of anatomical deformations on functional MRI connectivity.

Results: Consciousness-level dependent increases, ranging from UWS, MCS, EMCS and healthy controls, were found for DMN positive and DMN negative connectivity, brain metabolism and grey matter volume. DMN positive connectivity did not differ between patient groups but it was distinct between patients and healthy controls. DMN negative connectivity was observed in healthy controls and partially in EMCS but not in UWS and MCS. Patients in UWS and MCS further showed pathological between-network correlations. Brain metabolism correlated with both DMN positive and negative connectivity. Grey matter volume was not differentially modulated between the studied groups.

Conclusions: EMCS patients show a pattern of brain activity characterized by partial preservation of negative between-network correlations, which seem of metabolic neuronal origin and cannot be solely explained by morphological deformations. Conversely, pathological between-network correlations are observed only in patients suffering from disorders of consciousness.
Experimental Model of Neurotrauma: Neuroprotective Effects of Neuropeptides

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Objectives: Multiple studies demonstrated that peptides, such as neuropeptide Cortexin positively influences the adaptation of brain to extreme stress conditions. The purpose of this work was to study the mechanisms of brain damage in hemorrhagic stroke induced by acoustic stress and possible protective effect of neuropeptide drug Cortexin in sound-stressed animals.

Methods: Experimental model of epilepsy-prone rats of Krushinsky-Molodkina line was used. Previously we showed that after acoustic stress these rats develops seizures followed by high % of hemorrhages in brain. Methods of ESR-spectroscopy, electron and light spectroscopy together with immunoassay determination of autoantibodies to glutamate receptors (aAB Glu RcS) and luminescence method of ATP assay in blood were used. Cortexin was injected intraperitoneally till 1 h before acoustic stress.

Results: After acoustic stress the square of brain hemorrhages significantly increased. We also discovered the increasing of nitric oxide-Hb complexes in blood together with increased level of aAB to Glu RcS and the frequent fall in ATP concentration in plasma. The injection of Cortexin resulted in decreased mortality and diminishing of hemorrhage area. Pretreatment of Cortexin also decreased nitric oxide and aAb to Glu RcS levels in blood. It was also showed that Cortexin decreased swelling and destruction of cerebellar neurons in sound-stressed rats.

Conclusions: Acoustic stress leads to destructions of brain neurons and accompanies by increasing of nitric oxide and aAB to Glu RcS levels together with the significant ATP fall in blood. Pretreatment with Cortexin protected brain's destruction during acoustic stress.
Predictors and Indicators of Disability and Health-related Quality of Life Four Years After a Severe Traumatic Brain Injury: A Structural Equation Modelling Analysis From the Paris-TBI Study

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: To assess the predictors and indicators of disability and quality of life four years after a severe traumatic brain injury (TBI), using a Structural Equation Modelling (SEM), in order to disentangle factors which have a direct or indirect relationship with outcome.

Methods: The PariS-TBI study is a longitudinal inception cohort study of 504 patients with severe TBI in the Parisian area. Among 245 survivors, 147 patients were evaluated upon 4-year follow-up, and 85 completed the full assessment. Two outcome measures were analyzed separately using SEM: the Glasgow Outcome Scale-extended (GOS-E), which is a global measure of disability after TBI, and the QOLIBRI, a disease-specific measure of quality of life after TBI. Four groups of variables were entered in the model: demographics; injury severity; mood and cognitive impairments; somatic impairments.

Results: The GOS-E was directly significantly related to mood and cognition, injury severity and somatic impairments. Age and education duration had an indirect effect, mediated by mood/cognition or somatic deficiencies. In contrast, the only direct predictor of QOLIBRI was mood and cognition. Age and somatic impairments had an indirect influence on the QOLIBRI.

Conclusions: Disability and quality of life were directly influenced by different factors. While disability appeared to result from an interaction of a wide range of factors, including demographics, injury severity, mood and cognition, and somatic deficiencies, quality of life was solely directly related to psycho-cognitive factors.
Supporting transitions in neurorehabilitation. A pathway to improved psychosocial outcomes

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: A paradigm shift has been going on since the 1980’s, changing neurorehabilitation practices from primarily physical training to interdisciplinary rehabilitation based on the bio-psycho-social model. However, clients’ transitions during the rehabilitation process still seem to be a challenge in brain injury rehabilitation. A transition can be defined as a passage from one life phase, condition, or status to another. Transitions occur when a major change requires an individual to restructure ways of perceiving the world and to develop new ways of living in it. An acquired brain injury (ABI) cause an abrupt transition in life and ABI survivors are pondering whether or not they will be able to re-establish a sense of purpose or meaning in life and a (new) sense of self.

The rehabilitation process following an ABI is characterized by several organizational transitions: 1) From hospital to inpatient rehabilitation, 2) From inpatient rehabilitation to home and 3) Returning to productivity. Previous research has mainly focused on the transition from inpatient rehabilitation to home and the difficulties related to this transition. To inform the transitions processes in a long term perspective, this study investigated the status of persons with ABI two years after their hospitalization and examined their lived transition experiences.

Methods: Using a mixed methods design, 37 individuals aged 18-66 with moderate or severe ABI completed standard measures of functional independence (FIM), depression (MDI), quality of life (WHOQOL-bref) and were interviewed about perceived influences in their second (from inpatient rehabilitation to home) and third (return to productivity) transition phase during the rehabilitation process.

Results: Standardized measures revealed psychological problems two years post-hospitalization, especially depression (35.1 % of clients) and decreased psychological quality of life (61 %). Analysis of interviews found several factors seen as import in transitions; e.g. family relations, return to work, psychological support in identity reconstruction, and personal competences. George and Mary are used as case illustrations of two different transition routes.

Conclusions: Clients’ status two years post hospitalization is characterized by psychological problems. However, clients have suggested what may aid better transitions. A model based on client experience was developed to illustrate what they perceive as helping or hindering these two transitions.
Does Neuropsychological Rehabilitation Influence Perceived Self-Efficacy And Quality Of Life In Patients With Acquired Brain Injury?

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Background: Self-efficacy refers to the belief in one’s ability to achieve goals. In patients with acquired brain injury (ABI) higher levels of general self-efficacy and self-efficacy for managing brain injury-specific symptoms have shown to be associated with better quality of life (QoL). Furthermore, being highly self-efficacious in managing one’s health issues is assumed to be a key factor in successful chronic disease self-management. In neuropsychological rehabilitation programmes the focus is on teaching patients to compensate for, manage and deal with their cognitive deficits and the social and emotional consequences of ABI. Yet, it is unknown whether these programmes lead to higher levels of self-efficacy in managing brain injury-specific symptoms.

Objectives: We examined (1) the influence of neuropsychological rehabilitation on general self-efficacy, self-efficacy for managing brain injury-related symptoms and quality of life in patients with ABI, and (2) whether initial levels of general and brain injury-specific self-efficacy and cognitive functioning would predict QoL after completion of neuropsychological rehabilitation, and (3) whether cognitive functioning was associated with initial self-efficacy for managing brain injury-related symptoms.

Methods: This study was a retrospective clinical cohort study of 37 patients with ABI, attending an outpatient neuropsychological rehabilitation programme. Patients were on average 2 years post-injury (SD = 3.4). Measurements were taken prior to and after completion of the neuropsychological rehabilitation programme. General self-efficacy was measured with the General Self-Efficacy Scale (ALCOS-12), self-efficacy for managing brain injury-related symptoms with the Dutch version of the TBI self-efficacy questionnaire (SEsx), cognitive functioning with the Processing Speed Index of the Fourth Wechsler Adult Intelligence Scale (WAIS-IV), Stroop task, and the Fifteen Words Test, and QoL with the EuroQuol visual analogue scale (EQ-VAS). Paired sample t-tests, Spearman and Pearson correlations, and multiple hierarchical regression analyses were used to analyse data.

Results: QoL and self-efficacy for managing brain injury-related symptoms increased significantly (t = 3.70 and t = 3.74 respectively; p < .001) after neuropsychological rehabilitation, while no significant differences were observed for levels of general self-efficacy. Both general self-efficacy and self-efficacy for managing brain injury-related symptoms were positively associated with QoL, after neuropsychological rehabilitation (r = .69 and r = .84 respectively; p < .001). A lower initial level of cognitive functioning predicted worse QoL after neuropsychological rehabilitation (β = −.63, p = .05). Cognitive functioning was not significantly associated with initial self-efficacy for managing brain injury-related symptoms.

Conclusions: Optimisation of self-efficacy and QoL is possible through outpatient neuropsychological rehabilitation. In this programme, providing feedback, using incremental learning strategies and vicarious experiences are important elements in the development of self-efficacy. Yet, further research is needed to identify the ingredients of the treatment programme that contribute most to enhancement of self-efficacy. Pre-treatment cognitive screening can identify patients at risk for worse outcome.
Adjusting for Confounding by Indication in Observational Studies in Traumatic Brain Injury

Status: Accepted Presentation type: Oral
Category: Neurotrauma – health services and outcomes
Author's preference: Oral

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Objectives: Many randomized controlled trials in Traumatic brain injury (TBI) have failed to show benefit of treatment. Currently several international large-scale non-randomized studies are executed to identify effective treatment interventions for TBI. As such observational studies are suspect for confounding by indication, we compared three methods to adjust for confounding by indication, using existing TBI data.

Methods: We used 244 patients from the observational POCON study, including patients with moderate and severe TBI from five Dutch University hospitals enrolled between 2008-2009. And 677 patients from the randomized Tirilizad trial, including patients with moderate and severe TBI from multiple European and North American hospitals enrolled between 1991-1994. Two interventions were evaluated: ICP monitoring in POCON and intracranial operation in Tirilizad. Outcome was the Glasgow Outcome Scale (GOS) at six months, collapsed into a four-point ordinal scale (death and vegetative state combined). As a reference, we estimated unadjusted treatment effects with a proportional odds regression model. Subsequently we used three methods to adjust for potential confounders. First, standard adjustment in a multivariable model. Second, adjustment for the propensity of receiving the treatment, based on relevant baseline- and clinical characteristics. These two methods adjust for observed confounders. Third, we defined treatment on hospital level (percentage of indicated patients treated) and used a random effect model. We included treatment at both hospital and patient level. The hospital level effect can be interpreted as the odds of a more favorable outcome in patients treated in a hospital that is more tempted to use ICP monitoring or craniotomy in the treatment of TBI. This approach is expected to adjust for observed and unobserved confounders.

Results: Baseline- and clinical characteristics differed substantially between treated and non-treated patients, to the detriment of those treated. As a result, unadjusted ORs indicated negative effects of treatment on outcome. Also in the multivariate and propensity score adjusted analysis, treatment was associated with less favorable outcome (ICP monitoring: OR(multivariable): 0.92 (95%CI: 0.48-1.74); OR(propensity): 0.84 (0.48-1.47); Intracranial operation: OR(multivariable): 1.00 (0.65-1.53); OR(propensity): 0.90 (0.60-1.35). Treatment varied substantially among hospitals (ICP monitoring: 23-61%; intracranial operation: 19-42%). In random effect analyses, treatment on hospital level was associated with favorable outcome (OR(ICP) per 10% more patients treated: 1.20 (1.01-1.54); OR(intracranial operation): 1.46 (1.10-1.93)).

Conclusions: Strong confounding by indication may be present in non-randomized studies in TBI. With multivariable and propensity score adjusted analyses, which are most commonly used, still negative treatment effects were estimated, indicating residual unobserved confounding. Defining treatment variables on hospital level may provide less biased estimates of treatment effects and is a promising method to analyze observational studies in TBI. However, this should be confirmed in future research.
After care for people with acquired brain injury in the chronic phase – New equilibrium in the aftercare of people with acquired brain injury and their next of kin.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: This qualitative research project was aimed at gaining insight into the perspectives of patients and their next of kin on their ideas about living with acquired brain injury in the Netherlands. Objective was to identify themes and issues that were considered important for various people with ABI - even though their life stories and the impact of the injury was different for each individual. Two main themes were researched: 1) Living your life in society and 2) Experiences with the care system.

Methods: Open interviews were conducted using a topic list to discuss the two themes in depth. Respondents were invited to bring up topics and subjects they wanted to discuss. A heterogeneous sampling strategy was used, aiming at maximizing the variety of age, living conditions, gender and cause of the injury. All interviews with the 74 patients and 38 next of kin were recorded, transcribed and analyzed using the computer program for qualitative analysis QDA-Miner.

Results: Four themes could be identified: 1) Raising awareness on the part of the general public with regard to acquired brain injury 2) Participation in society 3) Knowledge about brain injury among professionals, like employers, general practitioners, social workers and people who work for unemployment agencies and 4) Monitoring people with brain injury, so as to prevent serious problems like getting into debt, family problems and loss of employment. Besides the four themes, using the structuration theory of Giddens, the underlying mechanism of how patients/next of kin, the society structure and the care structure relate to each other was revealed. The results show that current solutions for problems that people encounter, are often sought in the actor, and not in the structures of society and care.

Conclusions: Despite large differences on the individual level, people with brain injury and their next of kin share some themes and problems that they encounter every day while living their life. The major themes found now form the basis of the research line: “Personalized after care for people with brain injury” of the University of applied sciences of Windesheim Flevoland, where further research is done on how to improve the functioning of the society structure and the care structure for and with people with brain injury and their next of kin.
Vertical and horizontal knowledge integration in disability studies – a case illustrated from acquired brain injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Objectives: Disability research as an academic field was established in 1960s and 1970s in the Nordic countries and in the Anglo-Saxon world. Disability research was studied within the medical model, e.g. in medical and rehabilitation studies, while disability studies became a part of the social model, e.g. in social and psychological studies. It has been a lack of theoretical perspective in disability research and according to that a discussion of theoretical approaches in disability studies has been raised during recent years.

The aim of the study is to describe and illustrate conceptually how vertical and horizontal knowledge integration appear in disability research, exemplified within a case from a person with acquired brain injury.

Methods: The study adopted a qualitative approach to answer the research aim, undertaking a literature review to accompany an analysis the concepts, vertical and horizontal. The concepts were thereafter analyzed within theories from disability research and exemplified with a case from brain injury rehabilitation.

Results: Tentatively the conceptions, vertical and horizontal, are described and in addition, a bio-psycho-social perspective is mentioned and two theoretical approaches within disability research are described: human functioning sciences and interdisciplinary research.

Vertical knowledge integration can be seen as a stratification between different levels on a biological, psychological and social level. Horizontal knowledge integration can be understood across varying disabilities. The study indicates that vertical and horizontal knowledge integration in disability research are useful for a broader and deeper understanding of disability and functional impairment where, over the last few years, different theoretical perspectives have become increasingly common.

Furthermore, the study shows that acquired brain injury, in a scientific context, has been studied within different levels of society. For example:

- On a biological level, e.g. within biochemical blood analysis.
- On a psychological level, e.g. within neuropsychological diagnostics.
- On a social level, e.g. as a changeover process during recovery.

Conclusions: The study indicate that a variety of scientific contributions are needful in our understanding of the phenomenon of living with acquired brain injury in the contemporary society.
Prognosis in patients with TBI and Diffuse Axonal Injury: a systematic review of literature.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: To determine the prognosis of patients with traumatic brain injury (TBI) and Diffuse Axonal Injury (DAI) on MRI, according to present literature.

Methods: A structured literature search in Pubmed, Embase and Ovid was performed. Articles representing information about I) outcome in DAI patients in general, II) outcome DAI vs. Non-DAI, III) outcome according to MRI classification or another classification and IV) relation between lesion location/load and outcome were selected. When in doubt, articles were discussed before a decision for inclusion or exclusion for further review was made. The included articles were graded according to STROBE. A primary analysis, contained articles of high quality (STROBE score ≥19) and prospectively obtained outcome. In a secondary analysis articles of less validity were also included to test robustness of results. Odds ratios (OR) with 95% Confidence Interval were calculated.

Results: Title/abstract and full text screening of the 572 unique articles resulted in 25 articles. After a reference check 3 articles were added for further analysis, resulting in 28 articles. I) TBI patients with DAI in general have a favourable outcome in 55% of cases. II) OR for an unfavourable outcome for patients with DAI vs. TBI patients without DAI was 2.9 in the primary analysis and 3.4 in the secondary analysis. III) When MRI grading (grade 1-3, according to Gentry et al., specifying depth of lesions) was taken into account a higher grading resulted in a higher OR for unfavourable outcome. DAI grade 2 compared to 1 OR 3.3, grade 3 compared to 1 OR 8.5. In the secondary analysis the results were comparable. Since a gradual rise in OR per DAI grade a continuous OR was calculated, resulting in a OR of 2.9 (primary analysis) for an unfavourable outcome per increase in DAI grade. Again in the secondary analysis comparable results were found.

Articles not fit for either of the above mentioned 3 categories were described. IV) Lesions located in the corpus callosum were related to unfavourable outcome according to 2 articles, 1 did not find this relation. Lesion volume on ADC and FLAIR were predictive for outcome. The number of lesions had a relation to an unfavourable outcome according to 50% of describing articles.

Conclusions: The chance of unfavourable outcome in TBI is significantly higher when DAI is confirmed by MRI in comparison with MRI without DAI lesions in TBI. In particular when the 3 graded MRI scale by Gentry et al. is used, OR for an unfavourable outcome increases twofold with every grade, whereas number or specific locations of DAI lesions are not consistently found to predict outcome.
Emergency Preparedness and Ensuring the Safety of Persons with Brain Injuries

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: Poster

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Objectives: The most lethal part of an emergency is the lack of preparedness in dealing with it; people are caught off guard, becoming confused, frightened, and disoriented; and these challenges are even more pronounced for those with disabilities - particularly hidden ones such as brain injuries. This became apparent in 2004 with Hurricane Katrina, when thousands of evacuated people simply fell through the cracks. After critical analysis of what went wrong, and under new legislation mandating precise procedures, we now have more refined means of guiding people through emergency situations, the efficacy of which can be seen in more recent disasters.

Methods: The major failings in dealing with Katrina were lack of communication, education, and resources for dealing with large-scale chaos. Notably, emergency service providers were simply ill-prepared for handling the volume of shocked people. As the result of responsive education and protocols put in place to solve these problems, we are now seeing fewer casualties in disaster scenarios.

The key indicators of this process improvement are that supplies are being made accessible more quickly, emergency workers are better prepared to guide citizens out efficiently, and increased trust in preparedness protocols and evacuation processes has yielded more collected attitudes through disaster scenarios.

Results: We can be better prepared for future emergencies by distilling the lessons learned over the last decade into these four steps of prevention:

- Why don't we prepare?
- Understanding people with disabilities
- Accommodating people with disabilities in an emergency
- Preparing for an emergency

Conclusions: It's possible for us all to have a clearer understanding of why we should prepare before an emergency hits and what to do when that happens. This also dramatically improves aid to persons with disabilities, especially persons with brain injuries. The following questions can help us be better prepared:

- Do you have a "go kit" ready?
- Do you have an emergency plan, or know where to go if you are evacuated?
- Hospitals and shelters: Is your facility fully accessible to people with disabilities in a disaster?
- Service providers: Do you have the means of providing accessible transportation in an emergency?
Efficacy of Amantadine on Behavioural and Emotional Problems and Impairment of Executive Functioning due to acquired brain injury to the frontal lobes: a series of single case experimental design studies.

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: Brain injury due to different causes is common and can have severe functional impact. Frontal lesions often lead to cognitive impairments, but also to behavioural consequences, e.g. apathy, agitation, aggression, and emotional lability.

Amantadine may be effective in the treatment of these cognitive and behavioural consequences. Anatomical and neurochemical theory support these findings and amantadine is clinically used albeit without the support of scientific evidence.

The objective of this study is to establish the effectiveness and safety of amantadine on emotional lability/irritability, aggression, apathy and impaired executive functioning due to frontal lobe brain injury.

Methods: Study design: This study is a series of Single Case Experimental Design (SCED) studies. Each study has an A-A1-B-A, or A-B-A1-A double blind, randomized, placebo-controlled, and multiple baseline design. (A=baseline/withdrawal; A1=placebo; B=amantadine)

Study population: Adult subjects with acquired brain injury to the frontal brain or afferent and efferent pathways, due to various aetiologies (stroke, traumatic brain injury, brain infections, tumours, hypoxia) suffering from one or more of the following consequences: Emotional lability/irritability, aggression, apathy, and/or impairment of executive functioning hampering rehabilitation. Patients are in-patients and out-patients at the department of Neuropsychiatry of Huize Padua of GGZ Oost Brabant in the Netherlands.

Intervention : Amantadine is the pharmaceutical intervention in each Single Case experiment in this series. Dosage schedule amantadine in the B phase:
- Day 1-7, 100 mgs od
- Day 8-28, 100 mgs bd
- Day 29-35 100 mgs od

During baseline and withdrawal no amantadine is given. In the treatment phase (amantadine or placebo) the subject takes two pills per day. Depending on the randomisation schedule these will contain amantadine or placebo. Amantadine has no major side effects and low risk of adverse events.

Main study parameters/endpoints: The behavioural problems: emotional lability/irritability, aggression, and apathy will be measured by the Neuro Psychiatric Inventory (NPI). Individual target behaviour will be established and measured by a Visual Analogue Scale (VAS (1-100)). The impairment of executive functioning is measured by the Behaviour Rating Inventory of Executive Function-A (BRIEF-A).
Results: This research is ongoing. As it is a series of SCED studies we will be able to present the results from the first 7-10 studies.
Brain Injury: Voices of a Silent Epidemic

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Objectives: Long term outcomes from brain injury are difficult to predict and more challenging to fully understand. We see athletes who have been concussed, soldiers coming back from war with brain injuries, even political figures who have sustained brain injuries through assault who have lived to tell their stories. Even though traumatic brain injuries now receive unprecedented attention in popular media, the common perception of recovery still tends to gloss over the longer-term struggles that many face. What can we do to help others really understand what they are going through and to encourage successful reintegration?

Methods: This video was designed to help laypersons understand the impairments and changes in abilities that occur following brain injury. Viewers are guided through primary functions of the brain by active professionals in the field, supported by personal testimonials from survivors of brain injury regarding daily challenges and successes they face.

Results: Individuals who view this video gain a better understanding and perspective regarding what individuals with brain injury experience by seeing and feeling their brain injuries through their personal experiences. The professional narration assures clear scientific and clinical grounding, something that is often absent from such intimate examinations. The video has also been recognized for its potential to teach a number of professions, such as clinicians, caregivers, attorneys and policymakers.

Conclusions: Many survivors of brain injury can appear to be completely uninjured in their day-to-day lives, but the fact remains that altered brains often result in persistent hidden challenges that can have adverse and dramatic daily effects. Just as advances in neurology have improved the survival rate of those who sustain a brain injury, increased awareness and understanding of these injuries by laypersons and professionals will help improved recovery and reintegration of brain injury survivors. By exploring the cases presented in this video and tying them back to today's understanding of the brain, this silent epidemic is given a new voice that can speak to people unfamiliar to brain injury.
Genetic Variation in the Vesicular Monoamine Transporter is associated with Cognitive Outcomes after Traumatic Brain Injury

Status: Accepted Presentation type: Oral
Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: Traumatic brain injury (TBI) frequently results in impaired cognition, a process largely modulated by monoaminergic signaling. Genetic variation among monoaminergic genes may affect post-TBI cognitive performance. The vesicular monoamine transporter 2 (VMAT2) gene is responsible for the production of transmembrane vesicular proteins within monoaminergic neurons that facilitate storage of monoamines into vesicles for later release. Variation within other monoaminergic pathway genes has been associated with cognitive performance after TBI. The VMAT2 gene may be a novel source of genetic variation important for cognitive outcomes post-TBI given VMAT2's role in monoaminergic neurotransmission. Thus, the objective of this work was to evaluate associations between VMAT2 variability and cognitive outcomes post-TBI.

Methods: We evaluated 136 Caucasian adults with moderate-severe TBI for variation in VMAT2 using a tagging single nucleotide polymorphism (tSNP) approach (rs363223, rs363226, rs363251, and rs363341). We assessed cognitive impairment [cognitive composite t-scores (Comp-Cog)] using neuropsychological tests 6 and 12 months post-injury, with available normative data, targeting domains of executive function, memory, attention, and verbal fluency. We also examined how genetic variation interacts with cognitive impairment to influence functional cognition using the [Functional Independence Measure Cognitive subscale (FIM-Cog)] 6 and 12 months post-injury. The minimal number of effective comparisons (Meff) was established with these tagging SNPs, and adjustment for multiple comparisons was done using a Bonferroni correction.

Results: All variants assessed were in Hardy-Weinberg Equilibrium. The p-value for the association between rs363226 genotype and 6-month Comp-Cog (0.00584) was less than the threshold α level (0.0125) adjusted for multiple comparisons. A multiple linear regression model was then constructed to assess the relationship between this tSNP and 6-month Comp-Cog scores controlling for other covariates. This model showed that after adjusting for age, injury severity and education level, rs363226 genotype was associated with Comp-Cog (p=0.040). C-carriers had adjusted t-scores that were at or near the cut off for clinical impairment (t-score=40), and were 5-6 points higher than GG homozygotes. Post-hoc multivariate analysis, adjusting for depression status and antidepressant use showed that rs363226 genotype interacted with Comp-Cog to influence functional cognition (p<0.001). G-homozygotes had the largest cognitive impairment, and their cognitive impairment had the greatest adverse effect on functional cognition.

Conclusions: While this work requires validation in an independent population, we provide the first evidence that genetic variation within VMAT2 is associated with cognitive outcomes following TBI. Further work is needed to validate this finding and elucidate mechanisms by which genetic variation affects monoaminergic signaling, mediating differences in cognitive outcomes.
Principal Components Derived from CSF Inflammatory Profiles Predict Outcome Among Survivors after Severe Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: Studies have characterized absolute levels of multiple inflammatory agents as significant risk factors for poor outcomes after traumatic brain injury (TBI). However, inflammatory marker concentrations are highly inter-related, and production of one may result in the production or regulation of another. Therefore, a more comprehensive characterization of the inflammatory response post-TBI should consider relative levels of markers in the inflammatory pathway.

Methods: We used principal component analysis (PCA) as a dimension-reduction technique to characterize the sets of markers that contribute independently to variability in cerebrospinal (CSF) inflammatory profiles in a population with severe TBI. Using PCA results, we defined groups (or clusters) of individuals (n=114) with similar patterns of acute CSF inflammation that were then evaluated in the context of Glasgow Outcome Scale (GOS) and other relevant CSF and serum biomarkers collected days 0-3 and 4-5 post-injury.

Results: We identified four significant principal components (PC1-PC4) for CSF inflammation from days 0-3, and PC1 accounted for the greatest (31%) percentage of variance. PC1 was characterized by relatively higher CSF sICAM-1, sFAS, IL-10, and IL-6 levels. Cluster analysis then defined two distinct clusters, such that individuals in cluster 1 had highly positive PC1 scores and relatively higher levels of CSF cortisol, progesterone, estradiol, testosterone, brain derived neurotrophic factor, and S100b; this group also had higher serum cortisol and lower serum BDNF. Nearly 94% of individuals in cluster 1 had unfavorable 6-month outcomes (GOS score of 1-3). Multivariate analysis showed that individuals in cluster 1 had a 6.2 times increased odds of an unfavorable outcome at 6 months compared to cluster 2. Among survivors only, individuals in cluster 1 had a 7.9 times increased odds of an unfavorable (GOS 2-3) 6 month outcome. Cluster groupings did not discriminate mortality or 12 month outcomes in multivariate models.

Conclusions: PCA and cluster analysis established that a subset of inflammatory markers measured in days 0-3 post-TBI may distinguish individuals with poor 6-month outcome, and future studies should prospectively validate these findings. PCA of inflammatory mediators after TBI could aid in prognostication and in identifying patient subgroups for therapeutic interventions.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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With a population nearing 13,000,000 Ontario is Canada’s most populous province. Fifteen percent of these people live in an area classified as rural, in a region covering over 1,000,000 square kilometres. Each year in Ontario, approximately 18,000 people sustain brain injuries and require multidisciplinary rehabilitation. Many brain injury survivors require a rehabilitation program that includes metacognitive strategy training to address high-level cognitive skills that support the individual’s ability to participate in meaningful life roles including parent, community member and worker. It is well recognized that successful meta-cognitive training programs require repeated trials to consolidate and generalize skills.

Ontario’s geographic reality creates significant challenges to the provision of neurocognitive rehabilitation, as many specialized service providers are located in the larger urban centres such as Toronto. For northern Ontarians, travelling to the nearest rehabilitation centre may be prohibitive. This creates a disadvantage for rural survivors who are often unable access necessary rehabilitation treatment including occupational therapy and speech-language pathology. With the ubiquitous manner in which technology is integrated into society, tele rehabilitation appears a natural direction for therapy. In an effort to remedy the rural urban disadvantage, the authors offer survivors throughout the province tele rehabilitation for metacognitive strategy training. The tele-rehabilitation therapy provided maintains the same collaborative approach used in traditional therapy programming thus allowing for treatment of goals that are meaningful to individual clients.

Emerging literature, from a variety of health conditions, informs that tele rehabilitation provides the same benefits as traditional therapy methods. Using a secure web-based platform, participants engage in a live, interactive therapy session with the appropriate professional to achieve relevant and meaningful goals.

This presentation describes how collaborative tele rehabilitation is a promising approach and a feasible service delivery model for TBI survivors living in remote areas. A single case study will illustrate the benefits of multi-disciplinary meta-cognitive strategy training delivered in a manner that permits participation of people regardless of geography. Specifics including details of the technological requirements, information regarding the tele-health process including patient selection and the treatment modality will be reviewed. The authors will share their experiences using this emerging model and review effectiveness of this relevant treatment approach.
MMSE Score Is useful as predictable factor for Regaining the Urinary Consistency after Stroke

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: We aim to identify the correlation between cognitive impairment and patients who suffer from urinary inconsistency after stroke despite of presence of voiding desire.

Methods: We reviewed stroke patients who admitted national rehabilitation center from 2014.01 to 2015.01. We collected the information of patients by admission note: general characteristics; brain lesion; duration after disease; Mini-mental state examination score; voiding desire; incontinence; bladder medication on admission. Patients who had pre stroke urinary incontinence and inserted indwelling urethral/suprapubic catheter state were excluded. Patients were stratified two groups into continence and incontinence by record of admission note and incontinence was defined as involuntary urination. Demography and clinical characteristics of groups were analyzed by descriptive analysis with mean, standard deviation. By the independent t-test, identifying the differences of clinical characteristics between the groups. To find the most correlated clinical characteristics with urinary incontinence using logistic regression. All Statistical analysis was performed with the use of the SPSS 21 computer program.

Results: 229 patients who met the inclusion criteria entered the study and then classified two groups into continence and incontinence. Compared with the demographic and clinical characteristics of the two groups, side of injury site and MMSE categories except ‘register’ were significant by Chi-square and t-test, respectively (P< 0.05) [Table1]. Logistic regression analysis performed twice, through first regression, we find that total MMSE score has strong correlation with incontinence (P< 0.00), and the second, place and recall as categorie of MMSE were significant (P< 0.05)[Table 2]. By drawing a ROC curve for identifying cut off value, total MMSE score (AUR 0.69, P=0.00), place and recall (AUR 0.67 P=0.00 and AUR 0.69 P=0.00, respectively) were significant. [Fig. 2]. In addition, we suggest that recall score of ‘1’ was most valuable for cut-off value (sensitivity 69-83%, specificity 48-63%).

Conclusions: This study is showed that urinary inconsistency after stroke was correlated with cognitive function as evaluated by MMSE. In addition, as categories of MMSE, place and recall were significantly correlated with incontinence after stroke [Table 2] and recall was most useful factor as cut off value. This result suggests that patients who had recall score of at least ‘1’ will have more possibility to regain urinary consistency. Therefore, further studies should identify the significance of the recall score of ‘1’ as the cut off value for regaining the urinary consistency after stroke prospectively.
Objectives: This aim is to analyze CBR educational courses from the perspectives of ICF framework, for the exploration about its future direction.

Methods: This study is a descriptive research study analyzes the contents of a CBR training courses which was completed from 2013 to until the first-half period of 2015. ICF experts who have research experience and two of community-based rehabilitation education committee classified the contents of each curriculum subject into ICF framework and made the agreement on it.

Results: 1) The number of those who have received education for two and a half year, totalled 1,317. The rate of such education trainees shows that males and females account for 19.2 and 80.7%, in turn, respectively. The rates of vocation types are as follows: doctors (0.2%), nurses (31.6%), physical therapists (36.1%), vocational therapists (6.2%), social workers (4.9%), healthcare professionals (10.0%), administrative professionals (3.7%), and any others (7.3%), which shows that physical therapists account for the highest rate; nurses for the next highest rate.

2) Regarding 'advantage', there were shown 91.3 (2013), 92.8 (2014) and 91.3 points of the first-half of 2015, while as to 'practical ability feasibility', there were shown 85.0 (2013), 87.4 (2014) and 86.5% of the 2015. According to the 'comparative outcome on pre and post-education acquisition of education knowledges,' scores of every area have been significantly (p<.01) improved. The improved scores have shown 30.7 (2013), 31.2 (2014) and 27.8 points (2015).

3) Overall education courses have been run for 444 hours from 2013 until the first-half of 2015. The analytic outcome on the running hours of ICF concept-based education shows that the hours related to 'body structure' and 'body function' such as brain, spinal cord, articulation and tissues were 10.9% and 24.6% in turn, respectively. The hours related to 'activity and participation' such as use of assistive devices and the participation of rehabilitative programs were 48.1%. 'Environmental factors', such as family support, policy and housing structure reform, account for 16.4%. Regarding the operation of CBR education, the hours of 'activity and participation' reach the highest rate, while those of time of 'body structure' takes up the lowest rate.

Conclusions: The effectiveness of CBR educational courses have been got a very positive feedback by CBR workers. It is also showed that 'activity and participation' and 'body function' account for high ratios in accordance with the education objective of social integration and improvement of life quality of the community disabled. It is suggested that the current curriculum needs to be re-overhauled based on reflecting the concept of ICF, at a balanced level, in the future.
The association between physical activity recommendations and neurocognitive performance amongst healthy elite youth ice hockey players.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: No preference

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Background: The Public Health Agency of Canada recommends at least one hour of daily physical activity (PA) for 11-18 year-olds. Sport participation is the most common means of PA engagement amongst Canadian youth. Yet, with increased sport participation comes an increased risk of injury, which may act as a barrier to continued physical activity participation. Up to one-third of sport injuries amongst high school sport participants are concussions, which can negatively affect physical and cognitive function. Neurocognitive testing is a component of concussion management, often via pre-injury testing and normative values to facilitate post-concussion decision-making. The positive benefits of PA on cognitive function are well established. PA is not currently accounted for in the interpretation of neurocognitive tests commonly utilized in concussion care.

Objectives: To evaluate the association between Canadian PA recommendations and neurocognitive performance amongst healthy elite adolescent ice hockey players.

Methods: Bantam (13-14 years old) and Midget (15-17 years old) AA and AAA ice hockey players completed a self-report questionnaire detailing demographic information, previous injury/medical history and six-week PA history, as well as the Standardized Assessment of Concussion (SAC) and Immediate Post-Concussion Assessment and Cognitive Test (ImPACT) (n=781; 15.4% female). Participants who sustained an injury within six weeks of study entry, with an unhealed injury, or who did not complete the PA history questionnaire were excluded (n=199; 22.6% female). The association between meeting Canadian PA recommendations for the six weeks prior to study entry (i.e., 42 hours or more) and neurocognitive test performance [i.e., low, (<10th%ile), average (10th-90th%ile) or high (>90th%ile) score (based on sample; stratified by age group and sex)] was evaluated via ordinal logistic regression, adjusting for cluster by team (α<0.05). Confounding and modification were not evaluated secondary to limitations in sample size distribution.

Results: Canadian PA recommendations were met by 81.7% of participants. Distributions by sex, age group, or previous concussion history were similar between participants who did and did not meet Canadian PA recommendations. There was no association between meeting Canadian PA recommendations and neurocognitive test performance on the SAC [OR=0.85 (95%CI:0.44-1.64), p=0.630] or the ImPACT composite scores [Verbal Memory: OR=0.87 (95%CI: 0.53-1.41), p=0.567; Visual Memory: OR=0.82 (95%CI: 0.47-1.45), p=0.501; Visual Motor Processing Speed: OR=0.53 (95%CI: 0.27-1.02), p=0.057; Reaction Time: OR=0.95 (95%CI:0.61-1.49), p=0.828; Impulse Control: OR=0.78 (95%CI:0.41-1.46), p=0.433] amongst elite youth ice hockey players.

Conclusions: Self-reported adherence to Canadian PA recommendations for the six weeks prior to study entry was not associated with SAC or ImPACT performance in this sample of 13-18 year-old AA and AAA ice hockey players. These results suggest that meeting Canadian PA recommendations does not have to be accounted for in the interpretation of baseline neurocognitive performance in this population.
Traumatic Brain Injury Results in Long-Term Changes Resembling Motor Neuron Disease

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: No preference

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Objectives: Amyotrophic lateral sclerosis (ALS) is the most common form of motor neuron disease (MND) and is pathologically characterized by the progressive death of motor neurons, degeneration of the corticospinal tract, and the presence of transactive response DNA binding protein 43 (TDP-43) inclusions. To date the aetiology of ALS remains largely unknown, limiting our ability to prevent its occurrence or develop effective therapeutic treatments. Traumatic brain injury (TBI) is a common progressive neurodegenerative condition, and has been linked to the later onset of ALS. However, the notion that TBI may cause ALS remains controversial. As such, here we aimed to further study the potential relationship between TBI and ALS by performing experimental TBI in rats and assessing for the presence of progressive MND-like pathological and functional abnormalities.

Methods: TBI was performed using the lateral fluid percussion injury model. MRI data was acquired using a 4.7 T Bruker scanner at 1 and 12 weeks post-injury. Behavioural testing was performed at 12 weeks post-injury and brain tissue, spinal cords and muscle tissue were also examined post-mortem.

Results: Volumetric analysis of in-vivo MRI found that rats given a TBI had progressive atrophy of the motor cortices compared to rats given a sham injury. Additionally, tensor-based morphometry and diffusion-weighted imaging revealed progressive degeneration and diffusion tensor changes within the corticospinal tracts of TBI rats. Immunofluorescence analysis of motor cortex revealed a reduction in neurons and an increase in the number of neurons overexpressing phosphorylated TDP-43. Further, rats given a TBI also had fewer motor neurons in the spinal cord, increased expression of muscle atrophy markers, changes in muscle fibre contractile properties, and muscle atrophy. Finally, assessment of motor function on a beam task revealed severe impairments in rats given a TBI.

Conclusions: Taken together, these experimental TBI findings resemble the pathological and functional abnormalities common in ALS, and support the notion that TBI can induce a progressive disease process bearing similarities to those in MND.
Comparison of motor recovery and cognitive function between forced exercise and voluntary exercise in Alzheimer mouse

Status: Accepted  Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Poster

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Objectives: Alzheimer's disease (AD) is the most common cause of dementia in adults. Microtubule associated protein tau is abnormally phosphorylated in AD and aggregates as paired helical filaments in neurofibrillary tangles. The effectiveness of exercise, once the cognitive impairments are established, is not as clear. In terms of translating research in animal models to treatments involving exercise in AD, it is critical to evaluate exercise intervention at time points that address not only prevention, but also treatment of cognitive decline.

Methods: We provided exercise wheels to Tg2576 mice at 18 months of age for four weeks. At this age animals have significant cognitive impairment and neuropathology consistent with AD. Age matched sedentary TG (n = 10) and WT (n = 10) mice were also included, as well as groups provided access to an immobile wheel (TG n=9, WT n = 12). After four weeks, animals were evaluated in a radial arm water maze.

Results: Significant impairments were observed in the sedentary TG mice compared to WT in reference/long-term and working/short-term memory, as well as in probe trials. Exercised TG mice demonstrated improvements in memory, which made them indistinguishable from WT mice on all tasks. In addition, animals provided with an immobile wheel exhibited improvement in some, but not all cognitive measures.

Conclusions: Our findings demonstrate that exercise can improve cognitive performance in a mouse model of AD even if applied after the development of pathology.
Graph Analysis of Resting State Functional Brain Networks in Mild to Moderate Brain Injury: Relationship with Working Memory

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Background: Patients with traumatic brain injury (TBI) often show deficits in attention, memory and general cognition as a result of changes in brain structure and function following injury. Little is known about how such cognitive changes are related to changes in functional brain networks.

Objectives: (1) to evaluate changes in resting state functional brain networks in individuals with TBI using graph theoretical approaches and, (2) to evaluate the relationship between global metrics of functional connectivity and cognition.

Methods: 9 adults between the ages of 18-51 years with a history of mild-moderate traumatic brain injury (between 1-28 years post injury) and twenty-three healthy controls participated in this study. Resting state EEG was recorded using a 64–channel Hydrogel Geodesic SensorNet (EGI, Eugene, OR). EEG was recorded with a Net Amps 300 amplifier at a sampling rate of 250 Hz. Five minutes of resting data were collected while participants sat quietly with their eyes closed. A graph theoretical approach was used to characterize global and local network features. Cognitive status was evaluated using the NIH Toolbox Cognitive Battery.

Results: Group comparisons revealed increased values of global clustering coefficient (p<.001), increased density (p<.001) and increased global efficiency (p<.001). In addition List Sorting Working Memory was significantly negatively correlated with clustering coefficient (R=.989, p<.001).

Conclusions: Our results show that compared with controls, individuals with TBI showed an overall increase in functional connectivity. This increased connectivity may be reflective of adaptive mechanisms or structural disconnections between brain areas that is maladaptive (Caeyenberghs et al, 2012). In addition we found that the clustering coefficient was negatively correlated with a working memory task suggesting that the degree of increased connectivity is associated with worse performance in working memory. Further analysis of local network changes may provide further insights into the underlying changes in network connectivity following brain injury. Graph analysis of EEG data combined with cognitive evaluation may prove to be a useful marker of the severity of brain injury.
0256

**Therapeutic Brain Machine Interface (BMI) Application to Patients with Severe Hemiparesis**

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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**Objectives:** BMI can directly translate brain signals for the intension of moving fingers into commands for control of a motor-driven hand orthosis. BMI systems estimate patient’s motor intention from the amplitude modulation of event related desynchronization (ERD). We developed a new compact BMI system and applied it to a clinical rehabilitation setting. We detect ERD using a pair of dry electrodes. Patients wear the motor-driven orthosis, which extend their paretic fingers triggered with ERD.

**Methods:** Participants were 42 patients with severe chronic hemiparetic stroke. BMI training consisted of a 40-min session per day and was performed for 10 days. Before and after the BMI training, we assessed Fugl-Meyer upper extremity motor function (FM) and motor activity log (MAL) scores.

**Results:** After the BMI training we found significant improvements of FM and MAL. We found the improvement of FM and MAL had been maintained until 3 months after the end of intervention.

**Conclusions:** Our BMI improved UE motor function and daily use of the paretic hand. It was supposed that the BMI training induced functional recovery based on cortical and spinal plastic changes.
Long-term Outcome after Traumatic Brain Injuries in Northern Sweden: Changes in Life Satisfaction and Sense of Coherence between 6-15 and 12-21 years Post Injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Background: Studies of long-term outcome after a traumatic brain injury (TBI) have increased during recent years. However, our knowledge of changes over time, many years post injury is still incomplete. We have previously reported the situation regarding functional outcome (n=88) and life satisfaction (n=66) 6 to 15 years after a TBI. In 2014 we presented results from assessments of these individuals 12 to 21 years post injury. The results indicated that many people with a TBI, regardless of injury severity, can achieve and maintain a fairly high and stable level of functioning many years post injury. However, it is also important to identify patients’ subjective contentment with life, commonly referred to as ‘life satisfaction’ (LS), and their Sense of coherence (SOC), a resilience factor in handling demanding situations in life.

Objectives: To compare life satisfaction and sense of coherence, assessed in 2007 (on average 10 years post injury) with data on the same individuals obtained 2013 (on average 16 years post injury).

Methods: The sample comprises individuals in northern Sweden that had been transferred for neurosurgical care following a TBI from 1992 to 2001. A total of 66 individuals (age 18 to 65 years of age) were assessed in 2007, 6 to 15 years after their TBI, and the assessments were repeated in 2013, 12 to 21 years post injury. The following instruments were used: the Swedish versions of the Satisfaction with Life Scale (SWLS), and Sense of Coherence-13 item version (SOC-13).

Results: Four of the 66 individuals had deceased and one was not found in the official register. Ratings for 44 individuals (72%) have been collected. The mean age of the 6 women and 38 men in 2013 was 49 (range 28-70) years. Twenty individuals had a mild TBI and were significantly (P=0.001) older than the 24 with a moderate to severe TBI. Five of those with mild, and none of those with moderate-to-severe TBI, were older than 65 years. Thirty-three individuals were working 2007, and 29 were still in full-time or part-time work 2013. For the whole group (44 individuals), the mean for SWLS and SOC was 22 and 65 in 2007, and 21 and 64 in 2013. There were no significant differences in the ratings of LS and SOC between 2007 and 2013. Significantly higher scores on SOC was found in relation to higher age (P=0.007), but no other significant relationships were found between either SWLS or SOC and sex, time after injury or education level.

Conclusions: The results indicate that many people with a TBI, regardless of injury severity, can achieve and maintain a stable situation with regard to life satisfaction and sense of coherence many years post injury.
Exploring the relationship between cognition and real world reasoning in adults with severe TBI at 6 months post injury.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: No preference

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Background: Few verifiable links have been established between cognitive impairment and specific aspects of communicative function. Understanding these links will increase insight into the psychosocial consequences of TBI, and inform the development of appropriate social and vocational rehabilitation.

Objectives: This study aims to determine links between cognitive impairment and specific aspects of communicative functioning in adults with severe TBI, at six months post injury. It examines the association between cognitive and executive functioning and performance on the Functional Assessment of Verbal Reasoning and Executive Functions (FAVRES) (MacDonald & Melnichouk, 2005). The research questions addressed are: (1) is the overall performance on the FAVRES associated with overall neuropsychological test performance?; (2) what is the association between the performance on each of the FAVRES subtests and overall neuropsychological test performance?; and (3) what is the association between the performance on each FAVRES subtest and the performance on each of the three cognitive measures?

Methods: 38 participants with severe TBI (31 M 7 F; Mean age = 35.34 yrs (SD 12.34)) were assessed using the FAVRES and a modified neuropsychological assessment battery at 6 months post-injury in a cross-sectional observational study. The FAVRES comprises 4 complex cognitive communication tasks such as scheduling a workday (Task 2) and solving a problem (Task 4) yielding Reasoning, Accuracy and quality of Rationale scores. Neuropsychological data comprised three cognitive indices of (1) Attention and speed of processing, (2) Memory, and (3) Executive functions (EF) and a combined averaged score (Total Cognitive Index).

Results: A moderate to strong positive association was found between participants’ total Reasoning score on the FAVRES and their Total Cognitive Index (rho= 0.6, p <0.001). There was a strong positive correlation between the Total Cognitive Index and performance on Accuracy in Task 2 (rho= 0.67, p < 0.001) and Task 4 (rho= 0.7, p <0.001). There was a moderate positive association between the Total Cognitive Index and the Rationales in Task 3 (rho= 0.48, p <0.01) and Task 4 (rho= 0.52, p <0.01). Overall, Task 4 had the most significant associations with the three cognitive indices. Memory was associated with Accuracy (rho= 0.63, p <0.001) and Rationale (rho= 0.43, p <0.01) in Task 4. Accuracy was moderately associated with Attention and Speed of Processing (rho= 0.49, p <0.01) and EF (rho= 0.53, p <0.01).

Conclusions: Performance on the FAVRES was positively associated with the three individual cognitive indices, with Accuracy the most consistent and stronger associations across all four tasks. These findings also indicate that performances on cognitive tasks and on the FAVRES (particularly Tasks 2 and 4) are
linked with employment outcomes. Participants who performed poorly on these tasks also indicated reduced work hours or were unable to return to work.
Dual diagnosis, singular care: A joint neuropsychiatry, neuropsychology and neurorehabilitation clinic for those with acquired brain injury and psychiatric comorbidities.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Having either an acquired brain injury (ABI) or mental health (MH) problems has serious consequences for the sufferer and their family. When both are present, this becomes uniquely challenging. Integrated services are virtually non-existent, despite over 60% of ABI survivors having psychiatric comorbidities. This results in revolving door patients presenting at multiple NHS services, often ending up with crisis or forensic involvement. At Cheshire and Wirral Partnership (CWP) we have created an innovative joint clinic to address this situation. A ‘one stop shop’ for clients, with simultaneous access to consultants in neuropsychiatry, neuropsychology and neurorehabilitation, it facilitates holistic and timely intervention.

Methods: Over a two year period the clinic has seen 46 people for 108 consultations. Types of ABI include traumatic brain injury, tumours and infections; MH diagnoses include depression, paranoia, and psychosis. The Glasgow Outcome Scale-Extended (GOS-E) is assessed at initial referral and discharge. Ongoing data include the Health of the Nation Outcome Scale-ABI (HoNOS-ABI) and the Hospital Anxiety and Depression Scale (HADS).

Results: A case study is presented. Jane had a subarachnoid haemorrhage in 2004. She was still suffering from excessive rumination, sleeplessness and depression. Her initial HoNOS-ABI score was 23, decreasing to 6 over the course of eight clinic visits; her HADS scores similarly moved to within normal range. She reported feeling listened to and that practical treatment had ensued, enabling a return to driving, improved sleep, and recommencement of leisure activities, including active volunteering with a local brain injury charity.

Overall data for the clinic is also shared, demonstrating clinically significant positive outcomes across a range of domains including HoNOS-ABI and HADS scores, timely diagnosis and treatment, MH stability and re-engagement in rehabilitation. Interestingly, GOS-E remained static for the majority, raising questions about the sensitivity of the scale and its suitability for situations when orthopaedic sequelae of TBI may create a natural ceiling.

Conclusions: The clinic was universally well received, with clients, families, relevant health and social care professionals appreciating a singular service. The clinicians involved were able to integrate investigations, medication advice, psychometrics, and develop uniquely synergistic and systemic formulations. The ability to arrive at creative, cost-effective, and comprehensive therapeutic plans has improved outcomes for patients, services and the local health economy. There is now a three month waiting list and it is proposed to double the clinic’s frequency.
Magic Hands

Background: The aim of the project is to teach the children/adolescents with traumatic brain injury and hemiplegia magic tricks to enhance hand function and quality of life.

Objectives: Children/adolescents suffering from traumatic brain injuries (TBI) and hemiplegia often have reduced hand function. They need different ways to restore or compensate the lost functions. In addition, their cognitive skills may be impaired making it hard for them to keep up with their social relations. The challenge for occupational therapists and child life therapists is to find activities within the rehabilitation that could motivate these children/adolescents to relearn and use their hands in new ways. The reason for choosing magic tricks is that it is fun, something new and contains aspects of memory and planning as well as to be something that their age peers perhaps are not able to do.

Methods: The project starts with six training sessions on a period of two months together with a professional magician during and teaching the children magic tricks.

Before and after the training period the children are assessed with standardized instruments for hand function (Grooved pegboard) and quality of life (Disabkids).

The pilot project involves 4 participants with TBI and hemiplegia between 10-16 years of age.

Conclusions: We hope to be able to evaluate the feasibility of this method in order to be used as a complement within the rehabilitation program for children/adolescents after TBI.
Vocational rehabilitation after acquired brain injury in Dutch rehabilitation centers: an overview of practice variation between the centers

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Objectives: The abilities to perform work-related activities change dramatically if people acquire traumatic or non-traumatic brain injury (ABI). Given that most recovery occurs during the first six months after ABI, training that is provided during these months is thought to be most maximally effective. Because many people who acquire moderate-to-severe brain injury are admitted to inpatient or outpatient rehabilitation during the first months, it seems logical to pay attention to (return to) work during the rehabilitation process. However, it is unknown whether paying attention to work related issues is usual care in all rehabilitation centers. And, if vocational rehabilitation (VR) is provided in the centers, whether all centers are using a similar intervention. Recently, a module focusing on work has been developed that has to be used for the passing of the costs of the provided care in Dutch rehabilitation centers. Implementation of the module assumes the use of (a similar) VR intervention in all centers. The objective of the study was to describe the practice variation in the structure of VR interventions used in patients with ABI in Dutch rehabilitation centers.

Methods: Professionals of 18 Dutch rehabilitation centers were asked to participate. Per rehabilitation center one self-designed questionnaire was sent. With the questionnaire, the availability and the structure of the VR intervention used in each center was investigated. The questions could be divided into eight domains: availability of intervention, timing, criteria, coordination, disciplines involved, work training, external partners involved, transfer of information to external partners, and funding. After completion of the questionnaire, availability and content of the domains in the interventions were scored.

Results: Professionals of 12 rehabilitation centers completed the questionnaire. In all centers a VR intervention was provided. The employer and the occupational physician were involved as external partners in all interventions. For all other domains of the questionnaire, differences between the centers were found. Most striking differences were the timing of the start of the intervention (during inpatient and outpatient rehabilitation (50%), or only during outpatient rehabilitation (50%)), the funding (only from health care insurances (58%), or also from employers or other external resources (42%)), the provision of work training (yes: 58%; no: 25%; sometimes: 17%), and the use of work samples during work training (yes: 67%; no: 33%).

Conclusions: All Dutch rehabilitation centers that participated in the study were already using a VR intervention. However, a lot of practice variation was found. In order to decrease the amount of variation and to come to the implementation of a similar VR intervention in all centers, the differences between the existing interventions should be compared and discussed. It is expected that the current overview of the practice variation can be helpful during that process.
Effectiveness of an errorless learning (prompt fading) procedure for patients with an Acquired Brain Injury, severe behavioural problems and cognitive impairment

Status: Accepted Presentation type: Poster

Category: Neurehabilitation – case reports/clinical research

Author's preference: Oral

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Background: Trajectum is a facility for the treatment of individuals with mild to borderline intellectual disabilities located in the northern and eastern parts of the Netherlands. Treatment is offered to 556 inpatient and 715 outpatient clients, and some of this treatment is offered in a forensic setting. A recent file case study showed that approximately 60 inpatients (about 11%) have an ABI. Treatment aimed at the ABI issue is important in order to reduce clients' behavioural problems as well as to improve their quality of life.

Objectives: A teaching method that may be suitable for this target group is Errorless Learning. This study examines whether an errorless learning procedure is effective for teaching the names of (12) staff members to 5 adults with ABI and cognitive impairment including severe memory complaints.

Methods: A face-name association task with prompt fading was used. The intervention consisted of three 15 minute practice sessions a week for 7 weeks. In the first two practice sessions, 12 photos were presented one by one with the full first name below the picture, and the patient was asked to say the staff member's name. After every two practice sessions, the last letter of the name was taken off. If the patient did not correctly say the name, a letter was added back on. If the patient still did not know the name, another letter was added. When the patient said a name correctly, a letter was taken off. This process was repeated until there were no letters left and the patient had to say the name of the staff member correctly on seeing the photo.

Results: Data was collected at 4 time points: baseline, post-intervention, 1-month follow-up and 3-month follow-up. The mean numbers of correct responses at the four points were 3.6, 11.2, 7.0, and 3.8, respectively.

Conclusions: Results showed that the intervention was highly effective, but that the level of correct responses decreased during follow-up, with a return to baseline level 3 months following intervention. Future research should focus on ensuring a longer term effective procedure. This may be achieved through booster sessions, for example, where the procedure is repeated every so often.
Problem Solving Therapy During Outpatient Stroke Rehabilitation Improves Coping and HR-Qol: A Randomized Controlled Trial

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Stroke patients use insufficient active problem-oriented coping strategies, and experience a relatively low health-related quality of life (HR-QoL). Problem Solving Therapy (PST) is an intervention in which patients are taught to structure the problem solving process and to increase flexibility in applying different coping strategies in various situations. This intervention has been shown effective in different patient populations. In stroke patients, the effects of PST on coping strategy and HR-QoL are unknown. This study investigated whether PST is an effective group intervention for improving coping strategy and HR-QoL in stroke patients during the outpatient phase of rehabilitation treatment.

Methods: In this multicenter randomized controlled trial, patients in the intervention group received PST in addition to standard outpatient rehabilitation treatment, while patients in the control group received outpatient rehabilitation treatment only. Measurements were performed at baseline, directly after the intervention, and 6 and 12 months later. Data were analyzed using linear mixed models. Primary outcomes were task-oriented coping as measured by the Coping Inventory for Stressful Situations (CISS) and psychosocial HR-QoL as measured by the 12-item version of the Stroke Specific Quality of Life Scale. Secondary outcomes were the EuroQol EQ-5D-5L utility score, emotion-oriented and avoidant coping as measured by the CISS, problem-solving skills as measured with the short version of the Social Problem Solving Inventory-Revised, and depression as measured by the Center for Epidemiologic Studies Depression Scale.

Results: Included were 166 stroke patients, with a mean age of 53.06 years (SD 10.19). 53% were men, the median time post-stroke was 7.29 months (IQR 4.90-10.61 months). The effects of PST differed over time; no significant group differences were present directly after the intervention. Six months post-intervention the PST group showed significant improvement compared to the control group in task-oriented coping (p=.008), but not stroke-specific psychosocial HR-QoL. Furthermore, avoidant coping (p=.039), and the utility value for general HR-QoL (p=.034) improved more in the PST group compared to control after 6 months. The effects on task-oriented coping and utility appeared to remain stable up to 12 months, although the differences were no longer significant at this point in time.

Conclusions: PST seems a useful intervention for stroke patients, which may have added value to standard outpatient stroke rehabilitation. PST seems to improve task-oriented coping but not disease-specific psychosocial HRQoL after stroke over 6 months follow-up. Further, we found indications that PST may improve generic HRQoL recovery and avoidant coping.
Influence of guidelines on management of pediatric mild TBI: CT-assessment and admission policy

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Objectives: Over the last decade, annually the number of children with traumatic brain injury (TBI) dramatically increased. This progress in TBI among children has resulted in a rapid increase in frequency of pediatric Computed Tomography (CT) imaging, and therefore an increased risk of developing cancer associated with radiation exposure. In 2010, the guideline for patients with mild TBI (mTBI), an initiative from the Dutch Association for Neurology, became effective in all Emergency Departments (ED) in the Netherlands. The aim of this guideline was to define risk factors for CT-assessment. In this study we aim to evaluate the influence of guidelines on the frequency of CT-assessments and admission policy of pediatric mTBI.

Methods: Retrospective cohort study of children (aged 0-18 years) with mTBI admitted from 2008-2014 to the ED of the University Medical Center Groningen (UMCG). To evaluate the influence of the mTBI guideline 2010, we analyzed data "before", "in" and "after" 2010, respectively; 2008-2010 (control period, <2010), 2010 (acquaintance period, =2010) and 2011-2014 (research period, >2010). Children admitted to the ED <24 hours after trauma defined by a Glasgow Coma Scale (GCS) score of 13-15 on admission, were included. The primary outcome parameters of this study were the frequency of hospital admissions after primary care at the ED and CT-assessments.

Results: In this study 625 patients were enrolled, per period: n=211 (<2010), n=98 (=2010) and n=316 (>2010) with a mean age of 8.1 years (SD 5.9; range 0-18) and GCS scores ranging from 13-15 with 13 (2.6%) 14 (14.4%), 15 (83%). 59% of the patients were male. The amount of hospital admissions (p=0.003) and CT-assessments (p=0.020) increased significantly during the 2 time periods. No significant increase in CT abnormalities (p=0.408) is seen.

Conclusions: The new guideline on management of pediatric mild TBI did lead to a significant increase in hospital admissions and also more CT-assessments. No increase was seen of CT-abnormalities. This suggests that more unnecessary CT-scans were done resulting in more radiation exposure (with associated risks) for children. Further evaluation will be done to clarify the factors that are related to adherence of guidelines for the decision of CT-assessments.
Deal-ABI study: Dealing with daily challenges in Acquired Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Both emotional and behavioural problems are common problems in ABI. They often arise at later stages of the rehabilitation process and are strongly intertwined with the context in which they occur. A new way of gaining insight into person-environment dynamics is the Experience Sampling Method (ESM). The present study introduces the PsyMate to implement ESM in an ABI population. The PsyMate is a small electronic diary, specifically developed to introduce ESM in clinical practice. The present study was the first to introduce the PsyMate in an ABI population. The main objective was to investigate whether the PsyMate is a feasible way to implement ESM in an ABI population. A second goal was to identify possible person-environment dynamics.

Methods: Thirteen ABI patients participated in the study. Each patient had to fill out the PsyMate questionnaires for six consecutive days. The PsyMate monitored experiences and behaviour by signalling the patient and collecting and registering data within a strict time period. The PsyMate provided the patient with an average of ten signals (beeps) per day at random intervals from 7:30 A.M. until 10:30 P.M. Each beep was followed by a digital questionnaire assessing mood (positive/negative affect), location and context, activities, self-esteem and physical well-being. In addition to the PsyMate questionnaires, various pen and paper questionnaires regarding mood, well-being and quality of life were used as well as evaluation questionnaires regarding the PsyMate device.

Results: Results showed high feasibility with a 73.85% response rate and a 98.60% completion rate of questionnaires. With respect to person-environment dynamics physical activity was found to be a non-significant predictor of experienced negative affect, \( B = 0.03, \ SE = 0.07, \ p = 0.70 \). Negative affect, however, significantly influenced experienced levels of negative affect. This effect was found both over 90 minutes, \( B = 0.51, \ SE = 0.04, \ p < 0.01 \), and 180 minutes, \( B = 0.16, \ SE = 0.04, \ p < 0.01 \) preceding t=0. In addition, higher levels of neuroticism were shown to be significant predictors of the level of negative affect at 90 minutes, \( B = 0.16, \ SE = 0.07, \ p < 0.05 \) up to 180 minutes, \( B = 0.24, \ SE = 0.11, \ p < 0.05 \) preceding the t=0 measurement.

Conclusions: Results showed high feasibility and good compliance. Regarding the person-environment dynamics; results rebut initial expectations regarding the positive relation between physical demands and negative affect. Negative affect was more related to emotional state and personality. The present study showed that the PsyMate is generally well accepted within the ABI population and provides reliable data without interfering with daily life or affecting the data themselves, providing a versatile methodology that might serve both research and clinical practice.
Post-Concussional Syndrome (PCS) and the Effect of Holistic Rehabilitation

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – case reports/clinical research
Author's preference: Oral

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Objectives: The Center for Rehabilitation of Brain Injury has recently concluded an RCT-study of whether the principles of holistic rehabilitation can be applied to the treatment of patients with PCS.

The study included 89 participants suffering from PCS, 45 in the intervention group and 44 in the control group.

Methods: The intervention consisted of a 22-week programme based on neuropsychological consultations both individually and as group consultations. Furthermore, the participants received physical training adapted to the specific needs of the individual. The last part of the programme was directed towards support in returning to work and overcoming the obstacles within this area.

Results: We will present the promising results of this controlled study regarding work life integration and quality of life.

Conclusions: There is evidence that a holistic therapeutic milieu has an effect on overcoming the consequences after stroke and traumatic brain injury (TBI).
Childhood Traumatic Brain Injury and the Associations with Risk Behaviour in Adolescence and Young Adulthood: A Systematic Review

Status: Accepted  Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: To review systematically the evidence that childhood traumatic brain injury (TBI) is associated with risk behaviour in adolescence and young adulthood.

Methods: A literature search was conducted in the Web of Science and PubMed databases using the terms: child, pediatric, traumatic brain injury, head injury, adolescent, psychosocial, antisocial, conduct, substance use. Studies detailing original research were included if they reported outcomes between the ages of 13 and 20 years in participants who sustained a TBI between the ages of 0 and 13 years.

Results: Six studies were included in the review; one study was cross-sectional, five were longitudinal. Findings from three of the studies indicated a relationship between childhood TBI and increased problematic substance use in adolescence and young adulthood. There was evidence from three studies to support an association between childhood TBI and later externalising behaviour, however two studies did not support this link.

Conclusions: More research is warranted to explore the association between childhood TBI and later risk behaviour as the relationship is not currently understood. Future research should focus on injury severity, age at injury and assessment, and potential mediating factors.
Neuropsychiatric outcome after right amygdalohippocampectomy

Status: Accepted Presentation type: Poster
Category: Neurotrauma – case reports/clinical research
Author's preference: Oral

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Objectives: One cause of ABI is brain surgery, the medically intractable mesial temporal lobe epilepsy resective surgery: a so called amygdalohippocampectomy (AHE). It is well-known that the hippocampus, is important for human encoding and storage of information for longer time periods. The amygdala has been associated with processing affective and socially emotional relevant information. To date no study has investigated the neuropsychiatric symptoms, e.g. cognitive, social-emotional, self-versus proxy behavioral questionnaires, in patients with right AHE.

Methods: three patients (two female, one male) who underwent AHE participated in the present study. The control group (nine females, eighteen males) was matched for age, education level in years, and had no structural abnormalities on the MRI/CT. All patients were subjected to an extensive diagnostic procedure including brain imaging, extensive neuropsychological assessment, social cognition tasks and (behavioral) questionnaires.

Results: we adjusted for multiple comparisons using the Bonferroni correction. No difference was found for the neuropsychological tests. No statistical analysis was performed due to the small sample size (N=3) on the FEEST. Patients scored below cut-off point on the recognition of the emotion Fear and Disgust. No group differences were found on the RMET. Considering the detection and understanding of a Faux Pas no difference were found. The AHE group showed less expression of passive behavior (U =3.500, Z = -2.571, P = .003, r = -.47), and significantly used helping thoughts in stressful situations (U = .500, Z = -2.784, P = .001, r = -.51) on the UCL. Regarding the self-rating patients scores (FrsBe), AHE patients seem to experience less behavioral problems considering Apathy (U = 3.500, Z = -2.564, P = .005, r = -.47). Additionally, a nearly significant effect (trend) was found for working memory, less overall Depressive symptoms, Obsession-compulsion, Neuroticism, overall behavioral problems. Proxies rated more Disinhibition on the NPI.

Conclusions: The effects of an AHE seem to go beyond (expected) deficits in functions, which is in line with the current insight of cerebral networks. Despite a small sample size, the present study provides evidence that a right AHE leads to altered cognitive functioning (working memory), altered emotion processing (recognition and empathy) and altered behavior (disinhibition and self-reflection). This might explain why, in the present study, resection of the hippocampus does not simply result in memory deficits and resection of the amygdala in emotion recognition deficits alone. Studies have shown the involvement of the amygdala in psychopathy. Given our results, deficits in emotion recognition, behavioral disinhibition, adaptive coping, and self-reflection, one might conclude that disruption of the amygdala might lead to some traits of psychopathy. It should be noted that, obviously, not all patients who underwent AHE have traits of psychopathy.
Caregivers’ opinion about level of awareness in patients with disorders of consciousness

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: To assess family caregivers’ opinion about level of awareness in their relatives affected by Disorders of Consciousness (DOC). To compare caregivers' opinion with physicians' diagnosis based on clinical diagnostic criteria confirmed by Coma Recovery Scale-Revised (CRS-R). To assess psychological features associated with any divergence in judging patients’ awareness with respect to the clinical diagnosis.

Methods: We assessed 45 caregivers (34 females; mean age= 47.6 years, SD= 17.4) of 38 DOC inpatients admitted in a neurorehabilitation unit (16 females; mean age= 51.9 years) without any evidence of communication abilities as evaluated by means of CRS-R [1]. Caregivers answered two questions about level of awareness of their relatives (awareness of the environment and communication ability) and completed self-report questionnaires for assessment of psychophysiological disturbances, coping strategies, quality of perceived needs, and perceived social support [2].

Results: Fifteen caregivers believed that their relatives in vegetative state were aware (5 of them also considered their relatives as communicative), and 10 reported that their relatives in minimally conscious state could communicate in some way; no caregivers underestimated their relative's status. Therefore, 20 caregivers expressed opinions convergent with that of the medical staff, whereas 25 caregivers (55.5%) did not agree with clinical diagnosis: these 'positive-estimators' had higher depressive symptoms, lower tendency to use positive coping strategies and were more worried about the possible death of their relatives with DOC with respect to 'convergent-estimators'.

Conclusions: As shown by the present observational study, a high percentage of patients' caregiver tends to judge their relatives' conditions more positively than the professional examiners. This divergence of opinion might harm the relationships between the caregivers and the rehabilitative staff. Care professionals should consider that caregivers' opinion might be based on closer and longer observations than those possible for physicians and have to deal with caregivers' beliefs and expectations in order to build a therapeutic alliance and actively involve them in the rehabilitative program [3]. This point is of paramount importance in consideration of the delicate role of caregivers directly involved in the clinical decision making [4].

References:

Development is Interrupted Not Arrested: Proposing a Model of Self-Awareness Following Moderate/Severe Traumatic Brain Injury in Childhood

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Lack of self-awareness is a consequence of traumatic brain injury commonly reported in the adult literature (Hart et al 2009). Theoretical frameworks have been proposed and assessment and treatment interventions explored. Children and young people with interrupted development as a result of a moderate/severe Traumatic Brain Injury (TBI) in childhood may present differently to adults. Existing models may be insufficient to explain the unique perspective of children and young people following TBI (Krasny-Pacini et al 2015)

Primary objective to conceptualise self-awareness across domains within a developmental framework following TBI in childhood

Secondary objective to provide an age-related framework to guide clinicians’ understanding and guide interventions


Results: Quantitative and qualitative data support the proposal of a new conceptual framework for the ongoing development of self-awareness following a traumatic brain injury in childhood across all functional domains.

Proposed new conceptual framework includes three elements –

Self-awareness knowledge - Knowledge is a key component of the proposed self-awareness framework. In typically developing children, knowledge is accumulated over the course of childhood, and includes semantic and autobiographical elements. Opportunities for learning and experience increase a child’s knowledge through typical development

Self-awareness in context - When we are engaged in tasks we receive external and internal feedback regarding our performance. This is sometimes referred to as “on-line” awareness as it happens in the moment. Typically developing children rely on external monitoring in early childhood. The ability to self-reflect develops over time. Children and young people become less dependent on context and become more able to manage generalised situations.

Self-awareness in the abstract – accommodating self-awareness in future tasks involves the development of executive skills, as well as imagination and creativity. All of these complex skills have a prolonged development over the course of childhood
The framework has a developmental focus and proposes that there is change over time, related both to maturity and recovery. The impact of a TBI is explored across the elements in the framework.

Each element is underpinned with existing knowledge from child development and new insights from data in the research study.

**Conclusions:** The proposed conceptual framework accommodates the unique presentation of children and young people who have an interrupted development of self-awareness following a TBI.

The framework extends current thinking and will promote clinicians understanding of child related progression following a traumatic brain injury. Clinicians can use the framework to aid their assessment and develop age-related interventions.

Further research is indicated to develop the framework, and use it as a platform to develop research and intervention ideas.
Users’ experiential knowledge as a base for evidence-based practice in interprofessional rehabilitation

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: No preference

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Objectives: User involvement has been increasingly important for developing relevant health care services. Evidence based practice, in addition to the best research evidence, must include professional expertise and patients' experiential knowledge. How experiential knowledge intersects with research evidence and professional expertise in clinical settings is insufficiently understood. The chosen area of the present study is interprofessional rehabilitation of patients with traumatic brain injury and multitrauma. The aims are to gain understanding on how users' experiential knowledge is gathered and used in interprofessional rehabilitation on an administrative level and in daily clinical practice, as well as to explore the contribution of users' experiential knowledge in interprofessional rehabilitation and professional decision-making.

Methods: Observation of interprofessional team meetings at two specialized rehabilitation units. The patients participated in some of the observed meetings. Observations were complemented by in-depth semi-structured individual interviews with team rehabilitation professionals.

Results: The professionals identified and recognized two levels of user involvement. One level was administrative where user involvement included informed consent, participation in the interprofessional meetings and the user organizations. The second level was patient involvement expressed in daily contact with the professionals, daily conversations, personal involvement, referencing patients' needs and plans. Although administrative user involvement was fulfilled, the professionals did not always regard this formal involvement as appropriate or relevant, but rather as a meaningless formality. Understanding the patients' life experiences, needs, wishes and possibilities was more appreciated as a means for gathering patients’ experiential knowledge.

Conclusions: Incorporating users’ experiential knowledge in evidence-based practice can lead to a common understanding of the rehabilitation process. The users’ experiential knowledge influences decision-making in interprofessional rehabilitation. However, possible gaps between users' experiential knowledge and professional expertise are recognized. Conflict may arise between professionals' and users' perspectives on the rehabilitation process or because of patients' reduced awareness.

Keywords: user involvement, evidence-based practice, interprofessional rehabilitation
Suppression of GRASP65 Phosphorylation by Tetrahydrocurcumin Protects against Cerebral Ischemia-Reperfusion Injury via ERK Signaling

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: The aim of this study was to assess the neuroprotective effects of tetrahydrocurcumin (THC) in a mouse model of cerebral ischemia/reperfusion (I/R) injury, and to investigate the involvement of the Golgi stacking protein GRASP65 and the extracellular signal-regulated kinase (ERK) signaling pathway.

Methods: Cerebral I/R injury was induced using the Pulsinelli four-vessel occlusion method. After 5 min of reperfusion, mice received THC (5 mg/kg, 10 mg/kg or 25 mg/kg) or saline by celiac injection. After 24 h of reperfusion, mice underwent neurological evaluation. Infarct volumes were determined by triphenyltetrazolium chloride staining, and levels of superoxide dismutase and malondialdehyde were measured in brain tissue homogenates. Expression of GRASP65, phosphorylated-GRASP65 (pGRASP65), ERK, and phosphorylated-ERK (pERK) was determined by Western blotting.

Results: THC caused a dose-dependent decrease in the expression of pERK and pGRASP65. THC attenuated I/R injury-induced activation of the ERK signaling pathway and reduced the phosphorylation of GRASP65.

Conclusions: THC had a dose-dependent protective effect against cerebral I/R injury, mediated by suppression of the ERK signaling pathway and a subsequent reduction of GRASP65 phosphorylation.
CT Ratio Doubled after Introduction of New Minor Head Injury Guidelines

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Background: Most decision rules for minor head injury (MHI), for example the Canadian CT Head Rule or the New Orleans Criteria, are only applicable to patients with loss of consciousness, amnesia or confusion. However, even in absence of these risk factors intracranial complications do occur. In 2010 a guideline was introduced in The Netherlands that is applicable to all MHI patients regardless of loss of consciousness, amnesia or confusion. For adult patients this guideline is based on the CHIP decision rule.

Objectives: The aim of the current study is to evaluate the change of practice in regard to CT- and admission ratios after introduction of a new guideline for MHI.

Methods: The study is multicentre before-after study in which adult patients with MHI that presented to the Emergency Department (ED) during a 3-month study period after introduction of the new guidelines were compared to patients in a 3-month control period before introduction. Primary outcomes were CT- and admission ratio. Secondary outcomes were CT-outcome and guideline adherence.

Results: During the six-month period, 36050 ED visits were registered. 1361 patients met the inclusion criteria and were included (3.8% of all ED visits). During the study and control periods 682 and 679 patients presented to the ED with MHI, baseline characteristics were comparable in both periods. The CT ratio increased from 27.1% to 51.2% (p<0.001) after introduction of the new guidelines. Admission ratio increased as well from 18.7% to 23.9% (p=0.021). In the study period 24 patients had traumatic intracranial injury on CT, which was not significantly different from the 20 patients with traumatic intracranial findings during the control period (p=0.646). Adherence to the guideline was 85.5%.

Conclusions: After introduction of a more generally applicable guideline for MHI efficiency for CT use diminished and hospitalization increased. Further research should be done to improve efficiency of CT imaging in the absence of loss of consciousness, amnesia or confusion.

Dutch Guideline

(based on CHIP by Smits et al '07)

Applicable

GCS score 13-15

Major criteria*

1. GCS<15

2. Signs of skull fracture
3. Vomiting (≥ 1 time)
4. Posttraumatic amnesia ≥ 4h
5. GCS deterioration of 2 points
6. Pedestrian or cyclist versus vehicle
7. Ejection from motor vehicle
8. Coumarin use
9. Focal neurologic deficit
10. Posttraumatic seizure
11. Focal “high impact” injury

Minor criteria*

1. Fall from any elevation
2. Posttraumatic amnesia 2-4h
3. Visible injury to the head, excluding the face (without signs of fracture)
4. Loss of consciousness
5. GCS deterioration of 1 point
6. Age ≥ 40

* One major or two minor criteria indicates CT
Involvement of persons with TBI in brain trauma prevention programs - examples of good practice in Centre Naprej

Status: Accepted  Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: No preference

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In this paper we are going to present three examples of good practice in preventive work of Centre Naprej, where we provide long-term psychosocial rehabilitation for persons with acquired brain injury.

The first example represents preventive workshops intended to different target groups. In these workshops professionals together with users of our services raise awareness about the consequences of brain injury and preventive measures against it.

Second example is the provision of mandatory community service, which is ordered to persons, who have committed an offense - it is an alternative to servicing prison sentence, to settlement or prosecution. Persons, who carry mandatory community service in Centre Naprej, are mostly juvenile delinquents. In Centre Naprej they come in contact with persons who suffer the consequences of brain injury. In that way they gain an experience what can their risky and reckless behaviour cause.

The third example is organizing and conducting various events and actions in wider social environment. The main goal of such actions is to raise awareness of wider public about the acquired brain injuries and possible prevention. Second aspect is to include people with special needs in nearby environment and thus reduce their feelings of social exclusion and discrimination.

In our paper we will highlight the effects of our preventive work on narrow and wide public; and last but not least, the impact on our users, who engage in a new role as active trainers and citizens.

Keywords: preventive workshops, mandatory community service, actions in wider social environment, traumatic brain injury, Centre Naprej
Inequality in rehabilitation

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: The overall Ph.d.-study aims to investigate rehabilitation trajectories in adult patients with traumatic brain injury (TBI) and stroke, and to describe mechanisms behind the institutionalized (health care) part of inequality in health with emphasis on interfaces and critical transitions from time of accident to twelve month follow-up. The case study aims to explore the process of rehabilitation in a high status patient, related to professions in healthcare. The focus is on how a high status patient is perceived and handled in organizations and among professions, and strategies applied by the patient and relatives.

Methods: Observation and qualitative interview has been conducted of one patient following the patients’ trajectories though different phases of the rehabilitation process during admission at Traumatic Brain Unit. Interdisciplinary meetings are regarded as key elements of the empirical attention. The sociology of Pierre Bourdieu constitutes the theoretical framework and is central to theories structuring. Bourdieu's concepts of economic, cultural, social, health and symbolic capital are used to analyze the patient positions and strategies in the field. The concept of strategy is used to understand how the agents perform to optimize their position in general and also as 'good' patients, relatives and professionals and how they have incorporated the structural conditions.

Results: The presented case is a 60 year old female (MK) admitted to rehabilitation after a major car accident. The patient suffers from severe physical and cognitive deficits. MK is married and has 3 grown-up children. MK is an academic and is acknowledged within the field, as well as her husband. They live in a house on three floors and have a summer cottage. At the admission interview, the husband argues for examinations using the biomedical concepts, classifications and logic and the examinations are accepted. Consequently, it seems like an active resource to act pro-active. As well as it seems like the patient and relative have the ability to use and convert capitals. That means that the couple's knowledge is articulated and used in practice and furthermore that they have the ability to take advantage and make use of it in the rehabilitation process.

Conclusions: Denmark as part of the Nordic welfare states is relatively equal in access to treatment in health care, but inequality seems to be increasing. The case study shows how one high status couple with many resources uses capitals. Especially cultural health capital, cultural capital (including health literacy and ability to use language) and social capital (including family and networks) when interacting with the health and welfare professions in the rehabilitation field. Twenty patients with different status and capitals will be followed during the next year to describe a broader picture of patient’s use of capital and of strategies used in Denmark.
Participatory Research in the Transitions in Rehabilitation Project – a Preliminary Analysis of Experiences from User Panel Meetings

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Objectives: Participatory research is recommended in rehabilitation research. Patients have a personal experience of the rehabilitation process that is not available to researchers. Such experience may complement researchers' analytical skills and scientific perspective. Potential benefits are research being grounded in relevant clinical needs. Several principles are described related to the execution of participatory research. The participation ladder presents user/patient participation on various levels, engaging in identifying and prioritizing research topics, analyzing and interpreting data, and disseminating findings. In the 'Transitions in rehabilitation' project at Oslo and Akershus University College user representatives with traumatic brain injury, multiple trauma, and family members of trauma patients are involved in participatory research. The aim of this case study is to describe aspects of user participation in the project, how the process has been organized, the reasoning that grounded actions and choices in the process, and reflections around performing research in a collaborative process that includes user representatives and researchers.

Methods: A user panel consisting of 6 user representatives recruited by patient organizations, 6 researchers and 3 PhD students was established. A qualitative approach was applied with observations and tape recordings of the panel meetings. Present at the respective meetings were the user representatives and a maximum of 5 researchers/PhD students. Two meetings per semester were arranged, starting in 2014. The meetings were held in a seminar venue after working hours, and lasted two hours. The role of the panel was for the user representatives to serve as consultants in the different phases of the project. Preliminary analysis of the participatory research process is based on reading of all written documents concerning the participatory structure of the project, documents to and minutes from the meetings, and on discussions between researchers and user representatives on lessons learned.

Results: The first meeting had a structure where the participants had an open discussion regarding expectations, needs and plans for the user panel, and the aim of the meetings was agreed upon. The researchers sought to establish an equitable relationship among all the participants. Examples of content of the following meetings were: advice on interview guides, discussion of vignettes for focus group interviews with rehabilitation professionals, discussion of excerpts from interviews with informants in the Transitions project. More information about the collaborative process and contents of the panel meetings will be provided. Experiences concerning enhancing and inhibiting factors for user participation in research will be discussed.

Conclusions: The user representatives contribute with their experiences living with the consequences of trauma, and with pre-injury experiences as well as competences derived from education and work life. Participatory research through the panel meetings has established a common ground for developing the Transitions in rehabilitation project.
Performance of prediction for short term mortality in patients after severe traumatic brain injury: Inclusion of initial Glasgow Coma Scales and abbreviated injury score of head region

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: The Glasgow Coma Scale (GCS) and the abbreviated injury score of head region (HAIS) are validated prognostic factors in traumatic brain injury (TBI). The aim of this study was to compare models with GCS and/or HAIS and supplementary initial prognostic factors assessed on scene (os) and at hospital admission (ed) to estimate their prognostic performance and accuracy of discrimination for short term mortality.

Methods: Secondary analysis of a prospective epidemiological cohort study including patients after severe TBI (HAIS >3) with follow-up from the time of accident until 14 days or earlier death was performed in Switzerland. Performance of prediction [positive predictive value (PPV), negative predictive value (NPV)] and accuracy of discrimination [area under the ROC curve (AUC)] of different predictive test models were investigated.

Results: The cohort included 624 patients [median age 54 {interquartile range (IQR) 32-71}, median GCS(os) 9 {4-14}, abnormal pupil reaction 26%. Best performance of prediction and best accuracy of discrimination with four simple variables had the following prediction models: A) HAIS, motor part of GCS(os), pupil reaction, age (PPV 72%, NPV 82%; AUC 0.85); B) HAIS, motor part of GCS(os), pupil reaction, age (PPV 70%, NPV 84%; AUC 0.85) and C) HAIS, GCS(ed), pupil reaction, age (PPV 70%, NPV 84%; AUC 0.85).

Conclusions: Best performance of prediction and accuracy of discrimination for short term mortality after severe TBI was observed with a multi-variable prediction model using HAIS, motor GCS or GCS, pupil reaction and age. The combination of HAIS and GCS improve prediction for short term mortality. Inclusion of pupil reaction and age increase the performance of prediction and accuracy of discrimination for short term mortality.
Mental recovery after severe traumatic brain injury in children during treatment with selective serotonin reuptake inhibitors in the early period of rehabilitation.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Background: Neurotransmitters (dopamine, GABA, norepinephrine, glutamate, choline, serotonin) are involved in the mental recovery after TBI. There are drugs that regulate neurotransmitters. They are used in the treatment of traumatic brain injury. Data on the use of selective serotonin reuptake inhibitors (SSRIs) are contradictory, unclear purpose of the appointment, the condition being treated. The children have not been studied.

Objectives: To investigate the efficacy of SSRIs (Sertraline) in the mental recovery in the early period of the neurorehabilitation after TBI in children.

Methods: 35 children (5-18 years) with sTBI (GCS≤ 8) admitted to the Institute of Emergency Children's Surgery and Trauma for treatment and rehabilitation. All children had interdisciplinary approach and standard medications in early rehabilitation. Group 1 (18 children) - in the early period of rehabilitation additionally administered sertraline. Group 2 (17 children) - without sertraline. Methods: psychiatric and neurological; neuropsychological data, radiological studies, the use scales.

Results: Group 1 - The clinical status was: a vegetative state - 3 (children), minimal consciousness "-" - 4, minimal consciousness "+" - 6, amnestic confusion - 2, cognitive and emotional deficits - 3. SSRIs gave in view of the pathogenesis after TBI, lesions of subcortical structures and of the brainstem. The purpose was: to improve motor and emotional activity, to correct the motivation sphere, to improve cognitive disorders, to increase sociability. We used Sertraline due to minimal adverse events, due the lack of absolute contraindications and permitted use with 6 years. Sertraline administered 12.5 mg/day in the morning, with increasing dose over 3 days to 25-50 mg/day. In one patient, high power (87 kg) - 75 mg/day. Duration of reception - an average of 3-4 months. All patients tolerated sertraline without adverse events. The clinical status of 3 months: minimal consciousness - 2 (children), minimal consciousness «++» - 3, amnestic confusion «-» - 5, minimal consciousness «+» - 3, amnestic confusion - 3, cognitive and emotional deficits - 2. The clinical status of 3 months: a vegetative state - 4, minimal consciousness «-» - 4, minimal consciousness «++» - 2, amnestic confusion - 1, cognitive and emotional deficits - 6.

Mental recovery to a stage of emotional and cognitive deficits was in 50% of children with sTBI during treatment with sertraline, compared with 35% in the control group. Positive dynamics was diagnosed by scales.

Conclusions: Analysis of the dynamics of mental recovery showed a positive clinical effect of SSRIs (such as sertraline) in the early period of recovery after sTBI in children - to increase activity in the motor, emotional, motivational and cognitive areas.
Living With Cognitive Challenges After Traumatic Brain Injury. Experiences of Developing Coping Strategies - A Qualitative Study.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Objectives: Most studies on functional recovery and rehabilitation after traumatic brain injury (TBI) are of quantitative design. Qualitative studies are needed to understand how people with TBI experience the cognitive challenges they are facing in daily life and the development of coping strategies, in a long term perspective. The aim of the study was to gain knowledge about how people living with TBI experienced the process of developing and applying coping strategies, and how the specialist- and community health care services may support this process.

Methods: The study had a qualitative design, applying semi-structured interviews with seven individuals (five males and two females) with moderate-to-severe TBI, 5 years post-injury. The data were analyzed using a phenomenological meaning condensation approach.

Results: The informants had applied coping strategies in different ways and to a quite different degree. The importance of support from health professionals to address and name the difficulties they experienced was highlighted. The informants described that difficulties also provided insight into the changed bodily capacity.

Conclusions: The study may guide health care professionals to a better understanding of the process of developing coping strategies after TBI. It demands sharing of information, a language to describe the problems and discussions with health care professionals over a longer time span.

Key words: Traumatic brain injury, phenomenology, cognitive impairment, coping strategies
**Naloxon combined with dexamethasone demonstrates protective potential towards cerebral ischemia reperfusion injury: a result of synergy**

**Status**: Accepted  **Presentation type**: Poster

**Category**: Neurotrauma – basic research

**Author's preference**: Oral

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**Objectives**: Stroke remains a common disease with high morbidity and mortality in the developed countries. This study investigated the combined effects of naloxone and dexamethasone on neuronal injury caused by ischemia/reperfusion (I/R) in mice.

**Methods**: The mice were evenly divided into five groups: group A served as the sham-operated controls. The bilateral vertebral arteries in each group were electrocauterized. In groups B to group E, the bilateral carotid arteries were occluded for 5 min. After 5 min, the mice were treated with normal saline, naloxone, dexamethasone, or a combination of naloxone and dexamethasone, respectively. Thereafter, all the mice underwent reperfusion for 24 h. At the end of the experiment, the following substance levels were examined in the mice brain tissues. At the same time, neuroethological assessments of the mice were also performed.

**Results**: The results showed that the combination of naloxone and dexamethasone had significantly hindered oxidative injury to the brain by ischemia/reperfusion as compared to the normal saline-treated group (p < 0.01). The histological examination also demonstrated that the combination of naloxone and dexamethasone could mitigate the injury in mice brains. The activation of NF-κB was inhibited by naloxone and dexamethasone co-treatment.

**Conclusions**: The final experimental data we acquired show that, the combination of naloxone and dexamethasone may reduce the injury caused by ischemia/reperfusion, and could be a novel therapeutic strategy in the clinical treatment of stroke.
Improving cognition and daily life functioning of children and adolescents with acquired brain injury (ABI): the design of a randomized controlled trial into the effectiveness of computer-based cognitive retraining (CBCR) combined with explicit strategy instruction

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author’s preference: Poster

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Objectives: Computer-based cognitive retraining (CBCR) is a promising cognitive rehabilitation method. Unfortunately, evidence from well-designed studies into its effectiveness after pediatric acquired brain injury (ABI) is scarce. Furthermore, while CBCR had positive effects on cognitive functioning in other populations (e.g., children with ADHD), limited generalization to daily life functioning occurred. Explicit strategy instruction has been suggested to enhance treatment generalization, and was therefore added to the CBCR in the design of the present study. The aim is to improve not only cognitive functioning (i.e., attention, working memory, and executive functioning) but also daily life/psychosocial functioning (i.e., participation, family functioning and quality of life) of children and adolescents (age 8-17) with ABI.

Methods: The study has a multicentre, randomized controlled trial design. Children and adolescents with ABI (n = 120) who are 6 months to 2 years post-injury and experience problems with cognitive functioning, are recruited from rehabilitation centres and specialized schools in The Netherlands. All participants receive care as usual according to available methods in the participating centres. In addition, participants in the intervention group are offered a 6-week CBCR program with explicit strategy instruction. The CBCR program targets a wide range of cognitive functions (i.e., attention, working memory, and executive functioning) through repeated task practice while automatically adapting task difficulty to individual performance. The explicit strategy instruction consists of function specific strategies (e.g., ‘clustering items helps to remember them’) and metacognitive strategies (e.g., ‘repeat instructions in your head before beginning with a task’). Participants use the CBCR program at home 5 times per week for approximately 30 minutes and receive 1 hour of explicit strategy instruction per week from a cognitive rehabilitation specialist. Intervention effects are measured with tests of attention (e.g., d2), working memory (e.g., Word Order test) and executive functioning (e.g., Concept Shifting task), and parental ratings of neuropsychological functioning (e.g., BRIEF). Furthermore, children and adolescents as well as their caregiver complete questionnaires on daily life/psychosocial functioning (e.g., participation (CASP), quality of life (PedsQL)). Measurements are conducted before the start of the intervention (T0), post intervention (T1), and at follow-up 3 months after the intervention (T2).

Results: With the present study design, we aim to shift the focus of cognitive rehabilitation studies in pediatric ABI patients from cognitive functioning only to a more integrative treatment model considering also daily life outcomes. Combining CBCR and explicit strategy instruction is expected to improve cognitive as well as daily life/psychosocial functioning. Effects are hypothesized to sustain over a 3 month period. To our knowledge, this is the first randomized controlled trial to examine effects of CBCR with explicit strategy instruction on daily life/psychosocial functioning in pediatric ABI patients. If available, preliminary results will be presented.
Ambroxol Protects Mice Cerebral Against Ischemia/Reperfusion-Induced Oxidative Stress and Inflammation by the NF-kappaB Pathway

Objectives: Ambroxol possesses a wide range of pharmacological effects and has been demonstrated to ameliorate lung ischemia and reperfusion (I/R) injury. However, its effects on cerebral I/R injury remain unclear. In the present study, the role of ambroxol in attenuating oxidative stress and the inflammatory response in a mouse model of cerebral I/R injury was investigated.

Methods: ICR mice were subjected to 10 min of ischemia followed by 24 h of reperfusion. After ischemia, the mice were treated with ambroxol or an equal volume of normal saline. Neuroethological assessment and histological changes were compared and the relevant parameters of oxidative stress and inflammation were detected. The expression of Vascular endothelial growth factor (VEGF) and nuclear factor kappaB (NF-kappaB and NF-kappaB p65) were assessed by immunohistochemistry and western blotting.

Results: It was observed that cerebral function was significantly improved by treatment with ambroxol. Morphological analysis indicated that ambroxol clearly reduced tissue damage and the expression of NF-kB, and increase the expression of VEGF. Biochemical detection demonstrated that ambroxol inhibited the increase of tumor necrosis factor (TNF)-α and interleukin (IL)-1βexpression induced by I/R injury. Western blot analysis indicated that the expression levels of NF-kappaB was significantly downregulated in the ambroxol group compared with this in the I/R group, and the expression of VEGF was significantly upregulated in the ambroxol group compared with the I/R group.

Conclusions: These results indicate that ambroxol treatment inhibited the NF-kappaB signaling pathway, and activated the VEGF signaling pathway. Protecting cerebral tissue against I/R-induced oxidative stress and inflammatory response.
A case study: the positive effect of integrating a hobby into life after traumatic brain injury. A presentation by the case manager and the client.

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – activities and participation
Author's preference: Oral

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Objectives: The presentation will explore the importance and benefits of integrating a pre-accident hobby into a meaningful activity after a brain injury.

Hobbies can enhance both cognitive and memory skills. Hobbies help with developing memory skills because they involve repetition. They assist with cognitive skills because they provide an isolated area of concentration.

A hobby can also provide a positive outlet for behavioural improvement and can be both beneficial for the person who suffered a brain injury and for family or caregivers. Hobbies are also important because it is an opportunity to meet new people, build self-esteem, relieve stress, avoid boredom and enrich your perspective.

Methods: In 2009, our client was 18 years old when he was involved in a motor vehicle accident, which resulted in a severe brain injury (GCS 3/15). He had just finished high school at the time of the accident and was interested in pursing schooling at the local college.

He was experiencing severely impaired memory, decreased attention, executive function deficits, including issues with goal planning, initiation and problem solving, and slowed thought processing. He could not be left alone as he displayed poor judgment, which placed his safety at risk.

He began community rehabilitation including case management, occupational therapy, physical therapy, speech language pathology and psychology.

Results: Along with his occupational therapist, they developed his hobby with music production and deejaying prior to the accident into his main productive occupation.

The OT taught the client how to implement compensation strategies for his cognitive impairments. This included technology devices for organization, memory and executive functioning such as using high tech applications, special computers and voice recognition software.

The client, now 23 years old, will be present for the presentation and will explain how he was able to effectively develop a meaningful life in which he is deejaying several times a week for different audiences in various venues within Ontario.

Conclusions: Our client now spends the majority of his time working on his music and deejaying and finds this to be a meaningful and rewarding activity. He is unable to make it as a profession but he has been able to develop friendships and relationships with other deejays and event promoters and has a fulfilling routine.
The presentation reveals that hobbies can be possible after severe brain injury.
Cortical Thickness in Mild Traumatic Brain Injury: Longitudinal Studies in a Relatively Large Cohort

Status: Accepted Presentation type: Oral

Category: Technology – clinical research/applications

Author's preference: Oral

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Objectives: Mild traumatic brain injury (mTBI) is a major public health concern among civilians and military personnel. Magnetic resonance imaging (MRI) based diffusion tensor imaging (DTI) is shown to have potential in the diagnosis of mTBI. However, DTI requires specialized acquisition that may or may not be available at all MRI centers. In this study we investigated the potential role of cortical thickness based on conventional T1-weighted MRI in the diagnosis and prognosis in mTBI.

Methods: MRI data were acquired on 75 mTBI subjects in the acute phase (~24 hours) and in the recovery phase (~3 months) post-injury on a 3T Philips scanner. Another cohort of 60 subjects with orthopedic injuries only served as the control (O) group. Only subjects who completed scans at both time points were included in this study. FreeSurfer (v5.3.0) software package was used to compute cortical thickness based on the 3D T1-weighted at both time points. Cross-sectional analysis was carried out to compare cortical thickness between the mTBI patients and orthopedic controls at both time points. Longitudinal unbiased templates were generated for all subjects and cortical thickness measurements were compared between baseline and follow-up scans in the mTBI group. The unbiased templates created for the longitudinal analysis help minimize inter-subject variability and improve the robustness of cortical thickness measurements. To correct for multiple comparisons FreeSurfer's Monte-Carlo simulation was performed with 5000 iterations, with a False Discovery Rate (FDR) of p < 0.05. Age or any other nuisance factors were not included in the model.

Results: In the acute phase, significant cortical thinning was observed in the left middle temporal and the right superior parietal regions in the mTBI group relative to the control group (p = 0.01). At follow-up, significant cortical thinning was observed in the left middle temporal cortex in the mTBI group. No cortical thickening was observed at either time point in the cross-sectional analysis. In the longitudinal analysis, small regions with significant, but subtle, cortical thinning and thickening were seen in the frontal, temporal, and parietal lobes in the left hemisphere at follow-up.

Conclusions: To our knowledge, this is the first longitudinal mTBI with a relatively large sample size that investigated cortical thickness changes. It is interesting to detect cortical thickness change within 24 hours after injury. We can only speculate that this finding is perhaps an indicator to premorbid structural differences post mild traumatic brain injury. Our results indicate that cortical thickness assessed using conventional MRI could serve as an important measure in identifying subtle pathological changes in mTBI subjects. A longitudinal design with more time points in the recovery phase and a larger sample size could help establish the potential role of cortical thickness in mTBI.
What Do We Know About Sport-Related Concussion: Overview and Preliminary Data From the Concussion Assessment, Research, and Education (CARE) Consortium

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Sport-related concussion is a major public health problem. Despite recent advances, much remains unknown about the natural history of concussion and there are no objective biomarkers of physiological recovery available for clinical use. Furthermore much of our available data on concussion is limited to male American football players. Funded by the U.S. National Collegiate Athletic Association and the U.S. Department of Defense in 2014, the Concussion Assessment, Research and Education (CARE) Consortium is the largest, multi-site study of the natural history of concussion in both sexes and multiple sports, designed to address current gaps in our knowledge, and shed light on the neurobiological mechanisms of concussion and trajectory of recovery. To date, 10,000 richly phenotyped individuals have been enrolled and 300 sport-related concussions captured with the goal of better informing public debate about concussion care and policy. The CARE aims include (1) create a national multi-site consortium as a sustainable framework to answer critical scientific questions about concussion; (2) conduct a prospective, longitudinal, multi-center, multi-sport investigation that delineates the natural history of concussion in both men and women by incorporating a multi-dimensional assessment of standardized clinical measures of postconcussive symptomatology, performance-based testing (cognitive function, postural stability), and psychological health; and (3) conduct advanced scientific studies which integrate biomechanical, clinical, neuroimaging, neurobiological and genetic markers of injury to characterize the neurobiology of concussion.

This symposium will present an overview of what we know and do not know about concussion and preliminary findings from the first 18 months of CARE data collection. The session will consist of four presentations:

I. Overview of Sport-related Concussion: What We Know and What We Need to Know? This talk will review what is known about the natural history and neurobiology of concussion and highlight current knowledge gaps.

II. The CARE Consortium: Overview, Aims, and Methodology. This talk will describe the specific aims of the CARE Consortium, organizational structure and methodologies for the longitudinal clinical and concussion neurobiology studies. Rationale and limitations of the methodology will be discussed.

III. Preliminary CARE Data: What is the Natural History of Concussion? Preliminary demographic and clinical data on the initial 10,000 collegiate athletes enrolled in the study will be presented. Data on the injury characteristics, symptom resolution, return to play, and 6-month follow-up will be presented in the initial cohort of 300 concussed athletes.

IV. Preliminary CARE Data: What can Biomechanics, Neuroimaging & Biomarkers tell us about the Neurobiology of Concussion? Preliminary biomechanical and neuroimaging data on the initial cohort of concussed athletes will be summarized. Methodological and logistical challenges will be discussed.
An update on neuroradiology of traumatic brain injury: the LSU approach

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: Patients with suspected traumatic brain injury should be carefully examined to detect damage to the cortex and white matter tracts as well as the functional connectivity in main brain networks.

Patients with traumatic brain injury complain of symptoms like headaches, insomnia, depression, memory loss, bursts of anger, difficult in planning, bad social relationship, loss of some praxies.

We present our magnetic resonance protocol, capable to explain those symptoms and provide a better diagnosis and prognosis for these patients as well as some examples from our daily routine.

Methods: We have a standard protocol for patients suspected to have traumatic brain injury.

The equipment consists of two GE-MRs, Excite 1.5T with gradients 790 G/m. The sequences are 3D T1-SPGR(BRAVO), 3D FLAIR, 3D susceptibility sequence (SWAN), Tensor, magnetic resonance spectroscopy with ROIs in frontal lobe and cingulate gyrus and resting state functional magnetic resonance. 3D-BRAVO is used to perform brain segmentation and cortical thickness reconstruction as well as white matter connectivity using tensor data (BrainSuite, LONI). To measure fractional anisotropy and reconstruct fiber tracts we use GE software and also 3D-Slicer. Resting state fMRI data are acquired using 30 slices, 170 times (5100 images). The subjects are 30 patients consulting for litigation, diagnosed with post-traumatic syndrome, no less than one year after trauma. 16 men and 14 women. Mean age: 38 yo (10yo-67 yo).

Results: Susceptibility sequence was positive in 37% of patients. Cortical thinning was present in all patients in a following distribution: orbitofrontal cortex 90%, dorsal medial frontal cortex 83%, occipitaltemporal cortex 70%, central cortex 50%, hippocampus 26.7%, temporal cortex 23%, parietal cortex 20%. Fractional anisotropy was decreased in cingulum 57%, genu of the corpus callosum 50%, uncinated fasciculus 43%, splenium and inferior longitudinal fasciculus 23% each, superior longitudinal fasciculus 13%. Increased fractional anisotropy was present in cingulum 20%, superior longitudinal fasciculus 17%, splenium of the corpus callosum 13%, uncinated fasciculus and inferior longitudinal fasciculus 7% each. Magnetic resonance spectroscopy was abnormal in the frontal lobes (decreased NAA) in 73% and in posterior cingulate cortex in 28%. Abnormal connectivity in resting state fMRI was found in anterior cingulum 75%, posterior cingulum 67%, hippocampus 42%, insula 37%, caudate 25%, thalamus and prefrontal cortex in 13% each. Midbrain abnormal connectivity (13%) was always present in patients with persistent headache.

Conclusions: Abnormal findings in our protocol matched neuropsychological examination and explained the symptomatology in patients with normal computed tomography and standard magnetic resonance.

The symptoms, started after traumatic brain injury, correlated well in these patients
Using machine learning to predict return-to-work following traumatic brain injury

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Objectives: Return-to-work (RTW) is an important outcome measure following traumatic brain injury (TBI) and a common goal of rehabilitation efforts. Therefore, early and accurate prediction of RTW is important. However, accurate prediction of RTW following TBI has proven to be difficult. Prediction rates vary widely among studies and there is limited consensus on the most important demographic, medical or cognitive predictors of RTW.

One possible reason for the difficulty of predicting RTW could be due to limitations of the analysis methods typically used in studies predicting RTW following TBI, namely regression or discriminant analysis. An alternative analysis method that is gaining popularity in prediction research is machine learning. Techniques based on machine learning, such as support vector machines, can deal with complex non-linear data and derive a prediction model or classifier using cross-validation. This means that the model can be used to predict outcome for an individual patient, whose data have not been included to develop the model. The aim of this study was to examine the usefulness of machine learning for developing a cross-validated model to predict RTW one year after TBI.

Methods: The data came from a sample of 30 patients with TBI group (25 males, 5 females). All patients were tested twice on a battery of neuropsychological tests, shortly after injury and again one year later. Ratings of pre- and post-injury behaviour and social functioning were collected from relatives or partners of the patients.

By the time of the second assessment, 16 patients had returned to work and 12 did not. RTW status of 2 patients was unknown. The two groups were balanced for age, gender and IQ. Data of 23 variables from a range of demographic information, injury severity scores and neuropsychological tests obtained shortly after injury were included in the classification model.

Results: The average prediction accuracy was 78% (p< 0.05), which was the accuracy to predict RTW one year later TBI in individual, novel, patients, based on the variables obtained shortly after injury. Injury severity (GCS score) was identified as the most relevant and consistent variable to contribute to the prediction of RTW.

Conclusions: Using a machine learning-based technique the level of accuracy of predicting RTW obtained in this study was similar or better than prediction rates reported in previous studies, which used other analysis techniques but much bigger samples of TBI patients. A further advantage of the technique was that the prediction was based on independent data, which allows generalisation to new individual patients, similar to what would be used in the clinic.
Impaired Binocular Microsaccades in Hemianopia

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Homonymous hemianopia (HH) is the visual impairment in one half of the visual field after stroke or brain trauma. It greatly impedes daily activities; however, the visual field loss cannot fully explain the subjective visual impairments in HH. Impaired microsaccades (MS) could be another factor contributing to the visual impairments. These small, fast, jerk-like eye movements play a significant role in fading counteracting, high-acuity and high spatial resolution tasks. MS dysfunction would lead to blurred vision and reduced visual acuity, which were reported in HH. It is possible that the potential MS deficits in HH may contribute to the visual impairments. Abnormal MS are also found in other diseases like amblyopia, progressive supranuclear palsy, Parkinson's disease, Alzheimer's disease and mild cognitive impairment. But they have never been studied in hemianopia. Our aim is to investigate if and how MS features are altered in HH.

Methods: 14 Patients with homonymous hemianopia (mean age 59) and 14 healthy controls (mean age 60) were recruited. We used a fixation task (a white fixation dot was presented against a grey background). Participants were instructed to fixate the central dot. Binocular eye movements were recorded by an EyeLink-1000 system (SR Research, Ontario, Canada) with a 500 Hz sampling rate. An adapted MS detection algorithm was used to identify MS and a binocular conjugacy algorithm was specifically developed by us to quantify binocular MS conjugacy. Linear models were used to test the MS difference between the two groups.

Results: Group effect was not found in MS velocity, rate, percentage of binocular MS, and vertical conjugacy. The hemianopic group showed larger amplitude (mean=0.46, SEM=0.03) compared to the control group (mean=0.39, SEM=0.02) (F(1,26)=4.15, p=0.052), and a larger horizontal conjugacy index (mean=12.50, SEM=1.70) then controls(mean=8.58, SEM=0.64) (F(1,26)=5.71, p=0.024). This suggests that hemianopic patients' left and right eyes worked poorly together compared to normal eye coordination in healthy subjects. While controls' MS showed no preference over either side, hemianopic patients' MS showed a significant bias towards the intact side (F(1,25)= 4.93, p=0.036; F(1,25)=8.56, p=0.007).

Conclusions: Although MS magnitudes, velocities, durations, and frequencies were comparable between both groups, hemianopic patients produced significantly less conjugate binocular MS. While performing monocular and binocular MS, hemianopic patients tend to make more MS towards their intact visual fields. Thus, binocular MS are impaired in patients with homonymous hemianopia. The discovery of an asymmetric MS direction favouring the seeing field will facilitate a better understanding of the nature of vision loss in hemianopia and help us design new rehabilitation methods.
Justifying individual support worker input for individuals with cognitive difficulties following acquired brain injury; using Occupational Therapy theory and bespoke support worker records.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Poster

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Objectives: To use a theoretical model, coupled with real life data to justify the use of 1:1 support worker input to enhance the lives of individuals with acquired brain injury.

Methods: The extensively documented Model of Human Occupation (MOHO), developed by Dr. Gary Kielhofner in the 1980’s, is a theoretical model widely used in occupational therapy practice. It is based on the premise that humans are 'open systems', functioning within and responding to their environment. This lends itself readily to reflections within a theoretical framework, regarding the impact of acquired brain injury on an individual; according to their specific disabilities, environment and the context within which they function and live their lives.

This is coupled with a review of a convenience sample of Westcountry Case Management clients, providing a number of unique case studies. Each client support team completes bespoke daily care records via an online system; from which data can be exported to review the efficacy of the support package.

Results: Data garnered from the daily records is used to assess support worker input alongside reflections on the package from the perspective of the MOHO theoretical framework.

Conclusions: Skilled support worker input has the potential to impact positively on the way in which an individual 'open system' functions by manipulating the environment with which they interact. The MOHO clearly demonstrates the potential for positive change when an individual is supported in this way.

The use of bespoke, electronic support records allows support programs to be tailored according to assessed needs and their efficacy trialed and reviewed in an objective fashion.

Using theory and real life data in conjunction offers the clinical team useful tools with which to justify the support workers' role.
Predictive Value of Optic Nerve Sheath Diameter Measurement for Detecting Raised Intracranial Pressure in Paediatric Traumatic Brain Injury: A Prospective Observational Study

Status: Accepted Presentation type: Oral

Category: Technology – clinical research/applications

Author's preference: Oral

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Objectives: To determine the predictive value of transorbital ultrasound measurement of the optic nerve sheath diameter (ONSD) as a screening tool in the emergency unit for detecting raised intracranial pressure (ICP) in children with traumatic brain injury (TBI).

Methods: A prospective observational, cross-sectional study was performed on children presenting to the trauma unit with TBI. The initial Glasgow Coma Score (GCS), hemodynamic parameters and CT scan findings were recorded. The mean binocular ONSD measurement was compared to clinical, physiological and radiological findings. Clinical findings were The relationship between ONSD, demographic, physiological, clinical and radiological findings were described using logistic regression models to control for the effect of potential confounding variables and describe the diagnostic accuracy of ONSD for predicting clinical and radiological features of raised ICP.

Results: The median age was 44 months (IQR 15.5-97.5), with a slight male preponderance (1.2:1). Aetiology motor vehicle accident (58%), fall (23%), assault (14%), non-accidental injury (5%). The median initial GCS was 9 (IQR 5-12). The mean ONSD was 5.09 mm (SD 0.74). The correlation between ONSD and CT findings suggestive of raised ICP was good (r = 0.74, p < 0.001, Pearson's correlation coefficient). Using a linear regression model to control for age, arterial pCO₂ and systolic blood pressure, this relationship was still significant (R²=0.55, p= 0.01). Using an ONSD cut-off value of 5 mm demonstrated a sensitivity of 93.2%, specificity of 74%, positive predictive value of 62.5% and a negative predictive value of 93.7%. The area under receiver operating characteristic curve (AUROC) was 0.84, with a diagnostic odds ratio of 39.3.

Conclusions: Transorbital ultrasound measurement of the ONSD is a useful first line examination in the trauma unit for detecting raised ICP in children, and selecting appropriate cases requiring a CT scan or invasive ICP monitoring.
The role of GDNF in synaptic plasticity of neural network during hypoxia modeling in vitro

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Poster

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Objectives: The problem of protecting brain cells from hypoxia considered as one of the main urgent issues in modern biology and biomedicine. Nowadays various therapeutic approaches associated with the application of endogenous compounds or their derivatives to correct the negative effects of hypoxic damage are being actively developed. According to modern concepts neurotrophic factors play a key role in the functioning of neural networks of the brain during development and in the postnatal period. Glial cell line-derived neurotrophic factor (GDNF) regarded as one of the potential substances able to affect on the metabolism and cell viability under stressogenic conditions. Previously data shown that GDNF have pronounced neuroprotective effect which is manifested as increase cell viability of primary hippocampal cultures as well as preservation of spontaneous bioelectrical activity in the posthypoxic period. Thereby, the aim of the present study was to investigate the possible influence of GDNF on synaptic plasticity of primary hippocampal neural networks in normoxia and hypoxic conditions.

Methods: Dissociated hippocampal cells were taken from the brain of CBA mice embryos (E18) and cultured during 14 days in vitro (DIV) according to the previously developed protocol on multielectrode arrays (Alpha Med Science, Japan) or coverslips. Hypoxia modeling was performed on DIV14 by replacing the normoxic cultural medium with a medium containing low oxygen for 10 min. The main parameters of spontaneous bioelectrical activity were registered: the number of bursts, the number of spikes in a burst, the burst duration. The cell viability detection and differential evaluation of apoptosis-necrosis processes were also conducted. Moreover, we studied intravital mRNA BDNF and mRNA GluR2 expression using SmartFlare RNA Detection Probes (Merck Millipore, France) in combination with functional calcium imaging.

Results: Carried out experiments revealed that GDNF (1 ng/ml) application contributes not only to maintain the viability of dissociated hippocampal cells but leads to elimination of negative hypoxic effects on the spontaneous neural networks activity. In addition, the correlation analysis demonstrated GDNF affect on the reorganization of neural networks in the posthypoxic period. In normoxic conditions there were no changes in morpho-functional structure of neural networks in response to the injections of various GDNF concentrations (1 ng/ml, 10 ng/ml). Investigation of possible molecular mechanisms of GDNF in synaptic plasticity showed that neurotrophin application significantly (p <0.05) increases the expression of mRNA subunits of AMPA-receptors - GluR2 in normal conditions and prevents its reduction in posthypoxic period.

Conclusions: Thus, despite the fact that GDNF has no significant effect on the spontaneous network activity, the data demonstrates its participation in the functional reorganization of neural network activity, indicating the presence of pronounced neuroprotective and antihypoxic properties of this neurotrophin. The research was supported by Russian research found (grant №15-13-00140).
A tool using post-concussion trajectories to classify and direct clinical decision making for interdisciplinary management of individuals with protracted recovery from concussion

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: To present a clinical decision making tool to be used by the interdisciplinary healthcare team to guide the referral and assessment of individuals with protracted recovery from concussion.

Methods: Past research suggests there are multiple symptom "trajectories" following suspected concussion. Based on these findings and our clinical expertise, we propose six clinical trajectories to classify patients. The trajectories we propose are: oculomotor/vestibular, anxiety, post-traumatic migraine, cervicogenic, mental fatigue/cognitive, and physical fatigue. As clinicians, it is critical to determine applicable trajectories to guide treatment and to facilitate appropriate referrals. Based on proposed trajectories, we designed a clinical decision making tool to be used by a range of healthcare providers, including, but not limited to, physical therapists, neuropsychologists, neurologists, athletic trainers, and primary care physicians. Clinicians who do not have extensive experience evaluating individuals post-concussion, clinicians treating a patient with a complex presentation, and/or clinicians treating individuals who are not responding to treatment as expected are the primary target for this tool.

Results: The clinical decision making tool begins with two, central questions and guides the clinician through the subjective evaluation to reach the appropriate trajectory(s). Once the patient's symptoms have been classified in to particular trajectory(s), the clinician can begin a prioritized assessment based upon his/her expertise and make the appropriate referrals to other healthcare providers depending on the trajectories identified. The tool is intended to be used for initial assessment and then to track the recovery process by being used to reassess the patient's symptoms and determine if the individual's symptoms have changed over the treatment period. This tool is not intended to take the place of clinical reasoning, but instead guide decision making.

Conclusions: Due to the complex nature of concussion, an interdisciplinary, team approach is vital to the successful treatment of individuals with protracted recovery from concussion. This tool will improve clinical decision making and help facilitate referrals to improve the use of the interdisciplinary team needed to provide optimal care for these complex patients.
Long-term effects of the ABC method on aggression in neuropsychiatric patients with severe acquired brain injury.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Aggression is a common problem in patients with severe Acquired Brain Injury (ABI). The ABC method is a behavior management technique for use by nurses. ABC refers to the identification of Antecedent events, target Behaviors and Consequent events. Primary objective of this study was to evaluate the long-term effects of the ABC method on aggressive behavior in patients with severe ABI. Secondary objective was to explore the influence of patient characteristics on effects of the method.

Methods: A longitudinal intervention study was conducted in two permanent stay departments for patients with neuropsychiatric problems. Participants were 40 patients with aggression and severe ABI. Baseline assessment took place at 6 weeks before introduction of the ABC method (B1) and immediately before its introduction (B2). Post-treatment assessment took place immediately after introduction of the method (P1). Follow-up assessments took place at 9 weeks after its introduction (FU1) and at 18 months or at three years after FU1 (FU2). Outcome measures for aggression were two retrospective measures, the Social Dysfunction and Aggression Scale-11 (SDAS-11) and the Neuropsychiatric Inventory (NPI), and two daily measures, the Staff Observation Aggression Scale-Revised (SOAS-R) and the Agitated Behavior Scale (ABS). Data were analyzed with the non-parametric test Friedman's ANOVA.

Results: Analyses showed a significant decrease in aggression over time for the daily measures ($\chi^2_{SOAS-R}(4) = 14.917, p < .05$; $\chi^2_{ABS}(4) = 9.918, p < .05$). Post-hoc analyses however showed that changes between B1 and FU2 were not significant ($\chi^2_{SOAS-R} = .859, p = 1.00$; $\chi^2_{ABS} = .251, p = 1.00$). Stratified analyses further showed that decreases in aggression on the daily scales were particularly seen in patients with high cognitive functioning. For the retrospective measures, analyses showed a significant increase over time ($\chi^2_{SDAS}(4) = 28.611, p < .001$; $\chi^2_{NPI}(4) = 22.457, p < .001$). Post-hoc analyses showed that the increase between B1 and FU2 on the SDAS was significant ($\chi^2_{SDAS} = 3.019, p < .001$). On the NPI, no significant change between B1 and FU2 was found ($\chi^2_{NPI} = 1.948, p = .255$). Increase in aggression on the retrospective scales was particularly found in older and higher educated patients and in patients with lower cognitive functioning.

Conclusions: On one of the retrospective aggression measures, nurses indicated that aggression increased after implementation of the ABC method. On the other measures, no significant changes were found. The unexpected finding that aggression increased after implementation of the ABC method may have been influenced by increased awareness of aggression in nursing staff: after being trained in working with the ABC method, nurses may be more prone to noticing aggression problems than before.
Immediate Effects of Anodal Tdcs Combined with Patterned Electrical Stimulation on Gait Performance in Patients with Stroke

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: Supraspinal excitability and sensory input could play an important role for the modulation of spinal plasticity, which might contribute to the recovery of lower limb and walking function following central nervous system (CNS) lesions. We reported previously that anodal transcranial direct current stimulation (tDCS) combined with patterned electrical stimulation (PES) modulates spinal reciprocal inhibitory interneurons and improves the ankle movement in patients with incomplete spinal cord injury. The aim of the present study was to examine the immediate effects of anodal tDCS combined with PES on gait performance in patients with stroke.

Methods: Nine patients with subacute stroke participated in this double-masked, sham-controlled cross-over study. They randomly participated in the following three sessions on separate days: (1) anodal tDCS combined with PES; (2) anodal tDCS and sham PES; (3) sham tDCS combined with PES. We applied PES to the common peroneal nerve with a train of 10 pulses at 100Hz every 2s for 20 min. Stimulus intensity was set at the motor threshold of the tibialis anterior (TA) muscle. Anodal tDCS (1mA) was simultaneously applied to the primary motor cortex for 20 min. In sham condition, tDCS and PES were delivered for only the first 15s. Before and after the stimulation, participants were asked to walk at a self-selected comfortable speed over a 16 m walkway. We measured gait speed, surface electromyography (EMG), ankle joint angle, and ankle plantar-flexion moment during the walk. The EMG signals were obtained from the TA, soleus (SOL), and rectus femoris (RF) muscles on affected side. We calculated the co-contraction ratio as the values of EMG from SOL divided by the values of EMG from TA in the stance and swing phases of gait.

Results: The gait speed was not changed before and after the stimulation in all interventions. For simultaneous combination of anodal tDCS and PES, the EMG of the TA after the stimulation was significantly greater than that before in the swing phase. The EMG of the SOL muscles after the stimulation was significantly decreased in the swing phase compared with the baseline. In both anodal tDCS combined with sham PES and sham tDCS combined with PES, all the parameters did not change before and after the stimulation. There was significant difference in the co-contraction ratio among the three interventions, the combination of anodal tDCS and PES showed improvement in the co-contraction ratio after the stimulation, while other interventions remained unchanged.

Conclusions: These findings suggest that anodal tDCS combined with PES could improve walking function in patients with stroke.

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One Voice: The First International Symposium on Pediatric Concussion

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – activities and participation

Author's preference: No preference

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Objectives: Concussion is of great prevalence and concern amongst kids and families. There remains a lack of knowledge sharing events dedicated to translating research evidence generated within the pediatric concussion community. The One Voice: the 1st International Symposium on Pediatric Concussion was developed to address this knowledge gap. The objective of the symposium was to answer the following question: in the next 3-5 years, what do we need to do to help children with concussion do the things they want, need and love to do?

Methods: Sixty international leaders representing various stakeholder groups (clinicians, researchers, educators, sport organizations, policy makers, youth and parents) participated in knowledge sharing through a webinar series and consensus building and action plan development through facilitated workshops. Three surveys were conducted to evaluate the following: 1) Knowledge, Attitudes and Practice (KAP) Survey - to better understand the knowledge, attitudes and practice specific to pediatric concussion for all symposium invitees; 2) Webinar Series Evaluation - to evaluate the use of pre-symposium webinar series to share key knowledge amongst invitees; and, 3) Symposium Evaluation – to evaluate the symposium logistics, experiences, outcomes.

Results: The outcome of the One Voice Symposium resulted in three strategic directions for pediatric concussion being identified: 1) connecting kids to care; 2) moving facts forward; and 3) driving big change. The webinars were an effective information sharing method. In particular, participants felt that the webinars facilitated collaboration (87%), highlighted the work of others (96%) and current research (93%), and raised awareness about the need for concussion education (91%). The knowledge, attitudes and practice survey identified more work needs to be done on developing and implementing effective concussion education and prevention strategies. Overall, participants agreed that the action plan created was achievable (89%), inspires commitment and accountability (90%), addresses current gaps/barriers (93%), and is driven by the needs and priorities affected by concussion (91%).

Conclusions: One Voice was developed to meet the need for consensus building and development of a collaborative action plan in pediatric concussion. Evaluation findings will inform the development and delivery of future symposia and action planning events specific to pediatric concussion to best meet the needs of this vulnerable population. Moving the identified strategic directions forward will help to guide the future of pediatric concussion care around the world.
Family intervention for adolescents treated for brain tumors and their families

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author’s preference: Poster

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Objectives: The increasing survival rates in most childhood cancers also apply to brain tumors. However, the quality of the saved life after brain tumors is in many cases affected by an acquired brain injury (ABI). Besides altering the life more or less radically for the survivor himself/herself, an ABI affects the entire family. Families having a child surviving treatment for brain injury report high levels of stress and burden and significant levels of anxiety and depression. Elevated levels of psychological distress and high levels of family burden can persist for many years following the child’s brain injury. The long lasting stress that these parents are exposed to contains an experience of uncertainty, self insufficiency and lack of information of late complications. Thus, this stress just not has a negative influence on the parents but also on the outcome of the patient and his or her siblings. Given the long-term negative effects of acquired brain injuries on family system functioning and the bidirectional child-family influences on pediatric outcomes it is critical to look at effective ways of supporting families after acquired brain injuries.

Methods: The Brain injury Family Intervention for Adolescents (BIFI-A) developed in Toronto, Canada based on cognitive behavioral therapy and family therapy principles provide evidence that BIFI-A is a promising family system intervention. We have translated and adapted the BIFI-A manual into Swedish, educated five psychologists to be treatment coaches and recruited 10 families. We have tested the feasibility of the BIFI-A on Swedish population.

Results: The preliminary results show that the method is feasible to use on a Swedish population but we now need further studies.

Conclusions: The BIFI-A is feasible to use on a Swedish population but we will now proceed and investigate the direct and long lasting effect in a multicenter larger randomized controlled study.
Ultrastructural changes in neuron-glial networks with neurotrophic factors BDNF and GDNF under hypoxic conditions

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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ЦЕЛИ

поиск для новых веществ нейропротективных является одним из наиболее актуальных вопросов в области неврологии. Нейротрофины являются важными регуляторные белки, которые играют ключевую роль в функционировании центральной нервной системы могут быть использованы для разработки новых терапевтических стратегий для защиты клеток мозга к гипоксии повреждения. Тем не менее, вопросы о нейропротективных механизмов нейротрофинов остаются неясными.

Целью исследования было изучить антигипоксическими и нейропротекторные свойства BDNF и GDNF в ультраструктурным уровне под гипоксического состояния в пробирке.

МЕТОДЫ

у&
Exploring the King’s Outcome Scale for Childhood Head Injury in Children Attending a Rehabilitation Hospital

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: To examine 1) the inter-rater and intra-rater reliability of The King’s Outcome Scale for Childhood Head Injury (KOSCHI) for children attending a rehabilitation hospital with acquired brain injuries; 2) to examine convergent validity of the KOSCHI with other validated measures of overall health status; and, 3) to examine the responsiveness of the KOSCHI in this group.

Methods: A total of 200 youth between the ages of 4 to 18 years, from English speaking families, who have been diagnosed with an acquired brain injury were recruited from a post-acute inpatient pediatric rehabilitation facility with long-term follow-up. Children diagnosed with an acquired brain injury as a result of surgical complications for the treatment of epilepsy, have any developmental disorders, or have progressive inflammatory encephalopathy were excluded from the study. This prospective pediatric cohort study examined the inter-rater reliability of the KOSCHI using two data collection techniques: 1) in-person clinical interview by a pediatrician and a review of structured clinical notes by a pediatrician; and, 2) two independent reviews of structured clinical notes by a pediatrician and a community physiatrist. To assist in ensuring consistency of information being used, a structured clinical interview form containing all the necessary information to derive a KOSCHI score was created for this study. A scoring algorithm was developed through a series of pilot studies to aid in the KOSCHI scoring process. Convergent validity was assessed using two well validated measures of overall health status, the Mayo Portland Adaptability Inventory (Pediatric) completed by the physician, and the PedsQL completed by the youth’s family. Responsiveness of the tool was examined by looking at changes in overall score over a 6 month to 1.5 year follow-up timeframe.

Results: Statistical analysis will be complete at the end of the study, by October 2015. Final results including inter- and intra-rater reliability, convergent validity and the responsiveness of the tool will be presented.

Conclusions: Preliminary data analysis suggests moderate inter-rater reliability using a weighted kappa, consistent with previous literature that examines the KOSCHI using a retrospective chart review methodology. Moderate to good intra-rater reliability is also seen. Preliminary convergent validity data suggests a moderate correlation with PedsQL scores and good correlation with the Mayo Portland Adaptability Inventory scores. This study will be able to provide inter-rater reliability data for the first time having been applied in a prospective nature and will establish the effectiveness of the KOSCHI being utilized in a methodologically rigorous manner. The KOSCHI is currently being used in clinical research and practice, however little evidence is available to instruct others about its reliability and validity.
Predicting Consciousness Recovery in Patients with Severe Brain Trauma Using ERP

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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One of the most recent problems on neurophysiology in the field of TBI is the assessment of possible recovery of consciousness in patients with brain trauma followed up by long-term (more than 10 days) coma. ERP are used for the assessment of mental integrity and possibility of consciousness restoration in most cases, especially N100, N200 and P300.

In total, 184 examinations were conducted in 73 patients. Control group consisted of 60 healthy subjects. An oddball paradigm consisting of standard and deviant tones was used. Firstly, patients listened to tones without instruction. Then patients were given an instruction to count target tones regardless of stage of consciousness restoration and existence of verbal contact with a patient. Amplitude and latency of N100, N200 and P300 as well as amplitude mapping of P300 were analyzed. Wavelet-analysis of ERP was made. In some cases ERP and DT-MRI matching were carried out.

All three components - N100, N200 and P300 - were clearly detected at the patients with reversal unconscious state. The instruction to count target tones impacted all these components. ERP and DT-MRI matching revealed decreasing number of fibers of corpus colossus, with spinal tracts being preserved, in patients with a good recovery and intact ERP. The thinning of spinal tracts and atrophy of corpus colossus were detected in patients with recovery up to clear consciousness and yet slowed mental processing.

All components of ERP were absent no matter with or without instruction to count target tones as well as standard tones at patients with irreversible unconscious state. ERP on standard tones should be analyzed since the instruction to count target tones might result to better response to standard tones. This might be caused by poor ability to remember rare tones in deep oppression of consciousness. These patients won't go further than minimally conscious state. The amplitude and latency of ERP components reflect patient's state, though they are not significant enough to give a reliable prognosis of mental recovery. The "balding" of corpus colossus, thinning and unilateral atrophy of spinal tracts were detected in a patients with chronic vegetative state.

Topography of P300, which was recorded without instruction, correlated with the stage of consciousness recovery. Although each stage of conscious recovery is characterized by certain P300 localization, only P300 at vegetative state has a prognostic value.

The obtained data are discussed in terms of cortex-cortex and cortex-brain stem connections as one of the most probable neurophysiology mechanism of consciousness oppression.

The study was supported by RHSF Grant №15-06-10836.
Using a participatory action research approach to facilitate the implementation of the IADL Profile in clinical practice

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Background: Traumatic brain injury (TBI) practice guidelines emphasize the critical importance of assessing and rehabilitating executive function deficits, identified as a core cause of longterm disability. The IADL Profile is the only clinical/research tool to have been specifically developed to measure the repercussions of executive function deficits on independence in complex situations in home and community environments and guide treatment interventions. However, a gap remains between the evidence and actual tool use, which supports the importance of promoting its implementation using effective knowledge translation activities (KTA).

Objectives: (1) To identify perceived barriers to the clinical use of a standardized measurement tool, the IADL Profile, at the individual and organizational level; (2) to develop and implement KTA to facilitate its use.

Methods: Participatory action research including six rehabilitation centres in Quebec, Canada. 61 occupational therapists working in TBI programs (clinical experience = 12.4 ± 7.89 years) completed a 64-item questionnaire developed to identify the perceived barriers and facilitators to the use of the IADL Profile after an initial online training and workshop (T1, n=61) and then again after a 6-month trial period (T2, n=29). A focus group with champions and clinicians at T2 (n=11) was used to identify common barriers and facilitators and optimal KTA. Throughout the study, clinicians tested, commented, questioned and improved a multi-faceted knowledge translation strategy called the IADL Profile Knowledge Implementation Toolkit (I-KIT). The aim of the I-KIT is to address obstacles to the uptake of the IADL Profile in clinical practice. The I-KIT consists of: web-based learning, an interactive educational workshop, website, online support, outreach visits and clinical champions.

Results: Situations perceived as problematic to the use of the IADL Profile in clinical practice changed at T2 compared to T1. Concerns regarding clinical use of the tool at T2 centred around: time pressure, discomfort experienced by the therapist when administering certain components of the IADL Profile, therapist perceived lack of interest of TBI clients for some activities of the IADL Profile, impact of technological change on the applicability of the tool, and finally the clinical applicability of the IADL Profile interview with the client or significant other. Subsequent to the trial period, participants reported feeling more confident about administering the tool and fewer participants mentioned feeling a cognitive overload when administering the tool. Finally, a greater number of clinicians considered all 3 IADL Profile scenarios as applicable within their clinical context. I-KIT activities were globally considered as relevant, with satisfaction ranging between 58 and 100%.

Conclusions: Collaboratively developed I-KIT activities were positively perceived to facilitate clinical use of the IADL Profile. The trial period component of the I-KIT increased perceived clinician self-efficacy in administering the IADL Profile.
Management of Traumatic Brain Injury at the Emergency Department in Europe: A Survey Study

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: No preference

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Objectives: Previous studies have shown that there is no consensus about TBI management of traumatic brain injury (TBI) at the emergency department (ED) in different European countries. In this study we describe the current policies for management at the ED and for hospital admission of TBI patients in Europe.

Methods: 73 participating centers of the European CENTER-TBI (Collaborative European NeuroTrauma Effectiveness Research in Traumatic Brain Injury) study received 11 questionnaires about different phases of TBI care. These questionnaires, based on literature and expert validation, included 72 questions about TBI management at the ED and hospital admission. The questionnaires were completed between December 2014 and August 2015 and reliability of the questionnaires was estimated by calculating concordance rates between duplicate questions in different questionnaires (5% of the questions).

Results: 65 centers (response rate 89%) from 19 European countries completed the questionnaires with a satisfactory concordance rate (median 0.78). On average mild TBI is considered a Glasgow Coma Scale (GCS) score between 13-15 (51%) or 14-15 (45%). Moderate TBI is considered a GCS score between 9-12 (47%) or 9-13 (38%). At the ED various guidelines for the use of head CT in patients with mild TBI are used: NICE-guidelines (23%), Scandinavian guidelines (13%), Canadian CT Head Rule (9%) and CT in Head Injury Patients rule (5%). One third of the centers uses other (inter)national or local guidelines and 21% uses no guidelines at all. The guidelines are mainly implemented by written protocols and algorithms (48%) overseen by multidisciplinary groups (48%). In 11% of the centers s100B is routinely determined as a prognostic biomarker for neurologic deterioration. There are differences in indications for admission between the centers. For example, patients with pre-injury use of anti-coagulation would always be admitted to the hospital ward in 39% of the centers, while 43% of the centers indicated that these patients would only be admitted in presence of other risk factors. After discharge from ED, 37% of the centers schedule a routinely follow-up session, whereas after admission at the ward in 87% a routinely follow-up session is scheduled.

Conclusions: Large between-center variation exists in policies for diagnostics, and admission and discharge decisions in patients with TBI. The results of this study may be useful in the understanding of TBI care in Europe and show the need for further studies on the effect of different policies on outcome.
Randomized Placebo-controlled Trial of Methylphenidate or Galantamine for Persistent Emotional and Cognitive symptoms Associate with TBI and PTSD

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Traumatic brain injury (TBI) and posttraumatic stress disorder (PTSD) are both prevalent consequences of traumatic events during deployment among military personnel. Postconcussive (PCS) and posttraumatic stress (PTS) symptoms overlap in multiple domains, but cognitive complaints are particularly prominent in both conditions. However little is known about the treatment of cognitive complaints in individuals with co-occurring PCS and PTS. Studies of mTBI have typically excluded individuals with PTSD, while studies of PTSD have typically excluded individuals with TBI. Considering existing preclinical and clinical data, we initiated a trial of two pharmacotherapies – galantamine (GAL) or methylphenidate (MPH) -- for reducing cognitive and emotional symptoms in individuals with mTBI, PTSD, and co-occurring mTBI and PTSD. We hypothesized that treatment with MPH or GAL would be associated with greater reduction in cognitive complaints than placebo. Secondly, we hypothesized that MPH would result in greater improvement in executive function and processing speed than placebo, whereas treatment with GAL would result in greater improvement in memory. We also hypothesized that either active treatment would result in improvement in non-cognitive symptoms characteristic of each disorder.

Methods: This study was one of several multi-site trials conducted by the Injury and Traumatic Stress (INTRuST) collaborative network, established and funded by the U.S. Department of Defense to further understanding and treatment of the interaction of TBI and psychological health. Seven sites from within the network participated in this trial. The study was designed as a double-blind, randomized 15-week controlled trial (RCT) of galantamine 12 mg bid or methylphenidate 20 mg bid vs. matching placebo for 12 weeks duration. Primary assessments were conducted at baseline (week 0) and post- treatment (week 12), and briefer interim assessments at weeks 4 and 8. The study population (n=32) consisted of adults aged 18-55 who met criteria for diagnosis of PTSD and/or history of mTBI and clinically significant cognitive complaints (indicated by a T score ≥ 60 on the Postmorbid Cognitive Scale of the Ruff Neurobehavioral Inventory; RNBI (Ruff and Hibbard, 2003)).

Results: In this small pilot study, methylphenidate treatment was associated with clinically meaningful and statistically significant improvement compared to placebo on the primary outcome measure, the Ruff Neurobehavioral Inventory – Postmorbid Cognitive Scale, as well as on the secondary outcomes reflecting postconcussive symptoms (Rivermead Postconcussive Symptom Questionnaire). Of interest posttraumatic stress symptoms (Posttraumatic Stress Disorder Checklist) improved significantly as well and treatment was well tolerated.
**Conclusions:** These results suggest the need for a larger RCT to replicate and confirm these findings. Design considerations for such a trial should include the need for multiple sites to facilitate adequate recruitment and extension of the treatment follow-up period and intervals of assessment.

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Background: There is a lack of epidemiological literature regarding the national prevalence and long-term consequences of disability following Traumatic Brain Injury.

Methods: A National Disability and Health Survey was conducted in French households and institutions in 2008-2009. Participants included 33 896 adults representative of 49 million individuals. Face-to-face interviews collected data including sequelae from Traumatic Brain Injury, impairments, health and use of health services. Disability severity was derived from the Glasgow Outcome Scale. Analyses took into account survey design and weighting factors. Comparisons between persons with or without Traumatic Brain Injury were adjusted for age and gender.

Results: A total of 479 persons declared living with Traumatic Brain Injury-related sequelae, the 33 287 remaining participants formed the control population (no-Traumatic Brain Injury). Weighted national prevalence of Traumatic Brain Injury sequelae was 0.7% (0.9% in men, 0.5% in women). This corresponded to a weighted frequency of 344,495 adults living with TBI-related impairments in a French adult population of 49 million inhabitants. Median age was 50 (1st - 3rd quartiles: 38.3 - 62.3); median time since injury was 13.9 years; 0.2% were in a vegetative state, 22% had severe disability, 37% had moderate disability and 41% had good recovery. Participants who declared Traumatic Brain Injury reported more severe impairments than the no-Traumatic Brain Injury population for all items of the Brief International Classification of Functioning Core Set for Traumatic Brain Injury, with odds ratios ranging from 1.7 (behavioural difficulties) to 8.6 (motor difficulties). Participants with Traumatic Brain Injury who were in the "good recovery" category also had higher rates of impairments than matched controls. Rates of cardiovascular, respiratory, musculoskeletal, digestive, urological, neurological and psychiatric conditions were all higher in the Traumatic Brain Injury population than in the no-Traumatic Brain Injury population, with the highest odds ratios for the latter two domains. Use of health care services was higher in the Traumatic Brain Injury population, and women with Traumatic Brain Injury had high rates of unmet needs for health services.

Conclusions: Chronic sequelae from Traumatic Brain Injury are frequent and cause significant disability in the general population. Planning of post-Traumatic Brain Injury care should include long-term follow-up and take into account the specific chronic needs of this population.
Development of a suite of mobile applications to support communication and leisure pursuits for patients with acquired brain injury

Status: Accepted Presentation type: Poster

Category: Technology – clinical research/applications

Author's preference: Poster

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Objectives: To outline the development of a suite of apps to support communication and leisure pursuits for people with acquired brain injury. Key features of the apps will be presented and their use highlighted via case study.

Methods: A gap was identified in the current market for simple, accessible and age-appropriate apps that would enable adults with a variety of physical, sensory, cognitive and communication impairments due to acquired brain injury to use tablet computers for basic communication and leisure purposes. A suite of accessible and customisable apps encompassing the following was developed: 1. Yes/No and choices app. 2. Radio. 3. Photo album. 4. Youtube playlists app. Accessibility features were considered from the outset and form a core component of the suite of apps.

Results: Use of the suite of apps with patients with physical and/or cognitive impairment has shown the benefits of integrating technology into the assessment and treatment process of this group. Therapist and patient involvement in the development of the apps ensured that ease of set-up and customisation were to the forefront in the development process. Key features of the app suite include: 1. Individual user profile across the suite of apps. 2. Easy set-up and customisation of apps for users. 3. Reduced scanning demands for new switch users - potential for use as an entry level switch-based activity focussing on functional, personally relevant material (music/video/photos). The apps allow for: 1. Cause and effect training based on functional and personally meaningful activities. 2. Return to valued leisure activities for patients with acquired language impairments post brain injury with increased ease of access to radio and video clips. 3. Creative use of this readily available, mainstream technology can offer new opportunities for assessment and treatment with a complex and diverse patient group. Case studies will be used to demonstrate specific use and functionality of the apps.

Conclusions: Use of the suite of apps with patients with physical and/or cognitive impairment has shown the benefits of integrating mainstream technology into the assessment and treatment process of this group in line with best practice recommendations (Lancioni & Singh, 2014; RERC, 2014).
Hydrogen sulfide-releasing cyclooxygenase inhibitor ATB-346 enhances motor function and reduces cortical lesion volume following traumatic brain injury in mice

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: No preference

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Traumatic brain injury (TBI) induces secondary injury mechanisms, including dynamic interplay between ischemic, inflammatory and cytotoxic processes. We recently reported that administration of ATB-346 (2-(6-methoxynaphthalen-2-yl)propionic acid 4-thiocarbamoyl-phenyl ester), a hydrogen sulfide-releasing cyclooxygenase inhibitor, showed marked beneficial effects in an animal model of spinal cord injury, significantly enhancing recovery of motor function and reducing the secondary inflammation and tissue injury.

Here we evaluated the neuroprotective potential of ATB-346, a hydrogen sulfide-releasing derivative of naproxen, using the controlled cortical impact (CCI) injury model in mice, one of the most common models of TBI. Moreover, the aim of the present study was to carefully investigate molecular pathways and subtypes of glial cells involved in the protective effect of ATB-346 on inflammatory reaction associated with an experimental model of TBI. In these studies, TBI was induced in mice by CCI and mice were orally administered ATB-346, naproxen (both at 30 μmol/kg) or vehicle (dimethylsulfoxide:1% carboxymethylcellulose [5:95] suspension) one and six hours after brain trauma and once daily for 10 days.

Results revealed that ATB-346 attenuated TBI-induced brain edema, suppressed TBI-induced neural cell death and improved neurological function. ATB-346 also significantly reduced the severity of inflammation and restored neurotrophic factors that characterized the secondary events of TBI.

These data demonstrate that ATB-346 can be efficacious in a TBI animal model by reducing the secondary inflammation and tissue injury. Therefore, ATB-346 could represent an interesting approach for the management of secondary damage following CNS diseases, counteracting behavioral changes and inflammatory process.
Traumatic brain injury leads to development of Parkinson's disease in mice.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: No preference

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Traumatic brain injury (TBI) is among the leading causes of mortality and morbidity worldwide. TBI is an insult to the brain from the application of external physical force that leads to temporary or permanent structural and functional impairment of the brain. TBIs are reported as risk factors for sporadic neurodegenerative diseases. Parkinson's disease (PD) is a late-onset neurodegenerative disorder caused by degeneration of dopaminergic neurons in the substantia nigra (SNc). In that regard, the aim of this study was to investigate the possible development of PD following experimental model of TBI. TBI was induced in mice by controlled cortical impactor. At different time points behavioral tests (Open field, Elevated plus maze tests and Barnes maze) were performed; the animals were sacrificed 30 days after TBI (corresponding to 5-6 years in human) and the brains were collected for Western blot and immunohistochemical analysis. Our results showed that following TBI there was a significant decreased expression of tyrosine hydroxylase (TH) and dopamine transporter (DAT) in the SNc, which are specific markers of PD, and significant behavioral alterations. In addition, a strong increase in neuroinflammation evaluated as COX-2, iNOS expressions, IκB-α degradation, and NF-κB translocation, was evident. Moreover, neurotrophic factors such as BDNF, NT3, NGF, and GDNF were also decreased in 30 days after TBI. Interestingly, our results showed a significant accumulation of α-syn in microglia compared to astrocytes. This study suggests that there are currently under-appreciated biological mechanisms linking brain injury and neurodegenerative diseases.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Traumatic brain injury (TBI) initiates a neuroinflammatory cascade that contributes to neuronal damage and behavioral impairment. In the present study, we performed a widely used model of TBI to determine the neuroprotective propriety of palmitoylethanolamide (PEA) and the antioxidant effect of a flavonoid luteolin (Lut), given as a co-ultramicronized compound co-ultraPEALut. We demonstrated that the treatment with co-ultraPEALut resulted in a significant improvement of motor and cognitive recovery after controlled cortical impact, as well as markedly reducing lesion volumes. Moreover, our results revealed the ability of co-ultraPEALut to reduce brain trauma through modulation of nuclear factor-κB activation. In addition, treatment with co-ultraPEALut significantly enhanced the post-TBI expression of the neuroprotective neurotrophins glial cell line-derived neurotrophic factor compared with vehicle. co-ultraPEALut at the dose of 1 mg/kg also modulated apoptosis, the release of cytokine and reactive oxygen species, the activation of chymase, tryptase, and nitrotyrosine, and inhibited autophagy. Thus, our data demonstrated that co-ultraPEALut at a lower dose compared with PEA alone can exert neuroprotective effects and the combination of both could improve their ability to counteract the neurodegeneration and neuroinflammation induced by TBI.
Neuroinflammation following Traumatic Brain Injury

Objectives: To compare the level of microglial activation as a biomarker for neuroinflammation after traumatic brain injury (TBI) in patients with full recovery compared to patients with poor recovery after mild or moderate TBI, using positron emission tomography (PET). To investigate eventual regional susceptibility for neuroinflammation after a TBI.

Methods: In this study 18 patients with TBI (8 patients with full and 10 patients with poor recovery) with a mean age of 41±13 underwent dynamic PET scan with translocator protein ligand (11) C-PK11195. The imaging was performed using High-Resolution Research Tomograph (HRRT) PET and MR images were acquired using 3T Achieva (Philips Medical Systems, The Netherlands). Regions of interest were extracted using Freesurfer. Image analysis was done using MATLAB (R2011a) and PMOD (version 3.4, 2013 PMOD Technologies Ltd, Zurich, Switzerland) software. From the PET images, distribution volume ratio (DVR) and binding potential of (11)C-PK11195 ligand were calculated for evaluation of microglial activation by using cerebellum as reference region.

Results: We observed that patients with poor recovery had higher TSPO binding than patients with good recovery in all selected regions of the brain. However, the difference was not statistically significant for P-value <0.05. There were great individual variations in the amount of neuroinflammation, suggesting a wide variation in the inflammatory host response for a TBI.

Conclusions: The results show that those TBI patients who have a poor recovery tend to have higher microglial activation, i.e., neuroinflammation compared to patients who have good recovery. Thalamus was shown to be the brain region with the highest binding potential in most of the subjects. The clinical significance of great inter-individual variation is worth further studies.
Gender Differences in Affect Recognition and Empathy Following Traumatic Brain Injury.

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – basic research

Author's preference: Oral

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Objectives: Following a traumatic brain injury (TBI), the ability to recognize how others are feeling, consider their point of view and mental state (i.e., cognitive empathy) and to care about and share their feelings (i.e. affective empathy) are frequently impaired. The literature in affect recognition reports that women are generally more accurate at recognizing emotion then men, but we do not know if this advantage also occurs following TBI. Studies investigating gender differences in empathy in the typical population have reported mixed results: some indicating no differences between men and women, and others showing that women have more affective empathy than men. To our knowledge, gender differences in empathy have not been explored in the TBI population.

Methods: 203 (150 males) adults with moderate-to-severe TBI completed the Adult-Faces and Adult-Voices subtests of Diagnostic Analysis of Nonverbal Accuracy-2 (DANVA2) to measure affect recognition. The Interpersonal Reactivity Index (IRI), a self-report questionnaire, was used to measure perspective taking (cognitive empathy) and empathic concern (affective empathy).

Results: Males and females did not significantly differ on demographic variables. Females scored significantly higher than males on the Adult-Faces, F(1, 199)=4.87, p=.03, and Adult-Voices, F(1, 199)=8.74, p=.003, tasks of the DANVA2. No significant group differences for the perspective taking, F(1, 200)=1.93, p=.17 or empathic concern, F(1, 201)=1.90, p=.17 scales of the IRI.

Conclusions: This study is the first to explore gender differences in affect recognition and empathy following TBI. Similar to people without TBI, women with TBI outperformed men for both facial and vocal affect tasks; however, their capacity for cognitive and affective empathy did not differ from men. This was an unexpected finding that is not consistent with empathy differences found in the general population. Our results suggest that even though women with TBI are better able to recognize how others are feeling, they are not more likely to take that person’s perspective or care about their emotional experience. This finding is important to consider when working with people with TBI since it suggests that even though women tend to better recognize how someone else is feeling, they would benefit similarly to men from training in how to respond to other’s emotions.
Peer Survivors and At-Home Cognition Learning

Objectives: Research designed and led by Traumatic Brain Injury (TBI) survivors sought to investigate the existing and (individual) historic opportunities, accessibility and wishes for at-home learning of cognitive techniques by TBI survivors. The research further sought to investigate if persons with TBI believed there was a link between their own cognitive performance and the understanding of the general population concerning difficulties they might have.

Methods: Field interviews (n=65) took place in the Republic of Ireland with questionnaire survey data gathered from TBI support groups in the United Kingdom, the United States and Canada (n=184). The research collected data on the attitudes and the self-reported "rehabilitation readiness" of individuals who experienced moderate or severe TBI between 1 and 20 years before the interviews and questionnaires. Additional on-street public surveys in parallel sought to investigate the attitudes and understanding of selected typical TBI consequences.

Results: Irish participants reported low access to opportunities for formally organized rehabilitation of cognition (5 of 65 reported any access), while respondents in the UK, the US and Canada reported that cognitive learning or rehabilitation had been available to between 10% and 35% among them. All respondents, both in-person interviewees and questionnaire participants, asserted that they would value any or more access to cognitive learning or rehabilitation, of which a description was provided. 80% of all respondents claimed that they believed that family members or friends would assist in providing cognitive rehabilitation, if those family or friends were trained to do so. 63% of participants with TBI reported that they believed there was a window of time for cognitive training for themselves, beyond which they believed it would be less effective. The on-street public attitudes and recognition-understanding of brain injury (in the same countries) showed that unprompted recognition of TBI consequences was nil (0%), but that prompted recognition was high (84%).

Conclusions: TBI survivors expressed enthusiasm and readiness to gain access to cognitive learning assistance in at-home settings, but there are no data for the design or effectiveness of at-home family/friends-mediated assistance. TBI peer survivor research is able to find quantitatively and qualitatively-based additions to existing knowledge for rehabilitation-planning.
0316

**Associations between outcome of brain injury, self-awareness and risk: The development of the Brain Injury Needs Indicator (BINI)**

**Status: Accepted** **Presentation type: Poster**

**Category:** Neurorehabilitation – public policy and advocacy

**Author's preference:** No preference

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**Objectives:** The relationship between self-awareness and functional and participation outcomes following acquired brain injury (ABI) is well recognised (e.g. Prigatano & Schacter, 1991). However, there is ongoing discussion as to whether self-awareness is a necessary pre-condition to achieve positive rehabilitation outcomes (Ownsworth & Clare, 2006) and how frequent deficits of self-awareness are after ABI really are in this population (Machamer et al.,2013). Recent studies suggest that impaired self-awareness is related to poorer participation outcomes five years post-injury, but linked with better subjective quality of life (Kelley et al., 2014). The relationship between self-awareness, outcome and risk is less well understood and there the validity of risk assessments based on clinical judgement has been debated (Weatherhead et al, 2012). The aim of this study was to investigate the relationship between outcome of brain injury, impaired self-awareness and risk for the individual, and to validate the use of a composite score of outcome and self-awareness as an indicator of need.

**Methods:** This study used a retrospective correlational design. Measures of brain injury outcome (measured with the Glasgow Outcome Scale Extended, Wilson et al., 1998), self-awareness (Awareness Questionnaire, Sherer et al., 1998) and risk (measured with a structured matrix) for 24 individuals were included in a series of non-parametric correlational analyses.

**Results:** The majority of the sample presented with severe disability (79%), and some degree of lack of self-awareness, with 21% presenting with severe lack of self-awareness. Both outcome and lack of self-awareness were significantly correlated with risk (rs = .58, N = 24, p < .01), and median risk was higher in those with poorer outcome and impaired self-awareness. The correlation between outcome and risk, while controlling for self-awareness was moderate and statistically significant (rs = .50, p < .05, N = 21).

**Conclusions:** The results demonstrate that established measures of outcome and self-awareness following acquired brain injury are correlated with assessments of risk. This supports the practice of assessing risk on the basis of clinical judgement. These findings also suggest that using a score that combines GOSE ratings and awareness discrepancy scores can be a simple way of obtaining an indicator of a person’s level of risk at any point along the recovery process. We will discuss the practical implications of this approach to inform the incidence of disability post brain injury and the need for service development along the full length of the care-pathway.
0317

Relationship between Outcome following Traumatic Brain Injury and Allostatic Load

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: There is an association between traumatic brain injury (TBI) and an increased risk of death, for up to 13 years after injury, which is independent of gender, age and social deprivation. The allostatic load (AL) model proposes that stressors cause multi-systemic physiological deregulation, the damage from which accumulates and contributes to disease trajectories. Higher AL is associated with poorer physical and cognitive outcomes in the general population but has not been investigated systematically in people with TBI. This study investigates relationships between AL and TBI soon after injury and at 6 months follow-up.

Methods: AL is a composite construct of anthropometric, cardiovascular, immune, metabolic, and neuroendocrine functioning. Data were collected from patients in hospital after a severe TBI and a comparison group matched for age, gender and social deprivation. The primary outcome measure was the Glasgow Outcome at Discharge Scale (GODS) in hospital, and outcome at 6 month follow-up on the Glasgow Outcome Scale-Extended (GOSE) if in the community, or the GODS if in inpatient rehabilitation.

Results: The AL of 36 TBI participants was not significantly different from matched comparison participants at hospital discharge (Wilcoxon signed rank test, z = -1.73, p > .05, r = 6.19) or at 6 month follow-up (z = .06, p > .05, r = 6.55). There was no significant association between AL and the GODS at hospital discharge (Spearman rho = -.03, p > .05) or at 6 month follow-up (GOSE or GODS), (rho = -.08, p > .05). Components of AL (anthropometric, rho = -.08, p > .05; cardiovascular, rho = -.22, p > .05; immune, rho = .22, p > .05 or metabolic, rho = -.04, p > .05) at hospital discharge did not predict disability outcome at 6 months except for neuroendocrine (rho = -.45, p < .05), where lower levels of dehydroepiandrosterone and higher levels of aldosterone at hospital discharge were associated with poorer ratings on the Glasgow Outcome scales at follow-up.

Conclusions: There was no evidence to support the view that cumulative life stress as assessed by allostatic load explains the heterogeneity in outcome after TBI. Greater neuroendocrine system deregulation at hospital discharge was associated with disability outcome at 6 months. Neuroendocrine dysfunction could have significant implications for recovery from TBI and rehabilitation. A better understanding of this relationship is a potential area of future research.
Disability and health-related quality of life 20 years after moderate-to-severe traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: No preference

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Background: A large proportion of patients with moderate-to-severe traumatic brain injury (TBI) sustain long-term physical, cognitive and emotional impairments that have a deep impact on their functioning and health-related quality of life (HRQL). TBI outcome up to 10 years post-injury has been documented in previous studies. However, there is limited research worldwide on the very long-term outcomes after TBI (up to 20 years post-injury), and few studies have been conducted outside the US.

Objectives: The main objectives are to describe and explore the disability level and health-related quality of life 20 years after moderate-to-severe TBI and to assess changes in functional status from 10 to 20 years post-injury.

Methods: A 20-year follow-up of a two-year TBI cohort, consisting of 62 patients with moderate and severe TBI injured in 1995/1996 and admitted to the university-affiliated Trauma Referral Center (Oslo University Hospital). The Glasgow Coma Scale (GCS) was used to measure injury severity at the time of emergency admission to the hospital. Baseline data including socio-demographics and injury-related factors were abstracted from the medical records. 10-year follow-up was completed in 2005/2006 (1). 20-year follow-up will be finished by the fall of 2015. TBI-related disability is measured by the Glasgow Outcome Scale Extended (GOSE) and HRQL is assessed by the 36-item short-form health survey (SF-36) and Quality of Life after Brain Injury - Overall scale (QOLIBRI – OS) questionnaires. Descriptive analyses will be applied to summarize the data.

Results: The mean current age of the cohort is 50 years with a male to female ratio of 3:1. According to the GCS at the time of injury, a half of the patients suffered from severe TBI. The 20-year follow-up is still ongoing. We are currently analyzing the preliminary data and the final results will be presented at the congress.

Conclusions: Improved knowledge of the very long-term outcome after TBI would contribute to further development of the targeted long-term follow-up programs and management of TBIs in general.

Cerebral venous circulatory disturbance as an informative prognostic marker for neonatal hemorrhagic stroke

Status: Accepted Presentation type: Poster

Category: Technology – basic research

Author's preference: Oral

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Neonatal hemorrhagic stroke (NHS) is a major problem of future generation’s health due to the high rate of death and cognitive disability of newborns after NHS. The incidence of NHS in neonates cannot be predicted by standard diagnostic methods. Therefore, the identification of prognostic markers of NHS is crucial. There is strong evidence that stress-related alterations of cerebral blood flow (CBF) may contribute to NHS. Here, we assessed the stroke-associated CBF abnormalities for high prognosis of NHS using a new model of NHS induced by severe sound stress with latent (the pre-stroke group) and late (the post-stroke group) periods. With this aim, we used interdisciplinary methods such as a histological assay of brain tissues and vessels; laser speckle contrast imaging and Doppler coherent tomography to monitor cerebral circulation; high-resolution photoacoustic imaging of vascular architecture in the brain and multifractal analysis for a measure of complexity of cerebral hemodynamics. Our results suggest that the venous stasis with such symptoms as progressive relaxation of cerebral veins, decrease the velocity of blood flow in them associated with a reduced complexity of cerebral venous dynamics are prognostic markers for a risk of NHS and are an informative platform for a future study of corrections of cerebral venous circulatory disturbance related to NHS.

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Abstract 'Back from holiday' Meeting the need for an ecologically valid assessment tool for occupational therapists to assess executive functioning and behavior in patients with psychiatric disorders due to brain damage: evaluation, adjustment and determining the best scoring method.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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In cooperation with Research Group Neuro Rehabilitation Hogeschool Arnhem Nijmegen (HAN).

Objectives: In both mental health care institutions occupational therapists are responsible for testing cognitive and executive functioning, in addition to regular neuropsychological assessment by neuropsychologists, in order to establish functional goals and interventions in adults with psychiatric disorders due to brain injury. In our experience existing tasks like the Brannagan Executive Functions Assessment (BEFA) are too difficult for patients with severe brain damage. Searching for an ecological valid instrument that can assess executive functioning and behavior in daily complex life we developed a task called 'Back from Holiday'. This task has been used for some years now.

In the task patients must empathize with Mrs. Sugar. Mrs. Sugar has just returned from holiday and has to do a number of administrative tasks. She needs to sort her incoming mail and make a ‘to do’ list for her and her partner. In addition, priorities must be set. The mail contains bills and advertisements. Most things must be ignored. Then she has to make a day schedule. The task takes 45 minutes to administer and is scored on the following components: goal determining, taking initiative, planning and organizing, time estimation, behavioral inhibition and self monitoring performing the task.

The task is suitable to be administered at the patients' home or in a clinical setting.

Methods: A literature study was done by students of HAN, to examine whether executive functioning was actually assessed with the task. Subsequently three different scoring methods were compared (Perceive Recall Plan Perform assessment (PRPP), BEFA and a scoring method developed by the occupational therapists of Versalius). The HAN students also observed the occupational therapists administering the task and interviewed them about the task. Subsequently advice was given on standardization.

Results: The 'Back from Holiday' task showed to be an ecologically valid task in evaluating executive functioning and behavior in patients with psychiatric disorders due to brain damage. When task administering was compared between the occupational therapists similarities and discrepancies were found. Advice was given on how the task could be standardized better and how it can be scored best. The PRPP was chosen as scoring method because of its reliability.
Conclusions: The assessment was standardized in cooperation with the Research Group Neuro Rehabilitation HAN. When advice is implemented further research is necessary to scientifically substantiate the 'Back from Holiday' task.
Moderate and Severe Traumatic Brain Injury in Children: A Prospective Cohort Study

Objectives: To estimate the incidence of severe pediatric TBI, in a Norwegian Health Region, and to assess mortality and global outcome in children with moderate and severe TBI. The children were compared with youths and adults.

Methods: A prospective cohort study comprising TBI patients 0-16 years, who were admitted to a level I trauma center (2004-2013). The hospital is the only neurosurgical referral center in a region of 700,000 inhabitants. The hospital admits all children with severe TBI. TBI was classified into moderate; Glasgow Coma Scale (GCS) score 9-13 or severe; GCS score 3-8. Outcome was assessed with Glasgow Outcome Scale Extended (GOSE) at 12 months after injury. The pediatric TBI patients were compared with TBI patients aged 16-65 (adult group) prospectively included during the same time period.

Results: 51 patients below 16 (mean 9.2) years old and 342 patients 16-65 (mean 37.2) years old were included. Causes of pediatric TBI were 51% falls, 33% road traffic accidents, 2% violence and 14% other. In the moderate pediatric TBI group, 45% had normal CT (without intracranial lesions or fractures) compared to 13% in the moderate adult TBI group. Out of the 14 children with normal CT 6 had GCS score > 12. Only 5% had normal CT in both the pediatric and adult severe TBI groups. Median GCS score in moderate TBI was 12 for children and 13 for adults, in severe TBI, median GCS score was 6 and 5 respectively. The proportion of severe TBI was 39% in the pediatric group and 55% in the adult group. The annual age adjusted incidence of severe TBI was 1.6/100,000/year in children and 4.6/100,000/year in people aged 16-65. In-hospital mortality was 3.9% (n=2) in pediatric TBI and 13.2% (n=45) in adult TBI. The pediatric patients were discharged to other hospitals (22%), to rehabilitation (6%) or home (67%). GOSE score at 12 months was significantly higher in the pediatric moderate TBI group (median 8) compared to the adult group (median 7, p<0.001) and also significantly higher in the pediatric severe TBI group (median 6) compared to the adult group (median 5, p<0.017).

Conclusions: During the 9-year period few pediatric moderate or severe TBI patients were admitted, and the incidence of severe pediatric TBI was only one third of what was found in adult TBI. Moreover, the children had low mortality rates and better outcomes than adults. For moderate TBI, this might be explained by less severe injuries as indicated by a higher proportion of a normal CT scans in children.
Objectives: Published findings of estimates of prevalence of traumatic brain injury (TBI) in prisons range widely between 25 and 87%. These estimates are often based on selected or non-representative subgroups of the prison population and are without exception based on self-report. This study investigates the prevalence of recorded hospitalised TBI from medical records in the prison population in three prisons in the West of Scotland.

Methods: This is a data linkage study. Everyone in Scotland has a unique National Health Service identification number which is noted in all prison admissions. This was linked to the NHS database of all hospital admissions (Scottish Morbidity Records-01) for all prison inmates in the Glasgow area in Scotland on a census date in 2014 to determine the prevalence of hospitalised TBI. Scottish Morbidity Records classify disease using ICD codes. TBI was defined according to the ICD-9 and ICD-10 codes (ICD-9: 800,801, 803,804 and 850-854; ICD 10: S02.0, S02.1, S02.7-S02.9, S06.0-S06.9, and S09.90).

Results: Of 1135 prisoners, 97% were male, reflecting the admission policy of the prisons. Analyses were restricted to the 1096 male prisoners. Of these 327/1096 (30%) had a past hospital admission with a head injury. The prevalence of hospitalised HI in males in the general population in the Glasgow area who were in the same age range as the prison population (ie 21-72) at the census date and over the same exposure period (1981-2014) was 12%. Hence the prevalence of HI in the prison population (30%) was 2.5 times that in the general population. The proportion of prison inmates who sustained a TBI before the age of 25 was also higher (41%) than for the general population (14%).

Conclusions: There is a higher prevalence of hospitalised TBI in prisoners than in the general population and the TBI is more likely to have occurred before the age of 25 during which time the prefrontal cortex continues to develop. These findings are discussed in the context if indicators of the severity of TBI and implications for recidivism and rehabilitation.

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – public policy and advocacy

Author's preference: No preference

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Objectives: In this systematic review, we aim to: 1) create an up-to-date, knowledge synthesis on the risks of driving impairment posed by traumatic brain injury (TBI); and 2) generate rigourously developed, applicable, and editorially independent clinical recommendations on assessing and managing the risk of motor vehicle collisions associated with TBIs. In pursuit of this goal, we will use the skills of international knowledge experts, and incorporate the input of transportation and clinician knowledge-users.

Methods: Recommendations from existing international guidelines on driving with TBI were summarized and reviewed and precise questions were refined and prioritized to shape a search strategy for an updated knowledge synthesis. Data addressing the prioritized questions from the references of existing guidelines and systematic reviews, as well as the updated literature search, will be extracted and the quality of evidence and risk of bias will be rated by the synthesis team. Revised guidelines based on the knowledge synthesis will be developed, and clinician- and transportation- knowledge-users will provide feedback on their clarity, currency, applicability and acceptability.

Results: Three consolidated research questions were developed following a review of existing international guidelines and a topic prioritization exercise: 1) What is the absolute and relative risk of motor vehicle collision or driving impairment, as measured by on-road testing or computerized simulator, associated with TBIs of different severities? 2) Do in-office tests of cognitive functioning predict collisions or driving impairment after TBI? and 3) Does presence or absence of insight into deficits predict collisions or driving impairment after TBI? In the next stage of this work, we will create up-to-date, evidence-based knowledge syntheses and clinical guidelines on driving risks with traumatic brain injury (TBI) for clinicians and transportation authorities to apply in clinical practice and policy. This will involve performing extensive searches of literature databases; systematically determining study eligibility; extracting data and summarising available evidence; and assessing included articles for risk of bias. At the end of this process, we plan to use the results to revise and update the Canadian Medical Association (CMA) Driver's Guide and to apply the best practices acquired to revise the guidelines for other medical diagnoses.

Conclusions: Although reviews on the topic of fitness to drive in TBI have been conducted in the past, no recent synthesis has been done with the aim of creating quality guidelines for clinicians. This study will present the first systematic evaluation of national-level guidelines for determining medical fitness to drive. A well-executed knowledge synthesis incorporating knowledge-user input will increase confidence of clinicians using the guidelines, inform transportation policy, and provide a model for updating syntheses and Canadian and other international guidelines for other health conditions and driving.
Neuroplastic Effects of a New Multidimensional Cognitive Training Program in Brain-injured Adolescents: Possible Far Transfer Effects?

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Oral

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Objectives: Young patients with traumatic axonal injuries (TAI) often show a wide array of cognitive deficits that limit their recovery (Sharp, Scott & Leech, 2014). It is therefore a priority to find avenues to overcome these deficits in order to maximize their learning skills. Intensive computerized neurocognitive training has shown to enhance cognitive abilities (e.g. Spencer-Smith & Klingberg, 2015; Backeljauw & Kurowski, 2014). However, previous computerized training studies often focused on a single cognitive function (e.g. working memory) with limited far transfer effects. The present study investigated the effect of a multidimensional home based cognitive training program 'BrainGames' on cognitive functioning and brain structure, in young patients with TAI.

Methods: BrainGames includes eight different games using iPad technology, addressing the wide array of cognitive deficits of TAI, including sustained, selective and divided attention, inhibitory control, cognitive flexibility, verbal and visuo-spatial working memory and updating. Each game has adaptive levels of difficulty, whereby task difficulty increases with better performance. Four adolescents with TAI (mean age = 16y, 6mo (SD = 10mo); mean time since injury = 3y, 1mo (SD = 8mo)) trained extensively for eight weeks, about 35 min in each session (5 sessions per week). All training data was saved on a remote server and training progress was monitored for all games by computing the highest achieved score of each session. Near and far transfer training effects were assessed using computerized attention (Flanker task), working memory (Spatial Span) and executive function tasks (Tower of London). Besides cognitive tests, structural brain scans were administered before and after the training to investigate training-related neural plasticity. Trendlines for training progress were calculated using linear regression analysis. Wilcoxon signed rank tests were used to investigate training-related improvements.

Results: The trendlines of all games, except for one, showed significant positive slopes (p's <0.05), indicating improved performance over the 40 training sessions. Moreover, our training led to marginally significant improvements on non-trained working memory (p = 0.083) and attention (p = 0.068) tasks, and generalization to tasks of planning (p = 0.068).

Conclusions: These preliminary results indicate that an intensive home-based cognitive training can improve working memory, attention and executive functioning in children with TAI in the chronic stage. A more comprehensive evaluation, including more participants, will be performed in the near future. Our ongoing analysis of structural brain scans will allow us to gain more insight in specific microstructural markers (such as myelin), providing us important hints towards the mechanisms underpinning training-induced plasticity that may drive cognitive improvement in TAI.
Collaboration Between a Human Service Agency and a Research Institute to Better Serve Brain Injury Community

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: The Brain Injury Alliance of Washington (BIAWA), founded in 1982 as the Washington State Head Injury Foundation, remains the only organization in Washington State working to prevent, support, educate, and provide advocacy for all Brain Injury survivors, family members, and care givers. Our mission is to prevent all preventable brain injuries while providing support services, information, and advocacy to the hundreds of thousands of individuals and their families who are affected by Brain Injury.

Methods: We work on a daily basis with individuals across Washington on the phone, in person, and in group settings to enhance Brain Injury survivors’ capacity for the best possible quality of life. The BIAWA operates the toll-free Washington TBI Resource Line, provides in-person resource management and clinical case management, hosts Brain Health & Wellness classes, trains Peer Navigators, offers academic scholarships, and organizes outings for Brain Injury survivors and caregivers throughout the year.

Results: BIAWA also works closely with key academics at research institutions such as The University of Washington TBI Model System and Harborview Injury Prevention Research Center on studies pertaining to Brain injury. These studies have utilized BIAWA data and contacts and drawn upon the expertise and academic ties of researchers at these two institutes to conduct a statewide needs assessment in order to evaluate the content and nature of the support, trainings and programs needed for the Washington Brain injury community and to advise Brain Injury Alliance of Washington in better developing such programs based on the expressed needs.

Conclusion: In this poster presentation, BIAWA will depict successful partnerships between a human service agency and research institutions and the ways these collaborations benefit both the organizations mentioned as well as the community we serve. While specific data from papers/projects will not be covered, programing changes and new programing activities based upon both research collaboration and ongoing data collection from the community will be highlighted.
Introducing a means of recording, sharing, and tracking communication impairments: The Cognitive Communication Checklist for Acquired Brain Injury (CCCABI)

Objectives: Communication impairment is a major consequence of acquired brain injury (ABI) that impedes successful return to work, school, and social interactions. Reported incidence rates are as high as 80 to 100% depending on sampling procedures. International standards and guidelines recommend referral to evidence based speech-language pathology interventions for these individuals. Yet the full range of subtle communication impairments after ABI are largely misunderstood by those unfamiliar with brain injury research and this may include referral sources, funding sources, administrators, and the general public. Currently there is no consistent means of identifying, quantifying, and tracking the full range of communication difficulties across the continuum of recovery. There is a critical need for clear referral criteria and consistent terminology to promote understanding of communication impairments and to ensure fair and equitable access to communication intervention.

Methods: The Cognitive Communication Checklist for Acquired Brain Injury (CCCABI) was developed to provide an evidence based, accessible, and consistent method of identifying communication impairments after brain injury. The CCCABI is a brief interview and one page checklist summarizing 46 possible difficulties in 10 areas of cognitive and communication functioning. It is presented in language that is accessible to persons with brain injury, their families, administrators, funding sources, and health care professionals. The CCCABI is not intended to replace existing standardized assessment or outcome tools; rather it is a method of identifying communication problems and guiding individuals toward speech-language pathology services for comprehensive assessment. Brief and easily translatable into other languages, the CCCABI provides a shared framework for identifying neurologically based communication disorders at a macro level regardless of language, service setting, or research protocol.

As a first step in validating the checklist, a survey was constructed to obtain expert review of the CCCABI. 10 questions were constructed to evaluate the CCCABI in terms of its comprehensiveness, clarity, efficiency, and clinical relevance.

Results: 54 speech-language pathologists from 10 countries have evaluated the CCCABI to date. Findings indicate support for the CCCABI’s clinical relevance and utility. For example, 94% of respondents indicated that they agreed or strongly agreed that there is a need for such a tool. 87% agreed that the CCCABI includes all of the cognitive and communication difficulties most commonly seen after ABI. The next phase of validation will include review by individuals with brain injuries and their families, and clinicians from other disciplines.

Conclusions: The CCCABI has the potential to provide an accessible format for consistent identification of communication impairment, timely referral to speech-language pathology services, recording of baseline communication profiles, and tracking of general communication data across the continuum.
Persistent Post-concussive and Post-traumatic Stress Symptoms in Children and Adolescents with Mild TBI or Orthopedic Injury

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: To compare the occurrence of post-concussive and post-traumatic stress symptoms 3 months after mild traumatic brain injury (mTBI), complicated-mild TBI (cmTBI), and orthopedic injuries (OI) in children ages 4 to 15 years of age at injury.

Methods: Participants. Three hundred and twenty children ages 4 to 5 (n=66), 6 to 11 (n=130), and 12 to 15 (n=124) were recruited into a multisite longitudinal, prospective study examining the impact of TBI on children's outcomes. Patients were treated in the emergency department/observation unit (n=106), were admitted to the hospital (n=152), or were treated in the pediatric intensive care unit (n=62). Mild TBI (n=110) was defined by a Glasgow Coma Scale score 13-15 with no evidence of injury on neuroimaging. Complicated-mild TBI was defined by GCS scores from 13-15 with neuroimaging evidence of parenchymal injury (n=103). Children with OI had a fracture and no evidence of alteration of consciousness or injury to the head (n=107).

Procedure. Parents completed the Postconcussion Symptom Inventory (Gioia et al., 2009) shortly after injury to reflect preinjury level of symptoms for children ages 4-15 years and completed the questionnaire to reflect symptoms present 3 months after the injury. Children ages 9 to 12 years provided self-report of post-concussive symptoms at 3 months after TBI. In addition, they completed the Child Post-Traumatic Symptom Scale (Foa et al., 2001) to indicate symptoms persisting 3 months after injury. All data were collected using a web-based data capture system or by telephone interview.

Results: Parent report of post-concussive symptoms at 3 months after injury relative to preinjury ratings indicated increased scores in both TBI groups compared to the OI group on somatic (p<0.001) and cognitive (p=0.02) subscales. Self-report of post-concussive symptoms 3 months after TBI revealed elevated cognitive symptoms (p=.05) in ages 9-12 and both emotional (p=.05) and cognitive symptoms in adolescents (p=.02). Self-report of post-traumatic stress symptom severity differed by group and age. In children ages 9-11 years, symptoms were higher in mTBI than cmTBI groups, who both had more symptoms than the OI group (p=.01). In contrast, adolescent self-report was similar across the mTBI, cmTBI, and OI groups (p=.40), related to an increased number of symptoms endorsed by adolescents with OI.

Conclusions: Post-concussive somatic and cognitive symptoms persisted in patients with mTBI and cmTBI 3 months after injury relative to an OI comparison group based on parent ratings. Self-reported symptoms also revealed increased cognitive symptoms in ages 9-15, as well as emotional symptoms in adolescents. Post-traumatic stress symptoms were elevated in children with TBI and also in adolescents with OI. Children and adolescents who sustain TBI or OI should be followed clinically for several months after injury so that interventions can be implemented for those experiencing persistent symptoms.
Microstructural Analysis in Patients with Traumatic Brain Injury: A Global Approach Using Higher Angular Diffusion Imaging

Status: Accepted  Presentation type: Oral

Category: Technology – clinical research/applications

Author's preference: Oral

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Objectives: The aim of this study was to see whether there are any global changes in the fractional anisotropy (FA) values in the brain of patients with TBI compared to healthy controls using high angular resolution diffusion imaging (HARDI) method.

Methods: We studied 41 patients with mild TBI (GCS= 13-15) and 23 controls using diffusion-weighted magnetic resonance imaging (DWI). DW images were acquired with b-value of 1000 s/m² and in 64 directions. MR images of the TBI patients were acquired within one month after injury (acute) and again six months post injury (chronic). Constrained spherical deconvolution (CSD) was used to estimate the fiber orientation in each voxel of the DWI images. Then average FA values were calculated in each subject by reconstructing a white matter tract skeleton and rejecting voxels that have multiple fiber configuration i.e. only those voxels with one significant fiber direction are included.

Results: Patients with TBI showed a significantly (p-value <0.05) decreased global FA values compared to healthy controls in both acute and chronic stages after TBI.

Conclusions: By using this global approach, we can have a reliable method to assess the degree of white matter injury in patients with TBI in both acute and chronic stages.
The Influence of Cognitive Complaints, Cognitive Performance and Emotional Distress on Self-Efficacy in Patients with Acquired Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Self-efficacy refers to the belief in one's capabilities in achieving goals. High self-efficacy implies a high sense of control and mastery. In acquired brain injury (ABI) higher levels of both general self-efficacy and self-efficacy for managing brain injury-specific symptoms have been associated with better quality of life (QoL) and social participation. In patients with cancer and rheumatoid arthritis the stress-buffering effect of high self-efficacy is well documented. Highly self-efficacious patients reported lower levels of distress, anxiety and depression. In MS, better cognitive performance was associated with higher levels of self-efficacy. Cognitive performance is frequently affected in patients with ABI. Cognitive deficits often interfere with many aspects of daily life and psychosocial functioning. In stroke patients, subjective memory complaints showed to be associated with lower memory self-efficacy, but not with objective memory performance. The aim of this study was to examine the influence of cognitive performance, cognitive complaints and emotional distress on self-efficacy for managing brain injury-specific symptoms in patients with ABI.

Methods: Data were collected from a prospective clinical cohort study of 61 patients with acquired brain injury assessed after discharge home (mean time since injury = 14.8 weeks). Self-efficacy was measured using the TBI Self-Efficacy Questionnaire (SEsx), emotional distress with the Hospital Anxiety and Depression Scale (HADS), cognitive complaints with the Dysexecutive Questionnaire of the Behavioral Assessment of the Dysexecutive syndrome (DEX). Information processing speed was measured using the Symbol Digit Modalities Test (SDMT), cognitive flexibility with a compound score of condition IV of the D-KEFS trail making test (number-letter sequencing) and subtask III of the Stroop Color Word Test, memory with a compound score of the total correct and delayed recall score on the 15 words learning task. Multiple hierarchical regression analyses were used to analyse data.

Results: Higher levels of emotional distress (HADS) and higher levels of subjective cognitive complaints (DEX) were significantly associated with lower self-efficacy for managing brain injury-specific symptoms ($\beta = -0.37; p = 0.008$ and $\beta = -0.45, p = 0.002$ respectively). DEX scores accounted for 42% and HADS scores for 5% of the total 65% variance explained. Objective cognitive performance was not significantly associated with self-efficacy.

Conclusions: Control over interfering emotions and developing a sense of control and mastery over brain injury-associated symptoms seem to be of importance in the development of self-efficacy for managing brain injury-specific symptoms. To optimize self-efficacy, treatment programmes should focus explicitly on reinterpretation of interfering thoughts and symptoms and the reinforcement of self-beliefs.
Walking Speed is Associated with Cognitive Function After Head Injury

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: Gait speed is associated with improved survival in older adults. Gait speed is also a predictor of functional outcome following head injury (HI). People with HI walk more slowly than matched healthy controls, and performing a cognitive task while walking has a further negative effect on the gait velocity of people with HI. The coordination of the allocation of specialised resources to concurrent tasks in the healthy brain is a higher level (executive) function (EF) that is impaired in people with Alzheimer’s Disease (AD). During a gait and cognitive dual task (DT), walking speed was slower in AD patients than in controls. HI is also a risk factor for AD.

This preliminary study investigated the association between dual task gait speed and current cognitive function late after severe HI.

Methods: Fifty-six participants with severe head injury, aged 17-93 (mean 50 years) performed (i) single task (ST) walking over a flat 6-metre surface and (ii) counting (Serial 3s, counting backwards, subtracting 3s) and (iii) a dual task walking and counting task. Outcomes were walking speed (metres per second) and correct cognitive responses per second when walking. All participants were living in the community. Pre-DT cognitive tests were the Mini mental-state examination, the Symbol Digit Modalities Test and memory tasks from the Wechsler Memory Scale.

Results: DT walking speed was slower than ST walking speed (Wilcoxon signed ranks test; Z = -6.43, p < .001). Slower DT walking speed was associated with poorer executive functioning (rho = -.276, p < .05) and with poorer immediate recall (rho = -.366, p < .05) and delayed recall (rho = -.361, p < .05) at baseline. There was no significant difference in correct cognitive responses per second between the ST and DT conditions (Wilcoxon signed ranks test, Z = -.685; p > .05).

Conclusions: DT walking speed, even many years after a severe head injury, is associated with memory and executive function. DT walking speed is associated with poorer cognitive function in adults with severe HI. The potential of walking speed as an indicator of late cognitive decline after severe HI is discussed.
Use of Internet Before and After Injury in Individuals with Traumatic Brain Injury and Spinal Cord Injury

Status: Accepted Presentation type: Poster

Category: Technology – basic research

Author’s preference: Poster

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Objectives: To evaluate the extent to which individuals with Traumatic Brain Injury (TBI) and Spinal Cord Injury (SCI) use Internet both before and after injury and determine whether there is a difference in privacy precaution between subjects.

Methods: 100 individuals (50 with TBI, and 50 with SCI) from Neiva, Colombia were recruited to complete a questionnaire regarding their use of technology (Internet and social networks), and online privacy. The majority of participants were male (73.6%), mean age was 35 years old and mean education was 10th grade.

Results: The majority of individuals with SCI reported never having used the Internet before injury (70%), but use increased after injury (74%). Half of the participants with TBI reported never having used the Internet before injury (50%). However after injury, Internet use increased (58%). In addition, individuals with TBI showed lower scores on the scale of Internet privacy, having less precaution and less concern about their privacy and confidentiality while using the Internet, compared with those with SCI.

Conclusions: There is a high increase in the use of Internet in subjects with TBI and SCI with respect to its previous use, especially in the latter group of subjects. However, individuals with TBI have less precaution about their privacy online, perhaps due to the presence of cognitive deficit after injury. The widespread use of Internet and other services in this population may be an advantage as part of their rehabilitation and social integration.
Changes in Cerebral Blood Flow and their Relationship to Cognition following Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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**Background:** Traumatic brain injury (TBI) often produces persistent cognitive impairments and changes in cerebral blood flow (Kim et al., (2010) J.Neurotrauma, 27:1399-1411). Using functional magnetic resonance imaging (fMRI), we have previously shown that blood flow abnormalities in brain areas such as the posterior cingulate and precuneus, are associated with impairments in inhibitory control (Bonnelle et al., (2012) PNAS, 109:4690-4695). However, fMRI only provides a relative measure of blood flow and the abnormalities we have observed might be influenced by changes in the level of perfusion. Arterial Spin Labelling (ASL) is a non-invasive way to measure absolute cerebral blood perfusion and so can be used to clarify the basis for the alterations in fMRI signal seen after TBI.

**Objectives:** Here, we (1) investigate whether cerebral blood perfusion is altered following TBI using ASL and (2) assess the relationship of these changes in perfusion to impairments in response inhibition. We also assess the test-retest reliability of the perfusion signal in brain areas affected in TBI.

**Methods:** Two separate datasets were acquired. In the first, ASL data were acquired in 20 TBI patients and 7 healthy controls. In the second, ASL data were acquired from 20 different healthy controls on two occasions, separated by four weeks. All imaging data was analysed using FSL. Differences in perfusion between the TBI and healthy control groups were evaluated and estimates of test-retest reliability of the perfusion signal were calculated using the intra-class correlation coefficient (ICC) (De Simoni et al., (2013) Neuroimage, 64: 75-90). Inhibitory control was assessed in the first cohort with the use of the Stop Signal task (SST), a measure of response inhibition.

**Results:** TBI patients demonstrated significant reductions in perfusion in the posterior cingulate cortex and precuneus compared to healthy controls. In addition, the TBI patients showed a trend towards impaired inhibitory control on the SST (p=0.07). The reductions in perfusion were significantly correlated (r = 0.591) with SST performance, with a greater reduction in blood flow associated with worse performance. The cerebral blood perfusion signal was robust and reliable (ICC > 0.6) in regions such as the posterior cingulate, precuneus and thalamus. The middle temporal gyrus demonstrated the highest ICC (0.8), with only the inferior frontal gyrus demonstrating low reliability (ICC = 0.3).

**Conclusions:** Cerebral blood flow was reduced in TBI patients and was found to be associated with impaired inhibitory control, extending previous findings using fMRI. This supports the idea that ASL quantification of perfusion allows us to detect cognitively meaningful differences in brain function following TBI. In addition, the high test-retest reliability in key brain regions shown to be associated with cognitive performance suggests that ASL is a potential biomarker for pharmacological or cognitive therapy intervention studies.
Validation of the Early Functional Abilities Scale (efa) – A Four-dimensional Assessment of Brain Restoration after Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author’s preference: Oral

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Objectives: Based on the need for a sensitive rating scale for broad assessment of early recovery in patients with severe traumatic brain injury, we examined psychometric properties of a four-dimensional scale developed in Germany, the Early Functional Abilities (EFA) scale.

Methods: The design were item analysis of the Early Functional Abilities scale by Rasch models and loglinear Rasch models. We included 408 patients with TBI consecutively admitted for sub-acute neurorehabilitation assessed with the EFA scale, which was translated by standardized methods. The EFA scale consists of 20 items divided into four subscales: 1) Vegetative (autonomic) functions, 2) Facio-oral functions, 3) Sensorimotor functions and 4) Communicative/ cognitive functions and Activities of Daily Life (ADL).

Results: Male gender accounted for 76% and the mean age was 42.7 years, number of days in PTA (Post Traumatic Amnesia) was 53 days (median). According to the Rasch model, after removal of one item in the Sensorimotor functions scale, each of the four subscales of the EFA scale provides valid and objective, unidimensional assessments, i.e. statistically sufficient descriptions of patients in each of these areas. The EFA subscales are sensitive to progress and differences between patients in ranges where the Functional Independence Measure (FIM) scale has a floor problem. However, like FIM, the total EFA score is not unidimensional.

Conclusions: Early recovery of important aspects of traumatic brain injury can be assessed by profiles i.e. summated scores on each of the four types of functions included in the EFA scale. The subscores can be converted into proper measurements on interval scales that allow for adequate comparison within patients, of different patients and patient samples.
Early abnormal transient hyperemic response test can help predict refractory intracranial hypertension in traumatic brain injury

Objectives: Diffuse traumatic brain injury (TBI) with secondary refractory intracranial hypertension is a devastating and challenging event. Multiple medical and surgical treatment modalities have been implemented to treat this extreme condition with resultant significant long-term morbidity and mortality. A key concept in brain protection is early detection of derangements. We propose the transient hyperemic response test (THRT) to be such a method for early detection of worsening and earlier treatment of intracranial pressure.

Methods: We included patients with strictly speaking diffuse bilateral injury, with no evacuated lesion and no potentially surgical focal lesion. We employed the standard technique of the test, which is temporary digital carotid artery occlusion while insonating the middle cerebral artery using transcranial Doppler. Changes in the pattern of velocity profile would indicate the status of cerebral autoregulation.

Results: Out of 56 trauma patients seen in 12 months, 12 patients fit the inclusion criteria. All patients were treated with a standardized protocol for all TBI patients. The THRT was done 24 hours after TBI to ensure hemodynamic stability. Of those 12 patients, 4 had an abnormal THRT (33%) and upon serial clinical evaluation, 3 exhausted the medical therapy options for refractory intracranial hypertension and ended up submitted to a decompressive craniectomy (75%). Out of the remaining 8 patients, only 2 went for decompressive craniectomy (25%) as they responded to the aggressive medical therapy of IHT without the need to escalate to surgical decompression.

Conclusions: This gives an indication that early autoregulation assessment by THRT might be a guide to predicting the need for decompressive craniectomy much earlier than ICP monitoring would in such a challenging subset of patients.
Neuroprotection Against Traumatic Brain Injury by Xenon, but Not Argon, is Mediated by Inhibition at the N-Methyl-D-Aspartate Receptor Glycine Site

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Objectives: The inert anesthetic gas xenon is neuroprotective in models of brain injury and is undergoing clinical trials as a treatment for ischemic brain injury. Here we investigate the neuroprotective mechanisms of the inert gases xenon, argon, krypton, neon and helium in an in vitro model of traumatic brain injury, and test the hypothesis that inhibition of the NMDA-receptor at the glycine site underlies xenon neuroprotection.

Methods: We use an in vitro model of traumatic brain injury using organotypic hippocampal brain-slices from mice, subjected to a reproducible focal mechanical trauma, with injury quantified by propidium-iodide fluorescence. Patch-clamp electrophysiology is used to investigate the effect of the inert gases on NMDA receptors and TREK-1 channels, two molecular targets that may play a role in neuroprotection.

Results: We show that 50% atm xenon and, to a lesser extent, 50% argon are neuroprotective against traumatic injury when applied following injury. The other inert gases, helium, neon and krypton are devoid of neuroprotective effect. Xenon (50% atm) prevents the development of secondary injury up to 48 hours after trauma. Argon (50% atm) attenuates secondary injury, but is less effective than xenon. We show that adding glycine reverses the neuroprotective effect of xenon, consistent with competitive inhibition at the NMDA receptor glycine-site mediating xenon neuroprotection against traumatic brain injury. Argon neuroprotection is not reversed by glycine, indicating that argon does not act at the NMDA receptor glycine site. Xenon inhibits NMDA receptors and activates TREK-1 channels, while argon, krypton and neon have no effect on these ion-channels.

Conclusions: Xenon neuroprotection against traumatic brain injury can be reversed by elevating the glycine concentration, consistent with competitive inhibition by xenon at the NMDA-receptor glycine site playing a significant role in xenon neuroprotection. Argon neuroprotection is not reversed by glycine, indicating that argon and xenon do not act via the same mechanism.
Electrical brain injury, management challenges

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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We present a challenging case of 36 year old industrial worker who was electrocuted by 14000v current. He arrived to us in a poor neurological condition with severe progressive diffuse brain injury on serial imaging despite aggressive medical therapy for intracranial hypertension.

Interestingly, the patient also exhibited radiological evidence of dural sinus and cortical vein thrombosis. This is a hidden factor in the deterioration of such patients.

Imaging strategies and therapeutic approaches are summarized and a proposed step-wise approach to their management is proposed.
International Disaster Risk Management: Reducing the Vulnerability of Persons with Brain Injuries Through Emergency Preparedness

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: Oral

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Objectives: Keim (2008) reports in his study that, “Global climate change will increase the probability of extreme weather events, including heatwaves, drought, wildfire, cyclones, and heavy precipitation that could cause floods and landslides. Such events create significant public health needs that can exceed local capacity to respond, resulting in excess morbidity or mortality and in the declaration of disasters. Human vulnerability to any disaster is a complex phenomenon with social, economic, health, and cultural dimensions.” Disaster “resilience” after a brain injury can be complicated by the inability of the individual to be prepared and react quickly to an event. This creates a need for very special supports for pre and post disasters. Keim discusses two areas to focus on which include the individual’s susceptibility to a traumatic event (resilience) and the capacity to fully recover from it.

The most lethal part of an emergency is the lack of preparedness in dealing with it: people are caught off guard, becoming confused, frightened, and disoriented; and these challenges are even more pronounced for those with disabilities - particularly hidden ones such as brain injuries. This became apparent in 2004 with Hurricane Katrina, when thousands of evacuated people simply fell through the cracks. After critical analysis of what went wrong, and under new legislation mandating precise procedures, we now have more refined means of guiding people through emergency situations, the efficacy of which can be seen in more recent disasters.

Methods: The major failings in dealing with Katrina were lack of communication, education, and resources for dealing with large-scale chaos. This can certainly be noted across some of the recent international disasters like the Tsunami in Japan and the earthquake in Haiti. Notably, emergency service providers were simply ill-prepared for handling the volume of shocked people. As the result of responsive education, Vulnerability Reduction Programs and other protocols put in place to solve these problems, we are now seeing fewer casualties in disaster scenarios.

Results: We can be better prepared for future emergencies by implementing the lessons learned over the last decade through specialized universally designed programs for worldwide use.

Conclusions: It's possible for us all to have a clearer understanding of why we should prepare before an emergency hits and what to do when that happens. This also dramatically improves aid to persons with disabilities, especially persons with brain injuries. Further research into programs that have been successful in the area of emergency preparedness for people who have experienced the residual effects of a brain injury needs to occur.

Caregiver Appraisal at 12 Months after Severe Traumatic Brain Injury in Denmark and the United States

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: To examine differences in and correlates of caregiver appraisal at 12 months post severe traumatic brain injury (TBI) in two rehabilitation sites: Unites States (US) and Denmark (DK)

Methods: This was part of a larger study where the overall aim was to examine cross-national differences in outcome at 12 months after severe TBI. In the present study, 91 caregivers from US and 90 from DK completed the 35-item version of the multidimensional Caregiver Appraisal Scale (CAS), which was selected because it includes both positive and negative aspects of caregiving. Items were summed into four subscales: 1) Perceived Burden, 2) Caregiving Relationship Satisfaction, 3) Caregiving Ideology, and 4) Caregiving Mastery. Other measures included caregiver demographic characteristics and time spent caring for patients. Patient data included injury severity as assessed by functional measures at 12 months by FIM and Glasgow Outcome Scale-Extended (GOS-E). Data were analyzed using X² and T-test.

Results: There was no significant difference between sites in FIM and GOS-E scores at 12 months. US patients had a mean FIM score of 102 points (SD:31), as supposed to a mean of 99 points (SD:32) for DK patients. US patients had a mean GOS-E score of 4.9 (SD:1.9) vs. 4.8 (SD:1.5) for DK patients.

Caregivers’ mean age was 50 years, most were females (77%), and most were parents or spouses; in US respectively 52.7% and 18.3%, in DK respectively 47.3% and 30.8%. In the US, significantly more caregivers (60%) lived with the patient, compared to DK (40%) (p=0.001).

CAS: We found no significant difference in the Perceived Burden scale and the Caregiving Mastery scale. However, we found significant difference in the Caregiving Relationship Satisfaction scale and the Caregiving Ideology scale (p<0.001). In those two subscales, the US caregivers scored more positive feelings than the caregivers in DK.

Conclusions: In this sample of primary caregivers to patients 12 months after severe TBI, we found significant differences between the US and DK in two of the four subscales of CAS. The subscales where US caregivers scored more positive than their DK counterparts deal with caregiver relationship satisfaction and ideology. This may be due to different perceptions of caregiver roles in two different cultures and health care systems.
Evaluation of [3H]PBR28 as a Marker of Microglial Activation in the Rat Controlled Cortical Impact Model of Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Traumatic brain injury (TBI) is one of the most common causes of morbidity and mortality in children and healthy young adults worldwide. Following the primary insult, a marked neuroinflammatory response is observed that can persist long-term. Its presence provides a potential mechanism for the chronic effects of the condition. Microglial activation is central to the inflammation detected after TBI and has been observed in animal and human studies. The effect of long-term microglial activation is uncertain and could be beneficial by limiting further damage to neighbouring tissue, or detrimental through the prolonged release of pro-inflammatory mediators and reactive oxygen species. It is thus crucial to develop methods of detecting microglial activation longitudinally. Several imaging agents with the ability to visualize activated microglia in vivo by positron emission tomography (PET) have been developed which bind to the mitochondrial translocator protein TSPO. This protein has been found up-regulated in activated microglia. In this study, we evaluated the use of the TSPO tracer [3H]PBR28 to detect alterations in microglia activation in the controlled cortical impact (CCI) model of TBI by autoradiography.

10-week old male wild-type Sprague-Dawley rats were used for both CCI and control groups. Brains were analysed 2 weeks post-injury, when the model shows cognitive impairment. Autoradiography was carried out on coronal brain sections from CCI rats and their corresponding controls.

Greater [3H]PBR28 binding was seen in the CCI model compared with control rats. The binding was particularly increased in regions surrounding the site of injury. These results were in accordance with the strong and localised detection of activated microglia in the same region by immunohistochemistry using antibodies against Iba-1, confirming the specificity of the ligand.

Our data provide further evidence in support of the suitability of PBR28 as a tool for in vivo monitoring of disease progression and assessment of treatment response in future studies using animal models of TBI.
Quality of Life after Brain Injury (QOLIBRI) – Psychometric Properties of the Norwegian Version

Objectives: To test the psychometric properties of the Norwegian version of the Quality of Life after Brain Injury questionnaire (QOLIBRI) on people with traumatic brain injury (TBI) at 12-months post-injury. The QOLIBRI contains 37 items with a total scale and six subscales: satisfaction with Cognition, the Self, Daily life and autonomy, and Social relationships, and botheredness with Emotions and Physical problems.

Methods: A cross-sectional study of 204 patients with mild-severe TBI. At baseline we registered demographics and the injury-related variables Glasgow Coma Scale score (GCS) and Abbreviated Injury Scale score (AIS-head). At 12 months symptoms burden was assessed by Rivermead Post-concussion Questionnaire (RPQ) and Hospital Anxiety and Depression Scale (HADS). Disability level was evaluated by Glasgow Outcome Scale-Extended (GOSE). The response distribution, floor and ceiling effects and skewness were examined. Internal consistency of the QOLIBRI subscales and total score was tested by Cronbach's alpha. The fit of items belonging to each subscale was tested by the corrected item-total correlations (CITCs >0.40). Rasch analysis was used to examine the fit of items in the subscales. Dimensionality was tested by Principal Component Analysis (PCA). Confirmatory Factor Analysis (CFA) using Structural Equation modelling (SEM) was used for calculating overall fit.

Results: Mean age was 37.6 (SD 15.4) years. 72% were men. 48% were married/cohabiting, 81% were employed or studying pre-injury. GCS and AIS-head scores were 9.3 (SD 4.5) and 3.4 (SD 1.4) respectively. At the 12-month follow-up, 22% reported psychological distress on the HADS. Median RPQ score was 14 (IQR 2.8-25.0). According to GOSE 52% had a severe-to-moderate disability. QOLIBRI total score was 67.0 (SD 19.1). Subscale scores were Cognition 65.6 (21.9), Self 62.3 (22.4), Daily life and autonomy 66.3 (23.9), Social relationship 69.4 (21.7), Emotions 73.1 (24.4), Physical problems 67.4 (22.9). All CITCs within the respective subscales were >0.40 (range 0.43-0.60). Four items had a skewness slightly >1. Cronbach's alphas range from 0.75 (physical problems) to 0.96 (Cognition). Rasch analysis showed fit to the model for the Cognition, Self, Daily life and autonomy, Social relationship and Physical problems subscales. All items fitted the Rasch model for the Cognition, Self, Daily life and autonomy and Physical problems subscales. There was a misfit to the Rasch model for the Emotions subscale. PCA loadings on the single factor structure reflecting the QOLIBRI total score, showed an overall good fit with the single factor solution in most subscales with factor loadings >0.6 (range 0.53-0.81). The SEM indicate reasonable fit to the observed data (CFI=0.86, RMSEA=0.076, Chi square=1315, df=623, p<0.001), and meets the SRMR criterion but not the CFI criterion.

Conclusions: The Norwegian version of the QOLIBRI has favorable psychometric properties in patients covering the whole spectrum of TBI severity at 12 months post-injury.
Five year functional outcomes following moderate and severe traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: The impairment following traumatic brain injury (TBI), particularly for persons with moderate and severe injuries, could be multidimensional including physical, cognitive and behavioral/emotional impairments that could potentially last for lifetime. To better understand short and long-term impacts following TBI and facilitate effective rehabilitation strategies to meet the needs of this population, this study presents the functional outcomes up to five-years after injury for patients with moderate and severe TBI.

Methods: Patients with moderate and severe TBIs who were referred to Oslo University Hospital between 2005 and 2007 were included in the study. Inclusion criteria were age between 16 and 55 years, residing in the east region of Norway, and admitted with ICD-10 diagnoses S06.0–S06.9 within 24 hours of injury. At the study admission, all patients' demographic and injury characteristics and lengths of acute/post-acute hospital stays were documented. At 3-month, 1-year, 2-year and 5-year follow-ups, various functional outcomes were recorded, including the Functional Independence Measure cognitive (FIM-Cog) and motor (FIM-M) subscales, Disability Rating Scales (DRS), community integration questionnaire (CIQ) and employment status. Descriptive analyses were applied to summarize the data.

Results: A total of 133 eligible participants were included in the study. The mean age was 32.3 (±11.6) years, 77.4% were males, and 81.0 % were employed at the injury time. 57.1% injuries were caused by traffic accidents, 72.2% patients were severely injured with GCS 3-8, and the mean Injury Severity Score and Abbreviated Injury Scale Head were 31.0 (±13.8) and 4.4 (±0.9), respectively. Out of the initial participants, 110 (22 died, 1 withdrew), 105 (2 died, 3 withdrew), 100 (1 died, 4 withdrew) and 94 (2 died, 4 withdrew) patients participated at 3-month, 1-year, 2-year and 5-year follow-ups, respectively. The mean FIM-Cog and FIM-M scores were 27.3 (±9.2), 30.5 (±7.2), and 31.9 (±5.9), and 78.3 (±24.5), 83.4 (±19.9), and 86.4 (±16.8) at 3-month, 1-year and 5-year follow ups, respectively. The mean DRSs scores were 5.5 (±5.6), 3.1 (±4.8), and 2.1 (±4.0) at 3-month, 1-year and 5-year follow ups, respectively. The mean CIQs scores were 18.1 (±6.2), 19.1 (±6.4), and 20.2 (±5.1) at 1-year, 2-year and 5-year follow ups, respectively. The rates of employment in participants who were employed at the injury time were 25.0%, 61.2%, 53.2% and 60.8 % at 3 months, 1-year, 2-year and 5-year follow-ups, respectively.

Conclusions: Positive trends in cognitive and motor recovery and improvements in functional outcomes were documented in patients with moderate and severe TBI. A sizable number of patients still carried various functional deficits at 5-year post injury suggestive of long-term neurological damage and chronic condition. Future studies should identify risk and beneficial factors of the recovery process following TBI and tailor rehabilitation programs to meet the long-term needs of this population.
In-hospital Mortality Following Traumatic Brain Injury in Older Adult Statin Users

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: No preference

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Objectives: Every year more than 80,000 adults 65 and older suffer traumatic brain injury (TBI) in the United States. TBI-specific mortality rates increase with age, with 23% of Medicare beneficiaries aged 65-74, 32% aged 75-84, and 46% over 85 dying within one year of head injury. Increased risk of mortality following TBI highlights the need to explore pharmacological treatment options for older adults suffering TBI. One potential pharmacological option is statins, which can reduce cerebral inflammation associated with TBI. Several animal studies suggest a beneficial impact of statins following TBI; however there is no human study assessing the impact of statins in older adults with TBI. Translational research is required to assess the impact of statins on patients with TBI. The objective of this study was to assess TBI-specific inpatient mortality rates, comparing statin users with non-users prior to TBI.

Methods: This was a retrospective cohort study of Medicare beneficiaries 65 and older hospitalized with a TBI during 2006 to 2010. Patients were required to be 65 and older and have at least 6 months of Medicare Parts A, B, and D coverage prior to TBI. TBI was defined by ICD-9-CM codes 800.xx, 801.xx, 803.xx, 804.xx, 850.xx-854.1x, 950.1-950.3, 959.01. The exposure of interest was statin use, which was observed per 30-day periods relative to TBI using Medicare Part D prescription drug event claims. Beneficiaries with any statin use in the three months prior to TBI were classified as recent statin users while beneficiaries with statin use only more than three months pre-TBI were classified as past users. The primary outcome of interest was in-hospital mortality following TBI hospitalization. Bivariate analysis compared clinical and socio-demographic characteristics of statin users and non-users. Logistic regression was used to compare in-hospital death comparing statin users to non-users, controlling for covariates identified in the bivariate analysis.

Results: A total of 115,334 Medicare beneficiaries had at least 6 months of Medicare Parts A, B and D coverage prior to TBI. Of these, 9,983 beneficiaries did during the TBI hospitalization. Among those dying in-hospital, 4,675 (47%) used statins and 5,308 (53%) did not use statins pre-TBI (p < 0.05). The adjusted odd ratio (OR) for in-hospital death for recent statin users, compared to non-users was 0.90 (95% confidence interval (CI): 0.88, 0.99); the adjusted OR for past statin users compared to non-users was 0.86 (95% CI: 0.77, 0.95).

Conclusions: Statin use prior to TBI is associated with decreased risk of in-hospital mortality following TBI. The results suggest that both recent and past statin use prior to TBI may help improve survival following the initial injury, providing clinicians with potentially valuable information regarding the protective effects of statin use among older adults with TBI.
Ecological assessment of numerical skills in adults suffering from stroke

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Background: Disorders with numerical skills are common after a brain injury and can lead to major disruptions in patient's daily life. However, few studies have assessed the impact of these disorders, especially in everyday life. We developed the first French ecological test to evaluate number processing and calculation competences in patients, called the Ecological Assessment Battery for Numbers (EABN). Standardisation included 126 control subjects (2012); validation study (2015) confirmed good psychometric properties on 17 patients.

Objectives: The present study first assesses calculation skills and number processing in patients suffering from cerebrovascular disease patients with EABN. Second, relationship between disorders-related lesions and (1) brain lesion lateralization, and (2) formal analytical testing and (3) cognitive disorders were evaluated.

Methods: Patients suffering from a stroke were included in three departments of Physical and Rehabilitation Medicine. Inclusion criteria entailed having a stroke, be 21 to 93 of age, and exempt from prior neurologic or psychiatric disease. The systematic assessment included: EABN, and a formal calculation testing called Evaluation Clinique des Aptitudes Numeriques (ECAN), an evaluation of speech processing (Boston Diagnostic Aphasia Examination = BDAE), a cognitive assessment (Montreal Cognitive Assessment = MOCA), and assessment of independence (Functional Independence Measure = FIM). We studied the link between variables through multivariate analyses. Non parametric group comparisons were also conducted.

Results: Out of 48 strokes included, 36 showed left brain damage (LBD) (75%) and 10 right brain damage (RBD) (20.8%). Mean age was 59.2 years, mean duration after stroke was 8.5 months. 62.5 % of subjects showed a pathological score on EABN. LBD patients were significantly impaired (p = 0.0089) and slower (p = 0.0003) than RBD patients for all tests, especially for transcoding tests (reading numerical data, make a digicode, make a payment in cash or check, p = 0.0025). The total EABN score was correlated to the ECAN (p < 0.0001), what accounts for its sensitivity to capture numerical skills disorders. The correlation found with the language functions (p < 0.0001) was partly explained by the difficulties of LBD patients. Finally MOCA and MIF were correlated with the total score of the EABN (p = 0.0009 and 0.004 respectively).

Conclusions: The EABN is a robust promising tool that enable promote more systematic screening for calculation impairment in patients with a brain damage, (in particularly those with LBL left brain lesion) and assess its major impact on everyday life activity. This tool allows us to distinguish differences in performances according to differences in locations of the brain lesion. Therefore, it seems important to assess the number processing and calculation skills in clinical practice of all LBD patients, in addition to the formal cognitive assessment.
The “nif-ty”: the neuropsychological integrated formulation model for use in paediatric and adult acquired brain injury

Objectives:

- Understanding the complex needs of the severely affected paediatric and adult acquired brain injured populations poses a very real challenge to clinicians working in multidisciplinary settings (Limond, Adlam & Cormack, 2014)
- A shared model is required to ensure a co-ordinated and client-centred approach (Byard, Fine & Reed, 2011)
- The objective was thus to devise a transtheoretical integrative model for comprehensive biopsychosocial formulation to guide specific multimodal interventions
- We aimed to provide a model for salient interactive relationships between reported neuropsychological, behavioural and emotional problems to be explicitly documented for clinical use in brain injury settings

Methods:

- A review of complex cases formed the basis of identifying improvements to existing methods
- Key theories and models of formulation (from the macro to micro) were drawn upon i.e. the ecological model (Bronfenbrenner), CBT (Beck), family life cycle (Carter & McGoldrick), individual life cycle (Duvall), developmental neuropsychology (Anderson; Varga-Khadem), personhood (Kitwood), phenomenology (Husserl) and the ICF-CY (WHO)
- It was imperative that our new model had the following features: (i) it allowed the impact of the brain injury to be explicitly acknowledged through the entirety of the person’s biopsychosocial world, (ii) to be multifactorial & multisystemic, (iii) developmental (primary and secondary impacts), (iv) valuing of a strengths-based empowering approach, (v) to be explicit enough as to have predictive qualities and (vi) to be detailed enough to give rise to objective goal-setting

Results:

- A transtheoretical biopsychosocial formulation model for Neuropsychological Integrated Formulation “NIF-TY”, was devised that satisfied the above essential features
- It is a pragmatic tool that is tangible to all members of a multidisciplinary team that provides an integrated model to understand, intervene and evaluate clinical approaches
• It allows the development of a conceptual rationale for both direct and indirect working across the MDT and other supporting networks, therefore having utility for individual, parent, family, couple and staff work in brain injury

Conclusions:

• “NIF-TY” is an example of clinical innovation based on the evidence base that address a central clinical dilemma

• It is a biopsychocial integrated model which features neuropsychology at its heart to formulate the wide reaching impacts of brain injury

• It is anticipated that this model would require minimal adaptation to have utility in other client populations affected by health conditions related to neurological status and otherwise
Marital Instability Following Traumatic Brain Injury

Status: Accepted Presentation type: Oral
Category: Neurorehabilitation – case reports/clinical research
Author's preference: No preference

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Objectives: Research indicates that at least one-third of brain injury caregivers are spouses, and there is little doubt of their important long-term role in facilitating recovery and adaptation. Unfortunately, the impact of TBI on coupled relationships has been a consistently neglected area of focus. Research has typically focused on the perceptions of uninjured partners, and there are relatively few studies comparing partners' and patients' perceptions. Furthermore, research efforts to describe marital stability have been primitive, characterizing patients as married, separated, or divorced. Objectives for the present investigation included to: (1) characterize marital stability after traumatic brain injury considering the perspectives of the patient and the uninjured partner, and (2) identify predictors of marital stability.

Methods: The sample consisted of 42 couples with mild to severe TBI participating in an ongoing intervention to promote couples' adjustment and coping. Marital stability was measured using the Marital Status Inventory (MSI), with higher scores indicating greater potential for separation or divorce. The Revised Dyadic Adjustment Scale (RDAS) assessed relationship quality, with higher scores indicating greater marital satisfaction. These measures were administered to both the patient and their partner prior to initiating the intervention.

Results: Twenty-four percent of patients viewed their marriage as unstable on the MSI, as did 29% of partners. For most couples (72%), there was a consensus on the stability of their marital relationship. Twenty-five couples (60%) agreed that their marriage was stable, while five couples (12%) agreed that their marriage was unstable. An exact McNemar's test comparing patient and partner MSI scores did not indicate disproportionate perceptions of stability. Overall, 52% of patients and 50% of partners characterized their relationship quality as poor on the RDAS. Patients who rated their marriage as unstable on the MSI had RDAS scores 10 points below the cut-off for relationship distress. Partners who rated their relationship as unstable had a median RDAS score 15 points below the cut-off. A multivariate logistic regression was used to determine predictors of marital stability. Injury severity, partner sex, number of children in the home, length of relationship, and RDAS scores were included in the model. Results indicated that the RDAS was the only salient predictor of marital stability.

Conclusions: The MSI and RDAS may serve as useful tools in understanding relationships after TBI. Results suggest a substantial number of couples are at risk for marital breakdown and a larger number view their relationship as distressed. Although a variety of factors were considered, only marital satisfaction was predictive of marital stability. Given the importance of marriages and the role changes that commonly follow injury, clinicians are encouraged to consider the quality of relationships, particularly when formulating treatment plans.
Long Term Results of Constraint Induced Movement Therapy in Day Program for People with Acquired Brain Injury

Objectives: Out-patient day treatment program for people with brain injuries has a long tradition on our Department of Rehabilitation Medicine, General Teaching Hospital and First Faculty of Medicine Charles University in Prague. In 2013 we decided to introduce CIMT (Constraint Induced Movement Therapy) concept for patients with hemiparesis in this activity. CIMT as was described first by Taub (1994, 1999) and Millner 1999 is based on two basic principles, forced used of the affected arm by restraining the unaffected arm e.g. by hand splint or glove during dedicated exercise sections or ADL (activities of daily living) and massed practice of the affected arm through so called shaping activities. Shaping involves conditioning method in which an objective is approached in small steps of progressively increasing difficulty. In contrast to other forms of rehabilitation treatment of neurological disorders procedural learning is the most important principle of this method.

Methods: 18 patients with hemiparesis due to acquired brain injury age 18 and older were involved. They had good cognitive functions to understand and follow the tasks. Cognition was proved by neuropsychological assessment. All patients signed written consent before entering the program. All of them had paresis of upper limb and were able to extend wrist at least 20 degrees and fingers in metacarpophalangeal joints extend at least 10 degrees. Patients had four weeks of intensive day programme (five hours of special CIMT training a day, two hours individual - shaping, repetitive movements, ADL on the department, 1,5 hours group therapies and 1,5 hours individual therapies at home) from Monday till Friday. The evaluation of the effect was done by using standardised functional tests (e.g. Jamar dynamometer for grip strength, Frenchay arm test, grip visual score) as well as measuring time of shaping activities and spasticity scales (MAS - modified Ashwort scale and Tardieu scale). They were controlled after one month, three, six and twelve months after finishing the programme.

Key hypothesis: the effect of CIMT therapy persists more than one year after finishing intensive treatment. The effect is present even in chronic patients who are more than one year after brain damage.

Results: The results are very promising. All patients were much better after the intensive programme, 80 % were better even after three and six months after the therapy and 65 % even after one year.

Conclusions: CIMT method can be used even for chronic patients more than one year after brain injury and the results persist long time. Most important is the motivation and cognitive status of the patient.
Health-Related Quality of Life 3 Years After Moderate to Severe Traumatic Brain Injury: A Prospective Cohort Study.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: No preference

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Objectives: To evaluate the time course of health-related quality of life (HRQoL) after moderate to severe traumatic brain injury (TBI) and to identify its predictors.

Methods: Design Prospective cohort study with follow-up measurements at 3, 6, 12, 18, 24, and 36 months after TBI.

Setting/Participants Patients (N=97) hospitalized with moderate (23%) to severe TBI (77%), and discharged from 3 level-1 trauma centers, with a mean age of 32.8 (SD13.0) years (range 18-65 years) and 72% men.

Main Outcome Measures HRQoL was measured with the SF-36, including the Physical and Mental Component Score (PCS and MCS), functional outcomes with the Glasgow Outcome Scale (GOS), Barthel Index, FIM, and Functional Assessment Measure, and mood with the Wimbledon Self-Report Scale.

Results: The SF-36 domains showed significant improvement over time for Physical Functioning (P<.001), Role Physical (P<.001), Bodily Pain (P<.001), Social Functioning (P<.001), and Role Emotional (P-.024), but not for General Health (P-.263), Vitality (P-.530), and Mental Health (P-.138). PCS improved significantly over time, whereas MCS remained stable. After 3 years, HRQoL was the same as in the Dutch norm population (Figure 2). Time after TBI, hospital length of stay (LOS), FIM, and GOS independently predicted PCS, whereas LOS and mood predicted MCS.

Conclusions: After TBI, the Physical Component of HRQoL improved significantly over time, whereas the Mental Component remained stable. Problems of disease awareness seem to play a role in self-reported Mental HRQoL. After TBI, mood status is a better predictor of Mental HRQoL than functional outcome, implying that mood should be closely monitored during and after rehabilitation.
Epistemic privilege: Narratives from the families of vegetative and minimally conscious patients after serious brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: We conducted qualitative interviews with family members of patients in a vegetative or minimally conscious state as part of a larger research study. Our objectives were to gain insight into families' knowledge of the patient's medical condition, including their beliefs about the patient's preserved cognitive function and prognosis as well as their experience of research participation. This presentation will focus on family members' ways of knowing and how these at times conflicted with the logic of the biomedical model as well as impacted interactions with clinical staff.

Methods: Using a constructive grounded theory design, we interviewed the surrogate decision-makers of patients in a vegetative or minimally conscious state at two time points, before and after receiving test results from a functional MRI neuroimaging study. A semi-structured interview guide was designed to capture experiences of the original precipitating event, experiences of care delivery, understanding of the family member's consciousness, and reasons for participating in the study.

Results: We interviewed six family members twice, for a total of 12 in-depth interviews. Each interview lasted one hour or longer. Families often described poignantly how they maintained a sense of relationship with the patient despite their medical state. They described the myriad of ways in which they believed their family member communicated with them, frequently attributing some degree of consciousness to them. At the same time, families perceived that healthcare workers often treated patients with brain injuries as non-persons. In philosophy, epistemic privilege refers to a certain type of knowledge that can only be gained through direct experience of a phenomenon. We apply this concept in order to begin to theorize the differences in perspective between caregivers and clinicians that remain respectful of family's ways of knowing.

Conclusions: Our team has identified points of tension between clinician and family member's understanding of the patient's condition and specifically the different meanings of consciousness they assign. Families often believe they have specialized knowledge of the patient and express this as a form of communication which may be more symbolic than literal. While in the hierarchy of medical knowledge, families' claims are not legitimized, they provide important insight into the social meaning of consciousness and the role this plays in families' decision-making.
The “snap” 1 and 2: post-acute systematic neuropsychological assessment profiles for paediatric and adult severe acquired brain injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives:

- It is very difficult but imperative to gain a person’s neuropsychological profile in the post-acute stage of severe acquired brain injury (ABI) (Newby et al, 2013)
- Due complex physical and psychological deficits, an individual may be unable to engage in/score on standardised tests
- The primary objective was to develop a process to gain a systematic profile of an individual’s cognitive functioning in the post-acute stage
- Relevant information would be gained through MDT observations and unstandardised tasks mapping on to all domains of neuropsychological functioning

The “SNAP” 1 & 2 aimed to bridge the gap between brief bedside assessments (often administered on a one off basis that are rarely used to guide on-going rehabilitation) and formal assessment. The profiles were developed to allow systematic assessment of an individual over time and contribute to biopsychosocial formulation and interventions.

An additional aim for “SNAP” 1 & 2 was aid to provide meaningful information regarding an individual’s cognitive functioning at transition points between services.

Furthermore the profiles were to be pragmatic and low cost as to satisfy the demands of everyday clinical practice.

Methods: The “SNAP 1” is a descriptive “snapshot” profile devised by adapting the work of Adlam (2010). A profile composed of experienced clinical opinion regarding all neuropsychological domains was produced intended for use in multidisciplinary forums that gave rise to rehabilitation goals.

The “SNAP 2” is a more detailed profile based of more systematic clinical observation of everyday functioning and unstandardised tasks to tap into all neuropsychological domains. It was developed using experience from the authors’ clinical backgrounds and knowledge of informal assessments (such as the “NAID”, Crayton et al. 1998).

For both profiles, knowledge regarding how cognitive functioning maps onto everyday functioning and tasks was given considerable thought.
The profiles were developed in specialist residential rehabilitation settings that naturally gave opportunities of observing an individual’s cognitive skills in a novel environment, thereby allowing profiles of unscaffolded skills in action.

Results:

- SNAP 1 & 2 were developed to help empower and guide clinicians when an individual cannot engage in formal neuropsychological assessment
- They are used cumulatively to build understanding of an individual, in line with the individual’s recovery
- They are low cost, pragmatic tools that provide a helpful and accessible model to systematically profile neuropsychological skills

Conclusions:

- The post-acute Systematic Neuropsychological Assessment Profiles 1 and 2 (SNAP 1 & 2) can be used in early post-acute stages of severe ABI producing meaningful information regarding an individual’s cognitive functioning when they are unable to engage in formal assessments.
- The profiles empower clinicians to assess individuals early in rehabilitation thus avoiding unnecessary delays in gathering information to inform understanding and intervention to increase quality of life of those affected by severe acquired brain injury.
Longitudinal Changes in Cerebral Blood Flow After Sports-Related Concussion

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: While clinical effects of sports-related concussion (SRC; e.g., symptoms and impairments in neuropsychological functioning) typically resolve within several days, emerging evidence suggests persistent neurophysiological abnormalities beyond the point of clinical recovery after injury. Cerebrovascular alterations play a significant role in the evolution of neuropsychological and neurobiologic consequences of SRC as well as in the process of post-injury brain repair. Measurement of cerebral blood flow (CBF) in vivo can thus enhance the understanding of neurophysiological recovery process after SRC. This study was aimed to evaluate longitudinal changes in regional CBF during acute, subacute and chronic stages of SRC, as measured using advanced arterial spin labeling (ASL) MRI.

Methods: We compared CBF maps assessed using 3D pCASL (pseudo continuous ASL) MRI in 16 concussed football players (age 17.6 ± 1.6 years) obtained within 24 hours, at 8 days and 6 months after injury in comparison to a control group of 17 matched non-concussed football players scanned at the same intervals. Imaging group analysis was performed using the multivariate model including age and numbers of concussion in the past as covariates. All participants underwent comprehensive clinical and cognitive assessments at pre-season baseline evaluations and each follow-up time point, including administration of the Sport Concussion Assessment Tool 3 (SCAT3) and Standardized Assessment of Concussion (SAC).

Results: Both within- and between-group analyses showed that concussed football player demonstrated a significant decrease in CBF (p<0.05, corrected), mainly in frontal and temporal lobes, at 8 days related to 24 hours, with partial recovery of CBF at 6 months after injury. In contrast, scores on the clinical symptom (SCAT3) and cognitive (SAC) measures demonstrated significant impairment (versus pre-season baseline levels) at 24 hours (p<0.001) but returned to baseline levels at 8 days, and no difference at 6 months relative to the baseline measures.

Conclusions: Our preliminary results have shown a different longitudinal recovery trajectory of CBF as measured using ASL MRI in comparison of clinical assessments. Abnormal CBF was found in concussed athletes even after clinical recovery, which might indicate more prolonged neurophysiological recovery. The findings imply that clinical return-to-play decisions based on symptom recovery may be result in return to competition during a window of persistent cerebral vulnerability. Our study also suggests that advanced ASL MRI methods might be useful for detecting and tracking the longitudinal course of underlying neurophysiological recovery from concussive injury.
Clinical Improvement with Transcranial Direct Current Stimulation (tDCS) in Disorders of Consciousness Due to TBI

Objectives: Severe Traumatic Brain Injury (TBI) may result in a disorder of consciousness (DOC) that may last for months, years, or even a lifetime. DOC range from Unresponsive Wakefulness Syndrome (UWS, formerly known as Vegetative State) where patients show no signs of conscious/purposeful interaction with the environment, to Minimally Conscious State (MCS) where reproducible but not consistent interaction is apparent. To date, there is no therapeutic intervention for these patients who are expected to either recover spontaneously or not recover at all. Transcranial Direct Current Stimulation (tDCS) is a non-invasive technique that applies small electrical currents through the brain, and has been widely studied during the past 15 years. Effects of tDCS include cognitive improvement in healthy volunteers as well as clinical improvement in several neurological disorders, like stroke-induced aphasia, motor and visual deficits, cognitive deficits due to TBI or Parkinson's Disease. Multiple sessions of tDCS are considered to affect LTD and LTD mechanisms.

Methods: twelve TBI patients with DOC (2 UWS, 5 MCS-, 5 MCS+) with a median time (months) since injury 15 (range: 4-156) were treated with anodal tDCS (25 cm² sponge electrode, 2 mA) over the left primary motor area of the hand while they received verbal movement commands. tDCS was applied for 30 minutes daily with a mean number of 33 sessions totally (range: 14-59). Patients were assessed with the JFK Coma Recovery Scale - Revised (CRS-R). All patients had been stable with no signs of clinical improvement at least for the last 2 months before participation.

Results: 8 patients (75%) showed clinical improvement (mean CRS-R gain: 3.75) within an average of 16 tDCS sessions (range: 10-20). At the end of participation (average number of sessions: 33; range: 14-59) 6 patients (50%) improved their DOC status, with 4 patients (33%) regaining consciousness and 2 patients (17%) rising to MCS- from UWS.

Conclusions: 8 out of 12 patients (75%) that were not improving clinically for at least two months prior to tDCS showed clinical improvement after 10-20 sessions. This pilot case series study shows that tDCS holds promise in the rehabilitation of DOC. Its non-invasive and side-effect-free nature, together with the portable and inexpensive equipment makes tDCS an excellent candidate for large longitudinal controlled studies for the rehabilitation of DOC.
"Specs": seeing brain injury clearly - a psychosocial training package for professionals working with children and young people with acquired brain injury

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – case reports/clinical research
Author's preference: No preference

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Objectives:

- The primary objective of the "SPECS" training package is to increase skills and confidence of professionals working directly with children, young people (CYP) and their families affected by acquired brain injury (ABI).

- "SPECS" is an acronym for core psychosocial factors that help CYP 'be, do and participate' in meaningful lives that underpin successful neurorehabilitation: Social, Physical, Emotional, Cognitive and Spiritual.

The importance of addressing the holistic needs of CYP with long-term neurological conditions through specialist rehabilitation is a major motivator of the Annual Report of the UK Chief Medical Officer (2012) ‘Our Children Deserve Better’. It is imperative that professionals are trained to work to rehabilitate not only the cognitive and physical deficits but understand the intricate interplay between psychosocial support, cognitive recovery and long-term life outcomes.

Methods: "SPECS" was developed through multi-professional collaboration within an intensive rehabilitation setting. Using a needs analysis approach, a specialised tailored staff training package "SPECS" was produced that addressed the key social, physical, emotional, cognitive and spiritual needs of this client group with the context of clinical practice. SPECS was piloted and evaluated in May 2015.

Results: "SPECS" comprises of 4 teaching modules delivered through a variety of teaching/learning methods:

- Module 1
  Introduction to psychosocial care in ABI (how "SPECS" embodies comprehensive psychosocial care)

- Module 2
  Thinking about the child and young person in context (identifying "SPECS" needs of CYP and families)

- Module 3
  Supporting parents and families (generating and developing strategies to ensure "SPECS" needs are met)
Preparing for discharge and managing change (helping CYP and their families transition home successfully)

SPECS was evaluated quantitatively and qualitatively with a multidisciplinary staff group including speech and language therapy, occupational therapy, physiotherapy, social work, nursing and psychology.

Support was found for the effectiveness of the package in the following outcomes (i) understanding of psychosocial care in ABI, (ii) awareness and knowledge of managing the wider needs of CYP with ABI, (iii) ability to support parents and families, and, (iv) knowledge of how to prepare and manage discharge.

Conclusions:

- Effective psychosocial care involves a holistic approach to supporting CYP and families affected by acquired brain injury.

- SPECS is a training package that enables staff from multiple disciplines working in the field of paediatric acquired brain injury to build knowledge and skills in effective psychosocial care.

- SPECS is now being disseminated throughout The Children’s Trust, the UK leading charity of children with brain injury.
Assessment of young adults with mild traumatic brain injury using locomotor-cognitive dual-tasks: effect on gait speed and association with neuropsychological functioning.

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – case reports/clinical research
Author's preference: Poster

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Objectives: The objectives were (1) to compare persons with mild traumatic brain injury (mTBI) and healthy controls on gait speed while completing different combinations of locomotor-cognitive dual-tasks, and (2) to determine the association between dual-task performance and neuropsychological test results.

Methods: Eighteen participants with mTBI (13 women; 21.9y ± 3.8) and fifteen healthy control participants (9 women; 22.2y ± 4.3) were recruited. Participants with mTBI were tested 2-15 weeks post-injury (x=59 days ± 24).

Procedure. After being assessed with a neuropsychological test battery, participants were asked to walk in a gait laboratory along a 6-meter walkway while performing various combinations of locomotor and cognitive tasks. There were three locomotor conditions: (1) level-walking, (2) walking and stepping over a deep obstacle (15cm high x15cm deep), and (3) walking and stepping over a narrow obstacle (15cm high x3cm deep). Each locomotor condition was combined with four cognitive conditions: (1) No concurring cognitive task, (2) Stroop task, (3) Verbal fluency task, and (4) Arithmetic task.

Measures. The neuropsychological tests were: Digit Span, Auditory Consonant Trigrams, WAIS-Vocabulary, D-KEFS' Trail Making Test (TMT), Verbal Fluency and Color-Word Interference Test. Subjective symptoms were assessed with the Rivermead Post Concussion Symptoms Questionnaire. Gait speed (m/sec) was calculated from 3-D kinematic data (Vicon system).

Results: For gait speed, generalized estimating equations revealed main effects of group (p=.007), locomotor (p<.001) and cognitive condition (p<.001). Interactions between groups, locomotor and cognitive conditions also emerged (p<.001). Compared to controls, gait speed was found to be significantly slower in persons with mTBI in all conditions where a cognitive task was added to walking (differences ranged from 0.12 to 0.17 m/sec between groups). Regardless of group, presence of an obstacle significantly decreased gait speed in comparison of level-walking. Furthermore, each cognitive task significantly differed in affecting gait speed (no task < Stroop < Arithmetic < Verbal fluency) regardless of group. Groups did not differ on results of neuropsychological tests, but as expected the mTBI group reported significantly more subjective symptoms (x=5.17±5.53) than controls (x=1.93±1.58). Weak but significant correlations were found between gait speed and total symptoms on the Rivermead, execution time of TMT-condition 4 and execution time of Stroop-condition 4, and verbal fluency (total number of words).

Conclusions: This work provides further evidence that, as previously suggested in the literature, placing individuals with mTBI in conditions where they must simultaneously navigate their environment and perform cognitive tasks may be an effective way to assess potential residual impairments, even months post-mTBI, when neuropsychological tests have returned to normal levels. Since gait speed is relatively
easy to assess with limited technology, future work should focus on the development of locomotor-cognitive dual-tasks for the clinical setting.
Big data in clinical and experimental traumatic brain injury research

Status: Accepted Presentation type: Poster

Category: Technology – clinical research/applications

Author's preference: Oral

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Vast amount and highly heterogeneous data describing various aspects of Spinal Cord Injury (SCI) and Traumatic Brain Injury (TBI) have been generated over the last several decades and growing every day. However the next step, generating knowledge from existing data has been hindered by different issues including various heterogeneities, such as differences in outcome measures, data formats, etc. In addition, we currently do not have the ability to analyze and interpret our new data in the context of existing data. The current gap between clinical and experimental outcome measures, time points, etc. also needs to be addressed. The lecture is aimed to discuss some of these critical issues especially the challenges and potential solutions to decrease the gap between experimental and clinical data in TBI.
Neurobiological Model for use of rTMS + Amantadine as a Treatment to Modulate and Shape Neural Repair for persons in States of Disordered Consciousness

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Present evidence-based neurobiological model for using repetitive Transcranial Magnetic Stimulation (rTMS) with Amantadine to facilitate recovery of arousal, awareness and consciousness after traumatic brain injury (TBI).

Methods: rTMS was selected because of evidence indicating it can induce and modulate neural activity. Amantadine was selected because of evidence that it targets the dopamine system. Evidence suggesting that we combine rTMS and Amantadine relates to the unique systems targeted by each treatment, but also that these unique systems comprise common neural pathways supporting arousal, awareness and consciousness.

Results: Findings from an open label pilot study of rTMS indicated rTMS related neurobehavioral gains were enabled by improved neural activity and functional connectivity within and between regions important to arousal and consciousness (e.g., increased midbrain-right thalamus correlation: .25 to .60). Findings also indicated that rTMS-modulated regions (i.e., midbrain, thalamus, prefrontal cortices-PFC, striatum) local to and remote from site of stimulation (right dorsolateral PFC). DTI findings indicated rTMS related improvements in structural connectivity for fiber tracts (e.g., Superior lateral fasciculus, colossal and corona radiate fibers) intersecting with tracts descending to the brainstem (e.g., FA value increased for tracts near internal capsule from .26 to .31). We chose to pharmacologically modulate the dopamine system because the regions and tracts changing in relationship to provision of rTMS are integral to the dopamine system. Dopamine is one of several neurotransmitters important to arousal and consciousness, but dopamine is particularly well represented within the same regions we found to be altered by rTMS. Of the dopamanergics, we chose amantadine because it pre-synaptically primes the midbrain to indirectly release dopamine. The collective evidence suggested to us that there are three common pathways, with one of these bypassing thalamo-cortical circuitry, that could be leveraged via pharmacological stimulation of dopamine release for the purpose of amplifying or modulating rTMS induced effects. These common pathways are: (1) Dopamine released at the substantia nigra (SN) projects to Mediodorsal thalamus (MDT) and relays to the mPFC, (2) Direct and reciprocal connection between mPFC and MDT, and (3) Direct dopaminergic connection from ventral tegmental area in the midbrain to the medial PFC. This evidence informed our conceptualization of the hypothesis that indirect release of dopamine within these pathways would synergistically optimize rTMS effects.

Conclusions: A clinical trial is ongoing to test the hypothesis that rTMS+Amantadine will provide a synergistic effect on neurobehavioral recovery for four patients remaining in states of disordered consciousness for more than one year. This hypothesis is based on evidence of (a) Improved rTMS related neurobehavioral functioning, neural activity as well as functional and structural neural connectivity, (b) Role of dopamine system in mediating consciousness, (c) Mechanisms of action of Amantadine, and (d) Commonalities between the regions comprising the dopamine system and regions/tracts modulated by rTMS.
Improving Traumatic Brain Injury Outcomes: The Development of an Evaluation and Referral Tool at Groote Schuur Hospital, Cape Town

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: In the Western Cape Province of South Africa, and in the country in general, there is a great shortage of support, diagnostic and rehabilitation services for patients who have suffered traumatic brain injuries (TBIs). The majority of patients are discharged from the acute hospital setting without any knowledge of the consequences of TBI and without any understanding of what to expect in the future in terms of potential cognitive, behavioural and psychological impairments. The neurosurgical outpatient setting is typically busy, and often chaotic; furthermore, patients are frequently lost to follow up. This study sought to continue with the design and development of a comprehensive, yet brief tool (a questionnaire and algorithm) to aid patient referrals and ensure that no consequence of TBI is left unidentified and unaddressed. This tool is called the Groote Schuur Hospital Traumatic Brain Injury Evaluation (GSH TBI-E) and was initially created by Andrew, Balchin and Rothemeyer (2013).

Methods: Forty-seven TBI patients aged between 18 and 75 (mean = 35) were assessed, of which 94% were male. Over a third (36%) of the participants were unemployed prior to their TBI, and 89% were unemployed post injury. This study was designed around three distinct phases, each representing a different stage in the tool's development. This design was chosen in order to evolve the questionnaire and algorithm, allowing for specific issues to be focussed on, evaluated and then addressed. Phase One involved making further changes to the original questionnaire based on the findings of a previous pilot study. This was followed by trialling these changes to get an initial impression of the efficacy. Phase Two involved trialling the modified tool on a large sample in order to collect a critical mass of reliable and informative data, which would serve as the evidence for making any final refinements to the developing tool. Phase Three involved making any final changes to the GSH TBI-E based on the results of the data collected.

Results: The GSH TBI-E was shortened, simplified, and the original cognitive tasks were replaced with screening questions covering various areas of cognition. Overall, 81% of the participants showed signs of cognitive dysfunction; of these, 66% were seen at more than one-year post injury. There was a high prevalence of psychological sequelae, with 85% of the participants reporting at least one psychiatric issue; of these, 63% were seen more than one-year post injury. Just over half the participants (51%) reported symptoms of depression.

Conclusions: This study further highlights the prevalence of neurocognitive, behavioural and psychological consequences of TBI. Findings suggest that the GSH TBI-E will prove a useful means of identifying and streamlining referrals to specialists.
Guided Discovery Offers Slight Advantages Over Direct Skill Training in Acute Stroke Rehabilitation

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: The aim of this pilot study was to estimate the effects of guided discovery (GUIDE) and direct skill training (DIRECT) on recovery of independence after acute stroke in participants with cognitive impairments. Studies suggest that guided discovery may be advantageous for individuals with learning disabilities or impairments in executive functions compared to direct skill training, but the benefits in acute inpatient rehabilitation are unclear. We predicted that 1) participants in both groups would demonstrate significant improvements in independence in the first 6 months after rehabilitation admission, but that 2) participants who received GUIDE would demonstrate significantly more improvement than patients who receive DIRECT. Cognitive impairments occur frequently after stroke and contribute to significant disability.

Methods: We conducted a single-blind randomized pilot study with independent evaluators. Participants were recruited among individuals admitted to inpatient rehabilitation after acute stroke who demonstrated cognitive impairments (Quick Executive Interview≥3) and who did not have a diagnosis of dementia, major depressive disorder, recent substance abuse, or severe global aphasia. We assessed recovery of independence with daily activities using the Functional Independence Measure, administered at study baseline, rehabilitation discharge, 3 months and 6 months. Participants were randomized to GUIDE (n=22) or DIRECT (n=21). Both groups received 10 sessions (once per day) in addition to usual inpatient rehabilitation care. DIRECT sessions maximized the expertise of the occupational therapist who identified and prioritized problematic activities, identified barriers to performing these activities, generated strategies to address these barriers and instructed participants in these strategies, and repeated the process with a variety of problematic activities identified during the rehabilitation program. GUIDE maximized the expertise of the participant, allowing them to learn how to identify and prioritize activities, identify barriers to performing activities, generate their own strategies for addressing these barriers, and apply this process through iterative practice. Data were analyzed using descriptive and inferential statistics to describe the sample and to assess for differences between groups prior to intervention. Differences in the primary outcome (Functional Independence Measure) were analyzed using general estimating equations, with a random intercept and intervention and time as fixed factors.

Results: There were no differences between groups at baseline. Both groups improved significantly over time (F3,100=122.64, p<0.001). There was a trend suggesting that the GUIDE group may have improved more quickly (F3,100=2.51, p=0.06), with moderate effect sizes for differences in change scores noted at 3 and 6 months. Additional analysis of least squares means showed higher scores for the GUIDE group at 3 and 6 months.

Conclusions: For individuals with cognitive impairments, guided discovery may promote slightly better recovery of independence with daily activities than direct skill training.
Efficacy of a Multidisciplinary Outpatient Treatment for Patients with Mild Traumatic Brain Injury: 
A Randomised Controlled Intervention Trial

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Objectives: A substantial group of patients are reporting symptoms and disability after a mild traumatic brain injury (MTBI). Several authors have suggested the need for follow-up, but the impact of an early intervention has been debated because of conflicting results in earlier studies. To be unemployed affects various dimensions of physical, psychological and social health, and return-to-work (RTW) is an important goal and a good indicator of the patients’ well-being and adaption after MTBI.

The aim of this study was to evaluate the efficacy of a multidisciplinary, outpatient, follow-up program compared to follow-up by a general practitioner (GP) for patients with persistent post-concussion symptoms (PCS) two months post-MTBI.

Methods: One hundred fifty-one patients, 16-55 years admitted consecutively to the Neurosurgery Department from January 2009 to January 2012, with MTBI and sustained symptoms at six to eight weeks follow-up at two outpatient rehabilitation clinics in Norway were recruited to a randomised controlled trial. MTBI was defined as Glasgow Coma scale 13-15, unconsciousness less than 30 minutes and post-traumatic amnesia less than 24 hours. Exclusion criteria were other significant diseases that impact their working skills, substance abuse, unemployed in the last 6 months or lack of Norwegian language skills.

Demographic and clinical data were obtained from the hospital records, and data about sick leave from The Norwegian Labour and Welfare Service through a third accredited agency Statistics Norway.

Both groups received a multidisciplinary examination before randomisation at two months post-injury. The intervention, a multidisciplinary outpatient treatment consisted of a psycho-educational group intervention over a consecutive 4-week period and individual tailored contacts the first year post-injury. The control group was followed up by their GP with regular treatment after the multidisciplinary examination.

Primary outcome was RTW at 12 months and sustainable RTW (not receiving sick-leave benefits for a period of five weeks post-injury) first year after MTBI. Secondary outcomes were post-concussion symptoms (PCS), disability and the patient’s impressions of changes.

Results: In the intervention group, 49 (60%) participants and in the control group 50 (71%) participants had RTW at 12 months (p=.173). Adjusted for anxiety, depression and PCS, there was a significant difference according to median days to sustainable RTW in favour of the control group (p=.025) for patients sick-listed at randomisation.
Median numbers of PCS were 6 in the intervention compared to 8 in the control group (p=.041) at 12 months. Other secondary outcomes showed no differences between the groups.

**Conclusions:** The multidisciplinary, outpatient, follow-up program focusing on better understanding and reassurance of favourable outcome for MTBI may have reduced the development of PCS, but did not improve RTW for a vulnerable group of patients. Additional studies should focus on which factors that exhibit a direct impact on RTW.
Does delay in presentation affect application of UK NICE head injury guidelines? A clinical-vignette based survey.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Objectives: NICE guidelines aid the clinical risk assessment of head injury patients in the UK and identify patients that require a CT head scan to rule out serious pathology. They are based on research conducted on populations presenting within 24 hours of injury. There is little research to guide the risk assessment of patients presenting later. Clinicians may therefore differ in their application of the NICE guidelines to this group. We surveyed opinion of ED decision makers (higher specialist trainees and consultants) using a clinical vignette based survey to approximate such differences.

Methods: The vignettes were developed iteratively with head injury specialists at Hull Royal Infirmary ED and through piloting. Four paired vignettes were developed of hypothetical head injury patients with a NICE indication for a CT head scan presenting in an increasingly delayed fashion. These vignettes were disseminated on a UK Royal College of Emergency Medicine online newsletter and through contacting the clinical leads of each ED in the UK.

Results: 449/4073 ED consultants and middle grades in the UK responded (11%).

Significant variation in the application of NICE guidelines was identified in all four vignettes. In two vignettes a position of clinical equipoise was identified at different time intervals of delayed presentation. Local audit data showed that 36% of head injury patients presenting after 24 hours did so due to a headache. This is not part of the NICE guidelines but was found in the vignettes to significantly increase the likelihood of clinicians requesting a CT head scan in delayed presentation. Additionally, 27% of head injury patients presenting after 24 hours were asymptomatic, attending for a check up or due to advice. This is a cohort of delayed presentation head injury patients that clinicians were found less likely to apply the NICE guidelines to when a NICE indication for a CT head scan was present.

Conclusions: There is variation in the management of delayed head injury patients. Clinicians are less likely to apply NICE guidelines when risk stratifying this group and may use other factors. Further research is required if such assessment is to be evidence based.
Neurosurgeons’ Perspective on the Utility of Decompressive Craniectomy in Traumatic Brain Injury in Saudi Arabia, Paradigm Shift is Needed

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: Decompressive craniectomy has been proven a valuable tool in the face of refractory intracranial hypertension. We wanted to study the perspective and utilization of this modality in patients suffering from severe refractory intracranial hypertension.

Methods: A questionnaire was electronically sent to all registered neurosurgeons in Saudi Arabia. Within it, questions pertaining to the aspects of utility or futility of this procedure were included. For those performing craniectomy, questions about timing, laterality, dural augmentation and ICP monitoring were included. A comparison was made with data gathered from sending the same questionnaire to all neurosurgical residents in training.

Results: Out of 324 questionnaires, 233 responses were gathered (72%). Out of practicing neurosurgeons, only 40% believed in the utility of decompressive craniectomy. The remainder deferred it for several reasons; the highest among them was fear of futility. There was significant variability on the timing of the procedure if performed, laterality. Augmentation duraplasty was always done. This is at stark difference from the neurosurgical residents who had 89% of them favoring of decompressive craniectomy. A critical analysis of the factors driving these perspectives would be presented.

Conclusions: The somewhat shy stance on decompressive craniectomy among neurosurgeons in Saudi Arabia deserve a critical look and developing and disseminating protocols and guidelines describing the utility of decompressive craniectomy in the management of severe TBI might lead to an improved use and improvement in outcome. Factors leading to such a high percentage of deferral, for example fear of litigation; must be addressed at the logistical level amongst the authorities governing the health sectors in Saudi Arabia.
Prevalence of Post Concussion Symptoms in An Asian Country; Base Rates and the Effects of Mild Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – basic research

Author's preference: Oral

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Objectives: To develop a Bengali version of the Rivermead Post Concussion Symptom Questionnaire (RPCSQ) and use this in Bangladesh to ascertain base rates of symptoms in a normal sample and to investigate the effects of mild traumatic brain injury (MTBI), with a view to clarifying the aetiological basis of post concussional symptoms.

Methods: The Bengali RPCSQ was developed using back-translation procedures; a 16 item checklist using a 5 point scale of symptom severity relative to previous status. Group results are typically expressed as the percentage symptomatic on a particular item. Four groups comprised 524 participants, 18 years of age or older with no history of neurological disorder, substance abuse or significant psychiatric disorder: Mild Traumatic Brain Injury (MTBI; n=124, mean age 34.2 yrs, males 85%), seen 7-14 days post accident; Orthopaedic Patient Controls (PC; n=84, age 34.2 yrs, males 81%), seen 7-14 days post accident; Normal Controls (NC; n=272, age 29.25 yrs, males 67%) with no recent history of accident or injury; Previous TBI (pTBI, n=44, age 27.6 yrs, males 64%) who were approached to be normal controls but were found to have had previous TBIs.

Results: Cronbach's Alpha was 0.93, item-total correlations ranging from 0.31-0.81. Of the MTBI group 27% were illiterate or just literate. The mechanism of injury included assault (32%), struck by falling or flying objects (23%), pedestrian struck by a vehicle (23%) and accident while in a vehicle (19%). On average, 44% of the MTBI group and 42% of the PC group was symptomatic on each item. Both behavioural and cognitive symptoms were common in both groups, eg 59.7% of MTBI and 58.3% of PC reported fatigue, 45.2% in both groups reported being irritable, and 40.3% and 48.8% reported taking longer to think. NC yielded the lowest symptom rates on 10 of the 16 items but still an average of 37.9% were symptomatic on each item. NC ratings on cognitive symptoms at least matched those of MTBI, eg 43.4% versus 37.9% on forgetfulness, 49.3% versus 41.5% on poor concentration and 51.5% versus 40.3% on taking longer to think. MTBI patients and normal controls in Bangladesh were both approximately twice as symptomatic as TBI patients in the UK and USA (where an average of only 14 to 31% are symptomatic on each item).

Conclusions: The experience of post concussion symptoms is not caused by brain injury; it is a non-specific response to injury and life stresses. The clinical management of post concussion symptoms after mild brain injury should focus on addressing adjustment rather than provision of brain injury rehabilitation. There are culturally determined ways of expressing adjustment issues and this will influence symptom base rates and again will need to be taken into account in clinical management.
Intermittent hyperventilation as a safe adjunct to hyperosmolar therapy in the treatment of refractory intracranial hypertension

Status: Accepted
Presentation type: Poster
Category: Neurotrauma – case reports/clinical research
Author's preference: Poster

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Objectives: Hyperventilation is an established adjunct to the treatment of intracranial hypertension. Its use in the acute phase is helpful when facing acute herniation. Its subacute use has been subject to debate as it might lead to ischemic side effects if prolonged. We set out to study its effect in patients with diffuse brain injury.

Methods: We included patients with diffuse brain injury with no evacuated or potentially surgical lesion of all adult patients presenting with severe TBI in 12 months. All patients have ICP monitoring and are treated with a standardized protocol. Patients selected on the basis of transcranial Doppler of normal velocity and flow patterns. The hyperventilation protocol was used intermittently to PCO$_2$ of 25 for 6 hours on and 6 hours off for a total of 5 days.

Results: Out of 56 patients fulfilling inclusion clinical and TCD criteria, we applied intermittent hyperventilation on 5 patients. Of those 1 ended up to go for decompressive craniectomy. The remainder did not suffer any ischemic events on the CT with reasonable control of their ICP in the refractory period they were evaluated in.

Conclusions: Intermittent hyperventilation is a safe adjunct to hyperosmolar therapy in severe TBI with refractory intracranial hypertension. We would employ this in a prospective randomized manner to validate these findings.
Acute Concussion Triage Using Brain Electrical Activity as a Surrogate for Neuroimaging Biomarkers

Status: Accepted Presentation type: Oral

Category: Technology – clinical research/applications

Author's preference: Oral

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Objectives: There is an urgent need for an objective, point of care system for the evaluation of acute concussive injury. The use of brain electrical activity to assess concussion at the time of injury in athletes has led to publications demonstrating the sensitivity to functional brain injury in concussed athletes, has shown these abnormalities to persist beyond the point of normalization of symptom based clinical assessments, and reported the ability to predict return to play using features of brain electrical activity obtained at the time of injury. In this study we investigated the relationship between brain electrical activity findings in contact sports athletes using a quantitative electrophysiological technology with assessment of neuroimaging biomarkers. The aim of this study was to demonstrate that such technology could function as a surrogate for neuroimaging biomarkers.

Methods: All athletes received a multidimensional assessment battery pre-season, at time of injury, with multiple follow-ups including end of season and post-season. All injured athletes were matched to a non-contact sports control. The evaluations at each time point included: 5 minutes of eyes closed resting EEG, Functional Magnetic Resonance Imaging (fMRI, with and without task), Magnetic Resonance Spectroscopy (MRS), Diffusion Tensor Imaging (DTI) and neurocognitive testing.

Results: Ninety (90) athletes were enrolled in the study. Using the distributions of the derived measures separately from each of the modalities (fMRI, MRS, SWI, DTI, and neurocognitive assessments), athletes were divided into those outside 2 sd’s (“flagged”) and those within 2 sd’s (“non-flagged”) of the mean of the distribution for the measure. All further analyses were based on comparisons between these two groups.

A concussion discriminant algorithm derived from a large independent brain electrical activity database of concussed and non-concussed athletes was applied to each of the athletes. Comparisons of flagged and non-flagged athletes within each of the neuroimaging and neurocognitive measure sets were compared relative to classification as concussed or non-concussed based on the brain electrical activity index.

The non-flagged group had a mean discriminant score resulting in classification as non-concussed for all of the neuroimaging and neurocognitive measures. On the other hand, the flagged group had a mean discriminant score resulting in classification as concussed for many of the measures, including most significantly: fMRI (task condition), MRS (especially in the primary motor cortex, DLPFC) and reaction time (RT).

Conclusions: This preliminary data supports determination of concussion using a brain electrical activity index as a surrogate for neuroimaging measures. Further, findings suggest the clinical utility of such a technology (an easy to use, readily available, rapid, non-invasive system) in the triage of concussive injury at the point of care.
Acknowledgement: This work was supported in part by a grant from the GE-NFL Head Health Challenge I, and BrainScope Company, Inc.
Impact of the left unilateral spatial neglect on the rehabilitation of patients who have suffered a stroke

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: The aim of this research is to assess the impact of the left unilateral spatial neglect on the capacity to recover the control of the trunk, the balance and the walking ability of patients who have suffered a stroke and are undergoing an interdisciplinary rehabilitation program, compared with patients suffering from right homonymous hemianopia and with a control group.

Methods: This is an observational study of cases and controls.

It has been undertaken in the context of a rehabilitation hospital.

The final sample consisted of 81 patients (63-year old on average, 49 men and 32 women) who had suffered a first stroke (58 ischemic and 23 hemorrhagic cases).

They were classified into three groups according to an independent diagnosis with regard to the neurological and neuropsychological assessments undertaken prior to their hospital admission: control group without hemianopia or neglect (37 patients) group with right homonymous hemianopia and without neglect (19 patients) and group with left unilateral spatial neglect and without right homonymous hemianopia (25 patients).

The assessment was undertaken by using the Trunk Control Test, the Berg Balance Scale and the Tinetti Test (independent scores for balance and gait).

Results: Patients with left unilateral spatial neglect obtained the worst score, both at admission and at discharge, regarding trunk control, balance and gait, followed by patients with right homonymous hemianopia and the control group, respectively.

Only the differences between the control group and the group with left unilateral spatial neglect were statistically significant, both at admission and at discharge.

The duration of the rehabilitation treatment was longer for patients with left unilateral spatial neglect (221.68 days on average), followed by patients with right homonymous hemianopia (211.53 days on average) and, finally, the control group (171.05 days in average).

Conclusions: The presence of spatial neglect has a significant impact on the rehabilitation of trunk control, balance and gait, starting with higher physical disabilities and achieving lower levels of autonomy at the end of the treatment, despite requiring more rehabilitation time.
The specific identification of spatial neglect, and the design of specific programs to promote their rehabilitation or compensation, is required.

It would be interesting to undertake a prospective study including the degree of neglect and a group of patients with left hemianopia without neglect.
Turbulent transcranial Doppler flow as an early indication of intracranial hypertension in severe traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Prevention of secondary brain injury is the mainstay of ICU therapies in severe traumatic brain injury (TBI). Intracranial pressure monitoring is a key component of managing severe TBI patients. The use of transcranial Doppler as a surrogate for invasive ICP monitoring is well established. We describe our interesting finding in 3 patients who, on serial TCD evaluations, developed turbulent flow on the TCD spectrum not associated with ICP increase on monitoring, but a marginal increase in the pulsatility index. These changes corrected after instituting hyperosmolar therapy. All 3 patients were maintained on hyperosmolar therapy as deemed necessary by their clinical evolution. The change in the flow pattern on the TCD, not attributed to hyperemia, was an interesting trigger to use to objectively institute hyperosmolar therapy and in theory prevented further delay in instituting the necessary treatment for intracranial hypertension. Routine observation of TCD indexes and flow pattern might be useful in guiding the timing of escalation of therapy in severe TBI.
Change in Upper Limb Function following BTX-A or Pregabalin for Spasticity: A Case Study

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – case reports/clinical research
Author's preference: Oral

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Background: Limitations in upper limb (UL) function following acquired brain injury may result from the different interplay between positive and negative UMN features within an individual, along with any sensorimotor and/or cognitive deficits. In people with spasticity, this complexity makes it difficult to predict change in function following pharmacological interventions, as most treatments only target one component of the UMN syndrome.

Objectives: To evaluate the impact of two different pharmacological treatments for UL spasticity (Botulinum Toxin-A injections and pregabalin) in a 50 year old man 2 years post stroke.

Methods: A descriptive case study design was used to evaluate UL function pre and post intervention using the Action Research Arm Test (ARAT) and two emerging measures Dynamic Computerised hand Dynamometry (DCD) and the Upper Limb Performance Analysis (ULPA): Comparative Analysis of Performance-Motor (CAP-M). Post BTX-A outcomes were completed 4 weeks post injection and pregabalin measures 2 weeks after starting the drug with a intervening washout period.

Results: UL function was consistent prior to each intervention as measured by the ARAT (pre BTX-A ARAT total score=17/57 and pre-pregabalin=16/57). Performance on the ARAT improved following both interventions, however the change was not in a consistent pattern, with greater change noted following BTX-A injection (BTX-A=25/57; pregabalin=18/57). Following BTX-A injection UL performance on the ARAT improvement in performance was particularly noted on the grasp, grip and pinch sub-tests. Conversely, UL movement analysis using the ULPA CAP-M, produced greater improvements in the water pouring sub-test across all four tasks steps (Reach, Grasp, Transport and Release) for pregabalin compared to only the Release step for BTX-A.

Hand grasp and release as measured by DCD improved following both interventions. Grip strength increased following BTX-A injection from 8.3kg to 9.5kg post injection compared to 5.6kg to 6.1kg for pregabalin. BTX-A injection showed greater capacity than pregabalin to improve grip release (both speed of release and residual grip spasticity) and improve the extent of voluntary work/effort put toward the task.

Conclusions: This case study demonstrates the variable responses of adults with UL spasticity to pharmacological spasticity interventions. The difficulty in predicting the type and amount of change achieved with interventions may arise from interventions targeting a single aspect (positive UMN features) to a complex, multi-faceted motor/sensory-motor impairment. The need to measure and understand the UMN syndrome and the competing influences on UL function may assist clinicians to better predict clinical outcomes following spasticity management interventions.
Treatment of chronic non-fluent aphasia with rTMS combined with intensive speech therapy.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: In the early years, some publications have studied the application of repetitive transcranial magnetic stimulation (rTMS) in the treatment of aphasia. Here we present the results of a treatment protocol for patients with chronic non-fluent aphasia. This protocol combined rTMS with intensive speech therapy.

Methods: The program is aimed at patients with acquired brain injury chronic (> 6 months of injury) with non-fluent aphasia. The patients received 10 sessions combining rTMS treatment (20 minutes of stimulation frequency of 1 Hz, inhibitory, in the pars triangularis nondominant hemisphere) with intensive speech therapy for two hours. We have studied 20 patients that had completed this treatment, and we present the results before the treatment, after it, and the follow-up at two and six months. Average age: 57 ± 10.39, 13 men, 7 women, 15 motor aphasia and 5 global aphasia.

Results: None of the patients had significant adverse effects. An statistically significant improvement was observed in the Boston Naming Test (p = 0.001) and also grammatically (p = 0.018) after two weeks of treatment. This improvement was maintained after two and six months.

Conclusions: The treatment of aphasia with rTMS combined with intensive speech therapy is well tolerated by patients with non-fluent aphasia chronic phase, has few side effects and induces an improvement in various aspects of language, especially in nomination and grammaticality.
Oxidation-reduction potential (ORP) as a rapid, easy, and reliable biomarker for traumatic brain injury.

Status: Accepted Presentation type: Poster

Category: Technology – clinical research/applications

Author's preference: Poster

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Objectives: Assessing the extent of injury and prognosticating eventual outcome of patients with traumatic brain injury (TBI) using unbiased biomarkers has been a difficult goal to achieve. There are few current biomarkers and these rely on the arduous and interpretative use of immunoassays for detection. Because oxidative stress (OS) increases during TBI, a biomarker based on OS maybe a more readily accessible and reliable biomarker. Oxidation-reduction potential (ORP) is a measure of OS that represents the net balance between the potential activity of all known and unknown oxidants and reductants in a biological sample such as serum or plasm; providing a holistic assessment of the current state of the oxidant-reductant.

Methods: Data from a retrospective cohort of TBI patients admitted to one of two level I trauma centers in the Denver-metro area- between January 1, 2008 and December 31, 2012 (N=104) were used. TBI patients were identified through the trauma registry as having been assigned one or more of the diagnostic injury codes associated with traumatic brain injury based on the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)). TBI participants also had to have a head AIS score greater than or equal to two, and that score had to be the highest of all the AIS scores. ORP was measured in frozen plasma samples using the RedoxSYS Test. Whole blood was collected by venipuncture using heparinized Vacutainers. Samples were processed to plasma and stored frozen at -80°C. To measure ORP, 40 microliters of plasma were added to the sensor strip pre-inserted into the analyzer. All samples were run in duplicate.

Results: We observed three key results surrounding ORP as a potential biomarker: 1. ORP measures distinguished TBI severity (ISS scores), with patients scored at severe or profound (ISS > 16) having significantly higher ORP values than mild or moderate (ISS <16, p< 0.05); 2. Combining the emergency room probability of survival with ORP, the ICU length of stay could be estimated based on multiple regression analysis. For every increase in ORP by 10mv and 5% increase in survival probability, there was an expected decrease in ICU stay of 37 hours; and 3. The combined prognostic power of ORP and age predicted hospital discharge with an 89.3% sensitivity; comparable with the measures of serum-based tau.

Conclusions: ORP was able to identify TBI patients based on ISS scores and to forecast hospital discharge. Based on these findings, it can be concluded that ORP is a rapid, easy, and reliable biomarker for severity and outcome in TBI patients. Because measures of ORP can distinguish between injury severities, it may also be possible to use it to assess the efficacy of the several antioxidant treatments that are currently under investigation.
0371

**Acute posterior fossa subdural hematoma secondary to vertebral artery dissection on a pre-existing generalized posterior circulation dolichoectasia, A multidisciplinary therapeutic challenge**

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Dolichoectasia of the posterior circulation is a challenging entity due to its vague natural history and difficulty in establishing a systemic recommendation ofr treatment.

With this inherent difficulty in mind, we present a severe TBI patient who is 67-years of age known diabetic and hypertensive; who was a pedestrian hit by a car. His initial GCS was 7 and he was intubated. His initial CT scan showed a large compressive subdural hematoma in the posterior fossa not associated with a fracture. This triggered obtaining a CT angiogram that showed an abrupt change in the caliber of the left vertebral artery along with a small arteriovenous malformation in the left cerebellar tonsil. He underwent an emergency posterior fossa craniotomy to evacuate the hematoma. The patient was submitted to a formal DSA angiogram confirming the findings of the CTA.

Within 3 weeks, the patient suffered a second bleed in subdural space, for which the patient was submitted to a therapeutic endovascular occlusion of the left vertebral artery at V3-V4 junction.

6 weeks later he suffered another bleed, CTA at the time showed reconstitution of the flow in V4 segment via muscular branches transdurally.

We were out of options as our access endovascularly was blocked by the vessel occlusion plug and the presence unfavorable anatomy of the right vertebral artery. In addition, the patient was in poor neurological condition precluding any justification for a surgical intervention. He was declared palliative and died several weeks later.

This case illustrate the difficulty faced by vascular and endovascular neurosurgeons treating such a complex pathology as thrombosis and hemorrhage are weighed against each other for each decision one undertakes. This emphasizes the importance of a strong multi-disciplinary collaboration to better serve these patients with these complex and unforgiving pathologies.
Technology and Rehabilitation. The use of social network in people with Traumatic Brain Injury (TBI)

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Background: Information and communications technology (ICT) has an important role in the diagnosis and treatment of patients with TBI, as well as in stimulation and rehabilitation.

Objectives: To explore the impact of the use of social network in the process of rehabilitation in patients with Traumatic Brain Injury.

Methods: The project was developed within a group intervention, one hour per week, during three months. A Facebook group was created, and the patients were trained in search strategies and written publications. Specific tools were designed, to allow gathering qualitative data about the perception of patients on the use of technological tools, in relation to its importance and significance in everyday life. Furthermore, quantitative information was collected about how participants use the computer and their ability to perform in the specific task.

Results: During the activities related with the ICT, participants’ commitment and motivation has increased. The generalization of these tools in other areas was limited, requiring persistent support by professionals and personal assistants, denoting the limited incorporation of its use in everyday life independently, as a result of the difficulties to follow steps in the task. On the contrary, when individuals received the proper assistance, they participated and discussed assertively based on information sources.

Conclusions: A high level of motivation and interaction, progressively increased from ICT use, has been reported. Therefore, in order to continue the project and to facilitate an independent performance, continued support and training is required. That being said, to include the use of ICT during the process of rehabilitation for people with TBI, contributes to increase patient's motivation and participation.
Mortality Secondary to Accidental Poisoning after Inpatient Rehabilitation for Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: Poster

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Objectives: To compare the characteristics of those who died due to an accidental poisoning (AP) compared to all other causes of death after moderate to severe traumatic brain injury (TBI).

Methods: A recent study using the TBI Model Systems National Database (TBIMS NDB) weighted to represent the US population of adults receiving inpatient rehabilitation for TBI, determined that individuals with TBI were 10 times more likely to die due to AP, compared to the general population. This study compared characteristics of those that died of AP versus other causes of death in the TBIMS NDB. AP was identified by cause of death reported on death certificates within the ICD-9 code range of E850 - E869.

Results: The TBIMS NDB contained 13,959 cases, with 1,791 deaths occurring after rehabilitation discharge, of which 63 deaths (3.5%) were due to AP. Average time from injury to death was 4.8 years. All of the following comparisons were statistically significant. Compared to those that died of other causes, those who died of AP were more likely to: be younger (mean age AP = 35 vs. 59), have received their TBI as a result of a vehicular crash (56% vs. 29%) versus a fall (19% vs. 49%), have had a more severe TBI (Glasgow Coma Scale = Severe or Sedated 61% vs. 35%), and have Medicaid as their payer for rehabilitation (49% vs. 20%) versus Medicare (5% vs. 42%). At the time of last known follow-up prior to death, those who died of AP were more likely to: be living with parent(s) (31% vs. 10%) or alone (27% vs. 16%), be unmarried (88% vs. 64%), report drug (37% vs. 7%) and problem substance use (49% vs. 12%), be unemployed (30% vs. 15%) versus retired (11% vs. 44%), have been arrested in the past year (22% vs. 4%). However, those that died of AP had better global functioning (Glasgow Outcome Scale - Extended Severe Disability 24% vs. 54%) and less disability (mean Disability Rating Scale 5.2 vs. 8.1). Eighty-eight percent of AP deaths were drug-related (with 57% of those due to analgesics, antipyretics, and antirheumatics type drugs), and 10% were due to alcohol.

Conclusions: Adults who received inpatient rehabilitation in the TBIMS and later died due to an AP were functioning more independently, but had compromised social and economic circumstances, compared to those that died of other causes.
Incidence and characteristics of post-traumatic hydrocephalus during inpatient rehabilitation

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Background: Post-traumatic hydrocephalus (PTH) is a significant, treatable sequela and complication of TBI, typically defined as active ventricular distention with disrupted cerebrospinal fluid (CSF) flow. PTH incidence during inpatient rehabilitation is estimated to be as high as 45%. Untreated PTH may limit rehabilitation progress and outcomes. CSF diversion may improve acute clinical status, neuroanatomic patency, and neurophysiologic function. Acute complications of shunting occur in 20-64% of cases. Research is needed to develop patient selection criteria for ventricular shunting during TBI recovery.

Objectives: This retrospective chart review sought to describe incidence, clinical characteristics, complications and outcomes of TBI patients diagnosed with clinically significant PTH in acute inpatient rehabilitation.

Methods: All patients admitted to Craig Hospital for TBI from 2009 to 2013 were evaluated. Hydrocephalus was identified by ICD-9 code, and confirmed by clinical medical record findings including ventriculomegaly, delayed clinical recovery discordant with injury severity, hydrocephalus symptoms, or positive CSF Tap Test. Comparative analyses were conducted between broad PTH and non-PTH groups, and between individual shunted and non-shunted PTH patients.

Results: Seven hundred and forty five TBI patients consecutively admitted to inpatient rehabilitation during the study period were evaluated. Fifty nine (8%) were diagnosed with PTH. Median age of PTH patients was 25 years, and 73% were male. At initial presentation, 52 (88%) did not follow commands, and median time from injury to rehabilitation admission was 67 days (range 19-309). Neuroimaging demonstrated midline shift (52%), cistern compression (83%), subarachnoid hemorrhage (83%), subdural fluid collection (71%), cortical contusions (97%) and subcortical injury (32%). During hospitalization, 59% received a ventriculostomy, 54% had an ICP bolt placed, and 64% underwent craniotomy or craniectomy. Fifty two (90%) of PTH patients received a ventriculoperitoneal shunt (VPS), which was placed during rehabilitation in 56% of cases. Median time from injury to shunt placement was 69 days (range, 9-366). Seven (12%) of PTH patients experienced post-surgical seizures. Among shunted patients, 3 (6%) had shunt infection and 7 (12%) a shunt malfunction. By rehabilitation discharge, 36 (61%) of PTH patients emerged from post-traumatic amnesia (PTA). Median total FIM score at rehabilitation admission was 20 (range, 18-76), and at discharge was 43 (range, 18-118). Median change in FIM score was +13 (range, -41 to +86). Median FIM scores were higher for non-PTH patients (admission 48, discharge 93).

Conclusions: TBI patients who developed clinically significant hydrocephalus were more severely disabled at initial presentation and rehabilitation admission, than those who did not. Of the PTH group, 88% received CSF shunts, and of these 6% had shunt infections and 7% shunt malfunctions. PTH patients had lower FIM total scores at rehabilitation discharge. Future studies should prospectively examine clinical decision rules, timing and type of intervention and effect of rehabilitation treatment and outcomes.
Identifying Spoken Politeness Markers Associated with Work Stability After Traumatic Brain Injury Using a Novel Role-Play Task

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Persons with traumatic brain injury (TBI) often have difficulty modifying spoken word choices within different social contexts¹ which affects work outcomes.² We examined frequency of word choices marking politeness when addressing persons of different social status in the work setting in unstably employed persons with TBI (UE), stably employed persons with TBI (SE), and neuro-typical controls.

Methods: Participants: We recruited forty participants with TBI, employed in Job Zone 3³ before injury and who attempted to return to Job Zone 3 work after injury and 13 neuro-typical controls who were employed in Job Zone 3 for >12 months. The TBI participants included a SE group who maintained work for >1 year after injury and an UE group who did not. There were no statistical differences between groups for age, sex, education, TBI severity, or time post onset.

Procedure: Participants completed a voicemail role-play task, recording messages for two status conditions (boss and subordinate). PMs were counted and PM/minute scores were calculated. PMs are word choices (e.g., modal verbs and adjuncts such as would/could, possibly, maybe) that modify speech by avoiding definiteness.⁴

Analysis: A mixed between-within ANOVA assessed relationships between groups (UE, SE, and controls) on PM/minute within two status conditions (boss vs. subordinate). Multiple paired t-tests with Bonferroni correction detected direction in PM/minute for status conditions within groups.

Results: There was no significant interaction between group and status. There was a strong main effect for status (p<0.01) and group (p<0.001). Tukey HSD tests demonstrated significant differences in PM/minute between all groups. UE (p<0.05), and SE (p<0.01) groups used significantly fewer PMs/minute for subordinates. The neuro-typical group did not.

Conclusions: There were associations with job stability after TBI in mid-level work and word choice using sociolinguistic analysis. Persons with TBI performed fewer PMs than controls at the same job level. Persons with TBI used fewer PMs when speaking to subordinates.

Discussion: The voicemail task analysis distinguished job stability and instability in a group of adults with TBI. Consistent with sociolinguistic analysis of professional talk controls used more PMs for both statuses in a workplace context.⁵ Sociolinguistic approaches should be considered in developing assessments and treatments for vocational goals in TBI.


Hydrocephalus Predicts Outcome Following Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Background: Hydrocephalus is a frequent sequela of traumatic brain injury (TBI), and complication of related cranial surgery. Ventricle dilation and cerebral spinal fluid (CSF) derangement in post-traumatic hydrocephalus (PTH) are associated with gait and cognition deficits, seizures, and urinary incontinence. CSF shunting is the typical treatment. However, the role of PTH in overall patient outcome in TBI has not been well described.

Objectives: To assess the impact of hydrocephalus on outcome after TBI relative to other factors associated with recovery, during inpatient rehabilitation.

Methods: The study was a retrospective comparative analysis. All TBI patients admitted to Craig Hospital between 2009 and 2013 were evaluated for PTH, defined as: ventriculomegaly, hydrocephalus symptoms, delayed recovery disproportionate to injury severity, or positive Tap Test. Non-PTH patients included had available CT imaging, Glasgow Coma Scale motor (GCS\text{M}) scores at initial presentation, and enrollment in the Traumatic Brain Injury Model Systems (TBIMS) Database. Outcome measures were emergence and duration of post-traumatic amnesia (PTA), and rehabilitation Functional Independence Measure (FIM).

Results: Two hundred and sixty three TBI patients were included in the analysis, of whom 59 met clinical criteria for PTH. Median age was 30 years (range 16-73), and 73% were male. PTH was associated with initial failure to follow commands, longer time from injury to rehabilitation admission, midline shift or cistern compression, and craniotomy or craniectomy. Hydrocephalus patients had lower median total FIM scores at rehabilitation admission (20, PTH vs. 55, no-PTH, p<0.001), discharge (43, PTH vs. 114, no-PTH, p<0.001), lesser median improvement in FIM (+13, PTH vs. +48, no-PTH, p<0.001), less frequent emergence from PTA (61%, PTH vs. 92% no-PTH, p<0.001) and longer median PTA duration (122 days, PTH vs. 15 days, no-PTH, p<0.001). Findings were similar in subsets of patients with initial GCS\text{M}<6, and those who underwent cranial surgery. Earlier shunting was associated with higher FIM scores and shorter duration of PTA. In multivariate analyses, predictors of failure to emerge from PTA were PTH (AOR, 5.24; 95% CI, 2.46-11.11; p<0.001) and GCS\text{M}<6 at presentation (AOR 16.15; 95% CI, 2.14-121.96; p=0.007). Predictors of lower FIM score at rehabilitation discharge were PTH, GCS\text{M}<6 and longer time from injury to rehabilitation admission. PTH accounted for a 29-point reduction in FIM total score (95% CI, -21 to -37 points; p<0.001). Predictors of longer PTA were PTH, GCS\text{M}<6, craniotomy or craniectomy, and days from injury to rehabilitation admission. PTH accounted for 71 days of PTA duration (95% CI, 58 to 84 days, p<0.001).

Conclusions: Post-traumatic hydrocephalus predicts worse outcome during inpatient rehabilitation, with lower FIM scores at admission and discharge, less FIM improvement, and longer PTA duration. Earlier shunting was associated with improved recovery. Additional study on timing of diagnosis and CSF diversion for PTH is warranted.
Transcranial Doppler Circulation Arrest in the Initial Evaluation of Severe Traumatic Brain Injury Presenting With Brainstem Dysfunction, Therapeutic Implication

Objectives: Timely transport of traumatic brain injury victims could prove challenging in certain health systems and in special circumstances. Delays beyond the golden hour are detrimental to the outcome of these vulnerable patients. Facing a young patient suffering from TBI but exhibiting signs of brainstem dysfunction constitutes a dilemma especially if the injury occurred several hours earlier; where futility is a major concern.

Methods: To alleviate some of this subjectivity, we employed transcranial Doppler to allow a baseline indicator for future outcome of these patients if and whenever escalation of therapy was decided.

In 18 months, we faced 12 such patients, where post resuscitation GCS was 3 and they show no pupillary response. Transcranial Doppler was performed in all patients in the ER upon resuscitation and prior to transfer to the operating room. All patients were rushed into an emergency surgery so evacuate the hemorrhages leading to high ICP.

Results: There were 5 patients with maintained cerebral circulation. 1 of these patients died, another survived in a minimally conscious state, a third in persistent vegetative state and 2 were discharged home and integrated well with their families.

7 patients had evidence of circulation arrest. Of those 2 survived and were discharged home with their families. In both patients, although there was a circulatory arrest in the MCA insonation, the flow was not reversed in the ophthalmic artery. The remaining 5 patients had both circulation arrest and flow reversal in the ophthalmic artery; denoting attempt to collateralize from the external carotid artery system. All these 5 patients died.

Conclusions: Although our sample size is small, it does draw us to note that not all clinical brainstem dysfunction denoted circulation arrest, and that not all cerebral circulation arrests are lethal. Understanding the cerebral flow dynamics in such a neurological extremes is important to objectify our treatment decisions and maintain fairness and justice to these patients whom a palliative approach is taken easily.
Perceptions of Motivation: Identifying Facilitators and Barriers to Engagement in Acquired Brain Injury Rehabilitation

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Poster

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Objectives: Lowered motivation to engage in rehabilitation is often a problem in individuals who have sustained an acquired brain injury (ABI; Schrijnemaekers et al., 2014). Furthermore, motivation is not a well-defined concept in ABI rehabilitation (Maclean & Pound, 2000). However, there is little research on how individuals with an ABI define motivation, and what impact it has on engaging in therapy. The present study aimed to investigate perceptions of motivation and facilitators and barriers to engagement in adult rehabilitation.

Methods: Participants were recruited from two ABI community centers in Hamilton, Ontario, Canada. Semi-structured interviews were conducted with participants where they were asked to discuss their experiences with rehabilitation related to their brain injury, and perceptions of motivation. Interviews were audio-recorded and then transcribed for analysis. Data was coded independently using Dedoose qualitative coding software to identify common themes by two raters. The raters then met to resolve any discrepancies in themes.

Results: Twenty-one adults (85.7% male) were interviewed. Participants had a mean age of 47.7 (SD=9.9) and a mean time since injury of 18.5 years (SD=12.4). Fourteen participants had a traumatic brain injury (66.7%), while the remaining participants had a non-traumatic brain injury. Three major themes emerged to illustrate motivation in ABI rehabilitation. Theme 1: Motivation is Internal and External; Theme 2: Choice and Control Improves Engagement, and Theme 3: Characteristics of Rehabilitation make it Motivating.

Conclusions: The present study provides new information on the concept of motivation in individuals with an ABI, and how it impacts engagement in adult rehabilitation. Our study shows that motivation can have positive or negative internal or external factors, and any combination of these can impact engagement. It is important that clinicians understand the crucial role choice and control has in facilitating engagement. It is also important to recognize that certain therapy characteristics can make rehabilitation less engaging. Future research should identify to what degree changing these characteristics impacts engagement in rehabilitation, and how choice and control affects interest in therapy.
0379

Blunt cerebrovascular injury, implication of initial assessment and long term follow up in the Saudi health system

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: Blunt cerebrovascular injury is a rare and potentially devastating event. When missed, it carries a high risk for morbidity and mortality.

Methods: We review a series of cases that presented to our hospital over an 18-month-period whether in the acute event or in a delayed fashion.

Results: 3 patients were diagnosed immediately after their trauma and appropriate antiplatelet were administered with resolution of all dissections in 3 months. 4 other patients presented in a late fashion, 1 picked on imaging for a pulsatile mass and 3 presented with hemorrhagic events. Of those 3 patients, 1 was treated with endovascular coiling and 2 others died of exsanguinations.

Conclusions: From this review we realize the need for more rigorous evaluation in the initial setting where a suspected blunt cerebrovascular injury must be fully investigated and thoroughly followed up to avoid such a devastating outcome to young and productive members of society
Objectives: Characterize functional connectivity by four networks for Vegetative (VS) and Minimally Conscious (MCS) states relative to neurobehavioral function (NBF) and clinically meaningful improvement in NBF.

Methods: Eight TBI participants were clinically classified as VS or MCS using current clinical criteria at study baseline and 4-week endpoint. At same time points, NBF was evaluated with the Disorders of Consciousness Scale (DOCS25) and neural connectivity was evaluated using resting state functional connectivity (fcMRI) sequences.

All participants were stratified by baseline clinical classifications (VS = 3; MCS = 5). Baseline DOCS25 means were compared using t-tests. Associations between mean network values and DOCS-25 measures were compared, by group, using correlations.

Next, we stratified the sample (n = 8) according to whether or not a DOCS25 minimally clinically important difference (MCID) of at least 6.6 was achieved between baseline and endpoint. We compared mean network values between MCID groups using t-tests.

Results: MCS group (n = 5) had significantly higher DOCS25 compared to VS (n = 3) (VS = 50.6, SD = 6.5; MCS = 63.4, SD = 5.6; p = 0.025). There was no difference, within any network, between VS and MCS groups. Functional connectivity values between Attention and the other networks were, however, significantly stronger for the MCS group (p < 0.05; Attention-DMN: .06 and .59; Attention-Language: .18 and .48; Attention-Salience: -.03 and .21). Correlations between mean fcMRI network values and DOCS25 measures, by group, indicates that VS had positive and MCS had negative DOCS25 associations (e.g., MCS: Attention-Language and DOCS25 r = -.56; VS: Attention-Salience and DOCS25 r = .89). That is, higher DOCS25 measures, within the MCS group, are related to less functional connectivity for all network combinations. Similarly, higher DOCS 25 measures, within the VS group, are related to more functional connectivity for all network combinations.

Participants making a DOCS25 gain of at least 6.6 (n = 4), compared to those not exceeding 6.6 (n = 4), had significantly greater mean network values between Attention-Language (mean correlations: .55 and .27; p = 0.026) and significantly greater mean network values within the DMN (.33 and .24; p = 0.043), Salience (.42 and .29; p = 0.025) and Language (.42 and .29; p = 0.043) networks.

Conclusions: MCS patients had stronger functional connectivity between the Attention network and three networks supporting arousal and awareness. Participants making clinically meaningful DOCS25 change had greater functional connectivity between Attention and Language networks and within DMN, Salience and Language networks.
Isn't It Time That We Concern Ourselves With The Role Of Parent Post-TBI? Practical Implications Following A Case Report With A Father

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Despite the complexity involved in assuming a parenting role following a traumatic brain injury (TBI), to our knowledge, there is no assessment that documents the repercussions of executive functioning on newborn parenting. In Québec (Canada), "Parents Plus" is the only specialized clinic designed for adults with motor or neurological impairments having significant limitations with their newborn parenting role. The objectives of this case report were to (1) identify the difficulties encountered by a father with severe TBI while accomplishing everyday parenting tasks with his baby, (2) identify the parenting tasks that could be accomplished by the participant with adapted equipment to compensate for physical deficits and verbal assistance for cognitive deficits.

Methods: The subject's ability to care for his newborn baby was tested with a modified version of the Activities of Daily Living Profile (ADL Profile). The ADL Profile is a standardized, valid and reliable performance-based measure of independence in everyday activities for individuals with TBI. Administered within the person's home environment and using a non-structured testing approach, performance is scored on the basis of the person's ability to formulate goals, plan, carry out the task, and verify goal attainment. The parenting version of the ADL Profile involves observing the parent spontaneously interacting with his baby, in tasks such as feeding, bathing, and dressing. The assessment was video recorded and supervised by two occupational therapists and a researcher in occupational therapy.

Results: The participant, who had sustained a severe TBI 3 years earlier, was a 36-year-old father with a 3-month-old baby. To compensate for his physical difficulties, the participant has been provided adapted parenting equipment prior to the evaluation with the ADL Profile. Performance-based observations revealed that the participant was dependent for all tasks and operations. Notably, he was not able to recognize and respond to his baby's needs in a timely manner. The participant demonstrated poor ability to initiate and plan regular child-care activities and was unable to problem solve and adjust to somewhat unpredictable situations with his baby. Three practical implications were formulated: (1) the unstructured approach of ADL Profile permitted the observation of important cognitive difficulties encountered during childcare activities; (2) specialized equipment provided by the “Parents Plus” clinic enhanced this father's opportunity to safely interact with his baby; (3) increased feelings of parental self-efficacy were observed within the safe evaluation context.

Conclusions: Our initial results indicate that the modified ADL Profile shows much promise for future rehabilitation assessments and interventions with parents with diagnosed or suspected cognitive disabilities such as after a TBI. An ecological unstructured assessment adapted to the reality of parenting tasks may reveal difficulties otherwise undiscovered. Moreover, the sense of empowerment observed following such assessments should be further investigated.
Mdivi-1 Prevents Neuron Apoptosis Induced by Ischemia-Reperfusion Injury in Primary Hippocampal Cells via Maintenance of Mitochondrial Homeostasis

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Cerebral ischemia-reperfusion (I/R) process involves a complex, coordinated effort pairing a nuclear signal and followed by a mitochondrial response. Mitochondrial homeostasis disruption includes mitochondrial dynamic imbalance, dysfunction and bioenergetic deficiency, which plays a critical role in the pathogenesis of cerebral (I/R) injury. Since morphology influences function and biogenesis, morphological stability plays a crucial role in the three deleterious events mentioned above. Mitochondrial division inhibitor (Mdivi-1) is a selective inhibitor of mitochondrial fission protein dynamin-related protein1 (Drp1). The effect of Mdivi-1 on mitochondrial homeostasis undergoing in I/R condition has not been well investigated and the precise mechanisms is still largely unknown. In the present study, we constructed an in vitro I/R model using primary cultured hippocampal cells, which were ischemic for 6 hours and followed by reperfusion for 20 hours and examined the direct protective effect of mdivi-1 on mitochondrial morphology stability using Mito Tracker staining, as well as mitofusin 2 (Mfn2) and dynamin-related protein1 (Drp1) expression. Using different approaches we found that inhibiting mitochondrial division by mdivi-1 attenuates mitochondrial functional and structural defects, increases ATP production and, decreases ROS levels and cytcC expression. In addition, western blot analysis of the important factors associated with mitochondrial biogenesis indicated an activation of PGC-1α/NRF-1/TFAM signal pathway in mdivi-1 pretreated I/R injury. Our results suggested that reperfusion-induced neuron apoptosis was prevented by mdivi-1 through rescuing mitochondrial dynamic defect, promoting mitochondrial biogenesis and attenuating aberrant mitochondrial function. This effect may be related to up-regulation of critical transcriptional regulators of mitochondrial homeostasis.
Normative Data for the Post-Concussion Scale in High School Girls

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: The purpose of this study is to provide comprehensive normative data for the Post-Concussion Scale (PCS) for female high school athletes with and without pre-existing conditions, including learning disabilities, attention deficit hyperactivity disorder (ADHD), academic problems (i.e., special education classes and/or failing a grade), headaches, migraines, prior concussions, and history of psychiatric treatment, substance abuse treatment, and concussion.

Methods: Participants in this multi-year, cross-sectional, descriptive, cohort study were 19,785 adolescent female student athletes from Maine, USA, between the ages of 13 and 18, who completed baseline preseason testing with ImPACT® between 2009 and 2014. Students were excluded if: (1) they reported sustaining a concussion within the past 6 months (n=475), (2) they reported a history of treatment for epilepsy/seizures (n=191) or meningitis (n=83), or reported undergoing brain surgery (n=29), or (3) the language in which they completed the test was not English (n=263). The final sample included 17,860 girls (90.3% of the original sample), 15.4 years old on average (SD=1.2). All participants completed a background and health history questionnaire, and baseline neurocognitive testing, prior to participating in their first sport for that school year (some students participated in several sports during the year). The health survey asked whether they have had “problems with ADD/hyperactivity,” been diagnosed with a learning disability, received special education services, or received treatment for headaches, migraines, prior concussions, and psychiatric conditions. The Post-Concussion Scale (PCS) is a standardized self-report inventory that includes 22 symptoms that are rated from zero to six, with 1-2 being mild, 3-4 being moderate, and 5-6 being severe.

Results: The internal consistency reliability of the scale for the total sample and across subgroups ranged from 0.84 to 0.93. Normative tables including means, medians (Md), SDs, interquartile ranges (IQR), and 95th percentile and 98th percentile cutoffs were constructed for the total sample, those with no pre-existing conditions, and stratified for subgroups. Girls with no pre-existing conditions had low baseline total scores on the PCS (Md=2, IQR=0-6) compared to girls with ADHD (Md=8, IQR=2-20), learning disabilities (Md=7, IQR=1-18), a history of migraines (Md=7, IQR=2-16), or a history of treatment for a psychiatric problem (Md=10, IQR=3-23). There was a linear increase in total scores associated with a history of 1 (Md=4), 2 (Md=6), 3 (Md=7), and 4 or more prior concussions (Md=11). The greatest baseline total scores were obtained for girls with more than one pre-existing condition, such as ADHD and headaches/migraines (Md=16.5, IQR=5-30) or ADHD and prior psychiatric treatment (Md=18, IQR=4-31).

Conclusions: High school girls with pre-existing conditions are expected to have higher baseline scores on the PCS. Use of gender and health condition stratified norms will facilitate a more sophisticated interpretation of this test.
Exploring Neurobehavioral Symptoms in Women with Remote Mild Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: It is known that individuals with mild traumatic brain injury (mTBI) can experience physical, cognitive and emotional symptoms for years after their injuries (Sterr et al., 2006). Research has also shown that there are sex-based differences in recovery from TBI, with women faring worse when compared to men in cognitive, physical and emotional outcomes (Farace & Alves, 2000). The body of literature in this area includes study samples with a wide range of TBI severity levels, but little is known specifically about the long-term outcomes for women with remote mTBI who return to their previous level of functioning. The purpose of this study was to examine neurobehavioral outcomes and sleep quality between a group of adult women with remote mTBI and a healthy comparison group. The individuals included in this study were community-dwelling women who had returned to a reportedly high level of independence and functioning an average of 10 years after their injuries.

Methods: Participants were 17 women with a history of remote mTBI and 24 uninjured women. As part of a larger study examining cognitive-communication after mTBI, participants completed the Neurobehavioral Symptom Inventory (NSI) and the Pittsburgh Sleep Quality Index (PSQI). To determine if participants with TBI were still symptomatic, we compared NSI and PSQI scores between groups. We also correlated subjective measures with individual injury factors (e.g. number of TBI events, time post-injury), to determine if timing and number of injuries affected subjective outcomes.

Results: There were significant between-group differences in NSI scores (p=.002) and PSQI scores (p=.002), with the mTBI group reporting more neurobehavioral symptoms and poorer sleep quality. In addition, there was a strong correlation (r=.69, p<.01) between number of TBI events and NSI scores, a moderate correlation (r=.35, p<.05) between years post-TBI and NSI scores, a weak correlation between sleep quality (r=.30, p<.05) and number of TBI events and a moderate correlation between sleep quality and NSI scores, particularly for NSI total (r=.35, p<.05) and affective scale scores (r=.46, p<.001).

Conclusions: An average of 10 years post-injury, women with TBI continued to report neurobehavioral symptoms and poor sleep quality, which indicates that these symptoms merit attention even in the chronic stage after mTBI. Reports of subjective symptoms are clinically relevant, as they may impact outcomes such as cognitive performance and community participation.
Adolescent Concussion: Symptom Analysis after Cognitive Challenge

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: The purpose of this analysis was to examine whether the completion of a computer-based neurocognitive test, as a cognitive challenge, would elicit worsening symptoms in adolescents who have sustained a concussion.

Background: Current pediatric practice guidelines for return-to-play and return-to-school are a product of an expert panel of the 4th International Conference on Concussion in Sport (Zurich, 2012). Although not grounded in evidence, more so in concern for the growing pediatric brain, these conservative guidelines emphasize “cognitive rest” as an early intervention in recovery due to the complex pathophysiological and biochemical processes of this mild traumatic brain injury.

Methods: Study Design and Protocol: This exploratory investigation is a secondary analysis of an established dataset. Individuals who sustained a concussion and agreed to participate in the original study completed computer-based demographics, a pre-symptom analysis, the neurocognitive test (ImPACT®), and concluded with a post-symptom analysis. A random sample contained 120 de-identified predominantly Caucasian (80%) male and females (50% distribution) aged 14-18 years with the majority representing the 8th and 9th grade (60%). Sports most commonly and equally represented in both genders included lacrosse (36.5%) and soccer (18.3%), in addition to softball in females (12.2%). Data Analysis: Descriptive statistics, parametric and nonparametric related group analysis were performed. When analyzing pre- and post total symptom score differences, nonparametric procedures (Wilcoxon signed ranks test) were utilized to accommodate the resulting non-normal data.

Results: There was no significant difference between gender in relation to age, days since injury, or number of concussions. However, primary sport did yield statistical significance (p<.05) as males participated in more contact sports. The difference between pre- and post- scores showed no statistical significance at the total symptom score level (p=.068). However, closer examination showed significance (p<.05) in increased individual symptom scores pre- and post-completion of the cognitive challenge, for headache (mean=.158), dizziness (mean=.175), fatigue (mean=.333), and memory (mean=.267). Further examination of the change in total symptom score illustrated clear variability in individual results, showing some participants improved, while others worsened.

Conclusions: Despite the assumption that the cognitive challenge would elicit worsening symptomatology in all participants, dramatic variability was seen. Details regarding the study limitations, these results, and their application to current “cognitive rest” practice guidelines will be further described.
Diffusion Tensor Imaging Utility in Predicting Neuropsychological Performance in Mild Traumatic Brain Injury: Evidence of White Matter tract degeneration

Status: Accepted Presentation type: Oral

Category: Technology – clinical research/applications

Author's preference: Oral

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Objectives: To explore the prognostic value of diffusion tensor imaging (DTI) as a reliable imaging biomarker in predicting outcome in mild traumatic brain injury (mTBI) and microscopic structural alteration.

Methods: 61 patients with mTBI were prospectively recruited and scanned within an average 10 hours post trauma with assessment of their neuropsychological performance post full GCS recovery. A combined Tract Based Spatial Statistics (TBSS) anal and Region of Interest (ROI) analysis were used to process the DTI data (FA, MD, AD and RD). Results were then compared to 30 healthy control participants, both in the acute stage and 6 months post trauma. The differences between the groups (complicated versus uncomplicated) in terms of their neuropsychological performance and the nature of their WM integrity were established.

Results: Significant mean differences with mostly upward score trends were observed among patients with complicated mTBI in the domains of attention (M= -9.15, SD= 13.62, p= .007, d= .672), executive function (M= -10.4, SD= 16.07, p=.009, d= .647) and overall performance (M= -5.4, SD= 7.47, p= .004, d= .723) over time. The DTI and neuropsychological measures between acute and follow-up phases were compared and significant differences emerged, especially in the association and projection fibers. Evidence of axonal demyelination and axonal scarring possibly due to edematous processes and reactive astrogliosis were observed.

Conclusions: Our results provide new evidence for the use of DTI as an imaging biomarker and indicator of white matter damage occurring in the context of mTBI, and they underscore the dynamic nature of brain injury and possible biologic basis of chronic neurocognitive alterations.
Zbb-1 stabilized cx43 of astrocytes in ischemic stroke to facilitate neuronal recovery

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Objectives: Stroke is a type of worldwide cerebrovascular accident with high morbidity. The clinic reports of stroke are mainly associated with ischemic stroke, which would cause disturbance by neuroprotective reagents, there is hardly any effective medication could be taken as therapeutic strategy. Astrocytes, the dominant types of cells in central nervous system, perform significant of blood supply in brain, culminating in loss of brain functions. Except for thrombolytics followed roles in neurodegenerative disease and stroke. It is found that brain functions of many ischemic stroke patients could be improved to some extent probably via both neuronal and astroglial recovery. It is essential to illustrate roles of astrocytes in neuronal recovery, which could pave the way for therapeutic strategies of ischemic stroke.

Methods: Oxygen-glucose deprivation and recovery (OGD/R) was utilized to simulate ischemic stroke in vitro. The potential mechanisms of pathological changes in astrocytes treated with OGD/R was investigated. For the further downstream effect on astrocytes caused by OGD/R with administration of ZBB-1, analog of triptolide with novel structure and overexpression or RNAi Cx43. The neuronal growth was detected with mixed culture of astrocytes and cortical neurons. The middle cerebral artery occlusion (MCAO) model rats were utilized to simulate ischemic stroke in vivo. Immunocytochemical staining and western blot assay were used to detect the expression changes of Cx43 and Ephrin-A4 in astrocytes and related changes in vivo of astrocytes and neurons during ischemic stroke and administration ZBB-1.

Results: The upregulated Ephrin-A4 in astrocytes retarded growth of neurons cocultured with astrocytes treated with OGD/RP. Overexpression of Cx43 in astrocytes could ameliorate the morphological changes caused by OGD/RP. Administration ZBB-1 and overexpression of Cx43 could suppress the upregulation of Ephrin-A4 caused by OGD/RP, and the growth of neurons cocultured with astrocytes was improved. The correlation between downregulation of Cx43 and upregulation of Ephrin-A4 was also found in brain of middle cerebral artery occlusion (MCAO) rat after 24 hours of reperfusion, meanwhile the astrocytes demarcated area of neuronal growth. After period of recovery, Cx43 and Ephrin-A4 in astrocytes adjacent to infarct area were tuned back to normal status. Moreover, the neuronal growth broke through the demarcation of astrocytes.

Conclusions: ZBB-1 could stabilize Cx43 on astrocytes and facilitate them resisting deleterious effects of stroke induced brain injury to promote neuronal recovery.
The role of active astrocytes in the repair of neurovascular networks in adult rats after ischemic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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The role of active astrocytes in the repair of neurovascular networks in adult rats after ischemic brain injury

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Objectives: Neurovascular unit mainly includes neuron, astrocytes and vascular endothelial cells. Brain functional repair after injury depends on the reconstruction of neurovascular network. Ischemic injury induces neurogenesis in 'non-neurogenic' regions of adult brain. Such neurogenic effects can be enhanced by VEGF, a vascular biological factor. Besides, Ischemic brain injury can trigger reactive astrocytes to transdifferentiate into neurons. In the present study, we investigate the role of astrocytes in the reconstruction of neurovascular networks in brain repair after ischemic injury.

Methods: We injected a pGfa2-eGFP plasmid driven by the glial fibrillary acidic protein (GFAP) promoter into the striatum of adult rats following a transient middle cerebral artery occlusion (MCAO) and trace the fates of eGFP-expressing (GFP+) reactive astrocytes with immunolabeled specific neuronal markers.

Results We found that part of striatal GFP+ reactive astrocytes transdifferentiate into immature neurons (GFP+-Tuj-1+) cells at 1 week after MCAO and mature neurons (GFP+-MAP-2+) at 2 weeks. Astrocyte-derived neurons further expressed glutamate and dopamine receptors. Electron microscopy analysis indicated that these GFP+ neurons could form synapses with other neurons. Electrophysiological recording further revealed that the action potentials and active postsynaptic currents could be recorded in the neuron-like GFP+ cells, but not in the astrocytes-like GFP+ cells, indicating that those newly neurons generated from GFP+ astrocytes possessed capacities of firing spikes and receiving synaptic inputs. Putting together, striatal astrocytes-derived new neurons participated the rebuilding of functional neural networks, which is the fundamental basis for brain repair after injury. Moreover, VEGF increased newborn neurons in the non-neurogenic regions of rat brain after MCAO and also promoted transdifferentiation of striatal reactive astrocytes into mature neurons. Inhibition of reactive astrocytes by fluorocitrate could significantly reduce ischemia-induced neurogenesis and VEGF-enhanced neurogenic effects in the brains after MCAO. Therefore, VEGF-mediated increase of newly derived neurons is dependent on the presence of reactive astrocytes.

Conclusions: The results suggest that the resident reactive astrocytes responding to injury may play fundamental roles in the reconstruction of neurovascular networks in non-neurogenic regions of mammalian adult brains after injury.
We report a case of a premorbidly healthy and independent 85 year-old Indian male who suffered a Traumatic Brain Injury (TBI) after an accidental fall at home. There was loss of consciousness for less than 10 minutes. Glasgow Coma Scale was 15 on arrival at Emergency Department. Computed Tomography (CT) scan of the brain showed subdural haemorrhages (SDH). Post-Traumatic Amnesia was more than 24 hours and he developed seizures after 48 hours post-TBI, requiring admission to Intensive Care Unit (ICU). SDH was conservatively managed at first and main treatment objective was physical rehabilitation due to deconditioning as a result of hospitalization. However, SDH continued to progress and required surgical evacuation 1 month later. A second readmission to hospital occurred another month later where he complained of a pain in his leg that disrupted his sleep. A neurological, medical and general psychiatric assessment did not reveal any clear etiology. He was eventually referred for a neuropsychiatric assessment more than 3 months after injury in view of behavioral changes causing significant caregiver distress. Interestingly, information obtained from patient and caregiver was discordant. The neuropsychiatric formulation included an anxiety disorder and a sleep disorder.

This case prompted a literature review that highlighted some key issues:

1) Older people are more likely to sustain TBI from falls and are at greater risk of sustaining SDH with seemingly minimal trauma.

2) SDH in the elderly can expand over an extended period beyond acute hospitalization and result in delayed clinical presentations, raising the question of risks versus benefits of early evacuation.

3) Successful rehabilitation of the elderly with TBI should expand beyond a focus on musculoskeletal rehabilitation, and require special attention to several age-related changes that present specific challenges in the neurocognitive and psychiatric domains.

4) Sleep disorders and sleep-wake disturbances are under-recognized in the elderly with TBI and are likely to have a large impact on the neuropsychiatric sequelae of TBI.

5) There are several pharmacological considerations when addressing neuropsychiatric sequelae of TBI in the elderly.
Implementation of an Early Mobilization Protocol for Patients with Acute Acquired Brain Injury

Status: Accepted Presentation type: Oral
Category: Neurorehabilitation – case reports/clinical research
Author's preference: No preference

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Objectives: There is mounting evidence supporting early rehabilitation in the Intensive Care Unit (ICU) for patients with neurological disorders. Early and intensive rehabilitation in stroke patients has been shown to improve functional outcome, although best timing and intensity remains controversial. Increased mobility in a neurointensive care unit can lead to decreased length of stay (LOS), decreased use of restraints, and decreased hospital acquired infections. As such, the aim of our study was to develop and implement a new protocol to expedite Physical and Occupational Therapy Consultation in the Neurosurgical Intensive Care Unit, and to monitor its effects on patient care.

Methods: General criteria for exclusion from mobility were developed based on literature review. A document was created for the neurosurgeon to be addressed on daily ICU rounds requiring determination whether and to what extent a patient was to be mobilized. Diagnoses treated between 1/1/2013 and 12/31/2014 included acquired brain injuries (ABI) requiring neurosurgical admission with or without surgical intervention. Only patients admitted to a single cerebrovascular neurosurgeon were evaluated in this pilot program.

Results: The protocol was feasible and easily implemented with no significant complications associated with early mobilization. After implementation of the mobilization protocol, the time from ICU admission to consult of rehabilitation services was dramatically reduced and continued to gradually decrease from ultimately 14.91 days to 4.64 days over the study period (March-December 2014). Over the same time frame, there was a substantial decrease in acute care length of stay and stabilization, as well as an improvement in expected length-of-stay index.

Conclusions: These results demonstrate that early mobilization of patients with ABI is associated with decrease lengths-of-stay in the acute setting and, in turn, have enormous financial impact for hospitals. Larger studies are needed to expand research involving all acute neurological conditions in the ICU setting.
Effects of Brain Derived Neurotrophic Factor (BDNF) Valine66Methionine (rs6265) on Neurocognitive Performance in Patients with Mild Traumatic Brain Injury

Status: Accepted Presentation type: Oral
Category: Neurotrauma – case reports/clinical research
Author's preference: Oral

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Objectives: To assess the possible effects and association of BDNF Val66Met polymorphism and neuropsychological performance among patients with mTBI.

Methods: 48 patients with mTBI were prospectively recruited and scanned within an average 10 hours post trauma with assessment of their neuropsychological performance post full GCS recovery. A whole blood sample (10 ml) was obtained from the patients and standard DNA extraction method was used. Neurocognitive assessments were repeated again at 6 months follow-up. The paired t-test, Cohen’s d effect size and repeated measure ANOVA were performed to delineate statistically significant differences between the groups (Val/Val vs. Met allele carriers) and their neuropsychological performance across the time point (T₁= baseline/ admission vs. T₂= 6th month follow-up).

Results: Met allele carriers in this study generally performed more poorly on neuropsychological testing in comparison Val/Val group at both time points. Significant mean differences were observed among the Val/ Val group in the domains of memory (M= -11.44, SD= 10.0, p= .01, d= 1.22), executive function (M= -11.56, SD= 11.7, p= .02, d= 1.05) and overall performance (M= -6.89 SD= 5.3, p= .00, d= 1.39), while the Met allele carriers showed significant mean differences in the domains of attention (M= -11.0, SD= 13.1, p= .00, d= .86) and overall cognitive performance (M= -5.25, SD= 8.1, p = .01, d= .66). The Met allele carriers in comparison to the Val/Val homozygous, showed considerably lower scores at admission and remained impaired in most domains across the timepoints, although delayed signs of recovery were noted to be significant in the domains attention and overall cognition.

Conclusions: We postulate that the patterns of delayed recovery or worsening of neurocognitive performance among the Met allele as seen in this study are due to the known role of BDNF Val66Met substitution in influencing neuro-regenesis and neurogenesis post trauma.
Outcomes of Vision Therapy for TBI Patients Treated by a Single Optometrist: A Retrospective Review of 145 Patients

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Traumatic Brain Injury (TBI) affects about 8 million people each year. As half of the cranial nerves contribute to vision, it is not surprising that the majority of TBI victims suffer visual problems.

Often overlooked, these untreated symptoms such as diplopia, blurred vision, dizziness, and light sensitivity make everyday activities including reading, driving, and sports very difficult. Cohen et al. found vergence function to be affected in more than 33% of TBI patients and 42% still had insufficient vergence three years post-injury. As awareness of the latter has increased, optometrists have received a greater role in treating these patients.

Binocular vision is the most common vision disorder seen after TBI. This study looks at binocular vision disorders secondary to concussions; it reviews the outcomes of a cohort of TBI patients who were treated by a single optometrist with in-office vision therapy.

Methods: A retrospective chart review of all TBI patients with vision problems who were referred to Red Apple Learning Center from 2013 to 2014 was performed. Age, sex, presenting symptoms, tests performed, therapy used, and therapy outcomes were analyzed.

Results: 145 patients met inclusion criteria. Age range was 9-72 years. 71 were male (48.9%) and 74 female (51.0%). Cause of concussion included automobile, work, and sports accidents. Patients attended an average of two 30-minute vision therapy sessions/week.

At initial evaluation, 46.2% had diplopia, 24.8% dizziness, and 12.4% both. Near point of convergence was tested both before therapy and after program completion (normal= 5 cm or < break point).

Step vergences were also measured, both base-out (normal 23 or >) and base-in (normal 12 or >), with a near target for each patient pre and post treatment.

43.4% of patients did not complete their prescribed program. In addition, 35.9% of patients were prescribed computer software for home vision therapy; only 9.6% completed the later.

7.4% had normal near point of convergence pre therapy, and 57.4% were normal post-therapy. 69.4% had normal near point of convergence when they completed the entire program. Only 39.5% who stopped therapy prematurely had normal convergence point.

Pre-treatment, 1.1% of patients had normal base-out value for step vergence. 26.2% were normal post-therapy. 14.7% of patients were in the normal range for base-in at the start, while 28.2% had normal values post-therapy.
**Conclusions:** This study supports that binocular vision disorders can be successfully treated with in-office vision therapy. Near point of convergence, which showed the greatest improvement of all areas tested, improved after vision therapy. Vision therapy can also improve base-out and base-in step vergences in TBI patients with a near target.
A population based study of sex-specific predictors of outcomes after inpatient rehabilitation for traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: To identify sex-specific predictors of inpatient rehabilitation length of stay (LOS), total Functional Independence Measure (FIM™) score, and motor and cognitive FIM™ rating at inpatient rehabilitation discharge among patients with traumatic brain injury (TBI).

Methods: A retrospective cohort study using population based healthcare administrative data from Ontario, Canada. Patients admitted to inpatient rehabilitation for a TBI within one year of acute care discharge between 2008/09 and 2011/12 in Ontario, Canada were identified by specified International Classification of Diseases Version 10 (ICD-10) codes. Sex-specific multivariate linear regressions were conducted to identify predictors of inpatient rehabilitation outcomes.

Results: Between fiscal years 2008/09 and 2011/12, there were 1,730 patients identified as receiving inpatient rehabilitation for a TBI after acute care in this sample (70% male, 30% female). The majority of females in inpatient rehabilitation were older adults aged 65 years and older (51.1%) compared to 32.2% of older males in inpatient rehabilitation. Overall for both males and females, older adults had significantly shorter rehabilitation length of stay (p<.0001) and lower total FIM score and cognitive and motor rating (p<.01) at discharge. The interaction between age and sex was not significant in predicting inpatient rehabilitation outcomes (p>.05), however, the interaction between comorbidities and sex was significant in predicting rehabilitation length of stay (p<.05). Sex-specific multivariate regressions showed that the predictors of rehabilitation outcomes differ by sex. Injury in a motor vehicle collision (p<.0001) was associated with an increase in functional outcome while lower income quintile (p<.05) was associated with decreased functional outcome for females only. Increasing number of comorbidities (p<.01) and availability of informal support (p<.05) was inversely related to functional outcome among males only.

Conclusions: The present data provide evidence in support of a sex-specific approach to research to improve rehabilitation outcomes in the TBI population. Health service planning and resource allocation must take into account sex differences, particularly as the TBI inpatient rehabilitation demographic shift form younger males to older females.
A Population Based Study of Homecare Use After Pediatric Traumatic Brain Injury: Who Uses Homecare Services, What Do They Use, and How Much Does It Cost?

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: To determine the sex-specific predictors, types, and cost of publicly funded homecare services within one year of acute care discharge among pediatrics aged 0 – 19 with a traumatic brain injury (TBI) in Ontario, Canada.

Methods: A retrospective cohort study using the Canadian Institute for Health Information Discharge Abstract Database (DAD) and the Home Care Database (HCD). Patients with a TBI in the DAD with specified International Classification of Diseases Version 10 (ICD-10) diagnostic codes were linked to the HCD to determine homecare use within 1-year of acute care discharge. Overall and sex-specific multivariable logistic regressions were conducted to identify predictors of homecare use.

Results: Among 5,494 pediatric patients with TBI discharged from acute care between fiscal years 2006/07 and 2011/12, 14.7% (N=810) used publicly funded homecare services. The total cost for publicly funded homecare services was $2.4 million for 19,315 homecare claims filed. Although 70% of these claims were made by males, the cost per individual was higher among females ($3,220.70 vs. $2,884.20). The most common types of homecare services used were nursing and homemaking/personal support. Overall, significant predictors of homecare use included males (p<.05), severe TBI (p<.001), longer acute care length of stay (p<.001), and special care days (p<.001). For males, younger age groups (p<.001), having 8 or more comorbidities (p<.05), and injury in a motor vehicle collision (p<.001) also significantly increased the odds of homecare use within 1-year of acute care discharge. For females, aged 5-9 years (p<.01) and having 11 or more comorbidities (p<.01) also significantly increased the odds of homecare use.

Conclusions: This paper presents comprehensive information on the predictors and types of homecare use by sex that can be used for appropriate planning and allocation of homecare services for pediatric male and female patients with a TBI.
The Effects of Maxillofacial Injury on White Matter Integrity and Neuropsychological Function in Patients with Mild TBI

Status: Accepted  Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: The aim of the study was to establish the incidence of maxillofacial (MF) injury accompanying mild head trauma (mTBI) and the associated neurocognitive deficits and white matter changes.

Methods: A prospective review of 61 patients with mTBI (with/without maxillofacial injury) due to motor vehicle accidents (MVA) who have completed their admission computed tomography (CT), neurocognitive evaluation, and quantitative diffusion tensor imaging protocol was performed during admission and at 6 months follow up. Descriptive statistics were used for demographics, while a paired t-test and repeated measure ANOVA were used to establish the intergroup differences and susceptibility.

Results: The patients in the study were relatively young adults, with a mean age of 28.01 (SD= 9.5) and 11.8 (SD=1.7) years of education. 67.2 % (n= 41) of these patients had maxillofacial injuries (soft tissue = 32.8 %, facial fractures =34.4%) accompanied with 68.3 % (n= 28) of them having intracranial abnormalities based on admission CT. The executive function and attention were significantly altered across the time points, with patients who had both MF injury and intracranial lesion doing poorly at baseline and improves 6 months later, whereas patients with no visible intracranial lesion but have had MF injuries remains impaired, with signs of slowed recovery. The fractional anisotropy (FA) of genu of corpus callosum, anterior limb of internal capsule and cingulum for patients with MF injuries but without intracranial lesion showed trends of reduced integrity over time.

Conclusions: The risk of altered executive function and attention is significant in patients with MF injury with accompanying mTBI. Further prospective study is needed to distinguish the trend of FA reduction in patients with MF injuries but without intracranial lesion.
Method Matters: Approach to Collecting Post-Concussion Symptoms Influences the Outcome

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: To compare open-ended symptom reporting to endorsement of symptoms on a standardized post-concussion questionnaire.

Methods: Seventy-four previously healthy adults with mild traumatic brain injuries (MTBI) between the ages of 18 and 60 years (mean age=37.0, SD=11.8; 39.2 % female) and 39 controls (with ankle injuries, mean age=40.1, SD=12.2; 50% female) completed a web-based survey at 1 and 12 months after injury. As part of this assessment, participants were asked to type in symptoms spontaneously (“Please type in symptoms that you have because of the injury”). Following this open-ended symptom query, participants completed the Rivermead Post Concussion Symptoms Questionnaire (RPCSQ). On the RPCSQ, participants rated the severity of each of 16 symptoms.

Results: At one month, the MTBI group reported an average of 1.3 symptoms (Md=1.0, SD=1.4, IQR=0-2.0) on the open-ended question. In contrast, when completing the questionnaire (i.e., RPCSQ), the MTBI group endorsed more symptoms (paired samples t test, t [73]=5.26, p< .001), with an average of 3.2 symptoms (Md=2.0, SD=3.6, IQR=0 - 5.0). At twelve months, the MTBI group reported an average of 0.64 symptoms (Md=0, SD=1.1, IQR=0-1.0) on the open-ended questionnaire and 2.3 symptoms (Md=0, SD=3.2, IQR=0-5.0) on RPCSQ (t [73]=4.73, p <.001). At one month, 34% of the MTBI group endorsed four or more symptoms on RPCSQ compared to only 6.8% reporting this many symptoms on the open-ended question. At twelve months, 31.7% of the MTBI patients reported four or more symptoms compared to only 3.4% reporting this number of symptoms on the open-ended question. The differences were more pronounced for the control group. The control group did not report any post-concussion-like symptoms on the open-ended question at 1 or 12 months. However, when completing the RPCSQ, the control group reported on average 1.8 symptoms (Md=1.0, SD=2.8, IQR=0-2.0) at one month and 1.5 symptoms (Md=0, SD=3.2, IQR=0-1.8) at 12 months. At one month and 12 months following injury, approximately 25% of the control sample endorsed two or more symptoms on the questionnaire.

Conclusions: Trauma control subjects did not endorse symptoms when asked an open-ended question relating to symptoms due to their injury. However, when filling out a questionnaire, they did endorse post-concussion-like symptoms. MTBI patients endorsed considerably fewer symptoms in an open-ended format compared to when symptom reporting was solicited by a questionnaire. Clinicians should acknowledge that method matters in the assessment of post-concussion symptomatology. Furthermore, this can have decisive effects on PCS diagnostics.
The Effects of Cognitive Rehabilitation In Improvement of Attention Deficits And Diffusion Tensor Imaging Findings Following Mild Traumatic Brain Injury (mTBI) - a preliminary report.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: This study is to evaluate the effectiveness of cognitive rehabilitation therapy in the alteration of neuropsychological performance and diffusion tensor imaging (DTI) parameters in mTBI patients.

Methods: An interventional study of 6 months duration with the application of Cognitive Intervention Protocol. It has three phases:

1) Assessment phase: The mTBI patients with normal computed tomography brain scan finding and had fulfilled inclusion criteria, underwent structural DTI scan within 10 hours post trauma and evaluated using Screening - Neuropsychological Assessment Battery (S-NAB Form 1) within two weeks of injury.

2) Treatment phase: Patient education session and self-monitoring of symptoms were implemented, followed by individualized cognitive therapy, based on baseline deficits of neurocognitive performance. Computerized therapeutic rehabilitative tools were used, along with customized patient items. Frequency of therapy is weekly with 3 months post injury review of progress by using S-NAB (Form 2).

3) Follow-up phase: At six months, all participants underwent repeat DTI MRI scan and S-NAB and the results compared with baseline.

Results: Thus far, 7 patients with mTBI (mean age 24.14, SD 5.84) in the treatment group underwent DTI scanning at an average of 12.1 hours (SD 4.84) with neuropsychological performance assessment at an average of 8.25 hours (SD 7.08) upon full GCS recovery. Results were compared to 15 mTBI controls (who received standard treatment with a mean age = 28.15, SD 5.84). Seven patients in the treatment group completed the 3 months individualized cognitive therapy with the remaining patients still undergoing therapy. 60% of these patients made significant progress at 3 months post intervention in attention, language and executive functioning domains. Stepwise improvement of neurocognitive performance at both 3 and 6 months post trauma are expected with corresponding recovery in few white matter tracts.

Conclusions: Individualized cognitive rehabilitation therapy intervention within the first 6 months of injury may improve cognitive outcome with favorable changes structurally assessed by DTI parameters in mTBI patients.
Temporary Impairment in Buffering Capacity of Cerebrovasculature to Rapid Blood Pressure Changes Following Sport-Related Concussion

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Cerebral blood flow alterations are thought to play a primary role in the pathophysiology of sport-related concussion, while impairments in cerebral autoregulation have been proposed as a contributing mechanism underlying second-impact-syndrome [1]. The cerebrovasculature behaves as a high-pass filter, whereby higher frequency blood pressure oscillations (>0.20 Hz) are linearly transferred to the cerebrovasculature, while lower frequency oscillations are buffered [2]. Very little is known to what extent the frequency-dependent relationship between blood pressure and cerebral blood flow is affected by clinically diagnosed sport-related concussion [3]. The objective of this research was to prospectively evaluate the effect of concussion on this dynamic pressure-flow relationship.

Methods: Pre-season testing (T0) of two elite hockey and football teams was completed, with additional testing for concussed athletes (n=8) at 72-hours (T1), 2-weeks (T2), and 1-month (T3) post-injury. Oscillations in mean arterial blood pressure were driven by 5-minute repetitive stand-squat manoeuvres at 0.05 and 0.10 Hz, a technique recently proposed as the ‘gold-standard’ for this research question [4]. Beat-to-beat blood pressure was measured using finger photoplethysmography, while cerebral blood flow velocity was recorded in the middle cerebral artery using transcranial Doppler ultrasound. Transfer function analysis was used to characterize the coherence (correlation metric), phase lead (timing offset), and gain (amplitude modulation) between blood pressure and cerebral blood velocity waveforms. Within-subject post-injury outcomes were compared to baseline measures.

Results: Average coherence values were not different across time points at either 0.05 Hz or 0.1 Hz. Gain values across time points were unchanged when compared to baseline. Examining the 0.10 Hz preliminary data suggested a trend for decreased phase lead at T1 (-15%, p=0.08) and T2 (-13%, p=0.10) that recovered to baseline values (phase lead = 0.513 radians) by T3 (+4%, p=0.79).

Conclusions: These phase alterations suggest a transient post-concussion impairment of the cerebrovasculature’s capacity to buffer blood pressure oscillations. That reductions in phase were only observed at 0.10 Hz in the acute post-injury stages suggests a shift in the high-pass filter behaviour of the cerebrovasculature towards a lower cut-off frequency (closer to 0.10 Hz). This renders the brain more vulnerable to rapid blood pressure changes. This is a key finding, and may help to explain why the brain is more vulnerable to additional trauma during the post-injury recovery period.

Using the OSU TBI-ID to Screen Older Individuals for Traumatic Brain Injury

Status: Accepted
Presentation type: Poster
Category: Neurorehabilitation – case reports/clinical research
Author's preference: Poster

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Objectives: The current project focused on the need for routine brain injury screenings for older adults, age 65 years and over. This population is at great risk for brain injury due to the increased risk of falls (Faul, Xu, Wald, Coronado, 2010), the common co-occurrence of other health conditions (e.g., Parkinson’s Disease, strokes, heart complications, etc.), and an increased risk of motor vehicle accidents. Therefore, it is of supreme importance that professionals screen for brain injury among this population.

Methods: For the current study, researchers educated and trained professionals working at Area Agency on Aging (AAA) offices about brain injury and the use of the Ohio State University Traumatic Brain Injury Identification screening tool (OSU TBI-ID). The professionals screened their new and existing clients for three months after the researcher-conducted training and education session. The researchers then developed a de-identified database using the demographic information and responses of the clients on the OSU TBI-ID screening form. This database expressed the clients’ demographic distributions, as well as how many clients were identified as having a positive screening for brain injury, and their severity level of the potential brain injury. This project was an extension of the pilot study conducted with one rural AAA region in Nebraska previously. For the current study, the researchers expanded the only slightly modified procedures used formerly, and educated, trained and gleaned data from three additional AAA regions in rural Nebraska.

Results: The preliminary results for the current study are as follows. From two sites, 454 individuals were screened, compared to 83 people in the pilot study. Data is still being collected at the final site. Of the 454 individuals screened thus far, 25% (113) had positive screens for a traumatic brain injury. The severity level, using the OSU TBI-ID is still being evaluated and will be reported. Additionally, of the people with positive screens, 24% (27) of them had incurred multiple TBIs.

Conclusions: Survivors of brain injury contend with many challenges subsequent to their injury. When individuals are identified as having a history of traumatic brain injury they are more likely to be educated about services of which they may be in need. These services and their consequent interventions are more likely to be delivered in a timely manner, and researchers have documented the importance of early intervention for people with disabilities (Bricker, 1986; Kaiser, 2000; Hallahan & Kauffman, 2003). Providing such services will likely benefit survivors of brain injury in the same manner (Hux, Schneider, Bennet, 2009). Professionals must be made aware of the available education and training about brain injury and specifically the use of an effective screening tool such as the OSU TBI-ID.
New approaches to understanding and treating empathy deficits following severe head injury

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: We set out to test psychological methods for improving empathy and emotional attunement in people with a severe head injury. There are very few effective psychological treatments for modifying empathy deficits following head injury and more data is needed to inform judgements about which techniques reliably produce benefits. We argue that there is a need to target specific emotional state factors that directly impede empathy and social functioning. For example, newer psychological interventions such as Compassion Focused Therapy (CFT) propose that response tendencies and information processing styles are substantially affected by the emotional state of the organism. These “social mentality” systems can become dysregulated following head injury resulting in an overactivation of threat-based processing. One aim of CFT is to train techniques that activate the affiliative and attachment based mental states that underpin more empathic modes of processing. Based on encouraging pilot data, we tested the effects of a single session compassionate imagery intervention and measured outcomes in psychological and physiological domains.

Methods: Twenty-two people with severe head injury were recruited from community and inpatient rehabilitation settings and randomised to either a compassionate imagery or relaxation training intervention condition. All participants completed a preparatory video and information session specifically designed to address motivational and engagement issues. After preparation they completed a 50-minute intervention session involving either relaxation training or compassionate imagery training. Pre-post intervention measures assessed positive and negative affective state, anxiety, beliefs about compassion, treatment motivation, empathy, and heart rate variability.

Results: The main effect observed for both groups was a significant increase in treatment motivation (T=149.0, z=3.44, p=0.001, r=.50) and there was a trend toward improved empathy across both groups (p=0.06, dz=0.40). However, neither intervention condition showed an effect on indices of compassion. The descriptive results indicate that the participants experienced higher levels of fear of compassion than the general population but showed relatively normal levels of empathy.

Conclusions: These results highlight the challenges of directly importing therapy techniques that have been used successfully with other populations and applying them with people with severe head injury. Our data point to the need to carefully analyse barriers to treatment uptake such as low psychological mindedness or fears about compassion. Importantly, it seems that some of these barriers may stem from pre-injury psychosocial and subcultural factors, not just the effects of head injury. Our success in improving treatment motivation points to the potential benefit of carefully adapting, testing, and refining psychological interventions in a precise and targeted manner. This kind of data-driven approach should help to efficiently build up complex packages of intervention for post-head injury recovery that are tailored to the specific unmet treatment needs of this population.


**Diminished Cerebrovasculature Buffering Capacity After Repeated Concussions**

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: Oral

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**Objectives:** Previous research has demonstrated that players in contact sports with a history of 3 or more previous concussions are three times more likely to sustain a future concussion than those players who have never been concussed. (Guskiewicz et al., 2003, JAMA) In this same study it was revealed that recovery of neurological function after a concussion was slower in players who have a history of head injuries. The cause of these changes following repeated concussions is unknown but it is possible that alterations in the underlying cerebrovascular function may be responsible. To address this, the aim of the current study was to evaluate concussion history (3+ vs none) on the dynamic relationship between arterial blood pressure and cerebral blood flow in contact sport athletes and, thereby, determine the extent to which cerebrovascular buffering capacities are affected by repeated concussions.

**Methods:** Thirty-five junior elite football players (18-22 years old) from the same team were enrolled in the study (23 had no previous concussions; 13 had 3+ previous concussions). There were no significant differences between resting mean arterial pressure or cerebral blood flow as indexed with transcranial Doppler ultrasound in either the middle or posterior cerebral arteries. Cerebral pressure-flow dynamics were assessed using transfer function analysis at both 0.05 (10 second squat - 10 second stand) and 0.10 (5 second squat – 5 second stand) Hz using the gold-standard method of squat-stand manoeuvres. (Smirl et al., 2015, JAPPL) This method provides robust and reliable measures for coherence (correlation index), phase (timing buffer) and gain (amplitude buffer) metrics.

**Results:** There were no differences in coherence at either 0.05 or 0.10 Hz (>0.98 for all groups and frequencies). The gain metric was similarly unaffected at both 0.05 and 0.10 Hz in both the middle and posterior cerebral arteries (p>0.35). The group with a previous history of 3+ concussions had a significantly reduced phase at 0.05 Hz in the posterior cerebral artery (-17%; p=0.03), with a similar trend observed in the middle cerebral artery (-13%; p=0.08), while the 0.10 Hz phase measures were unaffected (p>0.42)

**Conclusions:** Consistent with the findings of Guskiewicz *et al.*, (2003) our results reveal that the timing buffer (as indexed with the phase metric) is diminished when individuals suffer 3+ concussions. These findings indicate that the pressure-flow dynamics are more pressure-passive during very low frequency oscillations in both the anterior and posterior cerebrovasculature beds following a history of repeated concussions. This indicates repeated head impact exposure can affect the intrinsic myogenic tone of the cerebrovasculature (Tan *et al.*, 2013, J Physiol), leaving it at greater risk for future injuries.

Developing A Model For Suicide Ideation After Severe Traumatic Brain Injury Using Structural Equation Modelling.

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: The risk of suicide ideation (SI) after severe traumatic brain injury (TBI) is double the level within the general population. Little is known about the mechanisms underlying this elevated risk. This study aimed to develop an explanatory model of SI after severe TBI, based on the interaction among distal (predisposing) and proximal (precipitating) risk factors, protective factors and SI.

Methods: Participants (n=90) with very severe TBI (Post Traumatic Amnesia > 7 days) were recruited from the Liverpool Brain Injury Rehabilitation Unit in Sydney Australia. Participants completed a battery of neuropsychological tests targeting executive functions as well as self-report measures of SI, positive and negative mood states, stress, self-awareness, self-esteem and problem solving. Treating clinicians rated participants on measures of aggression, frontal systems dysfunction and participation. Data were analysed using structural equation modelling.

Results: The final model demonstrated good fit indices (NFI 0.924, IFI 0.994, TLI 0.986, CFI 0.993, RMSEA 0.03). The model accounted for 34% of the variance in SI. One distal risk factor, poor problem-solving, had a direct relationship to SI. Other distal risk factors including post-injury aggression and disinhibition had direct and indirect links to depression (a proximal risk factor), which in turn mediated their relationship to hopelessness and SI. The protective factors (social support, hope, community participation, self-esteem) mediated the relationship between distal/proximal risk factors, hopelessness and SI. The protective effect of social support and community participation was mediated through their association with increased levels of hope and self-esteem.

Conclusions: The current model demonstrates the direct and indirect effects of risk factors and protective factors associated with SI after severe TBI. The model provides several suggested targets for clinical intervention to build positive mental health and reduce suicide risk. The model can now be tested prospectively to evaluate its predictive validity.
Protocol of Constraint-induced Movement Therapy for Patients after Traumatic Brain Injury

Status: Accepted Presentation type: Poster
Category: Neurotrauma – case reports/clinical research
Author's preference: Poster

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Background: We would like to highlight our experience of one-and-a-half-hours protocol of constraint-induced movement therapy we performed as a pilot study with a small group of patients with traumatic brain injury.

Methods: Inclusion criteria’s were traumatic brain injury with hemi paresis and neglected arm assessed by of Motor Activity Log with a rating under 2.5.

Occupational therapists have stimulated patients to conduct 10 sessions of intensive use of affected limb with the goal of performing purposeful movements when executing functional tasks. The patients were treated for 3 weeks, at least one-and-a-half-hours per day, 5 days a week. They were given home tasks and were encouraged to use the restraint glove as much as they could.

Results: The assessment after therapy showed an improvement in the quantity and the quality of use of the affected limb. Follow-up assessment after one month showed that the progress was preserved, sometimes increased further, but some patients went back to the old routine.

Conclusions: In order to verify the efficiency of the introduced CIMT protocol, it would be necessary to conduct a larger study with randomly selected patients.

Key words: Brain injury, constraint-induced movement therapy, one-and-a-half-hours sessions of occupational therapy
Keep your head up. A therapeutic psychoeducation program for people with ABI to avoid emotional problems.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Oral

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Objectives: People suffering from acquired brain injury (ABI) are often confronted with long term problems. Interventions for people suffering from the consequences of such an injury are mostly focused on the physical and cognitive rehabilitation during acute rehabilitation. However, studies show emotional problems (e.g. apathy, depression, anxiety) have a large impact on quality of life for brain injury survivors. Some studies found 1 third of brain injury survivors develop mental health problems (depression, anxiety, …). Surprisingly, we could not find any group therapy formats dealing these problems for this population. The program was developed especially to suit to the uniqueness of this target audience in order to prevent social and emotional problems.

The major objective of this project is to inform and discuss the consequences of a brain injury, with other ABI-survivors. Information is given after which group members can discuss about cognitive problems, but the focus lies primarily on the social and emotional issues that can affect a person's life.

Methods: To compile the programme, we searched the literature for existing programmes. None useful for this population were found. We used existing therapy formats (for other patient groups) and adjusted these.

Results: Based on literature about potential emotional consequences, we developed a programme covering 12 topics (e.g. motivation, coping strategies, fatigue, how to find meaningful daily activities, how to cope with worrying thoughts, role changes…). This extensive composition of topics is discussed in group with peers, moderated by a psychologist. Every session has been constructed the same way: starting with a short welcome and rehearsal of what has been discussed the week before, after which a new topic will be discussed. Therapist gives information which then is discussed by the group members. Information is given by worksheets. At the end of every session there is given a new assignment that is to be made towards the next session.

Conclusions: At this point, the group therapy programme is implemented in two different settings after which feedback is given and adjustments can be made. Afterwards, the programme will be available for Flanders & The Netherlands (from march 2016 on).
Physical Exercise Protects Against Traumatic Brain Injury In Rats By Upregulating Heat Shock Protein 72

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: Physical exercise is an inducer of heat shock protein 72 (HSP72) that has been promoted as a promising treatment strategy for people who undergo a transient attack.

Methods: We examined the effects of physical exercise (3 weeks before trauma) on functional recovery and histopathologic outcomes after moderate-level controlled fluid percussion injury, an experimental traumatic brain injury in rats.

Results: The physical exercise pretreatment increased expression of cerebral HSP72 and attenuated posttraumatic brain contusion, edema, apoptosis, and neuronal loss. It also improved neurological and motor deficits. Pretreatment with intracerebral injection of pSUPER•siRNA•HSP72, in addition to reducing cerebral expression of HSP72, significantly attenuated the beneficial effects of physical exercise pretreatment in reducing posttraumatic brain contusion, edema, apoptosis, neuronal loss, and neurological motor deficits.

Conclusions: The obtained results indicate that physical exercise is an important factor that can protect against traumatic brain injury. These findings may provide a new strategy in preventing traumatic brain injury.
Quantitative Analysis of Visual Pursuit as a Function of One’s Own Versus Other’s Face in MCS+ and MCS- Patients

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: quantitative analysis of visual pursuit can provide additional information about patients’ clinical status in prolonged disorders of consciousness (DOC) (Trojano et al. 2012). Visual pursuit seems to be modulated by stimuli’s saliency in minimally conscious state (MCS) but not in vegetative state (VS) (Trojano et al. 2013). Here we aimed to investigate: i) whether the most salient stimulus for human beings (one’s own face) can enhance visual pursuit when compared with matched but less salient stimuli (other’s face), and ii) whether within MCS visual pursuit is modulated by stimulus saliency as a function of patients’ level and complexity of behavioral responses (i.e., in MCS+ and MCS- patients; Bruno et al. 2011).

Methods: Among a total sample of 52 DOC patients (22 females) we could study 35 patients (8 patient excluded for lack of VEPs, 1 for corneal ulcers, 4 for oculomotor dysfunctions and 4 for involuntary movements). In 9 patients we could not obtain valid recording sessions, so the final sample included 26 patients (16 VS, 10 MCS-, 9 MCS+).

All participants underwent a quantitative evaluation of visual pursuit by means of a computerized infrared eye-tracker system. Stimuli were a red dot, patients’ own face, or a face of an unknown person slowly moving on a pc-monitor. Fixation duration and the proportion of on-target fixations were recorded.

Results: Mixed two-way ANOVA did not reveal significant differences in fixation duration among the three patient groups for any stimulus type. The proportion of on-target fixations differed significantly in the three patient groups (chi square=2426.8, p<.001), with the highest rate of on-target fixations in the MCS+ group (42.2%), and the lowest in the VS group (5.3%); on-target fixations differed significantly in MCS- (20.9%) versus MCS+ (chi square=455.5, p<.001), as well as in MCS- versus VS (chi square=836.2, p<.001). Most importantly stimulus type did not affect the proportion of on-target fixations in VS (chi square=4.4, p=NS) and in MCS- (chi square=2.32, p=NS), whereas it affected visual pursuit in MCS+ (chi square= 49.9, p=.001). In MCS+ patients the lowest rate of on-target fixations was observed for the red dot (34.7%), whereas on-target fixations for one’s own (44.2%) or other’s face (46.8%) did not differ significantly (chi square=1.7, p=NS).

Conclusions: quantitative assessment of visual pursuit provides additional information on DOC patients’ status, as it demonstrates significantly different clinical responses in VS, MCS- and MCS+ patients. Stimulus saliency enhances visual pursuit performance in MCS patients, and particularly in MCS+ patients. Human faces likely represent the most powerful stimulus (Sagiura 2015), but full exploitation of one’s own face processing is likely related to dynamic aspects, that are typical of real-life contexts (e.g., seeing oneself in a mirror) (Xiao et al. 2014; Thonnard et al. 2014).
How can we beat depression? Does early interdisciplinary control have a preventive impact on the risk of developing a depression after an acquired brain injury?

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – case reports/clinical research
Author's preference: No preference

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Objectives: The Ministry of Health and Elderly in Denmark has made a special initiative towards young people, years 15-30 with an acquired brain injury. This has resulted in five regional outpatient clinics who offer young people, with specific diagnoses an interdisciplinary control after discharge. All outpatient clinics cooperate with the municipality of the patient to obtain a relevant plan for neurorehabilitation.

It is well known that many patients post acquired brain injury develop a depressive disorder. Studies have reported a prevalence around 30 for developing a depressive disorder after TBI or Stroke. Other studies has shown a connection between depression and health related quality of life in youth post-TBI.

Aim of the project: We want to study whether an early interdisciplinary control and cooperation with the municipality has a preventive impact on the risk of developing a depression.

We also want to study whether an interdisciplinary control and evaluation about the need of further rehabilitation many years after the brain injury can have a positive effect on depressive symptoms.

Methods: All patients are examined by a neurologist or younger doctor, neuropsychologist, occupational therapist and physiotherapist.

The patients undergo a standard battery of tests including NIHSS, FIM, GOS-E, Mini-Best TEST, Himat, MDI and neuropsychological testing.

Patients in Group 1 are examined about three month after discharge while time since discharge is more varying in group 2. This testing is categorized as baseline (T0). The testing is repeated one year after baseline (T1).

Subjects: Young people years 15-30 with an including diagnosis (TBI, Brain tumor, stroke, encephalopathy or CNS infection) who are referred to one of the five regional outpatient clinics or located by letter. Patients with a congenital brain injury (before day 28th after birth) are excluded.

Two groups of patients:

Group 1: Patients newly diagnosed with one of the including diagnoses.

Group 2: Patients who earlier in life have been diagnosed, with one of the including diagnoses.

Results: At deadline for abstract admission we are still collecting data. The results will be presented at the conference.

Conclusions: At the conference we will answer the following questions:
Do young people with brain injury acquired earlier in life (group 2) have a higher degree of depressive symptoms compared to newly diagnosed patients at T0 (group 1)?

Does group 1 have a lower level of depression at T1 compared to group 2 at T0?

Does group 2 have a lower level of depression at T1 compared to T0?
Soluble Adenylyl Cyclase inhibition as a plausible target for attenuating Hypoxia induced Neuronal Injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: No preference

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Objectives: The cAMP signaling pathway with focus on G-protein responsive transmembrane adenylyl cyclase (tmAC) plays an essential role in modulating the apoptotic response to various stress stimuli. In addition to transmembrane AC, mammalian cells possess a second source of cAMP, the ubiquitously expressed soluble adenylyl Cyclase (sAC). Since mitochondria is key player in ischemia reperfusion induced brain injury and sAC has recently been shown to be located at this site, led us to hypothesize that sAC may play a role in apoptosis due to oxygen-glucose deprivation (OGD) injury.

Methods: Cortical neurons were cultured from E15 Wistar rat fetuses for 7 days in neurobasal medium supplemented with N2 and B27. The matured neurons were subjected to 1 hour oxygen glucose deprivation (OGD) at 5% O₂ and 5%CO₂ in glucose free medium and cultures were returned to normoxic media for 3 hr, 6hr, 12hrs and 24hrs. The matured neurons maintained in normoxic media served as control cells. Lactate dehydrogenase, cell viability and various apoptotic indices including ROS and mitochondrial permeability were measured to assess cellular injury and cell death. The pharmacological inhibition of sAC was done by treating cells with 15µM/liter of KH7 and 25nm of siRNA for 72hrs. Specificity of cAMP signaling pathway involvement was checked using PKA inhibitor. Control cells were also subjected to various inhibitions in parallel for corresponding comparisons.

Results: Immunocytological staining confirmed the 95% purity of cortical neuronal culture. Alterations in apoptosis markers showed 12 hrs time point post OGD followed by normoxia exposure to produce maximum damage. The effect of injury on morphology of cultured neurons showed reduction in number and loss of connections between neurons when compared with control neurons. Inhibition of sAC leads normalization of neuronal structure and their numbers. Cleaved caspase 3 protein showed significant reduction in apoptosis on sAC inhibition during OGD (p<0.005) and OGD followed by normoxia (p<0.05) as compared to control. A significant reduction in levels of LDH (p<0.005), caspase 9(p<0.05) and ROS generation (p< 0.005) were observed on inhibition of sAC activity which was followed by significant restoration of mitochondrial membrane potential (p< 0.005). The cytochrome C translocation further showed the involvement of mitochondrial mediated apoptosis. Inhibition of PKA during normoxia followed by OGD resulted in significant reduction in apoptosis (p<0.05) showing role of cAMP signaling.

Conclusions: Analysis of the underlying mechanisms revealed (i)sAC playing role in neuronal apoptosis due to OGD followed by normoxia (SI-SR) injury (ii) ROS generation causing activation of the mitochondrial pathway of apoptosis, i.e. cytochrome c release and caspase-9 cleavage. sAC inhibition or knockdown abolished the activation of the mitochondrial pathway of apoptosis in PKA dependent manner.
The neural substrate of disorganized visual search on cancellation tasks revealed by lesion-symptom mapping

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Oral

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Objectives: Cancellation tasks are widely used for diagnosis of attentional deficits in stroke patients. In these tasks, multiple targets have to be found among distractors and crossed out. Though it is achievable to cancel all targets without adopting a specific strategy, a disorganized fashion of target cancellation has been hypothesized to reflect a disorder in spatial exploration. Disorganized visual search might reflect a multitude of various deficits, such as disturbed executive function, spatial working memory disorder, or loss of a strategy or plan to guide spatial search. In the current study we aimed to examine which lesion locations result in disorganized visual search during cancellation tasks, in order to determine which brain areas are involved in search organisation.

Methods: A computerized version of a shape cancellation task was administered in 78 stroke patients. As an index for search organization, the amount of intersections of paths between consecutive crossed targets was computed (i.e. intersections rate). This measure is known to accurately depict disorganized visual search on a cancellation task in a stroke population. Ischemic lesions were delineated on CT or MRI images. Voxel-based lesion-symptom mapping and region of interest-based analyzes were used to determine the anatomical correlates of the intersections rate.

Results: Assumption-free voxel-based lesion-symptom mapping revealed an association between lesions in the right lateral occipital cortex, right superior parietal lobule and right postcentral gyrus to disorganized search, independent of total lesion volume. The complementary region of interest-based approach revealed correlations between the intersections rate and lesion volumes within the right superior parietal lobule, right inferior parietal lobule (the supramarginal gyrus, and to a lesser extent the angular gyrus), right superior and middle temporal gyri, and right lateral occipital cortex, also independent of total lesion volume.

Conclusions: Post-stroke disorganized visual search during cancellation tasks is related to lesions in the right occipital, parietal and temporal locations. These correlates overlap with regions that have previously been associated with conjunctive search and spatial working memory. This suggests that disorganized visual search is caused by disturbed spatial processes, rather than executive function or planning which is more related to frontal regions.
ACADEMIC PROFILES AMONG CHILDHOOD BRAIN TUMOR SURVIVORS

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – case reports/clinical research
Author's preference: Poster

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Objectives: Children treated for a brain tumor are at risk of getting cognitive difficulties that may lead to poor academic performance later on. However, little is still known about the academic profiles of these children. The purpose of this study is to explore how children treated for a brain tumor perform on reading, spelling and arithmetic skills one year after the treatment. Furthermore, the child's performance on these tests is followed up over time.

Methods: This is a retrospective study based on medical records, involving 45 children between 7 and 18 years of age who met the inclusion criteria of speaking and reading Swedish, IQ above 70, and without major linguistic or motor difficulties after the treatment. The children were seen for an academic evaluation over 4 consecutive years at the outreach rehabilitation team, Astrid Lindgren Children’s Hospital, Karolinska University Hospital. The academic tests included word comprehension, reading comprehension, reading speed, spelling, basic arithmetic skills and number sense.

Results: The results show that children treated for a brain tumor perform below the standard norms in reading speed, spelling and basic arithmetic skills and that there is a risk for decline over time in spelling and basic arithmetic skills. The children’s results in reading comprehension were at expected age level if the child was given extra time for performing the task.

Conclusions: The results suggest that children treated for a brain tumor have both strengths and difficulties related to academic skills. Extra support and flexible solutions at school are important in optimizing their development of academic skills.
Association of Severe Traumatic Brain Injury Patients' Outcomes with Cerebrovascular Autoregulation Impairment Events

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: The objectives of the prospective study were to explore associations of severe traumatic brain injury (TBI) patient specific cerebrovascular autoregulation (CA) dynamic and "optimal cerebral perfusion pressure" (optCPP) management [1,2] with the outcome of severe TBI patients. Patients’ ages and diffuse axonal injury (DAI) grade were also included in the analysis of the prospectively collected clinical data.

Methods: CA monitoring of 33 severe TBI patients was performed by using ICM+ software (Cambridge, UK) in Republic’s Vilnius University Hospital. CA status estimating pressure reactivity index (PRx(t)) and CPP(t) data were processed in order to obtain diagnostic information for making patient-specific treatment decisions by using management of the optCPP [1]. The analysis of CA status dynamic was performed and the relationship between duration of the longest CA impairment (LCAI) event and patients’ outcome was investigated.

Results: Association of Glasgow outcome scale (GOS) with the averaged value of PRx(t) showed negative correlation (r = - 0.40). The averaged value (PRx) > 0.24 was associated with mortality. The correlation between GOS and the difference ΔoptCPP = CPP - optCPP was r = 0.484. The critical value of CPP(t) declination from optCPP per - 6 mmHg was associated with mortality. Multiple correlation between GOS, ΔoptCPP and age was r = - 0.79. Durations of the longest single critical CA impairment events associated with mortality were 25 min when PRx(t)>0.8; 40 min when PRx(t)>0.7 and 80 min when PRx(t)>0.6. Multiple correlations between GOS, LCAI and age and between GOS, LCAI and DAI grade were r = - 0.73 and r = - 0.59, respectively.

Conclusions: The analysis of GOS association with duration of LCAI events showed that the duration of the longest CA impairment event and age are more significant factors impacting patients' outcomes than the averaged pressure reactivity index PRx(t) values. Multidimensional representation of GOS plots showed that better outcomes were obtained for younger patients (< 47 years) with lower DAI grades (1 or 2), for those whose LCAI event was shorter than 40 min when PRx(t) was above 0.7 within that CA impairment event and for patients whose CPP(t) was kept within the interval from optCPP to (optCPP +10 mmHg). OptCPP targeted therapy might be a useful tool for eliminating overly long single CA impairments and leading to more favourable outcomes for severe TBI patients.


Acknowledgement: This research has been funded by the grant MIP-118/2012 from the Research Council of Lithuania and the Swiss - Lithuanian grant No.CH-3-SMM-01/06.
Patient-centered neurorehabilitation, a casereport - Interdisciplinary examination and cross-sector cooperation

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: In Denmark all patients have the right to receive neurorehabilitation paid by the public welfare system.

We differentiate between:

- 1) Neurorehabilitation under hospitalization paid by one of the five regions in Denmark.
- 2) Neurorehabilitation after discharge, paid by the municipality where the patient live.

The doctor at the hospital is in charge of prescribing neurorehabilitation after discharge. The doctor can cooperate with other professionals to describe the need of and potential for rehabilitation.

In Denmark, five regional out-patient clinics offer young people (15-30 years old), with specific diagnoses which might result in acquired brain injury, an interdisciplinary control after discharge. The five clinics are a result of the desire to make a special initiative towards young people with an acquired brain injury.

All outpatient clinics cooperate with the municipality of the patient to obtain a relevant plan for neurorehabilitation.

Methods: The out-patient clinic in the North of Denmark has decided to have a special focus on patient-centered neurorehabilitation. We use the COPM (Canadian Occupational Performance Measure) to study the patients' evaluation of activity problems and goals for rehabilitation. The project cooperates with the therapists and social workers from the municipality where the patient live with the aim to:

- 1) Strengthen the cooperation between the patient and the therapists who rehabilitate with the patients.
- 2) Ensure the intensity of the rehabilitation.
- 3) Provide the professionals with relevant information about strategies and potential of the patient.

Results: We want to use the case to illustrate:

1) The importance of using the patient's goals as a starting point of cooperation and motivation.

2) The importance of cross-sector cooperation.
3) A method to ensure a patient-centered approach across sectors.

Case: The patient is a 20 year old man, who six month earlier are involved in a car accident. He has a contusion hematoma in the right frontal lobe, and a traumatic subarachnoid hemorrhage in the left occipital lobe. The patient attended in-patient neurorehabilitation clinics for three month. He is referred to the out-patient clinic at discharge. After discharge the patient continued his rehabilitation in the community.

The patient is characterized by an inappropriate behavior and lack of insight. We used the patient's self-reported activity problems to illustrate which type of rehabilitation he had to attend in order to reach his goals.

Conclusions: At the time of the conference the young man has participated in one-year follow up. The case will be supplemented with statements from the patient, relatives and professionals from municipality and the project.

On the conference we can also present the preliminary results from the ongoing evaluation of the value of the interdisciplinary examination at the out-patient clinic and the importance of the cooperation across sectors.
Neuropsychological Assessment of Torture Survivors with Post-traumatic Stress Disorder and Traumatic Brain Injuries

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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This paper presents the results of psychological and neuropsychological assessment of a group of refugees with PTSD and a group of refugees with co-morbid TBI and PTSD. The study was designed to evaluate the outcome related to co-morbid TBI+PTSD, compared to the outcome of PTSD alone. In addition, this study also evaluated the methodological barriers in neuropsychological assessment of refugees. Eighteen refugees diagnosed with PTSD and depression participated in the study. Seven of them reported head injuries that had led to loss of consciousness, and were assigned to the TBI+PTSD group with the remaining eleven in the PTSD only group.

Results indicated that neuropsychological assessment of refugees is challenging due to linguistic and cross-cultural barriers. Despite the adjustment of assessment according to suggestions from the literature, most refugees had difficulty doing the assessment, and for a small number assessment with the measures used in this study proved impossible. Non-parametric tests and box plots were used to evaluate the differences between the TBI+PTSD group and the PTSD Only group in terms of psychological symptoms, self-reported functioning, and neuropsychological outcome. While no significant result was detected, possibly due to small sample size and high variability within the sample, the box plots revealed a number of tendencies that were consistent with the study's hypotheses.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Traumatic Brain Injury (TBI) impact a young population with severe consequences in daily life because of the neuropsychological sequelae. Neuroanatomical damages such as diffuse axonal injuries (DAI) are related to global and neuropsychological outcome. The aim of this study is to describe global and functional outcome of patients with severe trauma. Preliminary results on anatomo-functional changes assessed by brain MRI are also presented.

Methods: 69 Patients from a neurosurgical reanimation’s cohort of the Pitié-Salpêtrière Parisian Hospital were included, with initial severity data recording. Glasgow Outcome Scale Extended (GOSE) assessed the global functional outcome. The Dysexecutive Questionnaire (DEX) and a complaint questionnaire measured behavioral and cognitive impairment. Employment status was evaluated. In the first 54 patients, we evaluated the relationship between white matter lesion in corpus callosum (CC) assessed by diffusion tensor imaging, and the interhemispheric functional connectivity measured from resting-state functional MRI.

Results: We evaluated the 69 patients, 64 months in mean after TBI. The median initial Glasgow Coma Score was 8 [3-15]. The average duration of coma was 20 days [0-120]. 33% had a good recovery (GOSE 7 or 8), 33% had a moderate disability upper level (GOSE 6) and 33% had moderate disability lower level or severe disability (GOSE<6). The average score on the DEX was 26 [2-55]. Principal complaints for patients were fatigability, a decrease of processing speed, memory difficulties, the need to be quiet, attention problem and irritability. At the evaluation 22 patients were employed against 45 before the accident, and 3 patients had adapted situation. MRI analysis on the first 54 patients showed a global loss of white matter integrity in CC as well as a decrease in interhemispheric functional connectivity measured from resting-state functional MRI.

Conclusions: Long time after TBI, the global outcome for these patients appears heterogeneous. The persistent behavioral and cognitive impairments showed important consequences in daily life for the majority of them. Neuroanatomical damages after traumatic brain injury such as loss of white matter integrity in CC relates to disruptions in functional connectivity. Future work using these data would try to correlate functional connectivity changes to global and neuropsychological outcome.
Treatment Of Traumatic Brain Injury In Adult Rats With Intravenous Administration Of Human Placenta-Derived Mesenchymal Stem Cells

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: We investigated the effect of human placenta-derived mesenchymal stem cells administered intravenously on functional outcome after traumatic brain injury in adult rats.

Methods: Human placenta-derived mesenchymal stem cells (MSCs) were harvested from two human donors. A controlled lateral fluid percussion was delivered to 30 adult male rats to induce traumatic brain injury, and 24 hours after injury, human placenta-derived MSCs were injected into the tail veins of the rats (n=20). These rats were divided into two groups: Group 1 was administered 1x10^6 MSCs, and Group 2 was administered 4x10^6 MSCs. Group 3 (control) rats received saline intravenously. Neurological function was evaluated according the modified neurological function score and inclined plane test. All rats were killed 28 days after injury, and immunohistochemical staining was performed on the brain sections to identify brain contusion volume.

Results: Treatment with 4x10^6 human MSCs significantly improved the rat's functional outcomes (p<0.05). The brain contused volume caused by lateral fluid percussion was also significantly attenuated by treatment with 4x10^6 human MSCs.

Conclusions: These data suggest that human placenta-derived MSCs may be a potential therapy for patients who have sustained traumatic brain injuries.
Microglial Production Of Tumor Necrosis Factor-Alpha In The Rat Brain After Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: Traumatic brain injury (TBI) induces a glial response in which both microglia and astrocytes become activated and produce tumor necrosis factor-alpha (TNF-α). The interrelationship between TNF-α and neurons, microglia, and astrocytes remains poorly understood.

Methods: We examined the activation of neuronal-TNF-α double-positive cells, microglial-TNF-α double-positive cells, and astrocytic-TNF-α double-positive cells and their involvement in the outcome after TBI.

Results: We found that the number of microglial-TNF-α double-positive cells, but not of astrocytic- or neuronal-TNF-α double-positive cells, was significantly higher in the ischemia brain area 3 days after TBI. In addition, TBI caused both cerebral infarction and motor dysfunction. There was also a trend of overproduction of serum TNF-α toward the end of the trial (14 days after TBI). Etanercept (a TNF-α antagonist) given intraperitoneally after TBI significantly reduced TBI-induced increases in the number of microglial-TNF-α double-positive cells in the ischemic brain areas, brain infarction, and motor dysfunction evaluated 3 days after TBI. The increased serum levels of TNF-α at the end of the TBI trial were also attenuated by etanercept therapy.

Conclusions: Our findings identify how microglial production of TNF-α affects the outcomes of TBI in rats. Etanercept selectively inhibited the activation of microglial-TNF-α double-positive cells in ischemic brain areas after TBI, which might be one of the mechanisms underlying the therapeutic benefits of using etanercept to treat TBI in rats.
Long-term fatigue after perimesencephalic subarachnoid haemorrhage in relation to cognitive functioning, mood and comorbidity

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: No preference

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Objectives: To study relationships between fatigue and objective and subjective cognitive functioning, mood, and comorbidity in the long term after perimesencephalic subarachnoid haemorrhage (PM-SAH).

Methods: Cross-sectional study. Objective cognitive functioning was measured with: Trail Making Test; Symbol Substitution; D2; Verbal and Semantic Fluency; Tower Test; Digit Span; 15-Words Test; Rey Complex Figure. Subjective cognitive functioning: Cognitive Failure Questionnaire. Fatigue: Fatigue Severity Scale. Mood: Hospital Anxiety and Depression Scale.

Results: Forty-six patients, mean age 50.4 (SD=9.4), mean time after PM-SAH 4.7 (SD=1.6) years participated. Patients with fatigue (33%) had significantly lower scores than patients without fatigue on most objective cognitive functioning tests (p<0.05). Fatigue score was significantly associated with subjective and objective cognitive functioning, mood, and comorbidity. After adjustment for mood and comorbidity, fatigue remained associated with attention and executive functioning.

Conclusions: This study supports our previous findings that a third of patients with PM-SAH experience fatigue and problems of cognitive functioning, also in the long term. Future research should investigate whether these patients would benefit from long-term follow-up and/or cognitive rehabilitation programs.
**Relationship between depression and experienced satisfaction with daily occupational performance after acquired brain injury.**

Status: Accepted  Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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**Objectives:** To explore whether there is a connection between experienced satisfaction with daily occupational performance and depression among young people with acquired brain injury. We want to investigate whether change over time is seen in both depression and performance evaluation or if a change can be seen in one domain (ex performance evaluation) without a change in the other one (ex depression). And explore whether duration of time since onset of brain injury has a connection to depressive symptoms.

This study will contribute to the fact that people with acquired brain injury report a diminished life satisfaction and a high prevalence of depressive symptoms. In a study they have found a connection between occupational gaps, life satisfaction and depressive mood after acquired brain injury.

**Methods:** The patients are examined by a doctor, neuropsychologist, occupational therapist and physiotherapist using a standard test-battery including NIHHS, FIM, GOS-E, COPM, MiniBest TEST, Himat, MDI and neuropsychological testing.

To ensure a patient-centered focus and examine how patients evaluate their own performance in daily activities we use COPM (Canadian Occupational Performance Model). The COPM is also a fundament in the planning of rehabilitation incorporating the clients’ experiences and goals.

The testing is conducted at the control (T0) and again one year follow-up (T1).

Subjects: As part of a national project in Denmark there are established an outpatient clinic for young people (age 15-30) with acquired brain injury in North Region Denmark. The purpose is to strengthen the effort towards the youth and ensure they are offered the rehabilitation they are in need of. The clinic offers an interdisciplinary control examination three months after discharge to every youth recently diagnosed with TBI, Brain tumor, stroke, encephalopathy or CNS infection. It is also possible for youths who have a previous history of one of the diagnoses to be referred to the clinic by their GP in order to assess the need of rehabilitation.

**Results:** At deadline for abstract submission we are still collecting data. The results will be presented at the conference.

**Conclusions:** At the conference we will be concluding on the following questions:

1. Is there a correlation between depressive symptoms and satisfaction with occupational performance at T0?

2. Is variety over time in self reported depressive symptoms and satisfaction with occupational performance dependent on each other?
3. Do duration of time since onset of brain injury has a connection to the level of depressive symptoms?
Therapeutic Evaluation Of Mesenchymal Stem Cells And Their Secretome In A Model Of Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: Bone marrow derived human mesenchymal stem cells (MSCs), which support repair when administered to traumatic brain injured (TBI) animals, in large part through secreted trophic factors.

Methods: We directly tested the ability of the culture medium (or secretomes) collected from human MSCs under normoxic or hypoxic conditions to protect neurons in a rat model of TBI. Concentrated conditioned medium from cultured human MSCs or control medium was infused through the peritoneal cavity of rats subjected to TBI.

Results: We demonstrated that MSCs cultured in hypoxia were superior to those cultured in normoxia in inducing expression of both hepatocytes growth factor (HGF) and vasculoendothelial growth factor (VEGF) in the cultured media. We further showed that both normoxic and hypoxic MSCs secretone treated rats performed significantly better than the controls in both motor and cognitive functional test. Subsequent post-mortem evaluation of brain damage at the 4-day time point confirmed that both normoxic and hypoxic MSCs secretone treated rats had significantly lesser extent than the controls in cerebral infarction volume and apoptosis. The TBI rats treated with hypoxia preconditioned MSCs secretome performed significantly more well in motor and cognitive function tests and had significantly lesser brain damage than did the TBI rats treated with normoxia preconditioned MSCs secretome.

Conclusions: Collectively these data suggest that hypoxic preconditioning enhances the capacity of the secretome obtained from cultured human MSCs to release HGF and VEGF and the therapeutic potential of the cultured MSCs secretome in experimental TBI.
Fall And Fear Of Fall In Aging Population After Stroke: A 1-year Follow-up Study - A Preliminary Report

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: The purpose of this study is to determine the frequency of fall at baseline and at 1-year follow up among stroke survivors. We also analyzed its relation to fear of fall and with other physical attributes of the elderly stroke population.

Methods: This is a longitudinal follow-up study of 65 stroke survivors who participated in a study at baseline and at 1-year follow-up. Our outcome measures were measured by using Fall Efficacy Scale-International (FES-I), Berg Balance Scale (BBS), 10-meter walk test (10MWT) for walking speed and lower extremity muscle strength. Other parameters also included Fatigue Severity Scale (FSS) handgrip and Barthel Index. We analyzed these parameter differences at baseline and at follow-up.

Results: The total number of patients at baseline was 75 (49 male, 26 female; mean age 66.7) and at 1-year follow-up so far were 25 (16 male, 9 female; mean age 68.6) At baseline, total frequency of fall was 23 times ($p=0.01$) as compared with control group and at follow-up thus far was 8 times ($p=0.9$). 12% were similar patients who have had falls at baseline and at 1-year follow up, with 20% of patients were new reported falls at follow-up. Three patients (12%) had falls only at baseline and the remaining 56% of patients experienced no fall at all. The FES-1 mean difference was a reduction by 7.7 ($p=0.1$), BBS mean difference of a reduction by 7.66 ($p=0.1$) and mean motor strength improvement of 5.47($p=0.04$). Other factors included handgrip, 10MWT, FSS and Barthel Index; all with modest improvement at follow-up.

Conclusions: Thus far reported recurrent and new fall incidents are still occurring at baseline and at follow-up despite other parameters reported positive changes over time. Causes and risk factors of fall is going to be explored further in the elderly stroke population with the completion of this study.
Attenuating Brain Edema, Hippocampal Oxidative Stress, And Cognitive Dysfunction In High Altitude Exposure By Hyperbaric Oxygen Preconditioning

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: We attempted first to assess whether heat shock protein (HSP)-70 could be induced by hyperbaric oxygen preconditioning (HBO₂P) in rats; second, to assess whether the proposed beneficial effects of HBO₂P in preventing the high altitude exposure (HAE) induced edema, hippocampal oxidative stress, and cognitive dysfunction could be attenuated by HSP-70 antibody preconditioning.

Methods: Rats were randomly divided into the following five groups: the (non-HBO₂P+ non-HAE) group, the (HBO₂P+ non-HAE) group, the (non-HBO₂P+ HAE) group, the (HBO₂P+ HAE) group, and the (non-HBO₂P+ HSP-70 antibody + non-HAE) group. In HBO₂P groups, animal received 100% O₂ at 2.0 ATA for 1 hour per day for five consecutive days. In HAE groups, animals were exposed to a simulated HAE of 9.7% O₂ at 0.47 ATA of 6,000 m in a hypobaric chamber for 3 days. The polyclonal rabbit anti-mouse HSP-70 neutralizing antibodies were injected intravenously at 24 hours prior to HAE experiments. Right after being taken out to the ambient, animals were subjected to cognitive performance tests. Then, they were anesthetized generally and killed before their brains were excised en bloc for water contents measurements and biochemical evaluation and analysis.

Results: In non-HBO₂P group, the animals displayed cognitive deficits, brain edema, and hippocampal oxidative stress (evidenced by increased toxic oxidizing radicals (e.g., nitric oxide metabolites, hydroxyl radicals), increased pro-oxidant enzymes (e.g., malondialdehyde, and oxidized glutathione) but decreased pro-oxidant enzymes (e.g., reduced glutathione, glutathione peroxide, glutathione reductase and superoxide dismutase) in the HAE. HBO₂P, in addition to inducing overexpression of HSP-70 in the hippocampus, significantly attenuated HAE-induced brain edema, cognitive deficits, and hippocampal oxidative stress. The beneficial effects of HBO₂P were significantly reduced by HSP-70 antibody preconditioning.

Conclusions: Our results suggest that high altitude cerebral edema, cognitive deficit, and hippocampal oxidative stress can be prevented by HSP-70-mediated HBO₂P in rats.
Objectives: People with mild traumatic brain injury (mTBI) may experience a protracted course of recovery that affects daily life occupations, including return to work. A multi-professional return to work (RTW) program is delivered at the TBI rehabilitation outpatient clinic at Oslo University Hospital (OUH). One challenge that people seem to encounter after mTBI, are attempting to return to work too early and with a higher work-load than they can tolerate, resulting in increased TBI symptoms and reduced functioning. One method applied with the patients in the RTW program is reflecting on one's occupational level and how the day and week is organized with various tasks and occupations, using the "Occupational Questionnaire" (OQ). The OQ is based on theory deriving from the Model of Human Occupations. The poster presentation will describe experiences from using the OQ in two cases with mTBI.

Methods: The RTW program at OUH is delivered to patients in the early phase after mTBI (8 -10 weeks after injury). Criteria for participation are having a protracted course of recovery, having post-concussion symptoms and being partly or fully sick-listed. Two patients, participating in the RTW program, will be illustrating the process of using the OQ. The OQ gives an overview of activities performed during the whole day, indicating the burden of activity, the use of breaks and rest, and the variation in the occupational pattern. The OQ is filled in by the patient at three different time-points, one giving a retrospective overview of the level of activity before the injury, a second showing the level of activity at baseline of the RTW program, and a third registration is made at a follow-up about 3 weeks after baseline. Each patient discusses his/her OQ with the occupational therapist, and a summary is shared with the multi-professional team.

Results: The process of applying the OQ in the RTW program will be illustrated by the two cases. The rehabilitative measures applied by the occupational therapist and the team will be presented. The focus is particularly on pacing of the activity level, where reflections on the OQ profile are used to seek an occupational balance between activity and rest in relation to well-being. The patients report that the OQ was experienced to be a useful tool, to promote coping and awareness of level of activity, "what I am able to tolerate and what kind of activities that promote recovery".

Conclusions: Rehabilitation for people with a protracted course of recovery after mTBI should focus on measures related to balancing daily life occupations and work-life balance. The Occupational Questionnaire may be a useful tool.
**Long-term social participation following pediatric ABI – design of a Dutch multi-centered study.**

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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**Objectives:** Research in paediatric ABI has long been mainly focused on physical and cognitive functioning (body functions and structure) and their determinants. Long-term prospective studies comprehensively describing functioning in terms of daily activities and participation are scarce. A systematic review (n=8) showed that a majority (25-80%) of children and youth with ABI were restricted in at least 1 participation domain (at home, school/work, in society), while problems hardly decreased over time. Many studies highlighted the reciprocal relationship between outcome of pediatric ABI and family functioning. However, participation and family impact studies showed a great variety in, i.e., type, severity and time since onset of injury, age range, number of measurements and outcome measures. Consequently results can hardly be compared or accumulated, necessary to decrease the current knowledge gap and enabling evaluation of rehabilitation programs with respect to participation outcome and family functioning.

Therefore the aim of this study is to prospectively describe the course of participation and impact on family in a large cohort of children and adolescents who are referred for ABI at a rehabilitation center in the Netherlands, using recommended outcome measures during a period of 2 years.

**Methods:** Design: multicenter, prospective, observational study.

Setting: 10 rehabilitation centers in The Netherlands.

Patients: 150 children, adolescents and young adults (4-25 year) with a diagnosis ABI, their families and a significant other person (like a friend or teacher). Exclusion criteria were physical, neurological or psychiatric consequences affecting study participation.

Assessments: questionnaires tapping into demographic (age, gender, family characteristics) and injury (type, severity, date of onset) information, as well as participation and family functioning. Administration of these questionnaires is standard procedure for the initial appointment at the rehabilitation center. After Informed Consent the same set of questionnaires was completed 12 and 24 months following their first appointment.

Primary outcomes are participation (Child and Adolescent Scale of Participation; CASP en CASP-Y) and family functioning (Paediatric Quality of Life Inventory Family Impact Module; PedsQL™FIM). Secondary outcomes are health care consumption, needs and satisfaction (Child and Family Follow-up Survey; CFFS, part 1, 4 and 5; patient file), quality of life of the child and family (PedsQL Health Related Quality of Life; PedsQL™HRQoL) and fatigue (PedsQL Fatigue).

Injury and rehabilitation treatment characteristics are collected from the patient files by the researcher.

**Results:** A medical ethical committee granted an exemption of assessment. Fifteen rehabilitation centers were invited to participate, 10 of them agreed to participate, 2 wanted to join somewhat later. A database was set up to process the data.
**Conclusions:** A protocol to conduct a multi-center study investigating consequences of ABI regarding participation and family functioning was developed and approved. Subsequently, a multi centered study started October 1st 2015.
Intimate Partner Violence Related Head-Neck-Face Injuries in Women at Hospital Emergency Departments: Visible Signs and Invisible Harm

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: No preference

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Background: Head-neck-face injury has been recognized as one of the commonest injuries identified in intimate partner violence related injuries at hospital emergency departments. However, few studies have been investigated the reasons of attack, social factors of abusers and victims and women’s help-seeking behaviours.

Objectives: The study aims to examine the patterns of head-neck-face injuries, reasons for attack, abusive and social histories by reviewing 5-year hospital data.

Methods: By using a retrospective cohort study, medical charts of abused women (n=854) presented to the hospital emergency departments in Hong Kong from 2010 to 2014 were reviewed by research nurses. The medical records were identified from two computerized systems and individual medical charts were then retrieved from Medical Record Offices and reviewed manually.

Results: There were 627 (73.4%) women admitted to emergency departments due to head-neck-face injuries, which were the most common injuries among them. Some of them (15%) complained loss of consciousness, dizziness, nausea, vomiting after injuries. The mean age was around 38.6. Majority of them were married (82.3%) and some of them were cohabited (13.6%). Half of the women had reported multiple episodes of physical violence attack and 16% of women disclosed psychological abuse, sexual abuse and economic abuse histories with the intimate partners. The reasons of the attack episode including couple relationship problems, extra-marital affairs, sexual problems, in-law conflicts, parenting issues, financial problems, alcoholism, drug addiction, gambling and some trivial matters. Different weapons have been used for the violence attack and some of them might cause serious injuries, such as knife, chopper, hammer, brick, metal rod, gas bottle, and cooking pot. There were 10% of women needed hospitalization but half of them discharged against medical advice.

Conclusions: The study findings inform clinicians about the linkage between head-neck-face injuries and risks in abused women. The invisible head-neck-face injury related cognitive and behavioural problems, which might lead to re-victimization would also be discussed.
Longitudinal changes in brain volume and cortical thickness and functional outcomes during the first year after mild traumatic brain injury

Background: Insufficient knowledge about the pathophysiological changes contributing to development of symptoms after mild traumatic brain injury (MTBI) is a diagnostic problem and makes it difficult to provide effective treatment.

Objectives: Describe longitudinal changes in global and regional brain volume and cortical thickness, from 8 weeks to 1 year after MTBI and to assess the relationship between these changes, self-reported symptoms, and global functional outcome 1 year post-injury.

Methods: Prospective study of individuals (n=154) with complicated (i.e., presence of intracranial abnormality on CT and/or MRI scan) and uncomplicated (i.e., absence of intracranial abnormality) MTBI defined as hospitalisation with GCS between 13-15 and loss of consciousness < 30 minutes, aged 16-65 year, admitted to the Department of Neurosurgery at Oslo University Hospital during a 2 years period (2011-2013). We excluded those with severe substance abuse, prior brain injury, psychiatric disease, progressive neurological disease, and language difficulties. Baseline data include clinical information based on medical records and brain imaging (CT) in acute phase. Both symptomatic and asymptomatic individuals were followed-up at 8 weeks and 1 year with clinical evaluation and MRI.

MRI data was obtained on a 3T whole-body MRI system (Signa HDxt, GE Medical Systems). The protocol included a 3D FSPGR T1-weighted sequence used for morphometric assessments. All patients' MRI data were evaluated with regards to gross pathologies.

Volumetric and morphometric analyses were performed using T1-weighted data by means of FreeSurfer (http://surfer.nmr.mgh.harvard.edu), allowing for automated estimation of subcortical and cortical volumes and cortical morphometric properties including cortical thickness and arealization across the brain surface.

Self-reported symptoms was assessed by Rivermead post-concussion symptom questionnaire (RPQ) and global outcome evaluated by Glasgow Outcome Scale Extended (GOSE). Results are presented in mean (SD).

Results: The mean age of the individuals was 39.8 years (SD 13.7), 63 % were men. A GCS of 15 was reported for 71% of patients. We observed relevant pathologic findings on CT and/or MRI scan in 72 patients (47%). Relevant pathology comprised extra axial haematomas in 61 (39.6 %), skull fractures in 38 (24.7%), contusions in 44 (28.6%) and DAI in 10 (6.5%) patients. At 8 weeks and 1 year follow-up, the
RPQ mean value was 12.58 (12.91) and 13.42 (14.2) respectively. The majority of patients showed favourable functional outcome measured by GOSE 6.71 (0.89) and 7.20 (0.83).

We are currently analysing the MRI data, and clinical associations with longitudinal volumetric and morphometric changes will be presented at the congress.

**Conclusions**: In combination with clinical assessment, MRI techniques used in this study, may provide important information on possible longitudinal structural changes to the brain from 8 weeks to 1 year after MTBI and the impact of changes on functional consequences.
Rehabilitation following cerebral anoxia: an assessment of 27 patients

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – activities and participation
Author's preference: Oral

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Objectives:

1) To evaluate cognitive and emotional impairments, disability and quality of life for adults with cerebral anoxia institutionalised in residential care facilities.

2) To evaluate the efficacy of medication, psychotherapy, support group and therapeutic activities.

Methods: Twenty-seven persons with cerebral anoxia were recruited, on average 8 years postinjury. Only twenty went through the whole study. Over three consecutive two-month periods, they were assessed four times to evaluate: baseline observations (T1-T2), adjustment of their medication (T2-T3); the effect of psychotherapy, support group, and therapeutic activities such as physical and artistic or cultural activities usually proposed in the facilities involved (T3-T4). Examined variables at all time points were cognitive status, anxiety and depression, anosognosia, alexithymia, disability and quality of life.

Results: All participants exhibited cognitive and emotional impairments comparable to those reported in the literature. Statistical analyses revealed good baseline stability of their condition, and no significant effects of changes in medication (between T2 and T3). Conversely, following implementation of psychotherapy, support group, and therapeutic activities (between T3 and T4), quality of life and social participation were significantly improved.

Conclusions: Social participation and quality of life for persons institutionalised several years after cerebral anoxia were improved by psychotherapeutic and therapeutic activities.
The Feasibility of Using Acceptance and Commitment Therapy (ACT) to Promote Recovery Following Severe Head Injury

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Adjustment difficulties are a major source of distress and disability following head injury but there are very few evidence-based treatment options available. Based on promising case study data, we set out to examine the feasibility of ACT as an adjunctive treatment for people with adjustment problems following severe head injury.

Methods: We conducted this feasibility study in accordance with the 2015 MRC guidance on the development and evaluation of complex interventions. This involves a deliberate and planned approach to assessing processes relevant to understanding mechanisms of therapeutic change and implementation issues (e.g., is the treatment acceptable to recipients, can therapists be trained with fidelity). Our design was modelled on a cluster randomised trial format with one intervention site (Glasgow) and two control sites (Leeds and York). We applied a mixed-methods approach to data collection and analysis. Focus groups were used to assess the experience of the intervention (for therapists and patients), the effects of completing study measures, and opinions about key RCT parameters such as being subjected to randomisation to treatment condition. We also piloted the quantitative assessment of key outcome and process measures using self-report scales. This covered factors such as emotional adjustment (anxiety and depression), treatment motivation, awareness and insight, psychological flexibility, and the acceptability of the intervention. Finally, measures of treatment implementation and feasibility were obtained from professional carers at each recruitment site. The intervention was a six-session manualised Acceptance and Commitment Therapy protocol developed specifically for people who were experiencing adjustment difficulties following a head injury. Treatment was delivered via 120 minute long group sessions provided by a trained therapist on a weekly basis. All other usual treatment parameters were free to vary across all study sites.

Results: Twenty-one eligible participants consented and 17 provided complete post-intervention data that could be subjected to analysis. All participants had sustained a severe head injury and were rated as severely disabled on the GODS. The retention in treatment rate was very good (>80%) and attrition was mostly due to discharge from the unit rather than dissatisfaction with the intervention. Themes that emerged from the focus groups included the importance of adjusting the therapy techniques to match the cognitive abilities of participants as well as pacing the therapy sessions to better match limitations in processing speed. Feedback from both patients and therapists suggest that some aspects of ACT such as cognitive defusion and the use of metaphor will require particular attention and refinement in future adaptations of ACT for people with severe head injury.

Conclusions: ACT is a feasible and acceptable intervention for inpatients with severe head injuries but there is a need for more work on therapy delivery techniques before testing in full scale effectiveness trials is warranted.
Elevated blood GFAP and UCH-L1 levels in acute orthopedic injuries without CNS involvement

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: Glial fibrillary acidic protein (GFAP) and ubiquitin C-terminal hydrolase-L1 (UCH-L1) are considered to be both sensitive and specific for traumatic brain injury (TBI) in acute injury diagnostics. The objective of this study is to report the levels of GFAP and UCH-L1 in patients with acute orthopedic injuries without central nervous system (CNS) involvement and to relate them with the type of extracranial injury, head magnetic resonance imaging (MRI) findings, and GFAP and UCH-L1 levels of patients with mild TBI (mTBI).

Methods: Serum UCH-L1 and GFAP were measured from 74 patients with acute orthopedic trauma without any TBIs or CNS diseases and compared with patients with TBI. For the patients in whom GFAP and UCH-L1 levels were in the upper quartile on arrival day biomarker levels were compared to those found within patients with mTBI with negative head computed tomography findings (n=52). The injury types and head MRI findings were recorded from all orthopedic trauma patients.

Results: The levels of UCH-L1 were not significantly different in patients with mTBI and orthopedic trauma. The levels of GFAP were higher in patients with orthopedic trauma as compared to patients with mTBI on arrival day (p=0.026), but the levels were not significantly different on the following days (Figure 1). Twenty-three patients with orthopedic trauma (31%) had elevated levels of GFAP, UCH-L1, or both. The patients with elevated levels of GFAP and UCH-L1 had significantly higher levels as compared to patients with mTBI (p<0.001) (Figure 2). The levels of UCH-L1 and GFAP in patients with orthopedic trauma correlated significantly on admission, on the day after the injury, and on the follow-up visit 3-6 months after the injury. Eight patients with high UCH-L1 values had injuries in the upper extremity and the majority of them had concurrently high GFAP values. Another eight patients with high GFAP levels had ankle fractures. Fifty-three patients with orthopaedic injuries underwent MRI of the brain, and 31 of those were reported as normal, the rest showing non-specific ischemic-degenerative changes or other insignificant abnormalities and in only one a suspicion of an old contusion. The majority of patients who had high levels of UCH-L1 and GFAP and underwent MRI of the brain had normal findings.

Conclusions: Levels of GFAP and UCH-L1 were not able to distinguish patients with mTBI from patients with orthopedic trauma. Patients with orthopaedic trauma with biomarker levels in the upper quartile had significantly higher biomarker levels than those found in patients with mTBI. The source of elevated GFAP and UCH-L1 levels in the presented patients remains unknown. Patients with orthopedic trauma with high UCH-L1 and GFAP values may be falsely diagnosed as being at risk of TBI. This may predispose them to unwarranted diagnostics and recurrent brain imaging.
A S100B/H-FABP Panel to Rule-out CT-scan Lesions in Mild Traumatic Brain Injury

Status: Accepted Presentation type: Oral
Category: Neurotrauma – basic research
Author's preference: Oral

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Objectives: Mild traumatic brain injury (mTBI) lesions are detected using CT-scan imaging. The majority of all CT-scans are negative for mTBI patients and moreover, they are harmful to the patients. Blood biomarkers have been investigated for their capacity to reduce the number of unnecessary CT-scans. The most promising protein so far is the S100b with 30% specificity and 100% sensitivity. H-FABP (heart-type fatty acid binding protein) has previously been highlighted in brain injury models. Here we investigated if this protein individually or in a panel could perform better than S100b and thus reduce the number of unnecessary CT-scan.

Methods: The plasma levels of S100b and H-FABP were measured using commercial immunoassays. The mTBI patients from three cohorts (Geneva, Sevilla and Barcelona) (n=350), GCS 15 and at least one symptom were recruited within 6h after trauma and dichotomized into CT-positive and CT-negative groups for statistical analyses where Mann-Whitney U test, ROC curves and Panelomix were used.

Results: Plasma H-FABP and S100b levels were significantly increased in CT positive patients (p<0.05). The best individual performance was obtained by H-FABP (SE: 100% and SP 35%) followed by S100B (SE: 100% and SP 22%). However, a performance of 45% specificity and 100% sensitivity was obtained when combining S100b and H-FABP in a panel.

Conclusions: This study demonstrated that a panel of S100b and H-FABP could be useful to rule-out unnecessary CT-scans. A further prospective multicentric study is warranted.
Objectives: The primary objective of this study was to identify specific factors related to return to work (RTW) after Acquired Brain Injury (ABI) from an ABI survivor perspective. It identified whether specific demographic and injury characteristics such as age, education level and prior occupation were related to the work status of individuals post injury. Factors acting as both barriers to and facilitators of the RTW process, and the role of individuals self efficacy levels were also examined. Participants were past or present clients of Headways’ ABI Rehabilitation Service.

Methods: Data was collected from forty participants, twenty of whom had returned to work post injury and twenty who had not. Mixed methods in the form of a semi-structured interview and self report measure were used to collect the data. The International Classification of Functioning, Disability and Health (ICF) was used as a theoretical framework for the interviews, the findings of which were then examined using thematic analysis.

Results: Age, education level and previous occupation were all found to be associated with RTW, with younger, more highly educated, with professional past occupations more likely to have returned to work post injury. The most common barriers to work for both groups were mental functions, particularly fatigue, mobility difficulties and self confidence. Self efficacy levels were found not to differ between those who had returned to work and those who had not. Factors found to facilitate a RTW included drive, the ability to drive a car and the support of various others, including employers.

Conclusions: These findings have important implications for health professional working with ABI survivors with the goal of returning to work as they inform the direction that rehabilitative efforts should take to aid their success. They may also guide the practises of Organisational Psychologists in supporting both employers and brain injured employees with RTW post ABI.
Head injury in asylum seekers and refugees

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: Asylum seekers and refugees (ASR) frequently flee persecution including violence. Little is known about the prevalence of head injury (HI) in ASR and consequently little guidance for service providers. This study investigates the prevalence of HI in ASR referred to a psychological trauma service.

Methods: Participants were 115 adult ASR referred to a community psychological trauma service with moderate to severe mental health problems associated with psychological trauma. They were screened for a history of HI using a questionnaire developed for the study. Interpreters were used when required.

Results: The prevalence of HI was 51%. This is considerably higher than general population estimates of HI of around 2% in Western countries. In 55% of ASR the cause was torture, human trafficking or domestic violence. Repeat HI was common, and reported in 68% of those with HI. An injury to the head was not known to mental health clinicians prior to screening in 64% of cases.

Conclusions: Emotional and cognitive consequences of HI may increase the vulnerability of this disadvantaged group. Routine screening for HI in ASR is needed, as are links to brain injury services for advice, assessment and intervention.
Sport Concussion Assessment Tool 3 - Day of Injury Scores of Professional Ice Hockey Players

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: The Sport Concussion Assessment Tool – 3rd Edition (SCAT3) is widely used to evaluate for the acute effects of concussion. We aimed to characterize day of injury SCAT3 subscores in relation to previously published normative reference values using a large sample of professional male ice hockey players. All scoreable SCAT3 components were used.

Methods: The SCAT3 was administered as a preseason baseline test to 465 players from 14 teams in Finland during the 2013-2014 and 2014-2015 seasons. The SCAT3 was administered individually before or after team practice (≥10 minutes after physical exertion) by the team physiotherapist and/or physician. During these two seasons, 74 concussions were recorded. Of all the concussions, 23 (31%) were assessed with the SCAT3 on the day of injury. One player sustained two concussions during the follow-up period; the number of concussed players was therefore 22. Day of injury SCAT3 scores were examined in relation to the league’s SCAT3 normative reference values. These values were based on the 2013-2014 preseason baseline results (n=304). Post-injury SCAT3 scores that were considered unusually low or high exceeded the 10th and 90th percentile ranks of the normative reference values.

Results: The mean age of the concussed players (n=22) was 25.9 years (SD=5.0, range=18-35). Most of the players (86%) were Finnish, and all were Caucasian. Signs of concussion were as follows: loss of consciousness=17%, balance/motor incoordination=13%, disorientation/confusion=17%, amnesia=26%, blank/vacant look=17%, visible facial injury in combination with any of the aforementioned=9%, GCS<15=9%. At least one of the aforementioned signs was seen in 48% of the cases. The average day of injury scores for the SCAT3 components were as follows: (i) Symptom Score (M=11.0, Md=11, SD=5.2, range=2-19); (ii) Symptom Severity (M=24.4, Md=23, SD=14.9, range=3-52); (iii) Sideline Assessment of Concussion (SAC; M=25.4, Md=26, SD=3.0, range=19-30); (iv) Coordination Score (M=1.0, Md=1, SD=0.2, range=0-1); (v) Modified Balance Error Scoring System (M-BESS; M=6.9, Md=4, SD=8.2, range=0-30); and (v) Tandem Gait (n=10; M=11.7s, Md=11.9s, SD=3.6s, range=7.2-20.0s). Of the 23 concussed players, 87% showed at least one abnormal SCAT3 component on the day of injury testing. The Symptom Score and Symptom Severity Score were the most sensitive to concussion; 87% of players had abnormal scores on one of these. The SAC was not strongly affected by concussion (only 22% had low scores), and the Coordination Score was normal 96% of the time. On the M-BESS, 45% of those concussed had unusually high error scores.

Conclusions: The SCAT3 is sensitive to the effects of acute concussion in professional ice hockey players assessed on the day of injury. The Symptom Scale was the most sensitive component of the test.
Intracranial complications after minor head injury: validity of CT prediction rules

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Objectives: Minor head injury is one of the most common injuries seen in the Emergency Department (ED). Some patients develop intracranial complications, which are potentially life threatening and might require neurosurgical intervention. Currently, computed tomography (CT) scanning of the head is considered the gold standard for fast detection of traumatic lesions of the neurocranium and brain. To limit radiation exposure and reduce costs only patients at risk for intracranial complications should be scanned. Various guidelines have been published to identify these patients. In this study we evaluated the Groningen CT protocol in a local cohort of patients with minor head injury and compared our head CT rule with three other prediction rules: the New Orleans criteria (NOC), the Canadian CT head rule (CCHR) and CT in Head Injury Patients (CHIP) rule.

Methods: Information on patients with head injury admitted at the ED of the University Medical Center Groningen are prospectively entered in a database. For this study, all digital files of patients seen by neurologists at the ED in 2011 were reviewed. Patients presenting with a Glasgow Coma Scale score of 13 to 15 were included. Secondary referrals, patients with age <6 and patients that left before CT scanning were excluded. Data on all risk factors from the different prediction rules were obtained. CT scans were reassessed and Trauma Coma Data Bank (TCDB) and Rotterdam CT scores were determined.

Results: Out of 328 included patients 282 were eventually scanned. Of these, 46 patients had a TCDB score of 2 or higher and three (1%) received a neurosurgical intervention. All prediction rules identified the patients in need of neurosurgical intervention. By applying the NOC 305 CT scans would have been performed and two patients with intracranial abnormalities would have been missed, these figures were 258/285 and 3/2 for the CCHR and CHIP study respectively. Finally, the Groningen CT protocol: 319 patients scanned and one patient with intracranial complications missed. All missed patients had a good recovery with the Glasgow Outcome Scale at discharge of moderate disability to good recovery.

Conclusions: All prediction rules resulted in a comparable number of intracranial complications missed: from one to three patients. All protocols identified the patients in need for neurosurgical intervention. The number of patients that would have been scanned using the individual CT rules varied considerably from 258 (CCHR) to 319 (Groningen) patients. As these results are preliminary further analysis will be done regarding adherence to guidelines and presented at the conference. In addition, these results have to be confirmed in a multicenter prospective study.
“Long Term Management of Severe TBI in Europe – The Value of a Network”

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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OBJECTIVES: Compare three models of service delivery which maximise recovery and social participation, in Northern France, Belgium, and UK.

•1. TC-AVC 59 62 Network (Odile Kozlowski Moreau³, François Danzé⁵, Bruno Pollez⁴, Marie Christine Liné³, Marc Rousseaux³)

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•3. Rehab Without Walls 27 Presley Way, Milton Keynes, MK8 0ES (Dr N Brooks, Ms C Johnson)

METHODS AND RESULTS

1. TC - AVC

Mission: Support people and families in Northern France (4 million inhabitants) after acquired brain injury, from early to late social reintegration, using a regional system comprising:

• 1. Multidisciplinary follow-up with rehabilitation centre physicians, and professionals from network mobile team. Multiple information sources used to define a personalised health plan which including the family physician.

• 2. Thematic working groups for professionals (e.g. patient and family information, driving, medical difficulties).
3. Educational and feedback sessions for patients and professionals.

Around 1,300 people have been followed since 2003, with a more coherent and complete follow-up, more effective functioning in daily life, and more life satisfaction (patients and family members). Professionals feel more confident and knowledgeable.

2. La Braise

Mission: Maintain long term care and management of people with acquired brain injury, by establishing and maintaining a network connecting those involved in the patient's daily life, including the patient, relatives, and professionals. This is achieved by constructing networks, for example:

- 1. Network between services (day centre, Functional Cognitive Rehabilitation Centre, Support Service, Respite and Rest Service, Neurosystemic Consultancy) responding to the evolving needs of the patient.

- 2. Network involving the various partners, including specialist services (hospitals, rehabilitation centres etc.), general services (psychologists, family and other doctors, social services etc.), nursing services, household help, etc.

3. Rehab Without Walls

Mission: Do "whatever it takes", to achieve maximum social and functional reintegration, and quality and productivity of life after a severe brain injury.

Our 22 case managers located in different areas of the UK find, coordinate, and quality assure services for Clients and families. As evidenced by personal feedback, questionnaire results, and BICRO scores, patient and families report feeling supported, and helped to achieve their maximum potential.

CONCLUSIONS

Networks are very effective in supporting patients, care givers, and professionals, who report that together, they can construct and manage individualised solutions for patients and families, with better and uninterrupted follow-up. Networks are essential to maintain long term daily functional stability of the patient and family members.
Factors predicting externalizing behaviour among young adults who experienced pediatric traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Oral

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Objectives: A growing number of research studies, undertaken within various national contexts, demonstrate a disproportionately high prevalence of traumatic brain injury (TBI) among youth and adult offending populations. Although this research demonstrates a robust association between TBI and offending behaviour, the neurocognitive mechanisms that link TBI to socially maladaptive behaviour remain poorly understood. The present study aimed to investigate rates of clinically significant externalizing behaviour in young adult survivors of paediatric TBI, and evaluate the contribution of pre- and post-injury risk and resilience factors to externalizing behaviour outcomes 16 years after injury.

Methods: This longitudinal prospective study comprised 55 young adult survivors of paediatric TBI (M age = 23.85; Injury Age: 1-12 years), representing consecutive admissions to the Royal Children’s Hospital, Melbourne emergency department between 1993 and 1997. Cognitive, social and behavioural functioning was assessed across the acute, 10-year and 16-year post-injury time points.

Results: One of every four young people with a history of pediatric TBI demonstrated clinical or sub-threshold levels of EB in young adulthood. More frequent externalizing behavior was associated with poorer pre-injury adaptive functioning, lower full scale IQ and more frequent pragmatic communication difficulty.

Conclusions: Pediatric TBI is associated with elevated risk for externalizing disorders in the transition to adulthood. Results underscore the need for screening and assessment of TBI among young offenders, and suggest that early and long-term targeted interventions may be required to address risk factors for EB in children and young people with TBI.
Relationship between late objective and subjective outcomes of holistic neurorehabilitation in patients with traumatic brain injury

Status: Accepted Presentation type: Poster
Category: Neurotrauma – case reports/clinical research
Author's preference: Oral

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Objectives: To explore the relation between objectively measured outcomes of neurorehabilitation and the participants’ subjective self-appraisal of those outcomes in patients with traumatic brain injury (TBI), and to compare the subjective outcomes of two holistic neurorehabilitation programs.

Methods: A cohort study in a setting of two neurologic rehabilitation centres, in Finland and the Netherlands. Forty-five participants (34 men, 11 women) with chronic moderate to severe TBI (mean ±SD age at injury, 30.1 ± 10.5y; mean ±SD chronicity, 9.7 ± 5.5y; percent posttraumatic amnesia, 80% over 1 or 4 weeks). These subjects resumed working at various levels of competence following post-acute, intensive, and comprehensive neuropsychologically oriented rehabilitation, and experienced no functionally incapacitating, medical or psychological problems, for a minimum of six months after discharge (mean ±SD time at work, 4.7± 2.3y).

The objective outcome measure was post rehabilitation level of work competence. This was transposed from the descriptions of the types of work attained by each subject into a number along a 10-point scale. To measure subjective outcome subjects rated themselves in six areas of post rehabilitation outcomes (effort during rehabilitation, meaning in life, productivity, acceptance, social life, and intimate relationships) along a 10-point scale.

Results: Sixty-seven percent of the patients attained competitive employment, mainly part-time, 22% attained subsidized, and 11% volunteer or sheltered workshop work ability. Median for the subjective self-appraisal of the six areas of wellness following rehabilitation was 8 or 9 out of 10 for the Finnish patients, and respectively 7.5 or 8 for the Dutch patients. The lowest self-appraisal for both of the groups was related to the ability to establish intimate relationships (mean ±SD, 7.7±1.6 FIN, mean ±SD, 6.9±1.9). A statistical significance (odds ratio [OR], 1.79; 95% confidence interval [CI], 1.20-2.68; P=.005) was found between the formed categories for the levels of work competence (sheltered workshop or volunteer work, subsidized work, and competitive work) and the subjective self-appraisal for ability to establish intimate relationships. Meaningfulness in life (effect size [r] =.36; P=.016), productivity in life (r=.57; P<.001), and the sum score of the self-ratings (r=.43; P=.003) were statistically significantly higher for the Finnish patients compared to the Dutch. The patients experienced more wellbeing in their life after the in-patient, shorter, and more comprehensive holistic neurorehabilitation program than the patients in the longer day treatment program.

Conclusions: The results support the need to evaluate rehabilitation outcomes involving both objective measures and subjective appraisals of them by the patients served. The findings also indicate that neurobehavioral and emotional disabilities may be the major challenge for facing rehabilitation and for enhancing intimate relationships, productivity, and overall wellbeing in life after TBI. Larger controlled studies are needed to clarify how composition of neurorehabilitation, and individualization in outcomes assessment might enhance the outcome of rehabilitation.
Repeated Behavioral Assessments in Patients with Disorders of Consciousness

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: No preference

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The clinical diagnosis of patients with chronic disorders of consciousness (DOC, i.e. unresponsive wakefulness/vegetative state (UWS/VS), minimally conscious state minus (MCS-; showing non-reflex behaviors), minimally conscious state plus (MCS+; showing response to command)) and emergence from MCS (EMCS) remains a major challenge. The Coma Recovery Scale-Revised (CRS-R) is a validated scale to behaviorally assess these severely brain-damaged patients. We here assess the influence of the number of CRS-R assessments on the patient's final diagnosis.

114 post-coma patients (>4weeks post-injury; 46 traumatic and 68 non-traumatic; 40 women; 36 UWS/VS, 16 MCS-, 54 MCS+, 8 EMCS) were assessed using the CRS-R for 6 times during a 15 days-period by accredited clinicians. Patients were medically stable and had no change in pharmacological or other treatment during the study period. Clinical diagnosis (UWS/VS, MCS-, MCS+, EMCS) based on 1, then 2, then 3, then 4 and finally 5 CRS-R assessments was compared with a “gold-standard” of 6 CRS-R assessments-based diagnosis using non parametric statistics (i.e., Friedman ANOVA and Wilcoxon’s test corrected for multiple comparisons). After each CRS-R assessment, patients were diagnosed according to the previous and the current assessments (e.g., a patient diagnosed as UWS/VS on the first assessment, MCS+ on the second, and UWS/VS on the third, is considered as UWS/VS for the first one, MCS+ for the second and the third (representing the diagnosis based on all the performed assessments)). Same analyses were run on CRS-R subscales scores (i.e., auditory, visual, motor, oromotor/verbal, communication and arousal).

The number of assessments had an effect on the clinical diagnosis (p<0.0001), independently of etiology. Differences were found between the "gold standard" diagnosis obtained after 6 assessments and those based on 1 (p<0.0001, 41% misdiagnosis), 2 (p<0.0001, 28% misdiagnosis), 3 (p=0.0003, 18% misdiagnosis), and 4 assessments (p=0.0253; 9% misdiagnosis). No difference was found between diagnoses based on 5 and 6 CRS-R assessments (p=0.33945, 4% misdiagnosis). The number of assessments influenced diagnoses: MCS- (p=0.0298), MCS+ (p<0.0001) and EMCS (p<0.0001). All the subscales were influenced by the number of assessments (all p<0.001). While auditory, visual and motor subscales showed the same pattern as diagnosis (i.e., no difference after 5 assessments), oromotor and arousal did not show any difference after 4 assessments, and communication after 3 assessments.

We here show that the number of CRS-R assessments changes the clinical diagnosis of patients with DOC and that up to 4 assessments, the behavioral fluctuations still impact the diagnosis accuracy. Auditory, visual and motor subscales are the most impacted by those fluctuations. We thus suggest, for diagnostic and research purposes, to repeatedly assess DOC patients at least 5 times within a short period (e.g., two weeks) in order to reduce the uncertainty of the bedside clinical diagnosis of patients with DOC.
Occurrence of Epileptiform Abnormalities and Seizures in Brain Injured Patients with Prolonged Disorders of Consciousness

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: the present observational study on patients with prolonged disorders of consciousness (DOC) was aimed to investigate: 1) the occurrence of epileptiform abnormalities (EA) and clinical epileptic seizures (ES) within 12 months after brain injury; 2) the correlation between EA and ES; 3) correlation of EA and ES with clinical diagnosis and level of responsiveness at study entry and at long-term follow-up.

Methods: We enrolled 116 inpatients (66 males, mean age: 56.6±17.4), with prolonged (≤3 months post-onset) DOC (87 in vegetative state-VS and 29 in minimally conscious state-MCS), following traumatic (n=26), vascular (n=49) or anoxic (n=41) brain injury. We recorded type [Hirsch, 2011] and frequency of EA, and number, type [Berg, 2010] and severity (in term of drug resistance) of ES within 12 months after injury. Such data were correlated with patients’ demographic features, clinical diagnosis and level of responsiveness assessed by Coma Recovery Scale-Revised (CRS-R) [Giacino, 2004] at time of EEG recording. We also assessed the relationships of EA and ES with clinical diagnosis and CRS-R total score at 30 months post-onset.

Results: EA were present in 56/116 (48.3%) DOC patients, and were not significantly associated with clinical diagnosis (49.4% of VS, 44.8% of MCS) or etiology (46.1% traumatic, 49.0% vascular or 48.8% anoxic brain injury).

EA were most often lateralized (92.9%), whereas generalized EA (7.1%) were found exclusively in anoxic patients. Frequency of EA was abundant in 28.6%, frequent in 46.4%, occasional in 16.1%, and rare in 8.9% of patients with EA. Patients with EA did not significantly differ for age, gender and CRS-R total score at study entry compared to patients without EA.

Among patients with EA, 24/56 (42.9%) developed clinically evident ES.

ES occurred in 32/116 patients (27.6%) and was not associated with clinical diagnosis (29.9% of VS, 20.7% of MCS) or with etiology (23.1% traumatic, 28.6.0% vascular or 29.3% anoxic brain injury). Patients with ES did not differ for age and CRS-R total score at study entry with respect to patients without ES.

All patients with ES and patients with abundant or frequent EA received antiepileptic treatment.

At the end of FU, 37/64 survivors recovered consciousness at least to some degree. The proportion of patients who recovered and mean CRS-R total score of the survivors were higher in patients without ES and/or EA, with respect to patients with ES and/or EA respectively, albeit not significantly (this held true for both VS and MCS patients).
**Conclusions**: a high number of DOC showed EA, most of them developed clinically evident ES within 12 months post-onset. Occurrence of EA and/or ES in DOC calls for appropriate levels of care. Presence of EA and/or ES did not affect recovery of responsiveness/consciousness at long-term FU, likely because of antiepileptic treatment.
A systematic review of the prevalence of traumatic brain injury among young offenders in custody

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – public policy and advocacy

Author's preference: Oral

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Objectives: In recent years there have been repeated calls for improvements in the recognition of and response to the mental and physical health needs of young people in the criminal justice system. This reflects concern for the apparent high levels of unmet needs and the likely ineffectiveness of responses that do not recognize these underlying needs to prevent future offending. Despite this awareness, it still appears rare for the influence of experiences of childhood traumatic brain injury (TBI) on adolescent offending to be recognized and responded to by criminal justice systems. Our research therefore sought to understand the prevalence of experiences of TBI among young people in custody.

Methods: A systematic review of research from various national contexts examined the prevalence of TBI among young people in youth justice custodial institutions, and comparative rates among young people in the general population.

Results: Ten studies were included in the review. Reported prevalence rates of TBI among incarcerated youth range from 16.5% to 72.1%, with variation largely explained by diversity in definition of TBI. There is consistent evidence of a prevalence of TBI among incarcerated youth that is substantially greater than that in the general population. This disparity appears more pronounced as the severity of the injury increases.

Conclusions: Several limitations in the literature are apparent, including a scarcity of evidence regarding: variation in prevalence by sociodemographic characteristics; the prevalence or impact of repeat experiences of TBI; and experiences of comorbidity of TBI and other developmental and mental health difficulties. However, the available evidence also suggests a range of implications for policy and practice, including the need for: more robust screening and assessment; tailored and responsive youth justice interventions; and greater investment in preventative services, such as family and educational support.
Xenon Provides Short-Term and Long-Term Neuroprotection in a Rodent Model of Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: Oral

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Background: Traumatic brain injury (TBI) is a leading cause of morbidity and mortality in western societies. Despite improvements in medical care, clinical TBI treatment is mainly supportive and no specific neuroprotective drugs are currently available. TBI results from external forces applied to the head, resulting in immediate and irreversible damage, known as primary injury, and triggering early, and long-lasting, secondary injury cascades. Over-activation of N-methyl-D-aspartate (NMDA) receptors is thought to play a key role in secondary injury development. Xenon is a noble gas and general anaesthetic. Xenon is a competitive inhibitor of the NMDA receptor at the glycine binding site and it has been shown to be neuroprotective in models of brain ischemia. Much less is known about xenon effect in the context of traumatic brain injury.

Objectives: Our work focused on evaluating xenon's neuroprotective efficacy in the reproducible controlled cortical impact model of blunt traumatic brain injury, mimicking elements found after moderate to severe TBI in humans, such as contusional lesion, brain oedema, elevated intracranial pressure and neurological impairment.

Methods: Adult C57BL/6 male mice (n=196) were fixed in a stereotactic frame under anaesthesia and underwent a right parietal cortical impact, delivered by a custom-made electro-pneumatic impactor with a 3mm diameter tip perpendicular to the brain surface. Impact velocity of 8m/s, impact duration of 150ms and brain penetration depth of 1.0mm were used. Throughout the procedure core body temperature was monitored and controlled. Animals were randomly assigned to control (75% nitrogen: 25% oxygen) and xenon treated (30%, 50% or 75% xenon: 25% oxygen, balanced with nitrogen) groups. Short term and long term outcomes, both functional and histological, were measured by researchers blinded to treatment. Statistical significance was assessed with one-way and two-way ANOVA with Bonferroni’s post hoc test (SigmaPlot software).

Results: Our study showed 75% xenon significantly (p<0.05) reduced contusion volume 24 hours after injury and significantly (p<0.05) improved neurologic outcome up to 4 days after injury & clinically relevant locomotor parameters 1 month after injury. Xenon treatment significantly (p<0.05) reduced contusion volume when given up to 3 hours after injury and significantly (p<0.05) improved neurologic outcome when given up to 1 hour after injury. Significant (p<0.05) reductions in contusion volume and an improvement in neurologic outcome 24 hours after injury were also achieved with 30% and 50% xenon concentrations.

Conclusions: Our results show for the first time in an animal model of TBI that xenon improves functional outcomes and reduces contusion volume. We demonstrate both a reduction in the development of secondary injury and improvement in functional neurological outcome. Our findings,
including the demonstration of long term neuroprotection and a clinically relevant therapeutic time window, support the idea that xenon may be of benefit as a neuroprotective treatment in TBI patients.
Short Term Effectiveness of a Literacy and Culture Free Neuropsychological Rehabilitation Program on Cognition and Post Concussive Symptoms post Traumatic Brain Injury: An Randomized Controlled Trial

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: It is estimated that there are nearly 1.5 to 2 million survivors of Traumatic Brain Injury (TBI) in India. TBI can lead to cognitive impairments and persistent Post Concussive Symptoms (PCS) which are frequently over sighted in the follow up clinics of Neurosurgery in India. The effectiveness of Neuropsychological Rehabilitation (NR) post TBI is well documented and established, but there is a paucity of literacy and cost effective cognitive retraining interventions for developing nations which can be used as home-based retraining interventions. A pilot study of a new cognitive rehabilitation intervention developed in India which was education and culture free was developed and its effectiveness studied.

Methods: Thirty four consenting individuals in an ongoing clinical trial (CTRI/2014/04/004555), between 18-45 years, educated from 0 to 17 years, within one month of Mild (n=26) or Moderate TBI (n=8); with cognitive complaints and/or PCS, were randomized using block randomization and assigned to the control group (Mean Age 30.8±9.2 S.D. Years) (Baseline n=17; follow up n=13) or the intervention group (Mean Age 32.3±10.2 S.D. Years) (Baseline n=17; follow up n=10). They were evaluated pre and post NR using standardized neuropsychological tools for episodic memory, recent memory, working memory, focussed attention, delayed recall, short term verbal memory, paired associate learning, new learning, visual memory, recognition, verbal fluency, perceptuo-motor functioning, anxiety, depression, PCS and Quality of Life (QOL). The 6-week, home-based Neuropsychological Rehabilitation included cognitive retraining for focussed and divided attention; short term and long term visual memory; visuo-spatial and planning ability; and relaxation techniques.

Results: Within group analysis using paired t-test/ Wilcoxon signed-rank test showed improvement in all domains in both groups. There were significant improvements in the intervention group as compared to the control after 6 weeks, in episodic memory (p =0.030); working memory (p=0.016); short term verbal memory (p=0.007); paired associate learning (p=0.050); new learning, anxiety (p=0.007); depression (p=0.032); PCS (p=0.050); and QOL (0.005). PCS still persisted in the control group on follow up (p=0.300), which shows NR was also successful in ameliorating PCS in the intervention group.

Conclusions: Frequently used cognitive interventions have been found to be non-reproducible in developing nations like India, as literacy rates can affect task performance. This intervention can be used with patients with low education levels or from lower socio-economic status who cannot afford daily visits to the Neuropsychologist or a tertiary care centre for Cognitive Remediation. Long term benefits of this intervention are being followed up to study its effectiveness 3 months, 6 months and 1 year post rehabilitation.
AMPAR Receptor Trafficking In Modelled Traumatic Brain Injury

Status: Accepted Presentation type: Poster
Category: Neurotrauma – basic research
Author's preference: Poster
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Objectives: Traumatic brain injury (TBI) is a major unmet medical need with no effective therapeutics to tackle detrimental disease progression. TBI can be defined simplistically as damage to the brain resulting from an external mechanical force [1]. TBI involves complex pathophysiological cascades underlying characteristic neurological symptoms including cognitive deficits and neuropsychiatric disorders [2]. AMPA receptors (AMPAR) are glutamate gated cation channels which function as tetrameric assemblies of four unique subunits to mediate fast excitatory neurotransmission in the brain [3]. AMPAR trafficking is the fundamental mechanism for regulating synaptic strength and synaptic plasticity, the cellular correlate of learning and memory [4]. Previous experimental studies have implicated AMPAR trafficking in neuronal death [5] and observed deficits in synaptic plasticity in TBI models [6]. The overarching aim is to investigate potential deficits in long-term potentiation in the perirhinal cortex underpinned by aberrant AMPAR trafficking.

Methods: An in vitro mechanical stretch model of trauma was combined with biochemistry to study AMPAR trafficking in cultured neurons and investigate cell death and deficits in synaptic plasticity. A clinically relevant in vivo fluid percussion model of TBI in rats in conjunction with histopathological, electrophysiological and behavioural analysis is being applied to further advance the study.

Results: Stretch injury induces subunit specific AMPAR trafficking in neurons providing evidence for increased surface expression of calcium permeable receptors. Alterations to surface complements of AMPARs are sustained. Injury capable of inducing trafficking results in no detectable cell loss up to 72hrs post trauma. The induction of chemical-LTD is impaired in cultures subjected to mechanical trauma.

Conclusions: Currently it can be concluded that in vitro trauma induces subunit specific AMPAR trafficking that isn’t associated with neuronal loss and this trafficking occludes the induction of LTD in culture. Ongoing and further work will build on these findings in an in vivo setting.

Acknowledgement:

Discourse Production After TBI: Is There a Severity Effect?

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Traumatic brain injuries (TBIs) are often associated with communicative deficits even in patients who are not aphasic. Accumulating evidence suggests that methods of discourse analysis provide an effective way to identify such deficits in non-aphasic individuals with TBI with different severity levels (e.g., Galetto et al., 2012; Cannizzaro & Coelho, 2012). However, little research has directly compared narrative abilities across the severity spectrum of TBI. In this study 60 Italian-speaking participants formed a group with severe TBI (N=20), one with moderate TBI (N=20), and one control group (N=20). The three groups were matched for age, level of formal education, and gender and all TBI participants were non-aphasic and in the chronic stage. The subjects completed tasks designed to assess attention, verbal learning, executive functions, and linguistic skills. Their narrative skills were assessed by administering the Multilevel Procedure for Discourse Analysis (Marini et al., 2011). All participants performed in the normal range on the Aachener Aphasia Test. On all tasks tapping cognitive skills, individuals with severe TBI performed worse than those with moderate TBI who, in turn, performed worse than controls only on the production of perseverative and non perseverative errors at the Wisconsin Card Sorting Test. Both groups of participants with TBI had reduced speech rate but only individuals with severe TBI had additional difficulties (reduced mean length of utterance, production of more semantic and morphological errors and fewer grammatically well-formed sentences than controls). Even more interestingly, the analysis of the macrolinguistic aspects of narrative production showed that both groups with TBI had difficulties in establishing links of local and global coherence. A series of Pearson product moment correlation analyses revealed that the macrolinguistic difficulties observed in the two groups of participants with TBI were correlated to attentive and executive difficulties. Overall, these results 1) confirm that procedures of discourse analysis allow clinicians to detect linguistic difficulties not captured by traditional linguistic tests, 2) highlight that severe TBI affects not only macro- but also microlinguistic skills, and 3) suggest that the macrolinguistic impairments observed in patients with TBI may at least in part depend on executive and attention skills.

References


Visual Tracking in Relation to the Level of Consciousness in a Cohort of Children and Adolescents With Prolonged Disorders of Consciousness

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Visual tracking (VT) has been associated with recovery from the level of the unresponsive wakefulness syndrome (UWS) into MCS. Visual functions are represented at multiple sites in the brain, resulting in conscious as well as automatic information processing. It is hypothesized that the emergence of signs of VT are associated with recovery of brain functions and predicts recovery into full consciousness.

To investigate this, the reactions to different visual stimuli at different levels of consciousness (LOC) are of interest. As part of a larger study, we investigated the relation between the observed LOC and reactions to the visual stimuli from the Western Neuro Sensory Stimulation Profile (WNSSP) in a cohort of unconscious children and adolescents.

Methods: Two-weekly longitudinal assessments with the WNSSP were performed in 44 patients with prolonged disorders of consciousness (DOC), aged 2-25 years, who were admitted to an early intensive neurorehabilitation program. Assessments started at the time of registration and ended the week before discharge of the program. VT items of the WNSSP included the horizontal (scores 0-3) and vertical tracking (scores 0-2) of a mirror, an object, and a picture and the horizontal tracking of an individual. LOC was established using the Post-Acute Level Of Consciousness scale (PALOC-s), resulting in 8 different LOC’s: coma (P1), UWS hypoactive (P2), UWS reflexive state (P3), UWS high level active (P4), MCS transitional state (P5), MCS inconsistent reactions (P6), MCS consistent reactions (P7), and conscious (P8). Visual and statistical analyses (linear mixed models) were executed on the relation between the WNSSP VT-scores and the PALOC-s scores.

Results: In total, 402 measurements were analyzed. On PALOC-s levels P2 and P3, the scores on the VT-items were low, demonstrating no reactions on visual stimuli, with no differences seen between the levels. A sudden increase on the VT-scores was seen between P3 and P4 and a somewhat lower increase between P5 and P6 on the horizontal as well as the vertical tracking items, demonstrating clear evidence of the processing of visual stimuli. The highest scores are seen on the tracking of the mirror, followed by the picture. Between P7 and P8 differences between different stimuli disappeared: the maximum scores on the WNSSP items have almost been reached at P7.

Conclusions: Visual tracking can probably differentiate between UWS and MCS and between MCS and consciousness. Especially, tracking one’s own face in the mirror in the highest level of UWS and the lowest level of MCS seems to be an important stimulus, suggesting the involvement of emotional structures in primary visual processing, what possibly forms an important feature for further recovery.

Further analyses will be done in order to investigate the differences between the different stimuli in the different LOC’s.
Standard EEG in Prolonged Disorders of Consciousness

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Clinical interpretation of patients' behavior (reflexive versus volitional) in patients with acquired disorder of consciousness (DOC) can be very difficult, because of severe sensori-motor deficits (Majerus et al., 2005). The present cross-sectional study on prolonged DOC patients aimed: 1) to correlate predominant background EEG activity and EEG reactivity with level of responsiveness assessed by Italian version of Coma Recovery Scale-Revised (CRS-R, Estraneo et al., 2014), and etiology; 2) to assess the diagnostic value of standard EEG in distinguishing vegetative state (VS) from minimally conscious state (MCS) patients.

Methods: We enrolled 63 stabilized inpatients (31 F; mean age 55.4 ±18.6 yrs.) with prolonged DOC (≥6 months post-onset, mean time:17±22 months), due to severe traumatic (n=19), vascular (n=22) or anoxic (n=22) brain injury. Thirty-four patients were in VS (CRS-R range:2-7) and 29 in MCS (CRS-R range:7-23). Mean CRS-R total score significantly differed between two diagnostic groups (p< .001).

In all patients we recorded background predominant EEG activity and EEG reactivity to eye closing and to tactile, acoustic, nociceptive stimuli and Intermittent Photic Stimulation (IPS).

We classified EEG background activity on the basis of frequency and amplitude of predominant cortical rhythm [ACNS Guideline 7, 2006]: 1) normal, i.e. posterior alpha rhythm and anterior-posterior gradient (APG), without focal or hemispheric slowing or epileptiform abnormalities; 2) mildly abnormal (MA), i.e. posterior theta activity (≥20 μV), not well organized APG, even with occasional posterior alpha rhythms; 3) diffuse slowing (DS), i.e. diffuse theta or theta/delta rhythms at amplitude ≥20 μV, without APG; 4) low voltage (LV), i.e. theta or delta rhythms <20 μV over most brain regions.

Results: More than half (60%) of enrolled DOC patients had DS as the background activity, whereas 18 % and 22 % of them showed MA or LW predominant EEG activity respectively. No patient presented normal EEG background activity. The distribution of EEG patterns differed significantly in MCS and VS (p<.001) and across the three etiologies (p=.003), but did not differ between mean of CRS-R total score in VS and MCS pts. Reactivity to IPS was significantly more frequent in MCS (86.2%) than in VS (38.2%; p<.001), whereas differences between MCS and VS only approached the significance level for frequency of EEG reactivity to eye closing (p=.06) and acoustic stimuli (p=.02). Presence of at least one of the five examined types of EEG reactivity was significantly more frequent in MCS than in VS (p<.001), and had good sensitivity (1.0) but low specificity (.63) for diagnosis of MCS.

Conclusions: EEG background activity and the pattern of EEG reactivity to IPS differed between two diagnostic groups (VS and MCS). Qualitative analysis of conventional EEG can provide useful, easily available, information to complement bedside behavioural assessment of DOC patients.
**Visual Memory Activation Changes post Cognitive Rehabilitation after Traumatic Brain Injury: A Controlled Trial**

**Status:** Accepted
**Presentation type:** Poster

**Category:** Neurorehabilitation – case reports/clinical research

**Author's preference:** Oral

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**Objectives:** Multitude of variables associated with a number of outcome variables present a risk factor for ambiguous findings in clinical trials and studies on Traumatic Brain Injury (TBI) (Levin et al., 2013). Impairments in memory are a major consequence after TBI (Sandry, DeLuca & Chiaravalloti, 2015). Functional brain mapping along with neuropsychological assessments can provide an objective evidence of deficits in people after injury.

**Methods:** Thirty four consenting patients from an ongoing Randomized Clinical Trial (CTRI/2014/04/004555) aged between 18-45 years, within one month post Mild or Moderate TBI were randomly assigned to the control group (CG) (Mean age: 30.8±9.2 years) (Baseline n=17; Follow up n=13) or intervention group (IG) (Mean age: 32.3±10.2 years) (Baseline n=17; follow up n=10). Patients were evaluated on neuropsychological measures and Functional Magnetic Resonance Imaging (fMRI) for Memory, Episodic memory, recent memory, working memory, focussed attention, delayed recall, short-term verbal memory, paired associate learning, new learning, visual memory, recognition ability and mental status were tested using standardized Indian neuropsychological tools namely: PGI-Memory Scale (PGIMS), Mini-Mental State Examination (MMSE) and Neuropsychological Evaluation Screening Tool (NEST). fMRI paradigm for short term visual memory was given to 8 consenting patients (CG: n=3, IG: n=5) using 1.5 MRI Tesla scanner using Superlab and binocular camera with eye-tracker (Nordic Neurolab, Norway). Feedback was taken using a 4-button response pad (Cedrus Inc., USA). The 6-week indigenized literacy free cognitive rehabilitation intervention included retraining in areas of visual short term, long term memory; focussed and divided attention; planning and visuo-spatial ability and relaxation techniques.

**Results:** Pre-post analysis using Wilcoxon signed-rank test showed improvements in memory in both the groups; but a more significant improvement in the IG was observed in episodic memory (p=0.030); working memory (p=0.016); short term verbal memory (p=0.007); paired associate learning (p=0.050); new learning (p=0.007) and mental status (p=0.005). Blood Oxygen Level Dependent (BOLD) revealed activations in culmen and precentral gyrus during visual recall of known objects and for unknown landscapes activations were observed in cuneus, parahippocampal gyrus, declive, cerebellar tonsil, fusiform gyrus, precuneus and lingual gyrus. Post 6 weeks of intervention, right middle frontal gyrus (Brodmann area 6) was significantly active in comparison to the pre-therapy fMRI session. The intervention group exhibited activation in left cerebral lingual gyrus in comparison to the control group.

**Conclusions:** These findings demonstrate retrieval of visual memory processing post cognitive rehabilitation, as demonstrated by activation in lingual gyrus during processing of visual cues and middle frontal gyrus activated during pressing of response buttons. Specific activations pre and post cognitive interventions can provide valuable information for cognitive recovery after brain injury, and may contribute to guide clinicians for specific biomarkers for rehabilitation.
Both Endoplasmic Reticulum And Mitochondrial Pathways Are Involved In Oligodendrocyte Apoptosis Induced By Capsular Hemorrhage

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: The white matter injury caused by intracerebral hemorrhage (ICH) includes demyelination and axonal injury. Oligodendrocyte apoptosis is reported to be involved in triggering demyelination. Experimental observations indicate that both endoplasmic reticulum and mitochondrial pathways could mediate cell apoptosis. The purpose of this study was to investigate the demyelination and the possible mechanisms in an autologous blood-injected rat model of internal capsule hemorrhage.

Methods: Transmission electron microscope was applied to examine the pathological changes of myelinated nerve fibers in internal capsule. Western blotting was used to detect the myelin basic protein (MBP) which was an important component of myelin sheath. Double immunofluorescence and western blotting were used to determine the apoptosis and apoptotic pathways. The levels of caspase-12 (a representative protein of endoplasmic reticulum stress) and cytochrome c (an apoptosis factor released from mitochondria) were assessed in this study.

Results: Demyelination occurred on day 1, 3, 7 after ICH onset. Myelin sheaths of internal capsule nerve fibers were swollen and broken down in ICH groups. MBP expression showed a downregulation after ICH with its minimum value occurred on day 7 post-ICH. Besides, neuron and Oligodendrocyte apoptosis were observed at different time intervals post-ICH accompanied with an upregulated caspase-12 expression and enhanced cytochrome c release.

Conclusions: These results suggested that oligodendrocyte and neuron apoptosis may contribute to the demyelination induced by internal capsule hemorrhage and oligodendrocyte apoptosis is positively mediated through both endoplasmic reticulum and mitochondrial pathways.
Years following the insult, traumatic brain injury patients often experience persistent motor control problems, including bimanual coordination deficits. Previous studies revealed that such deficits are related to structural white and grey matter abnormalities. Here, we uniquely assessed functional activation patterns during bimanual movement preparation and performance in traumatic brain injury patients. Eighteen moderate-to-severe traumatic brain injury patients (10 females; aged 26.3 years ± 5.2; age range: 18.4-34.6 years) and 26 healthy young adults (15 females; aged 23.6 years ± 3.8; age range: 19.5-33 years) performed a complex bimanual tracking task, divided into a preparation (2 seconds) and execution (9 seconds) phase, and executed either in the presence or absence of augmented visual feedback. Brain function was assessed using event-related functional magnetic resonance imaging. The average target error on the bimanual tracking task was higher for patients than controls \([F(1,42) = 16.30, p < 0.001]\) and for trials in the absence as compared to the presence of augmented visual feedback \([F(1,42) = 200.56, p < 0.001]\). Regarding functional imaging patterns, movement preparation was characterized by reduced neural activation in the patient group relative to the control group in frontal (bilateral superior frontal gyrus, right dorsolateral prefrontal cortex), parietal (left inferior parietal lobe) and occipital (right striate and extrastriate visual cortex) areas \([ps < 0.05]\). During the execution phase, however, the opposite pattern emerged, i.e., traumatic brain injury patients showed enhanced activations compared with controls in frontal (left dorsolateral prefrontal cortex, left lateral anterior prefrontal cortex, and left orbitofrontal cortex), parietal (bilateral inferior parietal lobe, bilateral superior parietal lobe, right precuneus, right primary somatosensory cortex), occipital (right striate and extrastriate visual cortices), and subcortical (left cerebellum crus II) areas \([ps < 0.05]\). Moreover, a significant interaction effect between Feedback Condition and Group in the primary motor area (bilaterally) \([p < 0.001]\), the cerebellum (left) \([p < 0.001]\) and caudate (left) \([p < 0.05]\), revealed that controls showed less overlap of activation patterns accompanying the two feedback conditions (i.e., increased neural differentiation) than traumatic brain injury patients. In sum, our findings point towards poorer predictive control in traumatic brain injury patients in comparison to controls. Moreover, irrespective of the feedback condition, widespread overactivations were observed in traumatically brain injured patients during movement execution, pointing to more controlled processing of actual task performance.
Emotional Functioning and Reactivity of University Students to Emotionally-Evocative Stimuli as a Function of a History of Mild Head Injury

Objectives: We further examined the dampened emotional arousal profile (i.e., underarousal - see Baker & Good, 2014) of students with self-reported mild head injury (i.e., MHI; sufficient to produce an ‘altered state of consciousness’) and their reactivity to emotionally-evocative stimuli relative to their peers with no MHI. Emotional disturbances following severe TBI to emotional stimuli have been shown (e.g., de Sousa et al., 2012), but little research has examined emotional responsivity via physiological indices to affective stimuli in the MHI population.

Methods: Participants (N = 85) were exposed to pictures with affective content (positive, negative, or ambiguous stimuli) from the International Affective Picture System (IAPS; Lang et al., 2008) while recordings of physiological state (i.e., electrodermal response [EDA]) and ratings of the stimuli were obtained (arousal, intensity, valence, empathy). Polygraph Professional equipment recorded EDA from the non-dominant hand. Participants were not informed that head injury was a primary variable of interest until debriefing to avoid biased responses (see Suhr & Gunstad, 2002).

Results: Over one third of university students reported a history of MHI with approximately half reporting a brief loss of consciousness. We hypothesized that, like persons with moderate to severe TBI, students with MHI would be less emotionally responsive to the stimuli than would be students with no reported history of head trauma. We examined this hypothesis via a 3 X 2 mixed model ANOVA with type of emotional stimuli (positive, negative, or ambiguous) as the repeated measure and MHI history (no MHI, MHI) as the between-subjects variable on EDA amplitude. A significant 2-way interaction of type of stimulus by MHI history was shown for EDA amplitude. As follow up, repeated measure ANOVAs were conducted separately for each group (no MHI, MHI). We found that for students with MHI, EDA amplitude did not change significantly as a function of stimulus type – i.e., flat emotional responsivity; yet students with no history of MHI produced significantly different EDA responses to the negative, positive, and ambiguous/neutral stimuli. Multiple comparisons revealed that negative stimuli produced the largest response relative to positive and ambiguous stimuli – all three stimulus types produced significantly varied EDA responses for students without MHI, p’s < .001. In concert with the underarousal hypothesis (e.g., Baker & Good, 2014), we expected lower ratings of the affective stimuli for those with MHI relative to those without MHI, but this hypothesis was not supported.

Conclusions: The results of this study illustrate that even persons with self-reported ‘mild’ head trauma demonstrate reduced/minimal affective responsivity in terms of autonomic responses to emotional stimuli that is characteristic of persons with TBI (Hopkins et al., 2002), albeit more subtly. These long-lasting individual differences in response to emotionally-relevant stimuli may ultimately challenge their overall functioning.
Sympathetic Underarousal: A Framework for Understanding and Managing Postinjury Psychiatric Symptoms

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: Psychiatric symptomatology is frequently reported following traumatic brain injury (TBI), with up to 90% of individuals reporting depressive symptomatology following their injury (Seel et al., 2003; van Reekum et al., 2000). One area of the brain that is frequently implicated in TBI is the orbitofrontal cortex (OFC), due to its vulnerable location in the skull (Bigler & Orrison, 2001; Wallis, 2007). The OFC has been implicated, among other things, for its role in the modulation and regulation of anticipatory sympathetic arousal through its connections with the brain stem (e.g., periaqueductal gray area, reticular formation and raphe nucleus, etc.) via the limbic system (Barbas et al., 2003; Carmichael & Price, 1995). Injury to this region, has been associated with dampened anticipatory sympathetic arousal and consequently, this has been found to impact decision-making processes (Bechara et al., 1996; 2004). The OFC has also been linked to many forms of psychopathology (e.g., depression, anxiety, psychopathy, etc.; Maller et al., 2010). This framework serves to explain the increased prevalence of these psychiatric symptoms as well as proposing a novel mechanism for their treatment.

Methods: Four studies from our laboratory have been conducted with University students with and without mild head injury (MHI) to build this framework. Participants completed a series of neurocognitive measures while measures of physiological arousal were taken (i.e., pulse, respiration and electrodermal activation) in addition to self-report measures of psychopathology (e.g., SCL-R-90, BDI, SPR-3, PAI, etc.).

Results: Consistently, within these four studies we have observed individuals who report a MHI as being physiological underaroused relative to their non-injured cohort. Further, we observed that individuals endorse more somatic/physical symptoms of depression and anxiety, as well items related to primary psychopathy (callous affect, but not interpersonal) and secondary psychopathy (erratic lifestyle and antisocial behaviour) relative to those without an injury. These symptoms, somatic/physical symptoms of depression and anxiety as well as psychopathic traits were found to be predicted by measures of physiological arousal (EDA) for the head injury group only, whereby the greater the underarousal endorsed more symptoms. Conversely, individuals without a MHI endorsed more affective symptomatology of depression and anxiety and this was not found to be related to physiological arousal.

Conclusions: These findings suggest that following a head injury, the clinical presentation of individuals may appear similar to that of a number of different psychiatric presentations, but instead may reflect underarousal sequelae (e.g., emotional blunting and dysregulation, motivational/initiation difficulties). Should these findings be replicated in larger clinical samples, underarousal may be a major therapeutic target differing considerably from traditional psychopathology targets. Further, it has implications for the psychiatric literature, as MHI may a major contributor of significant clinical heterogeneity given its prevalence.
Physiological Arousal and Personality Profiles of Mild Head Injury in University Athletes

Status: Accepted  Presentation type: Poster
Category: Neurorehabilitation – basic research
Author's preference: No preference

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Objectives: The incidence of mild head injuries (MHI; i.e., concussions) is exceedingly high, especially in high-risk athletic populations (e.g., football players; Vakil, 2005). Research suggests that high-risk athletes typically have riskier personalities than low-risk and non-athletes, including elevated levels of sensation seeking and aggression (e.g., Sonderlund et al., 2014) which may increase their risk of sustaining a MHI. Furthermore, despite the fact that most individuals with a history of MHI are high functioning, literature suggests that milder head injuries (e.g., MHI) can result in long-term alterations or dysfunction postinjury (e.g., Belanger et al., 2005). For instance, it has been observed that individuals with a history of MHI present with elevated levels of impulsivity and aggression postinjury (e.g., Mendez et al., 2013; Rochat et al., 2010), and have been found to persist long-term (McCrea et al., 2009). However, it is difficult to determine whether such personality traits are due to the head injury itself, or whether premorbid characteristics account for the apparent changes postinjury. The current study attempted to determine whether personality alterations postinjury are primarily a function of disruption to the brain, or whether apparent changes in behaviour reflect one’s preinjury status.

Methods: Seventy-seven individuals (M age= 21.01, SD= 2.752; 42% with a history of MHI) of various athletic status (non-athletes, low-risk athletes, and high-risk athletes) participated. Consistent with previous research, high-risk athletes reported having previously sustained more MHIs than low-risk and non-athletes, F(2, 74)= 5.678, p= .005.

Results: Individuals with a previous MHI displayed decreased physiological arousal (i.e., electrodermal activation), F(1,74)= 6.170, p= .015, and endorsed elevated levels of sensation seeking, F(1,74)= 3.419, p= .068, and physical/reactive aggression, F(1,74)= 4.085, p= .047, compared to individuals without a history of MHI. The elevated aforementioned personality traits were also associated with decreased physiological arousal. The athletic groups (i.e., high-risk, low-risk, and non-athletes) did not differ in terms of physiological arousal or personality characteristics.

Conclusions: It is proposed that individuals with a prior MHI sustained disruption to the orbitofrontal cortex (OFC), as this area is crucial in emotional regulation and behaviour inhibition (e.g., Morales et al., 2007). It is also possible that the observed physiological underarousal in these individuals renders them less able to anticipate events in their environment; as such, individuals present in a reactive, impulsive fashion to unanticipated events—consistent with previous studies (e.g., van Noordt & Good, 2011). Alternatively, perhaps individuals are attempting to increase their level of vigilance, and thus will present in a risk-taking fashion. Thus, changes in behaviour post-MHI may be associated with the physiological disruption of the injury itself. As there were no differences in personality between the athletic groups, it is unlikely that changes in personality are solely due to premorbid factors.
Studying the Comparative Effectiveness of Rehabilitation Interventions for Traumatic Brain Injury: Lessons Learned on the Use of Propensity Score Methods

Objectives: Describe the unique issues that must be addressed when using propensity score methods (PSM) to compare the effectiveness of TBI rehabilitation interventions, and report initial findings.

Background: The most effective rehabilitation methods for TBI have yet to be identified. Systematic reviews have concluded that studies of acute multidisciplinary rehabilitation remain sparse and have been minimally informative regarding which of the wide range of practices in current use are most effective. Difficulties with conducting experimental research in this area are widely acknowledged (e.g. heterogeneous population; ethical concerns with withholding treatment).

Estimation of treatment effectiveness using observational, rather than experimental, data has become increasingly popular following the development of rigorous statistical methodologies for causal inference. To date, PSM has been used minimally within the field of TBI rehabilitation, and yet shows great promise as a means to overcome some of the obstacles faced in conducting randomized controlled trials (RCTs). PSM allows for evaluation of the intervention as it naturally occurs, improving generalizability to real world populations and settings as compared to RCT findings that by the nature of the subjects or the artificiality of the intervention often do not replicate to other sites or to clinical samples. However, randomization offers confidence of unbiased estimation of the treatment effect and that confounding factors, measured or not, are equalized between treatment groups, allowing strong conclusions for causal inference. The strength of causal assertions made with PSM needs to be tempered by the extent to which the potential for bias has been controlled.

Methods: The USA Patient-Centered Outcomes Research Institute (PCORI) has funded a study of the TBI Practice-Based Evidence database using PSM. This multicenter dataset of 2120 participants includes detailed documentation of interventions, patient, and injury characteristics, and longitudinally collected patient-reported outcomes during the first year after discharge. The study will estimate the comparative effectiveness of different therapeutic approaches (contextualized vs. decontextualized; advanced vs. basic) and differences in delivery (degree of family involvement in treatment, time and level of effort in therapy) on participation, functional independence, and subjective well-being during the year following rehabilitation.

Results: While implementing PSM, we have encountered issues that have a unique presentation in longitudinal studies of the effects of TBI rehabilitation interventions and are not fully addressed in the literature: building propensity score models for multiple outcomes and associated problems with choosing covariates; evaluating differing dosages of interventions; defining therapeutic approaches; choosing the sample for developing the propensity scores when the follow-up sample differs from the original sample; and sensitivity analysis issues.
Conclusions: This presentation will present initial findings and use lessons learned from this study to illustrate the issues that need to be tackled when using PSM to address treatment selection bias in comparative rehabilitation research.
A Systematic Review of the Current Reporting Quality of TBI Rehabilitation Interventions

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Objectives: After Traumatic Brain Injury (TBI) someone will face many challenges due to impairments affecting a wide variety of domains. Recommendations for brain injury rehabilitation are extensively informed by systematic reviews and high quality RCTs however interventions are often poorly described, not enabling implementation in practice[1]. Recently, a Template for intervention description and replication (TIDieR) has been developed which provides guidance and a check list (12 items) for reporting interventions. The aim of this review is therefore to explore the ways, used to describe and measure the contents and quality of rehabilitation, capable of assessing the type, fidelity, quantity, and quality of rehabilitation interventions in people recovering from TBI in hospital, home and community settings.

Methods: A systematic literature search was performed to identify studies that describe rehabilitation, specifically for traumatic brain injury patients. The following electronic bibliographic databases were searched from the period January 2004 until January 2014: PubMed, PsychInfo, Web of Knowledge and CAHL were searched. Abstracts and papers were independently reviewed for inclusion and exclusion criteria. Studies with a small or a young TBI population (n<10, age<18yrs), no or pharmacological interventions, interventions that focus on family or caregivers, (Narrative) reviews, cross-sectional studies, letters, editorials, commentaries, unpublished manuscripts, dissertations, government reports, conference proceedings, meeting abstracts, and lectures and (7) non-English papers were excluded. Data was extracted and rated for quality according to TIDIER guidelines[1].

Results: 1789 papers were identified through initial searches. 747 abstracts and 144 studies were excluded after screening for inclusion and exclusion criteria (kappa 0.83 and 0.91 respectively). Data was extracted from 58 studies by three researchers and taken for further analysis. A total of 29 studies reported on fidelity or adherence, only 17 reported on both simultaneously. Six percent of studies reported on 11 out of 12 items of the TIDieR checklist for reporting interventions. 10 percent of studies reported on 10 items, whereas the remaining studies rated on 9 to 5 items of the TIDieR checklist.

Conclusions: Studies did not formally or systematically describe contents of rehabilitation interventions in TBI. This supports the adherence to TIDieR template and checklist for future reporting of interventions to provide a clear path to implementation of the proposed intervention in practice.

Background: Traumatic brain injury (TBI) is a complex injury with a wide range of symptoms and disabilities which can lead to a life long devastating effect on a patient and the family. Its incidence is increasing day by day. There is a need of better management in traumatic brain injury patient to reduce the mortality and morbidity associated with it. Cerebroprotein hydrolysate is a recent neurotrophic and neuroprotective drug which is in use for acute ischaemic strokes, vascular dementia, Alzheimer's disease and traumatic brain injuries with its proven potential.

Objectives: Our paper aims to evaluate the effectiveness and safety of cerebroprotein hydrolysate in the management of traumatic brain injury patients.

Methods: This was a randomized clinical study conducted in Department of Surgery, Gandhi Medical College Hospital. Total 200 number of patients were included in this study and were divided in two groups. Group 1 received cerebroprotein hydrolysate for 14-20 days and Group 2 received only conventional therapy as a control group. Both group were subjected to GCS, APACHE II scores and CT/MRI Brain on admission and was compared with the degree of improvement on 14, 20 days from the day of admission.

Results: Patients on cerebroprotein hydrolysate was compared to conventional therapy (Control) group. Patients with cerebroprotein hydrolysate showed statistical significance (p value = 0.001) in regards to GCS and in terms of functional and cognitive outcome.

Conclusions: Our Study concludes that the usage of cerebroprotein hydrolysate therapy can be safe and useful in traumatic brain injury in terms of functional and cognitive outcome with better recovery.

Key words: Cerebroprotein hydrolysate, Traumatic brain Injury, TBI
Magnetic resonance spectroscopy of the thalamus in chronic traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Karl Zimmerman, Gregory Scott, Ines Violante, Claire Feeney, David J Sharp

Objectives: Traumatic brain injury (TBI) patients may deteriorate clinically long after the initial insult. A possible cause is thought to be chronic neuroinflammation in the form of persistent microglial activation. Previously, positron emission tomography (PET) imaging studies have provided evidence for microglial activation in the thalamus months and years after moderate-severe TBI. Magnetic resonance spectroscopy (MRS) is an emerging non-invasive tool for evaluating TBI and provides an assessment of metabolic changes post injury. However, there is limited information on the value of MRS in chronic phase after moderate-severe TBI. Here we assess whether metabolite concentration changes associated with neuroinflammation are detectable in the thalamus of chronic TBI patients.

Methods: 27 patients following a single moderate to severe TBI (Mayo classification), 4.8-152 months since injury, and 11 age- and gender-matched healthy controls had structural T1 MRI and 1H-MRS. A single voxel of interest was placed over the left thalamus. Patients were rescanned 6 months after baseline. LCModel software was used to calculate concentrations of myo-inositol (a proposed glial marker) and N-acetyl aspartate (neuronal marker). Subjects with more than 20% standard deviation in estimated concentrations were excluded from results.

Results: In the cross-sectional data (N=19), analysis of variance was used to show that myo-inositol levels were increased in the TBI group relative to controls (p=0.027) and N-acetyl aspartate were decreased (p=0.022). In the longitudinal analysis of TBI patients (N=14), comparison of the baseline and 6-month follow-up scans showed a significant decrease in myo-inositol (p=0.043) but no change in N-acetyl aspartate. There was no effect of age or time since injury on the metabolite concentrations.

Conclusions: We demonstrate that abnormal 1H-MRS markers that have previously been associated with neuroinflammation are present in the thalamus up to 12 years after TBI. These results provide further evidence for chronic inflammation persisting in the thalamus. Hence, myo-inositol and N-acetyl aspartate levels measured by MRS provide potential biomarkers for chronic inflammation after TBI.
Impaired cerebral autoregulation during upright tilt in patients with severe brain injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: Upright tilt is an important tool for early mobilization of patients after severe acquired brain injury (ABI). Early mobilization is considered to be of importance for increasing awareness, in the prevention of contractures and pulmonary infections and to improve long-term outcome. A challenge for early mobilization is orthostatic instability that is often observed during head-up tilt which could lead to decreased cerebral blood flow velocity (CBFV) and decreased long-term outcome. We examined cerebral blood flow autoregulation in patients with severe brain injury and impaired consciousness using a tilt table and compared the results to those of healthy volunteers.

Methods: Fourteen patients (7 men, mean age 56.6 ±17.5 years) with severe ABI and 15 healthy volunteers (7 men, mean age 36.1±12.5 years) were included. The CBFV was measured by Transcranial Doppler in the middle cerebral artery and expressed as the flow velocity. Continuous arterial blood pressure (ABP) was recorded from the index finger using photoplethysmography. CBFV autoregulation was determined by the correlation between CBF and BP. An estimated cerebral perfusion pressure (CPP) was established through an equation taking into account the hydrostatic pressure during head-up tilt. After 30 min of resting, baseline values were obtained as the mean of 5 min. The subjects were then tilted head-up to 30, 60, and 80 degrees with 1 min's interval and remained at 80 degrees for 20 minutes or until the occurrence of significant hemodynamic changes i.e. a decrease in systolic BP > 20 mmHg, diastolic BP > 10 mmHg or an increase in heart rate > 30 bpm. Measurements were continued in the subsequent supine position to ensure a total recording period of 30 min. Cerebral autoregulation was assessed by calculating the mean flow index (Mx) between CBFV and MAP (Mxa) or CPP (Mxc). Spectral analysis of the HR variability was used to investigate baroreflex activity.

Results: In the supine position, MAP and HR were higher in the patients compared to the controls (p=0.0004 and p<0.0001, respectively) and the CBFV were lower in the patients (p<0.001). The patients showed a significant increase in the Mxc index during head-up tilt pointing at impaired autoregulation (P=0.001). Spectral analysis of HR variability in the frequency domain revealed significant lower magnitudes of ~0.1 Hz spectral power in patients compared to healthy control indicating baroreflex dysfunction in patients.

Conclusions: Patients with severe ABI and orthostatic instability during head-up tilt, show uncoordinated loss of autoregulation of cerebral blood flow more than one month after the accident. Interventions addressing this challenge are warranted.
Coordination of TBI Care in the U.S. Military: The TBI Pathway of Care and TBI Advisory Council

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: No preference

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Traumatic brain injury along with psychological health issues have been the signature wounds of the past 15 years of conflict. However, ongoing surveillance as well as other epidemiological evidence suggests that the vast majority of traumatic brain injuries for our United States service members are diagnosed in the Garrison/at home settings. This fact in conjunction with a relatively entry-level compendium of state-of-the-art and high level scientific evidence makes it paramount that work in the endeavors of traumatic brain injury continues even as the wars in Iraq and Afghanistan officially have come to an end. The US Department of Defense has readily assessed and understood the need to provide a coherent, collaborative and standardized approach to aid service members, veterans and their family members/caregivers. To this end, a Military Health System TBI Pathway of Care was created in order to ensure the most efficient way to provide and conduct research, education, and clinical care for the TBI populations across the continuum of prevention, screening, diagnosis, treatment, and reintegration. The TBI Pathway of Care goals include maximizing warfighter and beneficiary outcomes, advancing high clinical standards, and decreasing variances through continuous quality improvement. The purpose of this presentation is to inform medical professionals on how the US Department of Defense, in conjunction with Veterans Affairs, is developing a standardized, evidence-based and outcome focused program to ensure all aspects of TBI provide the most efficacious treatment, research and education to our beneficiaries.
Creatine supplementation for symptom alleviation after mild traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: Previous research on the biological markers of sustained post-concussion syndrome (PCS) after mild traumatic brain injury (mTBI) has suggested that those with mTBI have a reduction in prefrontal creatine (Dean et al., 2013), which is associated with poorer performance and reduced prefrontal BOLD response in cognitive tasks (Dean et al., 2015). In addition, dietary supplementation of creatine can alleviate PCS symptoms in the acute stage after injury (Sakellaris et al., 2006) or protect from PCS symptoms (Sullivan et al., 2000). It is an intriguing possibility that creatine may also alleviate symptoms, even in the long-term after injury. This study represents a first step, whereby it is investigated whether dietary supplementation leads to increases of creatine in the brain in a non-brain injured population, and whether this is related to behavioural performance or symptom report.

Methods: MRS and behavioural (n-Back; 0-, 2-, 4-back) data was acquired from ten vegetarian participants at three time points, one week apart. Week 1 was baseline, week 2 after placebo (maltodextrin) and week 3 after intervention (creatine monohydrate). Single voxel MRS was acquired from right dorsolateral prefrontal cortex. Both placebo and intervention were taken as 5g of powder dissolved in 250ml of water/milk, two times a day (morning/evening).

Results: Behavioural results indicated an effect of condition (0-, 2-, 4-back, p<0.001), session (week, p=0.013, and condition*session (p=0.006). Further analysis revealed this to be caused by a difference in the 4-Back between baseline and post-creatine (p=0.039), but not post-placebo (p=0.051). MRS analysis revealed no effect of session on total creatine (p=0.5), nor NAA (p=0.8), glutamate (p=0.3) or glutamine (p=0.2).

Conclusions: According to this preliminary data, creatine supplementation does not systematically affect creatine levels in prefrontal grey matter. This is despite better cognitive performance post-creatine compared to baseline. Although, this could be caused by a learning effect as it was necessary to perform the dietary intervention in the same order to avoid washout effects. Control behavioural studies are being run to investigate the level of performance increase achieved by practise alone. The implications for previous research reporting a symptom alleviation, or cognitive enhancement in clinical and non-clinical populations may be that this alteration is due to non-neural mechanisms. However, this study only sampled one grey matter area, and future studies will be required to investigate a number of grey and white matter areas.
The Distribution of Neuropathology Seen in Chronic Traumatic Encephalopathy Can Be Predicted by Finite Element Modeling of Impact Biomechanics and Can Be Observed in Human Neuroimaging Data

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author’s preference: Oral

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Objectives: The biomechanics of the initial impact in a traumatic brain injury (TBI) is a key determinant of neuropathology. In cases of chronic traumatic encephalopathy (CTE) tau pathology accumulates in the depths of sulci where brain deformation is thought to be large. However, the relationship between initial inertial loading and neuropathology is poorly understood, but this is critical for improving protection such as helmets. Here we use the Finite Element (FE) method incorporating brain structure and biomechanical tissue properties to test whether predicted impact-induced deformation corresponds with the distribution of neuropathology. To obtain converging evidence from empirical data we also tested whether this pattern of injury is also seen in the pattern of white matter injury assessed in patients using diffusion tensor imaging (DTI).

Methods: The FE method was used to build a high-resolution model of the human head incorporating anatomical and material properties. This approach was applied to model individual cases of TBI (one American Football TBI and one fall), where detailed information was available. Translational and rotational head accelerations were used from reconstructions of the impacts. Maximum principal Green-Lagrange strain and strain rate were calculated during the first 30 milliseconds after impact. Freesurfer was used to provide brain segmentations that were used to test whether strain and strain rate measures were greater in the gyri or depths of sulci. Analysis of Empirical data obtained from 70 TBI patients using diffusion MRI was used to explore fractional anisotropy estimates of white matter structure at the grey matter / white matter boundary were used for empirical validation of the model.

Results: For the American Football injury the predicted strain and strain rates were substantially larger in the sulci than gyri, in accordance with CTE neuropathology. In the fall case the predicted strain was also larger in the sulci, but sulcal and gyral strain rates were nearly the same. The duration of translational and rotational acceleration was much longer in the American Football injury compared to the fall case, which may explain the distinct biomechanical predictions. In the empirical human data FA estimates of injury at the gray/white matter interface showed evidence of greater white matter damage in the depths of sulci in a group of single impact TBI of various types.

Conclusions: We have developed a high-fidelity FE model of TBI that predicts greater injury within the depths of sulci, where tau pathology is concentrated in cases of CTE. The analysis of diffusion MRI provides converging evidence that a similar distribution of pathology at the gray/white matter interface is seen in human imaging. The work provides a biomechanical explanation about the distribution of pathology seen after TBI and a method for studying the impact of different protective strategies.
How to select an Assistive Technology for Cognition (ATC) to help individuals with TBI manage their finances: selection criteria and case study

Status: Accepted Presentation type: Poster

Category: Technology – clinical research/applications

Author's preference: Poster

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Background: Cognitive deficits incurred subsequent to a traumatic brain injury (TBI) largely increase the risk of financial mismanagement. It is thus urgent that optimal therapeutic interventions be identified to optimize independence in the management of one’s personal finances. Assistive Technologies for Cognition (ATC) have been identified as having great potential for supporting impaired abilities in individuals with cognitive deficits, and therefore likely to promote greater independence in complex tasks such as personal finances. However, little is known about how to select the best available ATC and how to train individuals with cognitive deficits to use them within the context of their everyday activities.

Objectives: 1) Analyse a series of ATC designed to facilitate the management of one’s personal finances based on evidence-based criteria from the literature and select the best available ATC for pilot testing with a TBI client; 2) Explore use of the best ATC with 1 individual having sustained a severe TBI.

Methods: For objective 1: Development of an analysis grid for ATC based on extensive literature review, definition of each criteria and evaluation of ATC on whether the criteria was present or absent in each ATC. For objective 2: Case study of a person (male, 47 years old), who sustained two TBI, trained with the selected ATC and pre-post measurements up to 3 months. Treatment: Nine sessions were provided to teach use of the ATC using a problem-solving approach (Cognitive Orientation to Occupational Performance). Budgeting skills was measured using the budgeting task of the Instrumental Activities of Daily Living Profile (IADL-Profile) and goal attainment was measured with the Canadian Occupational Performance Measure.

Results: Six ATC were selected and analyzed according to 31 criteria that included simplicity of the visual display, visual representation when expenses exceeded available budget, and alarms or reminders for future expenses or recurrent expenses. The ATC with the highest score (29/31 for the Budget Alert ATC) was then tested with 1 severe TBI client. A positive post-intervention training effect was found on the ability to plan the budget task of the IADL-Profile, using the ATC. The participant's satisfaction and the perception of his performance in relation to the trained objectives also improved. However, learning to use the ATC was difficult.

Conclusions: Use of an ATC combined with a problem solving strategy seems to have the potential to optimize the ability to plan a budget for people with TBI. This study supports the feasibility of a more robust study.
Functional correlates of creatine supplementation

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: Previous research on the biological markers of sustained post-concussion syndrome (PCS) after mild traumatic brain injury (mTBI) has suggested that those with mTBI have a reduction in prefrontal creatine (Dean et al., 2013), which is associated with poorer performance and reduced prefrontal BOLD response in cognitive tasks (Dean et al., 2015). In addition, dietary supplementation of creatine can alleviate PCS symptoms in the acute stage after injury (Sakellaris et al., 2006) or protect from PCS symptoms (Sullivan et al., 2000). It is an intriguing possibility that creatine may also alleviate symptoms, even in the long-term after injury. The previous study (Dean et al., 2015) demonstrated altered fMRI indices, correlated to reduced creatine, despite no difference in behavioural performance between those with mTBI and controls. This study therefore investigates the underlying functional changes brought about by creatine supplementation during a working memory task using combined fMRI and EEG in a non-brain injured population.

Methods: fMRI and EEG data was acquired during an n-back (0-, 2-, 4-back) task from ten vegetarian participants at three time points, one week apart. Week 1 was baseline, week 2 after placebo (maltodextrin) and week 3 after intervention (creatine monohydrate). Both placebo and intervention were taken as 5g of powder dissolved in 250ml of water/milk, two times a day (morning/evening). Analysis of the EEG and fMRI data is ongoing, and will be completed by the conference date.

Results: Behavioural results indicated an effect of condition (0-, 2-, 4-back, p<0.001), session (week, p=0.013, and condition*session (p=0.006). Further analysis revealed this to be caused by a difference in the 4-Back between baseline and post-creatine (p=0.039), but not post-placebo (p=0.051). If creatine supplementation enhances cognition, we predict that there should be a greater difference between target and non-target P300 in the post-creatine compared to post-placebo and baseline, particularly in the 4-Back. Furthermore, as previous work has linked reduced creatine to reduced prefrontal BOLD response, we predict increased prefrontal activity post-creatine in the 4-Back task.

Conclusions: Participants demonstrate better cognitive performance post-creatine compared to baseline. However, it was necessary to perform the dietary intervention in the same order to avoid washout effects. Therefore, a control behavioural study is being run to investigate performance increases achieved by practise alone. Even if no alteration in cognitive performance is observed, there may be adaptations in underlying functional processing such that less effort is required to achieve the same performance. As such, this study may help unravel the mechanisms by which creatine may be having its effect on sustained PCS after mTBI.
Preferences of Individuals with Brain Injury for the Methods of Involvement in Clinical Practice Guidelines Production

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – public policy and advocacy

Author's preference: No preference

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Objectives: Clinical practice guidelines (CPG) are increasingly used to enhance the quality of care offered to individuals with disabilities, including people with brain injury (BI). Best quality CPGs should consider the opinions and preferences of the target patient population. Little is currently known about the best methods to actively involve the individuals with brain injury in the production of CPGs. The goal of this study was to document the acceptability of two methods of involving individuals with a BI in CPG development.

Methods: We performed a crossover pragmatic trial with patients with BI. Patients were randomized into two groups. The first group participated in a focus group (control intervention) and the second group used a Wiki, i.e., a webpage that can be modified by those who have access to it (experimental intervention), to comment experts' recommendations included in a CPG. The participants rated the acceptability of the two methods and provided qualitative comments to explain their answers. The two groups then switched to the other method for complementing CPG recommendations and rated this method.

Results: Sixteen individuals with BI (56\% severe) completed the trial. Preliminary analysis showed that the participants rated the focus group intervention as simpler, closer to their usual communication habits, more advantageous and appropriate for them. However, the perceived effectiveness of the two methods was the same for the participants. Most of the participants (69\%) stated that they preferred the focus group method to the wiki method, explaining that the discussion and interaction occurring within the group facilitated the expression of their opinions and preferences. Participants who preferred the wiki method mentioned that it provided more time to express themselves.

Conclusions: Our trial suggests that focus groups are the preferred way for people with BI to express their preferences and perceptions as a means of being involved in CPG development. The results will inform the science of CPG development and contribute to the knowledge about PPI in rehabilitation services planning.
New perspectives for neuropsychological interventions in patients with disorders of consciousness

Status: Rejected
Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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After severe brain injury, many patients suffer from pronounced impairments of consciousness, attention, perception and reactivity. New diagnostic procedures enhance clinicians' understanding of maintained cognitive resources in minimally conscious patients (MCS). Based on those, specific therapeutic approaches can be formulated, that aim at improving important functional capacities in the areas of communication and motoric reactivity. Therapeutic concepts are described and results of specific interventions will be presented.
Oral Anticoagulants and Platelet Aggregation Inhibitors in Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Objectives: Each year traumatic brain injury (TBI) contributes to a substantial number of hospitalizations and deaths. Previous studies have demonstrated that Oral Anticoagulant (OAC) agents and Platelet Aggregation Inhibitor (PAI) therapy is associated with greater severity of injury at admission, longer stay at the intensive care unit and extended hospitalization, and finally an increased likelihood of poor functional outcome or even death. Although these studies recognized the implications of OAC and PAI among TBI patients, to our opinion several limitations have to be acknowledged: the majority of these studies consisted of relatively small sample sizes and/or lacked multivariate analysis. Our goal was to assess, whether the use of OAC and/or PAI is an outcome predictor in TBI and to what extent. We hypothesized that the pre-injury use of these drugs is associated with worse (functional) outcome after TBI.

Methods: Here we report our preliminary data; the final results will be available at the conference. From a prospectively collected TBI cohort we selected patients (aged > 16) with mild, moderate and severe blunt TBI admitted to the ED of the University Medical Centre Groningen in 2011. The digital patient charts and CT scans of these patients were reviewed for this study. For statistical analysis we classified patients as users of OAC or PAI agents, or non-users (NU).

Results: We analysed 483 patients in this study. 399 Patients were classified as NU, 41 as OAC users and 43 as PAI users. Not surprisingly we found an association between the use of OAC or PAI and higher age. PAI therapy was related to fatal outcome after TBI (OR=1.96 ± 0.47), in contrast to OAC. PAI users showed the highest mortality with 21%, followed by 12% and 7% among OAC users and NU respectively. Overall, mortality showed highest prevalence among severe TBI patients (39.7%), followed by moderate TBI (11.8%), mild TBI (3.1%), and head injury (2.3%). We also assessed the associations between INR and other characteristics. We observed an association between raised INR and unfavourable outcome and death (OR=2.10 ± 0.45), a lower GCS on admission and extended hospitalization (p<0.01).

Conclusions: Although other studies have demonstrated that the use of OAC and PAI is associated with an unfavourable outcome after TBI, we only observed this association for PAI therapy. Raised INR however was associated with worse outcome. As these results concern retrospective data from a single center caution is warranted about generalizability of the results. So far, we analysed primarily mortality as outcome measure and expanded results will be available at the conference.
Ontario Concussion Care Strategy: Cultivating the landscape to improve adult concussion care

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: Concussion is a large public health problem in Ontario with about one fifth of adult patients experiencing persistent symptoms for months to years. Without identification, concussed adults do not receive appropriate care resulting in significant avoidable direct costs of $16,000 and indirect costs of $6,000, per patient per year (minimum estimates).

The Ontario Concussion Care Strategy (OCCS) is a clinically driven initiative led by experts at St. Michael's Hospital, working with patients/families, and providers around the province with a shared vision to improve concussion care and reduce chronic impairment across Ontario. Objectives include:

- a) implement quality care metrics for concussion care in Ontario in order to standardize measurement to enhance patient care and facilitate research
- b) develop provider decision support tools
- c) build capacity for a sustainable province wide concussion care data base in order to monitor and improve care

Methods: A working group of the OCCS identified key (CDEs) for tertiary care settings through a synthesis of landmark literature which included the a) Ontario Clinical Guidelines for Concussion and Persistent symptoms b) National Institute of Neurological Disorders and Stroke- Common Data Elements for Concussion c) Consensus Statement on Concussion in Sport-Zurich, 2012. The overarching framework that guides the selection of CDEs for Ontario was the International Classification of Functioning, Disability and Health framework under the domains of body function, activity, participation, environmental factors and personal factors. An integrated software platform with provider decision support tools was developed. This facilitated the rapid identification of patient red flag responses with matched evidence based management strategies for providers.

Results: Tertiary care settings have piloted the shared patient-provider collection of CDEs and e-health provider decision support tools. Satisfaction surveys from providers and patients have been positive. Providers comment that the standardized data collection is improving practice. Patients felt validated in their ability to describe symptom and activity limitations.

Conclusions: This Knowledge Translation program is aimed at a transformational shared patient/provider approach to enhance patient care and reduce the impact of chronic impairment of concussion. Pilot testing of the electronic collection of CDEs with embedded provider decision tools has demonstrated positive patient and provider comments. More testing and evaluation in a variety of tertiary care clinics is needed. Lessons learned will help in the next steps of implementing CDEs across other clinical settings such as emergency, family practice and sports clinics.
OCCS seeks change the concussion landscape in Ontario to align with the international community using CDEs to position the province to contribute to the global goal of improved knowledge in the association between concussion management, reduced chronic impairments and improved clinical outcomes.
How do assessments of activities of daily living address executive functions: A scoping review

Status: Accepted  Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Background: Executive functions (EF) allow persons to adapt to situations arising in daily life and can be affected following acquired brain injury (ABI). Measuring the impact of dysexecutive syndrome on the accomplishment of activities of daily living (ADL) requires specific assessment tools, but choosing the right tool may be difficult.

Objectives: To conduct a scoping review on how assessments of ADL address EF and dysexecutive syndrome in persons with ABI.

Methods: A scoping review of peer-reviewed and grey literature published until August 2014 was conducted. To ensure the successful completion of the study, we assembled a team with content and methodological expertise. The team included two occupational therapists (OTs) having respectively, 18 and 20 years of clinical and research experience with the adult ABI population, and two researchers in the domain of independence in ADL and tool development, all having advanced knowledge of the theories and concepts underlying ADL and EF. Using a systematic procedure, literature was selected, results were charted, and tools were analysed with respect to their goals, underlying models, psychometric properties and clinical applicability. The analysis also included how tools considered components of EF according to Lezak’s model. This model is particularly interesting because it operationally defines four broad functional categories related to EF in the accomplishments of all activities (i.e. volition, planning, purposive action and actual performance).

Results: 12 tools, developed either to assess EF in ADL, independence in ADL considering EF (n=4) or ADL capacities (n=7), were identified and analysed according to multiple criteria. Two tools consider the volition component, nine assess a person’s ability to plan, 4 assess carrying out activities (purposive action) and 4 tools assess actual performance of task execution. Only one tool (i.e. ADL-Profile) assesses all components of Lezak’s model.

Conclusions: This review provides important information about existing tools to assist in tool selection and clinical decision-making related to ABI and EF.
Machine Learning Classification of TBI in US Service Members and Veterans

Status: Accepted Presentation type: Oral

Category: Technology – clinical research/applications

Author's preference: Oral

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Objectives: Traumatic brain injury (TBI) is an important cause of disability and morbidity in Service Members deployed in Iraq and Afghanistan. Diffusion tensor imaging (DTI) studies have demonstrated vulnerability to injury especially in the moderate and severe injuries. Limited data are available to uniformly support the diagnosis of mild TBI in a Service Member based upon DTI data or to outcome based on imaging alone. To address this need for improved diagnosis in this population, this study worked to develop procedures for the automated detection of white matter (WM) changes in mTBI using machine learning (ML) classification of DTI data. Neuroimaging data from patients with deployment-related mTBI and controls who also were deployed, but did not have history of TBI, were be analyzed using track-based spatial statistics (TBSS) and ML classifiers to distinguish differences in WM integrity.

Methods: In 92 Veterans with TBI and 34 controls, DTI data were acquired using an axial single shot twice-refocused spin-echo echo-planar sequence. A voxel-wise mass univariate analysis was performed in TBSS. Fractional anisotropy (FA), axial diffusivity (Da), radial diffusivity (Dr), mean diffusivity (MD), and mode of anisotropy (MO) were calculated and skeletonized in the white matter tracts. Comparisons were made between mild TBI vs. controls, severe TBI (n=3) vs. controls, and mild vs. severe TBI. In the ML preprocessing, the TBSS-aligned template was registered to the JHU-ICBM atlas with 48 WM ROIs. Ten different spatial filters with radial variance mean and median filtering were used with the 48 WM ROIs and five DTI measures creating 2400 features for each patient dataset. A grid search was used to find the optimal support vector machine parameters using a random half of the patients for training the other half for testing (17C, 46TBI).

Results: In the initial TBSS analysis, FA and MO correlated negatively with age. Da, Dr and MD all correlated positively with age (p < 0.05, FWE corrected, TFCE). FA, Dr, and MD voxels were significantly different between the severe TBI vs. both control and mild TBI (p < 0.05, FWE corrected, TFCE). In TBSS, there were no differences in DTI metrics between controls and mild TBI. Using SVM and FA maps, the model had very good sensitivity (96%) but poor specificity (18%) in TBI detection given the small number of controls in the training set and the large feature dataset. Current work is being done to isolate low FA voxels to run through data reduction/clustering and ML to possibly improve the diagnostic performance in classifying TBI.

Conclusions: Several DTI metrics showed correlation with age with voxel-based differences in FA in severe TBI. ML showed good sensitivity and current work is focused to improve the specificity in detecting TBI.
Brain Activation in Children After Concussion: Does Timing Post-Injury Matter?

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: Recent findings have shown that functional imaging can be used post-concussion to study brain activation in response to cognitive demands in children. In most studies, children at different stages of recovery, and with different levels of post-concussion symptoms (PCS) symptoms are generally grouped and conclusions are made for the group as a whole. It is becoming increasingly clear from work conducted in the last few years, that children who recover slowly from their concussion, usually defined as presenting with persistent PCS more than 4 weeks post-injury, may represent a specific subgroup of the pediatric concussion population, which continues to elude both clinicians and researchers. With this study, we aimed to compare the brain activation patterns of symptomatic children early post-injury, to those of children experiencing persisting symptoms 4-6 weeks post-injury, as well as to compare the concussed children to a group of matched healthy control subjects.

Methods: Scanning with fMRI during the performance of a working memory task was obtained in 20 children aged between 10 and 17 years, symptomatic early post-injury but with subsequent typical recovery, and 15 children of the same age, who remained symptomatic 4-6 weeks post-injury. Both groups were compared to 20 healthy individuals matched for age and gender. For the early symptomatic children, fMRI data were acquired within 1-2 weeks of the injury, whereas subjects in the persistent symptoms group were seen between 4 to 6 weeks of their injury.

Results: Brain activation findings obtained in the early symptoms-normal recovery (ESNR) group and the late symptoms-delayed recovery (LSDR) group had significantly weaker task-related activation compared to healthy controls. Group subtraction analysis comparing the ESNR and LSDR groups revealed that children in the LSDR had significantly less activation in the right dorsolateral prefrontal cortex (DLPFC) than their early recovery controls.

Conclusions: The results of this study may have significant implications for further imaging studies with the pediatric population. We have shown that timing post-injury may play a significant role in how brain activation is characterized on fMRI and that grouping children who recover quickly and those belonging to the “slow to recover” population may pose problems with regards to the interpretation of findings.
A Clinical Recommendation for Treatment of Post-Concussive Sleep Disorders in the United States Military

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: No preference

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More than 327,000 United States Service members (SMs) sustained a traumatic brain injury (TBI) between 2000 and 2015, 82% of which were concussions. The vast majority of SMs with combat related TBI report sleep disturbances. Poor sleep quality and length may prolong post-injury recovery; conversely, sleep has been shown to be restorative. The prevalence rates of insomnia, circadian rhythm sleep-wake disorders (CRSWD) and obstructive sleep apnea (OSA) are substantially higher in the concussion population than the general population. Military deployments further increase the risk for the onset or exacerbation of sleep difficulties given the crowded sleeping conditions, loud noise exposure and irregular sleep-wake cycles associated especially with combat deployments. The Defense and Veterans Brain Injury Center developed a Sleep Clinical Recommendation for use in the deployed environment to address sleep disorders following a concussion. Identification of knowledge gaps and military considerations were defined through a review of recent clinical studies by a multidisciplinary working group of military and civilian subject matter experts. The clinical recommendation was developed to provide guidance for the primary care manager (PCM) in deployed and non-deployed settings for the assessment and management of the three most common sleep disorders occurring after concussion: Insomnia (short-term or chronic), Circadian Rhythm Sleep Wake Disorder (CRSWD), and Obstructive Sleep Apnea (OSA). The Clinical Recommendation concluded that all patients presenting with symptoms following concussion should be screened for the presence of a sleep disorder. Insomnia (short-term or chronic) is the most common sleep complaint after concussion, and the initial diagnosis and management is facilitated by a focused sleep assessment and interview. Non-pharmacological treatment includes stimulus control and sleep hygiene as the foundation. If the addition of a sleep medication is necessary to augment stimulus control and sleep hygiene, low-dose, short-duration non-benzodiazepine sedative-hypnotic drugs (zapelol, zolpidem, eszopiclone, and zopiclone) for 2 weeks are recommended. Distinguishing a CRSWD from insomnia or other sleep disorders is based upon whether the patient is able to sleep without disturbance and awake refreshed when allowed to sleep on a preferred schedule. The Morningness-Eveningness Questionnaire (MEQ) may be beneficial for the screening and diagnosis of CRSWD. The patient history and the physical exam establish a presumptive diagnosis of OSA. Inclusion of the patient’s bed partner in the interview is useful regarding witnessed pauses in breathing and gasping or choking. The physical exam provides an assessment of obesity (as indicated by neck circumference and BMI), airflow obstruction, cardiovascular risk factors, blood pressure and retrognathia. Polysomnography is the gold standard for a confirmatory diagnosis of OSA and assessment of OSA severity. Attention to the specific clinical characteristics of the sleep disorder thus leads to the correct diagnosis and the most effective treatment strategy.
Managing Adult Concussion in the Emergency Department; Safer and Faster Pathways to Specialty Care

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: Concussion is a common emergency department (ED) presentation. Repeat emergency room visits often occur due to poor patient understanding of the recovery from concussion symptoms, management, expectations and access for follow-up care. Potential solutions include improved provider-patient communication and education surrounding this diagnosis, clear written discharge instructions, improved patient education, and access to primary or specialized care in a timely manner. Repeat ED visits ultimately contribute to longer ED wait times, and more importantly represent the mismanagement of a condition that is better suited to be followed by primary care physicians or specialists in select cases.

Methods: A novel ED Head Injury Clinic (HIC) triage system has been created and piloted at a large Canadian inner city tertiary care hospital. Several steps engage the adult concussion patient along the triage pathway. Initially, a verbal assessment by a clerical staff member identifies the need for the patient to complete a Rivermead Post-Concussion Symptoms Questionnaire (RPQ). Following a clinician assessment, most concussion patients are discharged home, receiving a package on the management of head injury. An information letter to the patient outlines that a follow-up phone call or email would be conducted by a Registered Nurse within 5 to 10 days post-discharge. Further assessment by the nurse includes a repeat RPQ for a score comparison. Using the comprehensive assessments patient risk is scored, then the patient is triaged to the most appropriate follow-up care; namely, self-monitoring, following up with their family physician, an additional phone call from the nurse, an appointment at the HIC or to return to the ED.

Results: To date 245 ED patients with a concussion have come through the new triage process. 17% (42/245) were triaged to the HIC and 83% (203/245) no HIC visit. Of those with no HIC, 24% (49/203) had repeat ED visits. However, of those with repeat ED visits only 24% (12/49) were related to their concussion.

Conclusions: Pilot data supports the utility of the nurse follow-up triage system by directing concussion patients presenting to the ED to the most appropriate follow-up care post-ED discharge. Since the onset of the pilot, 5% (12/245) of patients had a repeat ED visit from concussion. No pre-intervention data was available, however, ED provider anecdotal evidence supports a higher rate of repeat ED visits from concussion patients pre-triage. For patients whose condition warrants follow-up care at the HIC, this triage pathway has demonstrated optimized HIC patient flow and reduced clinic wait times with the added benefit of cost savings.
Effectiveness of a multidisciplinary rehabilitation program for persons with acquired brain injury and executive dysfunction

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Background: Cognitive and behavioural difficulties following acquired brain injury (ABI) may lead to severe limitations in activities and restrictions in participation. A holistic, intensive and multidisciplinary rehabilitation out-patient program was developed for persons with ABI at the Pitié-Salpêtrière Hospital, France (5 days/week for 7 weeks).

Objectives: To explore the effects of this rehabilitation program (specifically the cooking activity) on improvements in participants’ activity and participation related to preparing a meal and to determine whether gains are maintained 3 and 6 months post program.

Methods: A single case experimental design (SCED) with repeated measures pre and post-intervention with 7 adult participants with ABI with executive dysfunction (ED) (4 females, mean age 38 ± 10.1 yrs) was used. Main outcome measures: Participants’ ability to prepare a meal was assessed using the Cooking Task (CT) and the IADL-Profile (also used to measure participation) as was their performance (i.e. participation) using the nutrition domain of the Assessment of Life Habits (Life-H). The strength of performance changes over time (and where the differences were located) was measured using the non-overlap of pairs (NAP) and the two standard deviation band methods, in addition to visual analysis of the plotted raw data.

Results: A strong improvement effect (NAP index=1.0) between pre and post phases was found for number of errors on the CT for 6/7 participants; 4 participants showed significant improvement immediately after the program and at 3 and 6 months post. Six of seven participants improved significantly on the IADL-Profile (NAP=1.0); improvements between the post and 3 month post were found for 3/7 subjects and 4 participants improved between the post and 6 month follow-up. 4/7 participants showed significantly improved Life-H scores pre vs post program; 1-2 participants maintained these gains at 3 and 6 months post.

Conclusions: Significant improvements were observed in activity and participation outcomes related to preparing a meal in adults with ABI and ED who participated in the program. Treatment gains were maintained for the majority of participants at 3 and 6 months following the program.
Using of accelerometer in neurorehabilitation brain injury patients

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Neurorehabilitation of patients with brain damage is an interprofessional, complex, intensive, long-lasting and individually oriented process. One frequent consequence of brain damage is hemiparesis, which also causes a disorder of the upper extremity movement pattern. The movement ability of the upper extremity is essential for an individual’s self-sufficiency, the performance of common daily activities, and thus for an independent life in a family setting.

One of the aims of this work was to demonstrate, using objective function methods, the possibility of influencing the movement patterns of a paretic upper extremity by means of intensive interprofessional neurorehabilitation even several years after the brain damage. The second aim was to demonstrate that the monitoring of motor functions in patients after brain damage leads to improved motivation, thereby improving motor functions.

A study was conducted among 55 selected patients after brain damage with central hemiparesis who participated in the 4-week stay in a neurorehabilitation day care centre. Two groups of patients were studied, one group with an accelerometer (30 patients - Group A) and one group without an accelerometer (25 patients - Group B). The parameter studied with the accelerometer was daylong physical activity of the upper extremities, paretic extremity and non-paretic extremity.

Methods: 55 patients after brain damage with upper arm paresis were randomized to an experimental group (A, n=30) and a control group (B, n=25). Patients in both group attended a neurorehabilitation day care center for 4 weeks. Patients in group A were measured by sensor - accelerometer for 7 hours per day of the first week after admission and the last week in the care center. Data from accelerometer monitoring were analysed in special program WMSAPP (Wrist Motion Sensor APPlication software) version 0.0.3 and for final data analysis Wilcoxon paired test, Mann-Whitney test were also used. The following parameter was all-day percentage movement activity of paretic and healthy upper arm activity. We used 3 different types of sensors: left blue sensor is on the left wrist, right red sensor is on the right wrist and green body sensor on the left hip.

Results: Using of sensor - accelerometer in the experimental group (group A) significantly improved upper arm movement activity, can objectively detected the positive changes in movement spastic pattern. The accelerometer has the role of virtual therapist for the idea of permanent monitoring by the therapist. The patients were more motivated for active cooperation during the whole neurorehabilitation process.

Conclusions: The results of the study confirmed that brain plasticity can be activated by intensive interprofessional neurorehabilitation even several years after brain damage, rather than just one or two years after the injury or disease.
Computer-Based Vision Screening in Pediatric Acquired Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: The purpose of this study is to determine the feasibility of a computer based vision screening assessment to identify vision impairments in children and youth with acquired brain injury (ABI). While many rehabilitation professionals are skilled at identifying visual perceptual deficits, the assessment of basic visual skills may be overlooked, particularly in individuals with seemingly mild impairment. Impairment of basic vision skills may contribute to poor results on assessments (e.g. cognitive, physical, academic) and challenges in performing every day activities. Our findings will further our understanding about the use of screening assessments to identify impairments in basic visual skills in children and youth following ABI.

Methods: A prospective, cross sectional design was used. Participants were 15 children and youth ages 9-18 years with ABI (e.g. stroke, encephalitis, traumatic brain injury). Exclusion criteria were presence of diagnosed vision or visual perceptual impairment (e.g. hemianopsia) and primary diagnosis related to seizure disorder. Each participant completed a commercially available computer based screening assessment (VERA¹⁰). The screening assessment included acuity, fusion (suppression), stereopsis (binocular integration) and phoria (fixation disparity). If the participant 'passed' tests for acuity, a visual efficiency screening test was conducted. These included tests to identify potential deficits in the ability to use the eyes for functional activities (e.g. reading, changing focus from near to far objects as in a classroom situation). Results were analyzed using descriptive statistics and summary of observational data.

Results: All participants completed the computer based screening assessment and no adverse reactions were observed. All 15 participants 'passed' acuity screening but scored 'questionable' or 'fail' on tests of visual efficiency. In particular, two participants who were diagnosed with concussion did not report any specific visual symptoms (e.g. blurriness, double vision), but did indicate they were having trouble with school work and concentration. Some participants required assistance for holding test flippers and/or repetition of instructions.

Conclusions: The computer based screening assessment appears to be feasible for children and youth with ABI. Although acuity may be intact, findings of impairment in visual efficiency suggest that these children and youth experience problems with tasks requiring the eyes to work together (e.g. reading, focusing on near and far objects). More rigorous study is needed; however care providers should consider the need for a thorough vision assessment that includes components of visual efficiency for children and youth following ABI.
Clinical Recommendations for Neuroimaging Following Concussion in the Non-Deployed Setting

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: No preference

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More than 333,000 United States Service members (SM) sustained a traumatic brain injury (TBI) between 2000 and July of 2015. Approximately 82% were concussions, or mild traumatic brain injuries (mTBI). Most agree that concussion represents a physiologic injury and is not typically associated with intracranial contusions or hemorrhage. Several studies of civilian concussion have therefore concluded that cranial imaging is not indicated except in a small subgroup at risk for hemorrhage. However, in the US Military the use of radiologic imaging following a concussion varies from one medical treatment facility (MTF) to the next, and even from one health care provider to next. Standardization of imaging indications, as well as specific imaging techniques and settings, also varies and results in differences in the quality of the individual studies. Most importantly, and especially with magnetic resonance imaging (MRI), variations in imaging techniques can complicate comparison of serial imaging studies obtained at different locations during the continuum of care for concussed active duty SMs. The Defense and Veterans Brain Injury Center developed a Neuroimaging Clinical Recommendation (CR) for use in the deployed and non-deployed environment to provide evidence-based guidance for the use of all available imaging techniques to evaluate SMs in the acute, subacute and chronic phases after a concussion. Identification of knowledge gaps and military considerations were defined through a review of recent clinical studies by a multidisciplinary working group of military and civilian radiologists, nuclear medicine specialists, and other subject matter experts. The CR was developed to guide radiologists and primary care providers who are considering an imaging study for a concussed SM. According to the CR, a conventional computerized tomographic (CT) scan is the most appropriate imaging study in the first week after a concussion, but an MRI is more appropriate for SMs who remain symptomatic in the subacute (8 days – 3 months) and chronic (> 3 months) phases. Indications for the use of more specialized imaging modalities, such as single photon emission CT (SPECT) and positron emission tomography (PET) also are provided. Additionally, an appendix containing recommended minimum technical parameters and sequencing of MRI studies to further promote standardization is included in the document. The CR also includes recommended settings for microstructural imaging techniques, such as diffusion tensor imaging (DTI) and susceptibility weighted imaging (SWI). In summary, the Defense and Veterans Brain Injury Center Neuroimaging Clinical Recommendation provides a standardized approach to imaging following concussion, describes the utility of available imaging modalities for the different stages of concussion recovery, and specifies the recommended minimum parameters for an MRI of the head following a concussion.
Disruption to the Dopaminergic System Following Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Background: Persistent cognitive problems following traumatic brain injury (TBI) are common and cause significant disability. The heterogeneous nature of TBI means that the basis of these cognitive deficits is likely to be multi-factorial. To guide treatment the identification of common causative pathologies is likely to be beneficial. Animal and human studies have previously identified dopaminergic dysfunction following TBI. However, the cause of this disruption is unclear and could be related to damage to the dopaminergic nuclei in the substantia nigra or to their ascending projections in the nigrostriatal tract.

Objectives: To investigate: 1) whether striatal dopamine transporter (DAT) levels are reduced following TBI; 2) whether TBI causes structural changes to the nigrostriatal ascending pathways and/or atrophy of the substantia nigra or striatum; 3) whether reduction in DAT after TBI is correlated with atrophy of the substantia nigra or structural changes to the nigrostriatal tract.

Methods: 24 subjects who had suffered a moderate/severe TBI at least 6 months previously and had persistent cognitive problems were compared with 13 healthy controls. All subjects underwent an ioflupane (\(^{123}\)I) single-photon emission computed tomography (SPECT) scan and magnetic resonance imaging (MRI) including diffusion tensor imaging. DAT levels were measured from the SPECT scan in the striatum, and voxel-based morphometry methods were used to calculate substantia nigra and striatal volumes. A nigrostriatal tract mask created from 100 participants from the Human Connectome Project was used to calculate mean fractional anisotropy measures.

Results: Clinical reporting of the SPECT scans highlighted abnormalities in 66% of patients. Quantitative assessment showed reduced DAT levels in striatal regions in TBI patients with persisting cognitive problems compared to controls. Patients had evidence of substantia nigra and striatal atrophy, as well as increased mean diffusivity in the nigrostriatal tract and striatum. Striatal DAT levels correlated negatively with nigrostriatal tract mean diffusivity.

Conclusions: TBI patients with persisting cognitive problems have reduced striatal DAT levels implying a disruption to their dopaminergic system. The abnormalities of structural measures of the substantia nigra, striatum and nigrostriatal tract suggest that these measures may provide surrogate markers of dopaminergic system integrity. The relationship between DAT levels in the striatum and nigrostriatal tract mean diffusivity supports a possible causal relationship between damage to this pathway by TBI and functional dopaminergic dysfunction.
Subjective executive functioning as a predictor of coping style in patients with traumatic brain injury at all levels of severity

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Subjective executive functioning as a predictor of coping style in patients with traumatic brain injury at all levels of severity

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Objectives: The majority of patients with traumatic brain injury (TBI) sustains a mild TBI, of which the prognosis is generally favorable. However, patients with moderate to severe TBI can experience long-lasting cognitive, emotional and behavioral deficits that interfere with functioning in daily life and the resumption of work. Current literature suggests that executive functioning and coping style are important factors affecting outcome. Moreover, it is suggested that intact executive functioning is a prerequisite for the use of adaptive coping; as executive processes such as foresight, planning and initiation seem essential for the employment of active coping strategies. So far, the exact association between executive functioning and coping remains unclear as literature has provided us with mixed results. The aim of the present study is twofold. First, we aim to assess the association between executive functioning and coping among patients with TBI at different levels of severity. Second, we aim to investigate to what extent injury severity influences the association between executive ability and coping as a moderating factor.

Methods: We included 109 TBI patients from two prospective follow-up studies, of which 53 patients were classified as mild TBI, 19 patients as moderate and 37 patients as severe. Additionally, 33 healthy controls were included. Executive functioning and coping style were assessed by neuropsychological examination in the post-acute and chronic phase after TBI.

Results: Greater self-reported executive dysfunction was related to greater use of passive coping styles in all separate levels of severity and in the mixed TBI group ($\beta = .591, p < .001$). Additionally, a lower amount of self-reported executive dysfunction was related to higher levels of active coping in the mixed TBI group ($\beta = -.457, p < .001$) and the mild and severe TBI groups. Additionally, better performance on an executive test for response inhibition was related to greater use of active coping in the total TBI group ($\beta = -.178, p = .047$). No evidence for a moderating effect of injury severity on the association between executive functioning and coping was found.

Conclusions: Self-reported executive functioning was a significant predictor of coping style at all levels of injury severity in patients with TBI. Individuals who reported greater executive problems were predisposed to rely on a maladaptive passive coping style. Furthermore, these results suggest that less self-reported executive dysfunction was related to a higher use of an active coping style.
Measuring Psychological Functioning Following TBI with the TBI-QOL Emotional Functioning and Adjustment Item Banks

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: No preference

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Background: Psychological assessment after TBI should include all dimensions of emotional functioning and adjustment. The Traumatic Brain Injury - Quality of Life (TBI-QOL) measurement system contains 8 item banks that assess Depression, Anxiety, Resilience, Positive Affect & Well-Being, Grief/Loss, Self-Esteem, Stigma, and Anger. These item banks were developed from content obtained in focus groups with adults with TBI, their caregivers, and experts in TBI medicine. Item selection and instrument development were based on item response theory and computerized adaptive testing. The item banks were then calibrated and validated in a large, multi-site study.

Objectives: To provide further validation of the TBI-QOL emotional functioning/adjustment item banks through analyses of convergent validity.

Methods: A sample of 521 adult participants was recruited from 5 Traumatic Brain Injury Model System sites (also reported in Tulsky et al., in press). TBI was confirmed by medical record review. Injury severity was determined by emergency room Glasgow Coma Scale score and neuroimaging data. In an interview format, participants completed 6 of the 8 TBI-QOL item banks related to emotion/adjustment: Depression, Anxiety, Resilience, Grief/Loss, Self Esteem, and Positive Affect and Well-Being. Participants also completed criteria measures, including the Patient Health Questionnaire/PHQ-9, General Anxiety Disorder/GAD-7 scale, and the Satisfaction with Life Scales/SWLS. Each of the 8 item banks was analyzed with confirmatory factor analyses (CFA) to determine if all items in the item bank loaded on a single factor (i.e., the bank was unidimensional). Pearson correlation coefficients were computed using the scaled total scores of the measures to determine the interrelationships among emotional functioning and adjustment item banks and criteria measures.

Results: Confirmatory factor analyses provided support that items within each item bank fit a unidimensional model. TBI-QOL emotional functioning and adjustment item banks were interrelated with one another with moderate to strong magnitude. For instance, TBI-QOL Depression and Anxiety correlated strongly \((r = 0.81)\). TBI-QOL emotional functioning and adjustment item banks correlated with criteria measures with similar magnitude. For instance, TBI-QOL Anxiety strongly correlated strongly with the GAD-7 \((r = .76)\) and moderately with a more general satisfaction with life \((SWLS r = -.47)\).

Conclusions: The pattern of correlations among TBI-QOL item banks and with criteria measures provides evidence of concurrent validity of the TBI-QOL scales. Together with the results of the CFAs, the magnitude and pattern of the correlations indicated that the TBI-QOL item banks measure related but distinct aspects of emotional functioning. The TBI-QOL emotional functioning and adjustment banks cover a wide array of psychological functioning after TBI, including positive emotions (e.g., positive affect and well-being, resilience), negative emotions (e.g., depression, anxiety), and negative self-perceptions (e.g., self-esteem).
Urodynamic Assessment of Lower Urinary Tract Dysfunctions after Intrathecal Baclofen Therapy in Unresponsive Wakefulness Syndrome

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Spasticity of supraspinal origin is much more common than spinal spasticity, but treatment with Intrathecal Baclofen Therapy (IBT) has been evaluated far less frequently in this condition. Only a few reports have been published on Acquired Brain Injury (ABI), especially on the correlation of urodynamic findings. The most commonly expected urodynamic abnormality after TBI is involuntary detrusor contraction, which can be induced by the loss of cortical inhibition caused by suprapontine lesions. Very little is known about changes in urodynamic pattern in patients in Unresponsive Wakefullness Syndrome (UWS) The aim of this study is to urodinamically assess bladder function in patients on UWS before and after IBT.

Methods: We enrolled for this study 16 patients; all patients were in UWS for 9 extensive brain hemorrhage or Traumatic Brain Injury (7 patients). All patients were urodinamically evaluated before and one month after IBT. During urodynamic study were evaluated bladder compliance, presence and amplitude of detrusor overactivity (DO), maximum cystometric capacity (MCC), detrusor pressure at opening bladder neck (detrusor leak point pressure, DLPP). In all patients were evaluated post void residual pre and post IBT. In 12 patients we performed a second urodynamic evaluation 6 months after implant, evaluating the same urodynamic findings. At baseline all patients were in spontaneous micturition (reflex urinary incontinence), in 4 out of 16 patients clean intermittent catheterization (CIC) was necessary because high post-void residual (PVR).

Results: One month After IBT in 8 out of 16 patients was necessary CIC for high PVR (p=0.27), six months after implantation in 3 out of 12 patients (p=0.3) At urodynamic evaluation mean baseline MCC was 364.6 ± 150.1 ml, one month after IBT was 391.9 ± 40.8 ml (p<0.03) and 6 months after implant was 368.1 ± 146.2 ml (p=0.11). DLPP was 98.3 ± 7.4 cmH2O at baseline and 83.8 ± 11.5 cmH2O, 1 month after IBT (p=0.04); at 6 months after IBT mean DLPP was 85.7 ± 12.9 cmH2O (p=0.05 respect baseline). Mean PVR at baseline was 57.5 ± 21.7 ml, and 100.4 ± 50.9 ml one month after IBT (p=0.01), although 6 months after IBT mean PVR was 56.8 ± 24.5 (p=0.58 respect baseline).

Conclusions: After IBT there was a significant increase of MCC and a reduction of DLPP. Accordingly an increase in PVR in the first month was identified. While these results may seem a positive consequence of the therapy, they must be related to the type of patient treated, indeed the absence of a detrusor contraction supported by supraspinal centers can create an increase of the post-void residual. However, this discrepancy was filled out 6 months after implantation, and the PVR returns comparable to the baseline.
**Dog-Assisted Therapy for Patients after Brain Injury**

Status: Accepted  Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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**Objectives:** Dog-assisted therapy (DAT) is a targeted intervention, in which dogs that meet certain standards take a part in the therapeutic process, which is carried out by professionally qualified therapists. We wanted to test the usability of DAT in the rehabilitation of TBI patients by evaluating some aspects of their behaviour and by comparing them to the behaviour in basic therapeutic programs.

**Methods:** The specially designed DAT program has been used at the Department for rehabilitation of patients with traumatic brain injuries, multiple sclerosis and other neurological disorders at the University Rehabilitation Institute RS - Soča (URI - Soča) for eight years. The therapy takes place once a week for one hour and is performed by three to four therapeutic pairs (dogs and handlers) of the Tačke pomagačke association and by five professional therapists of URI - Soča: two physiotherapists, two occupational therapists, a speech therapist and occasionally by a psychologist. Individual treatment is performed by a therapeutic pair and a professional therapist. During DAT several activities are carried out: for gross and fine motor functions, improvement of sensibility, balance and movement coordination, gait training, relaxation, execution of different functional activities as well as activities for improving the speech and cognition. Five aspects of patients' behaviour—movement, alertness—attentiveness, communication, emotional and motivational state were regularly assessed on specially constructed rating scales. After each session therapists assessed the patients' achievements during DAT and comparatively during other therapy (PT/OT) sessions on all five rating scales and also assessed their general psychophysical condition, altogether 11 assessments were made for each patient.

**Results:** In the last five years 280 patients attended the program, among them 82 with TBI, 67 males and 15 females, aged between 17 and 90. The average ratings on the aforementioned aspects of patients’ behaviour were all quite high (around 2, with 3 being highest). There were no statistically significant differences between gender and age groups though there was a tendency of lower ratings for the middle aged group in comparison to older and younger participants. All the differences in the five assessed aspects of their behaviour between DAT and PT/OT sessions were statistically significant. That means that patients were rather active, attentive, communicative and also in a positive emotional and motivational state during different therapy sessions but during DAT they were significantly more positive in all of these aspects.

**Conclusions:** DAT can be an efficient addition to other therapeutic approaches in rehabilitation. The more relaxed, positive atmosphere in the company of dogs induced higher alertness, cooperation and generally a more positive emotional-motivational state of patients who are therefore often more successful in executing activities which can be transferred to other situations and thus generally improve their condition.
My Brain Made Me Do It: Using A New Ecologically-Valid Assessment Of Executive Functions To Investigate The Potential Involvement Of Head Injuries In Subsequent Criminal Behaviour

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: Recent research has suggested that many prisoner inmates have sustained a head injury during childhood or adolescence and in most cases, this is prior to committing their first offence (Wald & Helgeson, 2014). Many head injuries damage frontal brain regions which are still developing through adolescence and are not fully functional until the early twenties (Gogtay et al, 2004). Integrity of the frontal cortices is central to the Executive Functions (EFs) which are vital for appropriate decision-making and monitoring of everyday behaviour; an impairment in these abilities is evident in the inappropriate behaviour of offenders, who continue to engage in criminal activity in the face of known adverse risk to themselves and others. However measuring EFs objectively has been a subject of contention in the field particularly due to the lack of ecological-validity of the current assessments. The Jansari assessment of Executive Functions (JEF©) is a new tool developed to address these issues using virtual reality and resembles playing a computer game. JEF© has been demonstrated to be sensitive for assessing adults with Acquired Brain Injury (ABI) and also with different non-clinical populations (Jansari and colleagues, 2010, 2011, 2012, 2013, 2014). This study used JEF© to compare EFs in ex-offenders and non-offenders.

Methods: JEF© is a role-playing task set within a standard business office which mimics aspects of the Multiple Errands Task (MET). Performance is evaluated on subtasks designed to test eight constructs central to EFs: Planning, Prioritisation, Selective-Thinking, Creative-Thinking, Adaptive-Thinking, Action-Based Prospective Memory (PM), Event-Based PM and Time-Based PM. To evaluate level of head injury during childhood, participants were asked to complete the Traumatic Brain Injury (TBI) questionnaire.

Results: A one-way MANOVA on JEF© performance revealed a main effect of group F(9,15)=4.034, p=.009, Wilks λ= 0.292 (η2 of 0.708) with the power to detect the effect high (.930). Further, 86% of the ex-offender group had sustained a TBI preceding the age of their first offence and severity of head injury was positively related to difficulty on JEF©.

Conclusions: Given that in the UK, over 40% of ex-prisoners commit another crime within a year of being released, we suggest that JEF© could be used to reduce this level of recidivism. Since JEF© yields eight separate scores of EF these could be used to inform rehabilitation akin to that used in standard adult ABI work. These eight scores can be used to develop individualised EF profiles which can then be used to develop specific interventions tailored to suit the particular weaknesses of each ex-offender. It is hoped that in the long-run, the strategies learnt through this process will reduce the likelihood of the person falling into the ‘revolving door’ of recidivism and thereby have a huge benefit both to the individual and to society.
Pronounced Influence of Relevant Threat on Attention Allocation Due to Orbitofrontal Lesion

Background: The prefrontal cortex (PFC) subserves executive functions and is a crucial area to plan, perform and monitor complicated tasks. Within the PFC, the orbitofrontal (OBF) cortex coordinates the executive functions and emotion to generate self-control; patients with OBF lesions tend to have challenges in appropriate social conduct and inhibitory control. We have previously shown that the balance between voluntary and involuntary attention allocation in context of emotion relies on orbitofrontal circuitry [1]. Task irrelevant emotional stimuli tend to capture involuntary attention [2]. Exhausted attentional resources lead to diminished voluntary attention allocation to task relevant stimuli and consequently interference with task performance.

Objectives: We investigated the role of orbito-frontal cortex in voluntary and involuntary attention allocation to emotional stimuli and emotion-executive function interaction. We studied cognitive control processes in OBF patients in a context of threat-related stimuli. We used behavioral measures and event-related potentials (ERP) to investigate attentional capture by task-relevant and task-irrelevant emotional stimuli during a task requiring cognitive control.

Methods: Patients from the Tampere University Hospital with radiologically detected lesions in the OBF cortex (n=13) or ankle injury (controls, n=11) were recruited. EEG was recorded while patients performed a Go-NoGo visual discrimination task with threat-related and emotionally neutral stimuli (modified Executive RT-test). Threat-related stimuli were line drawings of spiders while neutral control images were constructed from the same line-components resembling a flower. Emotional and neutral images served either as a task-relevant Go or NoGo signal or as a task-irrelevant distractor. N2-P3 ERP peak-to-peak amplitude was used as a measure of attention allocation. We performed logistic regression analysis on different error types and total errors separately, and ANOVA on reaction times (RT) and Go and NoGo N2-P3 ERP amplitude, to assess the effects of Emotion (threat, neutral), Task-relevance (signal, distractor) and Group (OBF, Control).

Results: While the overall performance levels did not differ between groups, patients with orbitofrontal lesion performed relatively more accurately than the controls when emotion was significant in comparison to when it was not significant. Threat-related stimuli were associated with greater N2-P3 peaks in general. OBF patients evoked greater N2-P3 amplitude in response to significant threat NoGo and Go signals compared to controls.

Conclusions: Patients with OBF lesion showed enhanced attention-related brain responses due to relevant threat. OBF may be associated with enhanced allocation of attentional resources to threat-related stimuli relevant to the task. Relevant threat leads to mobilization of executive control resources shared with the task requirements. Pronounced influence of relevant threat on attention allocation due to OBF lesion may reflect increased effort to select the appropriate response or compensatory mechanisms to allow for uncompromised performance.
Combined robotic-aided gait training and 3D gait analysis improve the assessment of rehabilitation effects in children and adolescents with acquired hemiplegia

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: In the present study we evaluated the combined effect of robotic-aided gait training (RAGT) and physical therapy (PT) on functional abilities and gait pattern in children and adolescents with Acquired Hemiplegia (AH), through functional clinical scales and 3D-Gait Analysis (GA). To this aim, we studied the feasibility of a fully objective, and maximally operator-independent procedure of rehabilitation and assessment of pediatric patients.

Methods: A group of 20 patients with AH underwent 20 sessions of RAGT in addition to 20 sessions of traditional manual PT. Before (T0) and at the end of the treatment (T1) all the patients underwent a clinical examination that included the Gross Motor Function Measure, the Functional Assessment Questionnaire for the assessment of motor functional abilities, and the 6-Minute Walk Test. They also received GA before and after RAGT+PT. The rehabilitation protocol included one session of RAGT per day combined with one session of PT. Each RAGT and PT session lasted 45 minutes each. The treatment was administered five times per week, during the working days, and had a total duration of 4 weeks. Results were compared with those obtained from a control group of 10 AH children who underwent PT only.

Results: After the training (T1), experimental group showed statistically significant improvement of:

- GMFM total score and GMFM percentage, which confirmed the significant improvement in functional abilities
- GMFM dimensions ‘A’ (lie and roll), ‘C’ (crawl and kneel), ‘D’ (stand) and ‘E’ (run and jump). No significant changes were found for dimension ‘B’, related to sitting
- FAQ values
- 6minWT, which showed a consistent trend but not statistical significance.

GA highlighted significant improvement in stance symmetry and step length of the affected limb. Moreover, pelvic tilt increased, and hip kinematics on the sagittal plane revealed statistically significant increase in the range of motion during the hip flex-extension. We reasoned that asymmetry reduction couples with both the regularization of gait on the affected side, and the minimization of adjustments on the unaffected side. Increased pelvic tilt and hip kinematics hint to a primary effect of RAGT on the proximal lower limb junctions. This fact contrasts with results from PT, which rather are known to exert a preferential effect on the more distal junctions (knee and ankle).

Conclusions: Our data suggest that the combined program RAGT+PT induces improvements in functional activities and gait pattern in children with AH, and it demonstrates that the combined employment of RAGT and 3D-GA ensures a fully objective rehabilitative program.
Dynamic compressive mechanical properties of the porcine immature brain

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Head injury in infancy and childhood is the single most common cause of death and permanent disability. However, despite its frequency and importance, there is little information about the child head's biomechanical vulnerabilities. In response to these challenges immature (infant) porcine brain, as a surrogate for human immature brain, is used to investigate the biomechanics of infant brain response to potentially injurious scenarios. The following objectives have shaped the outcome of this research work:

1. Quantification of the mechanical behavior of the porcine infant brain at dynamic strain rates.
2. Understanding the biomechanics of the stress wave propagation through the immature porcine brain at dynamic rates.

Methods: A viscoelastic (polycarbonate) Split Hopkinson-Pressure Bar (SHPB) was employed to study the mechanical behavior of immature (infant) porcine brain. Here, infant brain samples were tested at strain rates ranging from 200 - 1500 s⁻¹. A striker bar, an incident bar, and a transmitted bar form the SHPB setup, and the brain sample was lodged between the incident and transmitted bars. All brain samples were surgically extracted from infant piglets procured from a local abattoir (tests were conducted within 6 hours after piglet procurement). Tests were started by setting the striker bar to impact the incident bar. The stress waves were propagated by the striker-incident bar impact, which deformed brain samples at dynamic rates. The high rate data was then acquired through strain gauges set on incident and transmitted bars. An in-house software was then used post-process the strain gauge data to obtain the mechanical response of the immature brain tissue.

Results: The mechanical response of the immature porcine brain showed a high strain rate dependency. The material properties of the brain also varied, due to strain rates. The stress-strain response showed an inelastic behavior of the tissue, comprising an initial "toe" region followed by a concave up-hardening trend, as the strain was increased. The mechanical response of the infant brain was akin to most soft biological tissues.

Conclusions: From SHPB tests, many dynamic compressive properties, beneficial to the characterization of the infant brain tissue under dynamic loading conditions, were captured and analyzed. The mechanical response of the immature (infant) brain tissue was rate dependent; however, the stress state levels were lower than that of adult porcine brain samples. The data acquired from these tests are crucial in building a high fidelity surrogate finite element model for the infant brain. Further analysis, preferably with a High Speed Digital Image Correlation (HS-DIC) system, needs to be conducted on the evolution of these softening effects, along with size effect and friction. These further details may provide information on local damage initiation and propagation within the infant brain tissue, due dynamic injury scenarios.
A Delphi procedure on routine outcome measures for the Dutch Neurotraumatology Quality Registry (Net-QuRe)

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: No preference

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Objectives: Moderate and severe traumatic brain injury (TBI) leads to a wide array of disturbances in the normal functioning of the brain. TBI is one of the major causes of death among people under the age of 45. In addition, over 50% of hospitalized TBI survivors experience long-term disability due to physical, cognitive or psychological deficits. The gravity of the condition stands in sharp contrast to the lack of scientific evidence on optimal care strategies after TBI. Despite many fundamental studies and several randomized clinical trials, the most effective interventions remain to be determined. As a result, the current care for TBI patients may vary widely between institutions, both acute hospitals and post acute rehabilitation centers. The Dutch Neurotraumatology Quality Registry (Net-QuRe) is a multi-institutional cohort study aimed at the development of a high quality database on the total chain of care for neurotrauma patients. In this multi-institutional cohort study patients with moderate to severe TBI will be followed for two years. The goal of Net-QuRe is to describe and compare the care strategies and enable fast identification of the most effective interventions. First, a standard set of TBI outcomes needs to be defined. The aim of this project was to reach consensus on the outcome measures for Net-QuRe.

Methods: Rehabilitation centers in the Netherlands were invited to participate in a Delphi procedure, consisting of three Delphi rounds. Professionals from multiple disciplines were selected, including physiatrists, psychologists, physiotherapists, occupational therapists, speech and language therapists, nurses, social workers and others. A questionnaire was developed, based on the International Classification of Functioning (ICF). For each ICF domain multiple outcome measures were listed, from which 2 instruments had to be chosen by each participant. Consensus was reached if an instrument was selected as first choice for a specific (ICF) domain by at least 75% of the participants.

Results: Eight rehabilitation centers participated in the Delphi procedure, including 80 rehabilitation professionals. The pros and cons of a Delphi method in a multicenter study will be discussed. Response rates and consensus rates will be presented. The Delphi procedure and the final set of outcome measures for evaluation of TBI rehabilitation will be presented.

Conclusions: A Delphi procedure seems a feasible method to obtain consensus on outcome measures in a multicenter study.
Mechanical Tissue Resuscitation increases neuronal expression of brain-derived neurotrophic factor (BDNF) in traumatic brain injury

Status: Accepted  Presentation type: Poster
Category: Technology – basic research
Author's preference: Oral

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Objectives: Our previous studies have demonstrated that Mechanical Tissue Resuscitation (MTR) using controlled sub-atmospheric pressure in rat and swine traumatic brain injury models (TBI) can reduce brain edema, preserve neural cells from secondary injury, improve functional recovery, decrease traumatic intracranial hemorrhage, decrease injured volume in MRI and necrotic volume in histology. MTR in a rat spinal cord model also effectively reduced edema, preserved myelin survival, and improved functional recovery. We have confirmed that MTR increases cerebral blood flow and normalizes metabolites in injured brain tissue.

Many inflammatory cytokines and nerve growth factors play important roles in TBI, including pro- and anti-inflammatory cytokines such IL-1, IL-6, IL-10, TNFα, IFNγ, CCLs, and growth factors such as NGF, BDNF, GDNF, NTF3/4 etc. This study evaluates effects of MTR on the expression of 28 genes in an injured brain model.

Methods: The TBI was induced in adult male SD rats with a CCI device. The 6 mm impactor tip was used to produce 2 mm brain deformation between bregma and lambda. In the treatment group, an open cell matrix with an evacuation tube was placed directly on the impacted cortex and 25 mmHg subatmospheric pressure applied.

Results: Ipsilateral cortex from injured only, injured+MTR treated, and sham groups were collected and total RNA was extracted from each specimen. A semi-quantitative real-time QRT-PCR was used to measure mRNA levels of those 28 genes normalized with internal controls. Expression of genes such as IL-1b, IL-1a, IL-6, and CCL-2 in injured group are significantly greater compared to sham group at 24 hrs post TBI. BDNF expression was upregulated significantly (5.8 times) in MTR treated cortex compared to the injured cortex 6 hrs post injury (P < 0.01).

There are at least 11 variants of BDNF gene with different promoters. Further QRT-PCR was performed with variant primers and results indicated that mainly variants V1 (P < 0.05) and V4 (P < 0.01) expressions were increased significantly under MTR application. 5 transcription factors (TF) binding sites (MZF-1, GATA-1, GATA-2, CdxA and SP1) were selected by promotor analysis of both V1 and V4, and gel shift assay was performed by nuclear extracts from ipsilateral rat cortex with specific probes for those TFs. Results indicated that TFs of GATA-1, GATA-2 and MZF-1 are involved in regulation of BDNF gene expression during MTR application. Co-localization labeling with BDNF, GFAP and NeuN antibodies indicated that BDNF is expressed in neurons, not in astrocytes. More BDNF positive neurons were found in injured cortex treated with MTR.

Conclusions: Application of MTR to traumatic brain injury can increase BDNF gene transcription and protein expression in neurons. Such expression may correlate with improved neuron survival with MTR.
Amantadine in pediatric patients with disorders of consciousness due to traumatic and non-traumatic brain injury

Objectives: Amantadine is a NMDA-receptor agonist and has as such a dopaminergic effect by increasing the release of dopamine and by inhibiting the reuptake into the presynaptic cell. Previous experiences showed a faster recovery in adult and also casuistic pediatric patients with traumatic brain injury (TBI) regarding responses to commands, intelligible speech, reliable yes-or-no communication, and functional-object use.

Methods: The data of 6 pediatric patients (age range 2 - 17) with TBI (n = 2), intracranial hemorrhages due to AVM or medulloblastoma (n = 2) or acute hypoxic events (n = 2) was analyzed retrospectively. Amantadine was initiated in a phase with only little change in consciousness and administered for a period of 5.8 weeks, starting 40.8 weeks (range 14 - 145) after the injury. The efficacy was evaluated with regard to the amelioration in the ability to communicate, speech comprehension and the recovery according to the JFK recovery scale (revised) compared to the weeks before initiation.

Results: After the initiation of amantadine, the best recovery was observed in the two patients with intracranial hemorrhages (JFK(r) 9 - 17) and in one of the two patients with TBI. The least efficacy of amantadine was seen in the two patients with hypoxic events (JFK(r) 7 - 7,5).

Conclusions: Our observation suggests that amantadine can have a beneficial effect also in children with disorders of consciousness, especially in patients with traumatic or non-traumatic injuries other than hypoxia. The effect of amantadine in these pediatric patients needs to be further examined.
Examining the Value of an Integrative, Sensorimotor, Multi-Tasking Virtual Environment in the Computer Assisted Rehabilitation Environment (CAREN) in Distinguishing between Service Members with Traumatic Brain Injury Alone and those with Comorbid Post-Traumatic Stress Disorder

Status: Accepted Presentation type: Poster

Category: Technology – clinical research/applications

Author's preference: No preference

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Objectives: Mild traumatic brain injury (mTBI) and post-traumatic stress disorder (PTSD) are common, and frequently comorbid, in service members (SMs) returning from the conflicts in Afghanistan and Iraq, with one study finding that 43.9% of returning SMs with mTBI met criteria for PTSD. These comorbid conditions can be difficult to distinguish. Interestingly, multi-tasking performance is often affected, which can be especially challenging to assess objectively. The Computer Assisted Rehabilitation Environment (CAREN), a dynamic system that incorporates multi-planar motion with interactive, adaptable virtual environments (VEs), allows clinicians to integrate advanced multimodal technology in the assessment and rehabilitation of injured SMs. The objective of this study was to assess whether performance on an integrative sensorimotor, multi-tasking VE in the CAREN is robust enough to distinguish between patients with TBI alone and patients with TBI and comorbid PTSD.

Methods: Data were obtained by independent review of clinical notes, objective outcomes, and PTSD Checklist - Military Version (PCL-M) scores from 103 SMs with TBI (101 Male) assessed in the CAREN from 2010-2015. The CAREN VE, the Shark Hunt (SH) task, requires weight-shifting to move (navigating a boat) towards target objects (sharks). The main outcome measure was a composite score based on time spent on the task, task difficulty settings, and penalties incurred. In 68 SMs, the impact of multi-tasking on performance improvement was specifically measured with a recall task during a second run of the Shark Hunt task (SH-recall). A linear regression was calculated to determine whether performance in each task differed by PTSD symptom severity (PCL-M score), then whether PCL-M score and symptom clusters (re-experiencing, avoidance, and hyper-arousal) moderated the relationship between performance on the SH task and the SH-recall tasks.

Results: Linear regression revealed no statistically significant difference in performance on the SH task according to PCL-M score. However, performance on the SH-recall was significantly related to PCL-M score (β = -0.869, p = 0.017), such that performance decreased as PCL-M score increased. In addition, PCL-M total score and symptom clusters significantly moderated the relationship between performance on the SH task and the SH-recall task such that SMs with high PCL-M total scores (β = 4.56, p < 0.001), and elevated avoidance (β = 1.71, p = 0.003) and hyper-arousal (β = 3.12, p < 0.001) cluster symptoms, showed significantly less improvement in performance from the SH task to the SH-recall task.

Conclusions: In a population of SMs with TBI, adding a recall task to a motor coordination task on the CAREN blunted performance improvement when SMs had greater symptoms of comorbid PTSD. These findings suggest that the Shark Hunt VE is a robust CAREN task that could be utilized to aid in identifying patients with a dual diagnosis.
Predictors of Functional Outcome in Traumatic Brain Injury using a Brief Computerized Cognitive Battery

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Objectives: Identifying predictors of outcome in traumatic brain injury (TBI) is important when developing appropriate treatment options and maximizing functional recovery. Current research suggests that the best predictive model of outcome involves a combination of patient, injury and cognitive factors. Due to time limitations, screening is often performed during initial stages of care as a means to prognosticate outcomes. The Cogstate Brief Battery™ (CBB) is a computerized assessment tool that provides cognitive measures of psychomotor speed, visual attention and vigilance, visual learning and memory, and working memory. We sought to determine the utility of the CBB as an early prognostic tool in a TBI inpatient sample while controlling for demographics and injury severity.

Methods: Individuals with TBI were recruited at the Toronto Rehabilitation Institute (TRI) as part of a 5-year multisite project, Practice-Based Evidence (PBE) study which examined the course of recovery from TBI through rehabilitation, discharge and follow-up. A hierarchical linear regression was used to predict functional outcome at discharge from inpatient rehabilitation as measured by the cognitive subscale of the Functional Independence Measure (Cog-FIM); demographic variables (age, sex, and years of education) were entered in the first step, injury severity indicators (Glasgow Coma Scale, length of stay in days) were entered into the second step, and scores on CBB tasks (accuracy, speed, and variability for each of the four tasks) were entered into the final step.

Results: Results indicated that the overall model was statistically significant ($R^2 [13, 37] = 0.66, p <0.001$) with level of education ($\beta = 0.26$), GCS Category ($\beta = -0.27$), length of stay in days ($\beta = -0.35$), and One-Back variability ($\beta = -0.35$) significantly predicting Cog-FIM scores at discharge. Inconsistent performance in working memory tasks may be indicative of poorer outcomes at discharge.

Conclusions: Results support previous research that a combination of pre-morbid, injury and cognitive factors may be useful in predicting functional outcomes in TBI. Initial performance on the CBB appears to be predictive of functional outcome at discharge, suggesting that the CBB may be a sensitive tool for short neuropsychological screening post TBI.
Continuous Partial Myoclonic Epilepsy Mimicking Palatal Tremor in a Prolonged Disorder of Consciousness Patient

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Palatal tremor (PT) is defined by short, mostly rhythmic contractions of the soft palate and sometimes of the lower facial muscles, pharynx and larynx. It is distinguished into essential and symptomatic PT (SPT). SPT is caused by lesions of the brainstem, and usually associated with a hypertrophic degeneration of the inferior olive nucleus. Possible etiology includes vascular lesions trauma, multiple sclerosis and brainstem tumors. Rarely SPT has been reported as epilepsia partialis continua and only in one case after an acute cortical infarction (Jung HJ et al., J of Clin Neurosci 2013). Here we describe a severe acquired brain injured patient in vegetative state (VS) who presented a rare picture of continuous facial myoclonus associated with PT of cortical origin.

Methods: Subject: A 82-year-old woman affected by prolonged VS (> 3 months post-onset) due to a severe left hemispheric ischemic stroke, not involving the basal ganglia or brainstem, after occlusion of the middle cerebral artery. Brain CT showed a large ischemic lesion of left fronto-temporo-parieto-occipital lobes. Standard EEG showed predominant left hemispheric slow activity (theta/delta rhythm) without epileptic abnormalities. At 12 months post-injury, she developed a continuous pseudo-rhythmic, low-amplitude and low-frequency (1-2.5 Hz) myoclonus of lip, soft palate and base of the tongue. Methods: A video bronchoscopic examination (VBE) and video EEG with surface electromyography (VEE) of the bilateral orbicularis oris were performed in order to assess the origin of myoclonus.

Results: VBE revealed synchronous jerky movements of tongue, palate, pharynx and larynx. VEE showed continuous pseudo-rhythmic EMG bursts of short duration (<200 ms) and low frequency (1-2.5 Hz) in the bilateral orbicularis oris. These continuous EMG bursts were associated to epileptiform abnormalities (continuous isolated sharps) in left temporo-occipital brain region. These findings were consistent with diagnosis of cortical (epileptic) myoclonus.

Conclusions: Few cases of epileptic PT have been reported so far (Tatum et al., Neurology 1991; Noachtar et al., Epilepsia 1995), only in one case in the acute phase of cortical stroke (Jung HJ et al., J of Clin Neurosci 2013). This report confirms that onset of PT may be related to epileptic activity, providing further evidence of the cortex role in its generation. A cortical origin should be considered in patients presenting with SPT, also in the very late phase of ischemic brain injury, particularly if there is no evidence of a brainstem lesion.
Assessment of Health-related quality of life after TBI: Comparison of a disease specific (QOLIBRI) with a generic instrument (SF-36)

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Background: Psychosocial, emotional, and physical problems can emerge after traumatic brain injury (TBI), potentially impacting health-related quality of life (HRQOL).

Objectives: Until now, however, neither the discriminatory power of disease specific (QOLIBRI) and generic (SF-36) HRQOL nor of their correlates have been compared in detail.

Methods: These aspects as well as some psychometric item characteristics were compared in a sample of 795 TBI survivors. With the Shannon H’ index absolute informativity - as an indicator of an instrument’s power to distinguish between individuals within a specific group or health state - was investigated.

Results: Psychometric performance of the two instruments was predominantly good, H’ was generally higher and more homogenous for the QOLIBRI as compared to the SF-36 subscales. Notably, the SF-36 „Role Physical“, „Role Emotional“ and „Social Functioning“ subscales, showed less satisfactory discriminatory power than all other dimensions or the sum scores of both instruments. The absolute informativity of disease-specific as well as generic HRQOL instruments concerning the different groups defined through the identified correlates differed significantly.

Conclusions: When the focus lies on how a certain subscale or sum score differentiates between individuals in one specific dimension/health state, the QOLIBRI can be recommended as the preferable instrument.
Combination of Treatments with Erigo® and EMG-triggered Stimulation to Enhance Recovery in a MCS Patient: a Case Report.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: New technologies help to verticalize patients with Disturbs of Consciousness (DOCs) since the early phase of treatment combining tilting table with a computer controlled stepping mechanism; it’s been reported that this therapy may improve awareness in VS/MCS (Vegetative State/Minimally Conscious State) patients through activation of the cardiovascular system and intensive afferent sensory stimulation. Moreover the use of functional electrostimulation may help the improvement of motor activities failure caused by a CNS injury through maintaining joint mobility, muscle mass improvement, treatment of paresys as residual muscle strength is detected. With the aim of fostering recovery we propose the combined use of innovative technologies in the rehabilitation of DOC’s patients. The use of Erigo® based therapy, together with a specific drug therapy, since the very early phase of rehabilitation may initially initiate the improvement of the awareness scoring. Afterward it may allow a combined therapy based on EMG-triggered stimulation.

Methods: We describe the case of a young Patient who had brain injury (BI) on the 14th of February of this year. Brain CT scans showed, when admitted to the ICU, an haemorrhagic lesion within the pons with extension to the right cerebral peduncle and an ischaemic lesion at the right thalamus plus diffuse cerebral edema. An external ventricular derivation catheter was positioned and then removed after 3 weeks. A diagnosis of ventriculitis complicated the clinical evolution for three weeks. Coma recovery scale (CRSr) at admittance in our rehabilitation clinic after 46 days from BI showed following score: 3 (uditive function) + 3 (visual function) + 4 (motor function) + 2 (oral/verbal function) + 1 (communicative function) + 2 (awareness). We started as soon as possible treatment with Erigo®: daily treatment for 5 days/week, 30 min of Erigo® plus 30 min of standard therapy. Variables assessed were: angles of passive ROM of hips and knees, Aschworth Modified Scale (AMS), CRSr. EEG, SEP and AEPs were also assessed. The patient showed an important improvement at CRSr after 3 months: 4 (uditive function) + 4 (visual function) + 5 (motor function) + 2 (oral/verbal function) + 2 (communicative function) + 3 (awareness). Note that one month before 2nd CRSr assessment we started oral amantadine (up to 150 mg/die). We then applied an EMG-triggered stimulation treatment performed during the Erigo® therapy.

Results: In only 45 days of latter treatment we scored a great improvement at CRSr, AMS. Also EEG and evoked potentials demonstrated an impressive amelioration.

Conclusions: Treatment with Erigo® in an early phase of rehabilitation for DOCs patient, combined as soon as possible with functional electrostimulation, seems to be safe and very helpful to enhance the recovery from DOCs. We intend, with this case report, to allow discussion on treatments in severe BI.
Assessment of blood biomarkers of mild traumatic brain injury in professional rugby; a case control study

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Background: Assessment procedures are vital in the management of concussion and mild traumatic brain injury. Blood biomarkers have been proposed as viable objective assessment tools in brain injury with perhaps the best validated to date being the protein S100. However it is widely accepted that S100 lacks the specificity required to be a reliable biological correlate of mild brain injury such as concussion.

Objectives: The purpose of this ongoing study is to develop additional objective biological tests for concussion in a sports injury setting to add to the existing battery of tests that presently includes cognitive and clinical assessment. Specific objectives include: to investigate plasma S100b concentration following normal competitive play and concussive episodes; to compare plasma S100 concentration in elite professional rugby players with age matched non-contact athletic controls; to develop an objective blood biomarker to aid in the diagnosis of concussion and to help the management of the return to play process in elite professional rugby players

Methods: The participants are elite professional rugby players (n=44), with rowers from amateur rowing clubs acting as age-matched athletic controls (n=16). Blood samples are collected by venepuncture at baseline (at least 14 days prior to training/competitive play) and one hour following competitive play. Plasma is prepared and assessed for S100B concentration by ELISA (Abnova). Metabolomic profiling of samples is carried out by two-dimensional gas chromatography coupled to time-of-flight mass spectrometry (GC×GC-TOFMS).

Results: Statistical analysis revealed a significant increase in plasma S100b following competitive play, compared to pre-season baseline (p<0.001; Kruskal-Wallis with post-hoc Dunns multiple comparison test). Over one thousand metabolites were detected by GC×GC-TOFMS in a single sample run, covering a functionally wide range of small molecules such as amino acids, fatty acids, sterols, carboxylic acids, sugars, alcohols and amines. The post-match metabolic profile showed significant changes in several metabolites; these are at present being validated and analysed further.

Conclusions: Our results reveal a significant effect of competitive play on circulating S100b. Data on metabolomic profiles are being collected continually throughout the season and being clustered according to concussive and non-concussive episodes. It is hoped that this analysis may reveal concussion-specific changes in the metabolomic profile of players that may form the basis of an objective test of mild brain injury to aid decision making regarding return to play.
A specific multi-nutrient intervention, designed to enhance synapse formation and function, improves functional outcome following traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Background: Traumatic brain injury (TBI) leads to major neurological impairment and at present there is no satisfactory treatment for this condition. Recent clinical trials in Alzheimer’s disease have demonstrated the efficacy of Fortasyn® Connect (FC), a specific multinutrient combination that was designed to compensate for the loss of neuronal membranes and synapses in dementia patients. This specific multi-nutrient combination contains essential nutritional precursors and cofactors such as docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), choline, uridine monophosphate, phospholipids, folate, vitamins B6, B12, C, E and selenium, which synergize to support neuronal membrane formation and function. Recent clinical trials have shown improvement in cognitive function and increased cortical connectivity in Alzheimer’s disease patients following daily intake of this multi-nutrient combination. TBI can lead to major tissue disruption, neuroinflammation and axonal damage. In the long-term TBI increases the risk of developing neurodegenerative conditions. Because of the relevance of neuronal membranes and synapses also in TBI, we hypothesised that a diet supplemented with this specific multi-nutrient combination could have protective and pro-regenerative effects after TBI.

Objectives: We investigated in a mouse model of TBI whether this supplemented diet can counter the tissue injury occurring after TBI and lead to an improved neurological outcome.

Methods: Adult male C57/BL6 mice received an injury by controlled cortical impact (CCI) and were then assessed on a multitude of behavioural tasks, carried out at various time intervals, for 70 days post-injury (dpi). Following TBI, animals were fed daily with a control diet or the supplemented diet until the end of the study.

Results: The supplemented diet significantly attenuated over the whole duration of the study the global deficit post-TBI assessed using a modified neurological severity score (mNSS). The supplemented diet also decreased the injury-induced impairment in the Rotarod test (used to explore motor coordination, balance and strength), which was carried out in the injured animals in the first 3 dpi. Following CCI, mice developed a marked impairment in spatial memory, which was assessed in the Morris Water Maze (MWM) between day 13 and day 18 post-TBI. The dramatic injury-induced deficit revealed in the probe trial in the MWM, was corrected by the supplemented diet.

Conclusions: These results suggest that a diet supplemented with this specific multi-nutrient combination, which has already been shown to be very well-tolerated in patients with dementia, has marked therapeutic potential in TBI.
Sex vs. Gender Effects on Self-Reported Executive Function after TBI

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: Recent studies have suggested sex-based differences in traumatic brain injury (TBI) outcomes, from basic neurobiological processes to psychosocial functions. Results are not consistent across studies, however, and there continues to be debate about the extent and nature of differences between men and women with TBI. We hypothesized that psychosocial outcomes are affected not only by biological sex but also by gender – a social construct emerging from a combination of genetic and epigenetic influences.

Methods: Participants were 101 adults: 53 adults with TBI (23 females) and 49 uninjured adults (29 females), matched group-wise for age and education. Participants completed the Short Form of the Bem Sex Role Inventory,¹ a self-report questionnaire that lists 30 characteristics that are stereotypically masculine (e.g., ambitious, self reliant), feminine (e.g., affectionate, sympathetic), or neutral (e.g., happy). Participants rated on a scale from 1 (never true) to 7 (always true) how frequently the 30 characteristics described them, and mean scores for masculine and feminine items were entered into data analysis. Participants also completed the self-report form of the Behavior Rating Scale of Executive Function (BRIEF-A).²

Results: BRIEF-A scores for the general executive control index were predicted by injury status (t = 6.17, p < .001) and self-reported masculinity on the BSRI (t = -4.57, p < .001), but not by sex (t = -4.96, p = .34) or self-reported femininity (t = -4.41, p = .68).

Conclusions: Self-rated executive function problems were correlated with self-identified masculinity but not biological sex, in adults with and without TBI. The study had limitations: sex was judged based on physical appearance; there is considerable debate about the construct of gender, whether it is a spectrum, and how it is captured by self-report instruments like the BSRI; and executive function was self-reported, albeit with a well-validated standardized scale. Also, the BSRI was created in the 1970s, and average BSRI scores for men and women have changed in the decades since (with women reporting more masculinity in recent decades), although the inventory has been validated in many studies 3 and continues to be used in gender research. Nevertheless, the finding raises questions about sex and gender as predictors of outcome after TBI and suggests that both might be useful constructs to consider.


Window to Hope Cognitive Behavioral Group Therapy Among US Veterans with Traumatic Brain Injury: Results from an Efficacy Trial

Objectives: United States Veterans with traumatic brain injury (TBI) have higher rates of suicide than the general Veteran population. Window to Hope (WtoH) is a cognitive behavioral group therapy program developed in Sydney Australia to treat hopelessness after TBI. A partnership was established between the Liverpool Brain Injury Rehabilitation Unit and the Rocky Mountain Mental Illness Research Education Center to evaluate the efficacy of WtoH for US Veterans with moderate to severe TBI.

Methods: Using a waitlist control design, forty-four Veterans with a history of moderate to severe TBI and significant hopelessness (Beck Hopelessness Scale of 9 or greater) were randomized to intervention (10 week group therapy) or waitlist groups. Data were collected at three time points to facilitate evaluation of the intervention for both the intervention and waitlist groups. That is, those initially allocated to the waitlist group were also provided with the opportunity to receive the intervention after Time 2 data was collected.

Results: Post-randomization, attrition was limited. Thirty-five Veterans (79.5%) attended at least half of the sessions, and twenty-eight (63.6%) attended at least 80% of sessions. Participants initially allocated to the intervention reported significant decreases in hopelessness (p=0.03) when compared to those in the waitlist group, after adjusting for baseline differences. Among Veterans initially allocated to the waitlist condition, adjusted results suggested significant decreases in hopelessness (p=0.01) and depression (p=0.003) between Time 2 and Time 3 (pre-intervention to post-intervention), when compared to decreases between Time 1 and Time 2 (baseline and start of the intervention).

Conclusions: Findings support the acceptability and feasibility of delivering this program to US military Veterans. Moreover, preliminary data from the Phase I randomized controlled trial support the efficacy of WtoH, with clinically meaningful and statistically significant reductions in hopelessness noted. Limitations included small sample size and variability in reported symptoms.
Post-concussion syndrome and quality of life after mild traumatic brain injury in Malaysian patients

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: This study investigates the incidence and pattern of post-concussion syndrome (PCS) in mild traumatic brain injury (MTBI) patients within the first six months and its association with quality of life (QOL).

Methods: Patients admitted for MTBI were recruited prospectively from a single center. All patients were followed up at 1, 3 and 6 months post injury and assessed for the presence of PCS using Rivermead Post Concussion Questionnaire (RPQ). At 3 and 6 months, QOL of patients with and without PCS were compared using Quality of Life after Brain Injury (QOLIBRI).

Results: Fifty-three patients were included in the study. Motor vehicle accident was the most common cause of injury (79%) while sports-related accident was the least common (2%). PCS incidence reduced from 37.7% at one month to 16.7% at six months post injury. Somatic symptoms were reported early after MTBI (1 month) eg headache and dizziness, whereas cognitive symptoms were more common at a later stage (6 months) eg forgetfulness and longer-to-think. Patients suffering from PCS documented a lower QOLIBRI score (p<0.001) and there was a significant negative correlation between RPQ and QOLIBRI score both at 3 months (p<0.001, r = -0.785) and 6 months (p<0.001, r = -0.777).

Conclusions: The incidence of PCS after MTBI was highest at one month and declined with time. Patients suffering from PCS showed a negative effect on their QOL. Early detection of PCS and a longer follow up beyond 6 months may be required to ensure optimal management of MTBI patients with PCS.
Quantitative Electroencephalography (qEEG), Virtual Reality (VR) and Transcranial Random Noise Stimulation (tRNS) in a case of cognitive impairment related to Parkinson’s disease.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: We want to use qEEG to assess the result of a combined tRNS and VR treatment in a case of cognitive impairment in Parkinson's disease.

Methods: In May 2015, qEEG was performed on a user diagnosed with Parkinson's disease. The qEEG assessed the EEG, the evoked potentials in a GO / NO GO task and the user's connectomes and surfaces as calculated by BrainStorm.
After analysis of the results of qEEG, the user was advised to perform 30 sessions of tRNS, combining it in their treatment sessions with cognitive stimulation.
30 sessions were performed of 30 minutes of tRNS combined with virtual reality treatment with the cognitive rehabilitation application NeuroAtHome.
In each of the 30 sessions a further 30 minutes of virtual reality treatment were performed with the cognitive rehabilitation application NeuroAtHome, but without tRNS.
In September 2015, following the recommended treatment, another assessment of qEEG was performed.

Results: The patient obtained significantly better results in the EEG and in the evoked potentials in the GO / NO GO task. Furthermore, the plasticity changes observed in the surfaces and connectomes calculated by BrainStorm are very obvious.

Conclusions: The result of the combination of both treatments in this type of user looks very promising. It emphasizes the importance of expanding the study to a larger number of users and comparing it with a control group.
Social Participation and Navigation (SPAN): A Pilot Study of an App-Based Coaching Intervention for Teenagers with TBI

Status: Accepted Presentation type: Oral

Category: Technology – clinical research/applications

Author's preference: No preference

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Objectives: 1) To describe the initial prototype of an app-based coaching intervention: Social Participation And Navigation (SPAN); 2) To report on results from a 4-week pilot test with 4 teenagers with TBI that examined implementation feasibility and preliminary effects on social participation, social competence, social communication and goal achievement.

Methods: The SPAN prototype included: 1) an iPhone app to support goal setting and implementation of planned steps and strategies to accomplish social participation goals; 2) Online Key Topics and Brief Tips with information and strategies to support effective social participation; 3) Weekly coaching sessions with college students without TBI via Skype; 4) Initial training and weekly supervision for coaches.

Pre- and post-test standardized measures completed by teenagers and parents included: 1) The Social Competence Scales of the Child Behavior Checklist and Youth Self Report (Achenbach, 1991; Achenbach & Edelbrock, 2001) and 2) The Quality of Communication Life Scale (Paul et al., 2005), modified for adolescents by Burgess and Turkstra (2010). Satisfaction and usability surveys were completed by teenagers, parents and college student coaches. Type and number of goals achieved were recorded. Process and outcomes data also were obtained from coach session notes.

Results: There were significant increases social competence/participation/communication and decreases in social/total behavior problems (medium to large effect sizes). No improvements on parent-reported measures were found. Three of four participants achieved at least one goal. Goals focused on becoming more social, meeting new friends, spending more time with existing friends, taking a more active role in activities, and planning fun outings.

The SPAN prototype was feasible to implement. The app, coaching, and tips and topics were identified as helpful to extremely helpful by participants. Teenagers liked the coaching for building rapport and troubleshooting around challenges. Teenagers and coaches reported that the step by step goal-setting process led to real outcomes. There were some challenges with scheduling Skype sessions and at the time there was no way to share the app at while chatting. Two coaches identified that it was difficult to know how to manage parental involvement.

Recommendations included: Making the app easier to use by building a tutorial and simplifying in-app instructions and integration; providing programmed reminders about action steps planned on specific days; allowing screen sharing on the iPhone to have app synchronous access; shortening and adding audio narration and hyperlinks to key topics; and creating clearer parent role expectations.

Conclusions: The results were promising and suggest that SPAN might provide benefits to teenagers with TBI. However, results cannot be generalized due to the small sample of convenience and short
duration of the pilot. The feedback obtained was used to refine SPAN for a larger implementation trial that will run for a longer (12-week) duration.
Persistence of chronic headache, fatigue and depression in patients who are symptomatic 6+ months following a mild or moderate traumatic brain injury at study entry

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Although some patients with traumatic brain injury (TBI) recover to their previous level of functioning, others suffer from long term debilitating symptoms. The purpose of this study was to investigate if there were changes in symptoms including headache, fatigue and depression severity measures over time among a mild to moderate TBI population.

Methods: A convenience sample of patients who were at least 6-months post-TBI, attending a tertiary outpatient head injury clinic in Toronto, Ontario, were recruited. Participants’ demographic, injury and general health information were collected. The Rivermead Post Concussion Symptoms Questionnaire (RPQ), Fatigue Severity Scale (FSS), and Patient Health Questionnaire-9 (PHQ-9) were collected over three patient visits with at least 2 months between each visit. Friedman tests were used as a non-parametric alternative to repeated measures ANOVA to test for differences in median scores between visits. Post hoc Wilcoxon signed rank tests were used to compare differences between specific visits when significant differences were present.

Results: Of the 218 patients who have been recruited to the study, 56 have completed all 3 visits to date (45% [n=25] male, 55% [n=31] female; mean age 42 years [range 18-65 years]; mean time post-injury 27.1 months [range 6-89 months]). At the first appointment, patients indicated high levels of fatigue (mean ± SD FSS score of 49.1±12.4; ≥36 suggests the presence of fatigue), and depression (mean PHQ-9 score of 13.9±5.6; ≥12 indicates major depression). Rivermead scores were also high at the first appointment (RPQ3: 7.2±3.2, RPQ13: 36.0±8.6). Rivermead: Friedman tests showed no statistically significant improvement in headache severity on Rivermead assessments. Improvements were observed in dizziness (p=0.015), fatigue (p=0.003), taking longer to think (p=0.049) and blurred vision (p=0.045). After Bonferroni adjustment, post hoc tests showed that only fatigue (p=0.003) and dizziness (p=0.005) were significantly improved at the final appointment compared to the initial appointment.

Fatigue Severity Scale: No statistically significant changes over time.

PHQ-9: No statistically significant changes over time.

Conclusions: Despite treatment directed at headache, depression and fatigue by experts in Head Injury Medicine, this population with mild or moderate TBI who were at least six months post-injury reported persistent high scores on headache severity and other Rivermead symptoms, Fatigue Severity Scale and Patient Health Questionnaire-9. Although some improvements in median Rivermead scores were observed over time, FSS and PHQ-9 scores remained statistically unchanged. These findings highlight the importance of continued clinical research in this area.
Autobiographical memory development and social cognition in adolescents with Fetal Alcohol Spectrum Disorder

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Background: Adolescents with Fetal Alcohol Spectrum Disorder (FASD) often demonstrate deficits in social cognition and emotion processing, which negatively impact the development of appropriate social skills. Consequently, they can experience social and community withdrawal and display an increased likelihood of remaining socially isolated in adulthood. Autobiographical memory (AM) has been found to be critical for the development of appropriate social behaviours; however, it has not been determined whether AM is impaired in children and adolescents with FASD and if this contributes to inadequate social skill development and social withdrawal.

Objectives: To determine: (1) the effects of prenatal alcohol exposure on the AM recall; (2) the relationship between AM recall performance on social cognition (i.e. theory of mind and social problem solving) in youth with and without FASD.

Methods: A two-group comparison study was carried out with 18 adolescents with FASD and 18 age and sex-matched typically developing control (TDC) participants between the ages 13-17 years. The groups were compared using analysis of variance (ANOVA) on the number of AM details that they recalled using the Children’s Autobiographical Memory Interview. Theory of mind and social problem solving were investigated using clinical and experimental measures to assess social cognitive skills. Hierarchical linear regression analyses were completed to understand whether the number and type of AM details recalled could predict social cognitive performance.

Results: Findings revealed that adolescents with FASD demonstrated weaknesses in AM compared with the TDC group (p<0.05). Specifically, they showed deficits in recalling event (e.g. who was there, sequencing of events), perceptual/sensory (e.g. sounds, tastes and visual details) and thought/emotion (e.g. feelings at the time of the event) details from past experiences. In both groups, AM recall was found to significantly predict theory of mind task performance (p<0.05).

Conclusions: This study is the first to our knowledge that has investigated AM in adolescents with FASD. Our findings have implications for understanding behavioural regulation issues in adolescents with FASD that may be underpinned by impoverished AM. Overall, the information presented in this study can help inform the development of intervention techniques that are unique to the cognitive needs of adolescents with FASD and provide support for adapting effective AM interventions from other populations.
A patient with mild traumatic brain injury and hyponatremia

0517

Status: Accepted Presentation type: Poster
Category: Neurotrauma – case reports/clinical research
Author's preference: Poster

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Case presentation

A 35-year old man was seen at the Emergency Department of our hospital after an alcohol related fall down the stairs. His medical history included seizures caused by cerebral cavernous hemangiomas treated with Levetiracetam. He was unconscious for a few minutes and presented with a Glasgow Coma Scale score of 14. He was diagnosed with mild traumatic brain injury (mTBI).

The initial CT brain showed the known hemangiomas and fractures of basilar skull, left mastoid and right temporal bone, without intracranial traumatic lesions.

He was admitted for observation at our ward. Paracetamol, Tramadol and Metoclopramide were prescribed. Posttraumatic amnesia was approximately 36 hours. From day three he developed progressive headache, agitation, dizziness, nausea and vomiting. At day six he complained about tingling of his left arm. Follow-up head CT did not demonstrate any new abnormalities. Routine blood tests showed a sodium level of 115mmol/l and serum osmolality of 235mosm/kg. Further tests were normal, including thyroid hormones and morning cortisol. Urinary sodium was 39mmol/l and urinary osmolality 293mOsm/kg.

The low serum osmolality (<0,285mOsm/kg), high urinary osmolality (>200mOsm/kg) and high urinary sodium (>25mmol/l) in a euvolemic patient suggested a syndrome of inappropriate antidiuretic hormone (SIADH). MRI brain didn’t show new abnormalities, especially no hypothalamic or pituitary lesions.

Fluid restriction (1L/day) was started and he received 3%NaCl. Sodium improved only slightly to 117mmol/l. At day seven opioids were discontinued, at day twelve Levetiracetam was tapered and finally discontinued at day fourteen, while starting Valproic acid, to eliminate the possibility of drug-induced SIADH. Because no changes in sodium occurred, fluid restriction was adjusted to 750ml/day at day eleven. After this the hyponatremia improved and normalized in six days.

Discussion

We describe a case of SIADH in a patient with mTBI without any traumatic intracranial abnormalities. Much research has been done on hyponatremia and TBI, but mTBI is frequently excluded. A study that included mTBI with CT-abnormalities found no correlation between initial GCS and occurrence of hyponatremia. However, a relation between hyponatremia and traumatic intracranial abnormalities on CT was seen.

Although hyponatremia in mTBI without traumatic cerebral abnormalities is uncommon, no other explanation was found in our case. No cases have been described about cavernous hemangiomas and SIADH. Only one case about Levetiracetam and SIADH has been reported. In our case improvement of sodium happened before discontinuation of Levetiracetam. Also a relation between SIADH and opioids has been described before; our patient didn’t show improvement after cessation of this drug.
Conclusion

We demonstrate that even in mTBI without traumatic intracranial lesions SIADH can occur. If a patient with mTBI develops symptoms fitting hyponatremia, sodium should be checked.
Language Analysis of Plea Colloquies and the Implications for Individuals with TBI

Objectives: Traumatic Brain Injury (TBI) in both children and adults is associated with an elevated risk of arrest and incarceration (Elbogen et al., 2012; Schofield et al., 2015). Navigating proceedings in the criminal justice system requires advanced communication abilities (Wszalek & Turkstra, 2015), abilities that are impaired in many individuals with TBI (Catroppa & Anderson, 2004; Ferstl, Guthke, & von Cramon, 2002; McDonald, 2007). One such proceeding is the judicial colloquy. These colloquies determine whether a defendant is capable of waiving important rights; consequently, they have critically important legal and social consequences. There is, however, considerable variation in how judges deliver these colloquies, so the exact nature of colloquy language and communication demands is unknown.

Methods: To characterize the complexity of legal language in these plea colloquies, we analyzed language structure and content of 177 official transcripts of plea colloquies from courts in Wisconsin, USA. This analysis was part of a larger study examining processing of judicial language in individuals with TBI, and was the first step in developing ecologically valid stimuli. Language was analyzed using CHAT/CLAN (MacWhinney & Wagner, 2010), a computerized program for automated language analysis.

Results: Results show that when comparing the plea colloquies alone to full proceedings, judges’ language in plea colloquies contained significantly more words per utterance \( b=1.91, t=5.59, p<0.001 \) and more morphemes per utterance \( b= 2.28, t=5.96, p<0.001 \). These findings suggest that the formal plea colloquy, which is the most important part of the criminal proceeding, has higher language demands than the total proceeding. Furthermore, Flesch-Kinkaid scores revealed considerable variation in the overall readability of the judges’ colloquy language: scores ranged from 4.5 to 9.1, with a mean score of 7.04.

Conclusions: These findings all suggest that plea colloquies would present a language challenge for defendants with TBI-related cognitive and communication impairments, and have direct implications for judicial policy and proceedings.
The Effect Of Demographic And Clinical Characteristics Of Patients With Stroke On Rehabilitation Outcomes

Status: Accepted
Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: We have investigated demographic and clinical characteristics of patients with stroke treated in our brain injury unit and their effects on rehabilitation outcomes.

Methods: Medical records of 110 patients with stroke who was hospitalized in our rehabilitation center between January 2013 and December 2014 were reviewed. The demographic characteristics such as age, sex, training period as well as clinical characteristics including etiology, anatomical localization of the lesion, risk factors, and complications were investigated. The results of Berg balance scale, mini-mental state examination (MMSE) and Chedoke-McMaster stroke assessment scale were assessed. Outcome measures including functional independence measure (FIM) and functional ambulation classification (FAC) were used to assess the efficacy of rehabilitation program. Multiple linear regression analysis was applied to evaluate the factors affecting the difference between the outcome measure scores on discharge and admission.

Results: 110 patients with stroke comprising 37 females (33.6%) and 73 males (66.4%) with an average age of 61.0±14.4 years were included in the study. The etiology of the stroke was 75 (%68.2) ischemic and 35 (%31.8) hemorrhagic. The most frequent risk factors were hypertension (58.2%), smoking (37.3%), diabetes (24.5%), coronary artery disease (21.8%), dyslipidemia (19.1%) and presence of previous stroke (13.6). The most frequent complications were spasticity (80.0%), speech disorders (aphasia and dysarthria) (52.7%), shoulder pain (33.6%), dysphagia (27.3%), urinary incontinence (26.4%), depression (20%), and convulsion (20%). The variables that strongly predicted the difference between FIM and FAC scores on discharge and admission were MMSE/training period (p=0.041 ve p=0.023), and MMSE/training period/Berg balance scale score (p=0.021, p=0.047 ve p<0.001), respectively.

Conclusions: The results suggested that the higher MSE and training period predicted the better recovery both on FIM and FAC scores and the higher Berg balance scale score predicted the better recovery only on FAC scores.
Are Rehabilitation Outcomes After Anoxic Brain Injury Different From Traumatic Brain Injury: Matched Case Control Study

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: To compare rehabilitation outcomes of patients with anoxic brain injury (AnBI) with control patients who have traumatic brain injury (TBI). Materials-

Methods: Patients with AnBI and TBI who were admitted to clinic between 2011-2014 were included in the study. We investigated patient records retrospectively and recorded demographic data, Functional Independence Measurement (FIM), Functional Ambulation Scale (FAS) before and after treatment. Patients with AnBI were matched to patients with TBI admitted within the same time frame on age, same coma interval and FIM score before treatment.

Results: Forty patients with AnBI and 20 patients with TBI were included. Mean age in AnBI group was 37.7 years and 29.4 years in TBI group. Coma interval in AnBI group was 47.4±34.0 days and 43.4±39.0 days in TBI group. There was no significant difference between groups by means of age, gender, coma interval, FIM and FAS score before treatment (p>0.05). Etiology in AnBI group was cardiac arrest in 72.5% of patients while 80.0% of patients in TBI group were due to motor vehicle accidents. FIM score in AnBI group was 41.7±28.5 before treatment and increased to 57.1±31.4 after treatment. FIM score in TBI group was 33.9±25.5 before treatment and increased to 37.6±60.7 after treatment. There was no statistically significant difference in FIM scores after treatment between groups (p>0.05). Frequencies of swallowing dysfunction, speech disorder and urinary-fecal incontinence in AnBI group were 42.5%, 75.0% and 90.0% respectively. In TBI group frequencies of swallowing dysfunction, speech disorder and urinary-fecal incontinence were 40.0%, 90.0% and 30.0%, respectively. There were no differences between groups by means of swallowing dysfunction and speech disorder but frequency of urinary-fecal incontinence in AnBI group was significantly higher from TBI group (p=0.018, Chi-square test).

Conclusions: In this study, we did not find significant differences in rehabilitation outcomes of patients with AnBI compared to patients with TBI. Considering the lack of information in literature about AnBI rehabilitation, this study may have importance to guide rehabilitation teams.
Sleep Efficiency after Traumatic Brain Injury and Agitation Scores on an Inpatient Brain Injury Rehabilitation Unit

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: To determine the relationship between nighttime sleep efficiency and agitation after moderate to severe brain injury.

Methods: Ten adults with moderate-to-severe traumatic brain injury who were admitted to an acute inpatient brain injury rehabilitation unit in post-traumatic amnesia [PTA] and met inclusion criteria were enrolled in the study after informed consent was obtained from the designated decision-maker. Actigraphs [Respironics Actiwatch 2], which measure sleep efficiency [SE], were placed on participants within 24 hours of admission to the rehabilitation unit. SE was calculated with Respiration Inc: Actiware version 5.57 for both a set sleep period from 2300-0700 and the participants’ actual sleep period. The Orientation Log [OLOG], the Toronto Test of Acute Recovery after TBI [TOTART], twice daily Agitated Behavior Scale [ABS] scores, number of restraints and sleep logs were obtained prospectively. Participants were followed for one week after clearance of PTA as measured by OLOG and TOTART. A nonparametric analysis between ABS and SE was conducted with Spearman’s Rank Order Correlation Coefficient.

Results: Of the eight participants who completed the study, seven were male. Six of the participants were involved in a MVA and two suffered injury from a sports-related accident. Median Glasgow Coma Scale [GCS] on admission to the ED was 9 [range 6-13]. The median number of days from injury to admission and consent was 22 days. Five participants [63 %] had impaired sleep efficiency on the first day of study. Six [75%] had impaired sleep efficiency over the first three days of study. Median SE per day was 80% [range 27.7%-95.6%]. Median A.M. ABS score was 16 [range 13-38]. Median P.M. ABS score was 15.5 [range 13-31]. High ABS scores, reflecting more agitation, were inversely related to the previous night’s SE for both the set period SE [SE - Morning ABS = -.253 p = .026 and SE - Afternoon ABS = -.351 p = .003] and the individually adjusted SE [SE - Morning ABS = -.251 p = .026 and SE - Afternoon ABS = -.238 p = .046]

Conclusions: Disrupted sleep is highly prevalent on an acute rehabilitation unit and has been associated with increased length of stays and higher costs. This study showed a high prevalence of disrupted sleep upon admission to rehabilitation. Our pilot study suggests that poor sleep is associated with increased agitation scores, which has not been reported in the literature. Further study is needed to evaluate this preliminary finding and to determine if improved sleep could reduce agitation and improve outcomes.
**Prevalence, Characteristics, Neuropsychiatric Symptoms, And Quality Of Life Of Young People With Acquired Brain Injury In Dutch Nursing Homes: Study Design**

Status: Accepted  Presentation type: Poster  
Category: Neurotrauma – prevention and public health  
Author's preference: No preference  
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**Objectives:** Little is known about young patients with severe acquired brain injury (ABI) needing intensive care due to chronic physical and/or behavioural disabilities who reside in nursing homes. Epidemiologic data and evidence based guidelines for ABI in long-term care do not exist.

In order to achieve a suitable provision of care for these patients, establishing the prevalence, and investigating the characteristics, neuropsychiatric symptoms (NPS), and quality of life is the first step in this process.

The Dutch situation provides an excellent opportunity. The Netherlands is a small and densely populated country with more than 180 long-term care organizations well spread throughout the country. These organizations are specialized in somatic and psychogeriatric care, provided by multidisciplinary teams led by an Elderly Care Physician (ECP).

The primary goal of this study is to investigate the prevalence, characteristics, NPS, and quality of life in young patients with ABI in all Dutch nursing homes.

**Methods:** A cross-sectional, observational, multicentre, quantitative, study among young patients (18-65 years) with ABI admitted to specific ABI wards in Dutch nursing homes.

Studying the characteristics, NPS and quality of life will be preceded by a nationwide prevalence study. Young patients in the chronic stage of ABI will be enrolled from the ABI wards of all Dutch nursing homes.

Patient characteristics will be collected from medical files. Health status will be assessed by the Medical Outcome Study Short Form, quality of life by the Quality of Life after Traumatic Brain Injury, NPS by the NeuroPsychiatric Inventory NH, aggression by the Cohen Mansfield Agitation Inventory, sexual inappropriate behaviour by the St. Andrews Sexual Behaviour Assessment. We focus specifically on aggression and inappropriate sexual behaviour because a pilot survey among nursing staff showed these are the most problematic NPS with the highest impact. Cognition is measured with the Mini Mental State Examination, and activities of daily living by the Disability Rating Scale. Medication will be retrieved from the prescription/pharmacy system.

**Conclusions:** The results will provide insight into the prevalence, characteristics, NPS, and the quality of life of young patients with ABI in Dutch nursing homes, which will help care providers to match their care supply with the patients' care needs and to enhance the awareness of the consequences of ABI. Results could lead to recommendations for a suitable provision of care, including psycho-social interventions, and psycho-education, and improvement of quality of long-term care through ABI specific guidelines.
Comparison between traditional physiotherapy treatment and the combination of traditional treatment with virtual reality

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – basic research
Author's preference: Oral

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Objectives: To compare traditional physical therapy following acquired brain injury with the combination of traditional physical therapy and the use of a natural interface device.

Methods: 15 patients who have suffered an acquired brain injury in the past year and who were admitted as long-term in-patients to a hospital run by the Valencian health agency (Agencia Valenciana de Salud) were randomly assigned to two rehabilitation groups: a control group in which only traditional physical therapy was used, and an experimental group in which traditional physical therapy was combined with treatment with a natural interface (NeuroAtHome). In both groups the total number of treatment hours was between 20 and 30, with equal variation across the groups. Two evaluations were made: one at admission, and another a month after rehabilitation was started.

Results: Both rehabilitation groups improved between their pre-treatment and post-treatment scores. Both groups had an equivalent improvement.

Conclusions: Traditional physical rehabilitation has a positive effect on the evolution of acquired brain injury patients. The natural interface tool NeuroAtHome can substitute for hours of traditional therapy and obtain the same beneficial results in the neurological rehabilitation of the patient. In this way it is possible for patients to reduce the hours in which they visit rehabilitation centres by combining this traditional therapy with telerehabilitation at home, or by doing sessions in the centres with less direct attention from the physiotherapist.
Life Satisfaction and Strain Among Informal Caregivers of Patients with Traumatic Brain Injuries

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: This study aims to determine the life satisfaction and strain of informal caregivers when caring for traumatic brain injury (TBI) patients.

Methods: A cross-sectional survey on a purposive sampling was performed in a single-centre in Malaysia recruiting caregivers of patients with TBI. Life Satisfaction Questionnaire-9 and Caregiver Strain Index questionnaires were used to ascertain the life satisfaction and strain of caregivers respectively. Relationship between life satisfaction and strain was analysed, together with factors significantly associated with strain.

Results: A total of 141 caregivers (77.3% women, average age of 46.1 years ±12.8 and mean duration of care giving of 24.8 months ±43.8) were included in the analysis. Most caregivers (75%) were satisfied with their lives but more than half claimed to have strain (57%). There was a significant relationship between life satisfaction and strain among the caregivers (p<0.001). From multiple linear regression analysis, caregiver’s monthly income of less than RM3000 (OR 6.48, 95% CI 1.48-28.40, p=0.04), presence of patient’s neurobehavioural disturbances (OR 4.48, 95% CI 1.60-12.55, p=0.004) and cognitive dysfunctions (OR 31.72, 95% CI 10.27-97.96, p<0.001) were significantly predicting caregiver’s strain.

Conclusions: Caregivers with lower monthly income and caring for TBI patients with cognitive and neurobehavioural disturbances are at higher risk of having strain. Rehabilitation interventions post-discharge should aim at supporting caregivers at risk.
Cognitive-Linguistic Impairments following Left Temporal Cortex Contusion: A case Report

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: There is limited information on the nature of language impairments in brain injured adults with the syndrome of left temporal lobe contusion. Previous studies (McLauren-Helmer, 1995., Nelson et al, 1982., Marion, 1999) have only identified the presence of non-specific ‘expressive aphasia’ in such cases. Hence, the objective of the present study was to undertake a comprehensive analysis of language in an adult with the temporal lobe contusion syndrome.

Methods: Subject. DT, a 45 year old male, mono-lingual speaker of Tamil (an Indian language), with a history of violent attack on the head resulting in temporal lobe contusion syndrome served as the subject. A CT scan evaluation confirmed left temporal fracture with intracranial and subarachnoid hemorrhagic contusion. Loss of consciousness lasted one day. In the acute stage DT was only able to produce meaningless monosyllabic expressions (ah..oh..). Pt. was diagnosed with global aphasia and right hemiparesis. Two Months post-onset, DT began to understand simple sentences, use gestures, and words. Cognitive deficits were evident in handling money, remembering names, and he was disoriented to time, date, and place. DT’s words were mostly unintelligible (neologistic distortions). Six months post-onset, he spoke in sentences that were partially understood by family and friends. DT displayed symptoms of conduction aphasia characterized by problems of repetition, phonemic paraphasias, reading and writing disorders. At this time a comprehensive cognitive-linguistic evaluation was completed.

Results: DT’s language performance was assessed with the Bilingual Aphasia Test (BAT)-Tamil version (Paradis, 1993). The subtests of BAT that were used include the following: Auditory comprehension for body-part commands, and sentence picture matching. The subtest on semantic processing included tasks such as odd-word identification, synonym identification, and antonym identification. The sentence judgment subtest included tasks that required judgment of grammaticality, and semantic anomaly of sentences. Language production subtest included tasks such as non-word repetition, word repetition, sentence repetition, and sentence formation. Reading subtest sampled word and sentence level oral reading. Writing subtest was not administered because of DT’s right-sided hemiplegia. A brief neuropsychological evaluation was also completed.

Conclusions: DT’s performance on BAT subtests is presented in terms of percentage of correct responses: Body part comprehension (auditory comprehension) 100%, sentence-picture matching (auditory comprehension) 40%, Odd-word identification (semantic task) 100%, Antonym and synonym identification (semantic task) 40%, Semantic anomaly judgment 80%, grammaticality judgment 50%. Word repetition 80%, Non-word repetition 28%, and word reading 100%. Neuropsychological assessment revealed the following profile for DT: Nonverbal IQ 109, Verbal IQ 64, significantly impaired short term memory, moderately impaired visual and verbal recall, normal visual, visuospatial, and visual constructive skills, and moderately impaired verbal fluency and verbal reasoning. This performance profile appears to suggest a complex interaction between cognitive and linguistic processing deficits in DT.
Comparison between traditional neuropsychology treatment and the combination of traditional treatment with virtual reality

Status: Accepted
Presentation type: Poster
Category: Neurorehabilitation – basic research
Author's preference: Oral

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Objectives: To compare traditional neuropsychological therapy following acquired brain injury with the combination of traditional neuropsychological therapy and the use of a natural interface device.

Methods: 25 patients who have suffered an acquired brain injury in the past year and who were admitted as long-term in-patients to a hospital run by the Valencian health agency (Agencia Valenciana de Salud) were randomly assigned to two rehabilitation groups: a control group in which only traditional neuropsychological therapy was used, and an experimental group in which traditional neuropsychological therapy was combined with treatment with a natural interface (NeuroAtHome). In both groups the total number of treatment hours was between 20 and 30, with equal variation across the groups. Two evaluations were made: one at admission, and another a month after rehabilitation was started.

Results: Both rehabilitation groups improved between their pre-treatment and post-treatment scores. Both groups had an equivalent improvement.

Conclusions: Traditional neuropsychological rehabilitation has a positive effect on the evolution of acquired brain injury patients. The natural interface tool NeuroAtHome can substitute for hours of traditional therapy and obtain the same beneficial results in the neurological rehabilitation of the patient. In this way it is possible for patients to reduce the hours in which they visit rehabilitation centres by combining this traditional therapy with telerehabilitation at home, or by doing sessions in the centres with less direct attention from the therapist.

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: Traumatic brain injury (TBI) can trigger chronic neuroinflammation, which may impair recovery and predispose to neurodegeneration. Previously, using [11C]-PK11195 positron emission tomography (PET), a marker of the translocator protein (TSPO) expressed by activated microglia, we observed inflammation in the thalamus up to 17 years after TBI. Treating this inflammation may improve long-term outcomes after TBI. The second-generation tetracycline minocycline is neuroprotective in animal models of TBI, and an important action appears to be the inhibition of microglial activation. Here, using the second-generation TSPO ligand [11C]-PBR28, we test the hypotheses: (1) that thalamic TSPO, as measured by [11C]-PBR28 PET, is higher in chronic TBI patients than aged-matched controls; and (2) that minocycline therapy following TBI will reduce thalamic TSPO as measured by [11C]-PBR28 PET.

Methods: Fifteen patients at least 6 months after a single moderate to severe TBI (Mayo classification) underwent baseline imaging with [11C]-PBR28 PET and magnetic resonance imaging (MRI). 10 patients were randomised to receive a course of 12 weeks of oral minocycline, 100mg twice a day, and 5 patients received no drug. All patients had a second PET and MRI scan 12 weeks after the baseline scan. Fifteen healthy controls, matched to the TBI patients for age and the Ala147Thr polymorphism in the TSPO gene which affects [11C]-PBR28 TSPO binding affinity, underwent a single [11C]-PBR28 PET scan and MRI. Distribution volume ratio (DVR) and volume of distribution (Vt) derived from the Logan graphical method were generated for quantification of TSPO levels. In all TBI patients, difference images (baseline – follow up) were calculated. Voxel-wise analyses on DVR and Vt parametric images registered into standard anatomical space were performed to compare TBI patients at baseline with controls, and to compare change in the minocycline versus no drug groups.

Results: Microglial activation was increased in TBI patients versus healthy controls in multiple areas, including the thalamus and frontal white matter. Comparison of scans in the TBI group showed widespread decreases in microglial activation in patients treated by minocycline. These were not seen in the untreated group.

Conclusions: In the first study to use [11C]-PBR28 PET after TBI, we provide further evidence for persistent microglial activation in patients at least 6 months after injury. We also use [11C]-PBR28 to demonstrate that minocycline reduces microglial activation. These results suggest that minocycline may limit pro-inflammatory microglial activity contributing to neurodegeneration, and provide support for a clinical trial of minocycline to improve long-term outcomes after injury.
A Randomized Placebo Controlled Trial of Progesterone With or Without Hypothermia in Patients With Acute Severe Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Among the newer neuroprotectant modalities; hypothermia and progesterone have shown a beneficial role in preliminary studies enrolling patients with severe traumatic brain injury (sTBI). The primary objective of this study was to evaluate efficacy of progesterone with or without prophylactic hypothermia in acute sTBI patients.

Methods: This is a prospective, outcome assessor and statistician blinded, randomized placebo controlled phase II trial of progesterone with or without hypothermia (Factorial design). All adult patients (18-65 years) with acute sTBI (GCS score of 4-8) and presenting to trauma centre within 8 hours after injury were included in the trial. Computer generated randomization was done after exclusion and sequentially-numbered, opaque, sealed envelope technique was used for allocation concealment. The enrolment duration was from January 2012 to October 2014. The primary endpoint was dichotomised Glasgow Outcome Scale (GOS) score (Poor recovery = GOS 1-3; Good recovery GOS = 4-5) and secondary endpoints were Functional Independence Measure (FIM) score and mortality rate at six and twelve months follow up after recruitment.

Results: A total of 107 patients were randomized into four groups [Placebo (n = 27), Progesterone (n = 26), Hypothermia alone (n = 27) and Progesterone + Hypothermia (n = 27)]. The study groups were comparable in baseline parameters except higher incidence of decompressive craniectomy (DC) in the placebo group (p = 0.001). The analysis of GOS at 6 month revealed statistically significant better outcome in hypothermia group (82%; p = 0.01) and weaker evidence for progesterone group (74%; p = 0.07) as compared to placebo group (44%). However, the outcome benefit was marginal at one year follow up for Hypothermia group (82% versus 58%, p = 0.17). The adjusted odds ratio of poor recovery at 6 months in Hypothermia group was 0.21 (CI = 0.05–0.84, p = 0.03), as compared to placebo group. Although mean FIM scores, at 6 and 12 months respectively, were marginally higher in Hypothermia and Progesterone groups compared to placebo (p = 0.06 and 0.27), the proportion of functionally independent individuals were similar in all groups (p = 0.79 and 0.51). The mortality rates were similar in all groups at 6 and 12 months (p = 0.78 and 0.52 respectively).

Conclusions: Strong evidence for prophylactic hypothermia and weak evidence for Progesterone therapy was observed for better primary outcome at six months as compared to placebo. Similar trend was observed at 1 year follow up. Contrary to our hypothesis, prophylactic hypothermia therapy suppressed the beneficial effects of progesterone therapy in sTBI patients. The complex cascade of factors responsible for such interaction are still unknown and needs to be further determined.
Blood Mitochondrial Enzymatic Assay as Predictor of Long Term Outcome in Severe Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Recent studies have observed central role of mitochondrial dysfunction in severe traumatic brain injury (sTBI). Till date there are no clinical studies estimating relationship of blood mitochondrial enzymes to long term outcome in sTBI.

Methods: Out of 107 sTBI patients (18-65 years with Glasgow coma score of 4-8 presenting within 8 hours after injury) randomised for placebo controlled phase II trial of progesterone with or without hypothermia, we serially analysed blood mitochondrial enzymes (Complex I – C1, Complex IV – C4 and Pyruvate Dehydrogenase complex - PDH) using dipstick method at admission and 7 days later for 37 patients, irrespective of assigned group. Predictive potential and cutoff values of blood enzymes on dichotomised glasgow outcome score (GOS), functional independence measure (FIM) and survival status at 1, 6 and 12 months was analysed using independent student T-test and receiver-operating characteristic curve respectively.

Results: Favourable GOS (4-5) at 1 year was associated with higher admission serum C1 levels above 0.19 pg/ml (AUC 0.89, sensitivity 81.3% and specificity 83.3%), admission C4 levels above 0.19 pg/ml (AUC 0.71, sensitivity 87.5% and specificity 66.7%) and C1-day7 levels above 0.17 ng/ml (AUC 0.82, sensitivity 75% and specificity 83.3%). Unfavourable GOS (1-3) at 1 year was associated with higher admission serum PDH levels above 0.23 ng/ml (AUC 0.77, sensitivity 66.7% and specificity 75%). Functionally independent outcome (FIM > 108) at 6 months was associated with higher admission serum C1 levels above 0.19 pg/ml (AUC 0.90, sensitivity 83.3% and specificity 75%). Functionally dependent outcome (FIM108) at 6 months was associated with higher C4-day7 levels above 0.23 ng/ml (AUC 0.85, sensitivity 62.5% and specificity 91.7%). Survivors at 1 year had significantly higher admission serum C1 levels above 0.19 pg/ml (AUC 0.85, sensitivity 76.5% and specificity 80%) and C1-day7 levels above 0.17 ng/ml (AUC 0.78, sensitivity 70.6% and specificity 80%).

Conclusions: This is the first clinical trial associating blood mitochondrial enzymes to long term outcome. Serial monitoring and optimization of blood C1, C4 and PDH levels could aid in prognostication and potentially guide in using mitochondrial targeted therapies. Cause-effect relationship or a mere association of these blood enzymatic markers to outcome needs to be further studied. Ultimately, a comprehensive prognostic model that incorporates blood mitochondrial enzymatic assay to assess global redox status along with clinical and radiological parameters will be useful for clinical practice as well as clinical research.
Predicting outcomes on admission to residential rehabilitation with the Mayo-Portland Adaptability Inventory: 'Truth or dare?'

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: No preference

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Objectives: Several studies have addressed the question of predicting outcome following acquired brain injury (e. g. Husson et al., 2010; Lingsma et al., 2010; Perel et al., 2006). A better understanding of the factors that predict outcome furthers our knowledge of the mechanisms underlying the rehabilitation process; enables clinicians and service providers to better estimate and describe the improvements that might be expected as a result of rehabilitation, and informs the level of input required to match the severity of each individual's disability (Malec & Degiorgio, 2002). Recently, Malec and colleagues (2015) developed statistical formulas to predict levels of community participation on discharge from post-hospital brain injury rehabilitation. The aim of this study was to evaluate these equations with a new sample, and to compare the models reported by Malec with newly generated linear discriminant models.

Methods: This study consisted in a retrospective analysis of measures of outcome from 289 admissions to post-acute residential rehabilitation, comprising individuals with various forms of acquired brain injury. The main measure was the Participation Index of the Mayo-Portland Adaptability Inventory (MPAI-4). Individual characteristics including age, gender, time since injury, injury severity and Participation Index score on admission were entered in the models.

Results: Outcome predictions based on Malec and colleagues' (2015) equations moderately correlated with observed outcomes (rs = .61, N = 285, p < .01), and there were no significant differences between predicted and observed outcomes (Z = .69, p > .10). Newly generated models revealed that the MPAI-4 Participation Index and log time since injury were good at predicting outcomes, particularly at the two extremes (limited and excellent). Prediction models were also compared across different diagnoses.

Conclusions: These results further support the use of predictions of outcome based on assessment results on admission. We discuss the validity of using these methods across diagnoses other than traumatic brain injury, and the degree of confidence that might be placed on actuarial predictions across different levels of outcome.
The Influence of Country of Origin and Attitudes Towards Healthcare, Language Preference, and Health Outcomes in Individuals with TBI

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Exploring one uniquely diverse TBI Model System (TBIMS) center in New York, we examined the health disparities present among minority individuals with TBI in comparison to the predominantly white (67%), male (74%) individuals with TBI enrolled in the TBIMS National Database. Focusing on healthcare providers who provide inpatient rehabilitation care to individuals with TBI, we investigated how racial and cultural differences may influence patient attitudes towards healthcare providers and, consequently, minority healthcare outcomes.

Methods: Data was collected through medical record abstraction and patient self-report, composing a sample of n = 38 participants with diagnosed moderate to severe TBI from a demographically diverse, urban public hospital, looking across the five primary rehabilitation disciplines: occupational therapy (OT), physical therapy (PT), speech/language therapy (SL), social work (SW) and psychology (PSY). Measures and Analyses: Descriptive statistic and t-tests were utilized to examine the relationship between patients’ country of origin (i.e., U.S. born or born outside of the U.S.) and patient attitudes towards healthcare, language preference, and functional health outcomes (i.e., acute rehabilitation admission scores on the Functional Independent Measure (FIM) scale and length of stay (LOS) from acute admittance to rehabilitation discharge).

Participants: 18 participants reported born in the U.S. (74% male, 47% white), with a mean age of 47.8 years (SD = 15.5). 20 participants reported born outside of the U.S. (80% male, 45% Hispanic), with a mean age of 43.1 years (SD = 16.2).

Results: Regarding attitudes towards healthcare, there was more distrust towards healthcare providers by those born outside of the United States. Language preference results indicated that 70% of patients born outside of the U.S. felt “uncomfortable communicating in English” and preferred using their native language when communicating about their healthcare with their providers. Forty-seven percent preferred to utilize interpreter services, if their healthcare provider was unable to speak their native language. Additionally, those born outside of the U.S. had lower FIM scores upon intake and significantly longer length of stays during acute and rehabilitation care.

Conclusions: Previous studies have reported higher patterns of mistrust in the healthcare system and with healthcare providers within minority populations, and increased risk of mortality due to patient/provider language discordance, the need to bridge the gap of understanding between minority groups and their healthcare providers is paramount. This study begins to examine the healthcare disparities not only prevalent among TBI populations, but across the rehabilitation research field.
Rehabilitation Outcome After Decompressive Craniectomy

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: The clinical value of decompressive craniectomy in the management of increased intracranial pressure in patients sustaining brain injury is controversial. The objective of this investigation is to review the rehabilitation outcomes of patients who have undergone decompressive craniectomy.

Methods: Retrospective clinical review of the rehabilitation outcomes of 46 consecutive patients who were admitted to a brain injury program for acute rehabilitation during a 6 year period. Functional assessment was determined by Functional Independence Measures (FIM) scores. Patients with craniectomy were compared to a cohort of 1310 patients who did not undergo craniectomy.

Results: Among the 46 patients who underwent decompressive craniectomy, 21 were diagnosed with traumatic brain injury (TBI), 18 with cerebrovascular accident (CVA) and 7 with other acquired nontraumatic brain injuries. Patients undergoing craniectomy tended to be younger 44.3 v. 58.4 years (p<0.001) and experienced longer length of stay (LOS) (28 v.18.2 days; p<0.001). Craniectomy patients had lower admission total FIM scores compared to a cohort of brain injured patients who had not undergone craniectomy (35.2 v. 53.1; p<0.001). Furthermore, craniectomy patients exhibited lower discharge total FIM scores (71.2 v. 84.5; p<0.001) but higher total FIM score gains from admission to discharge (36.1 v. 31.3; p =0.021). FIM change per day (i.e. FIM efficiency) was lower among the craniectomy patients but was not statistically significant (1.8 v. 2.3; p=0.051). Craniectomy TBI patients had lower admission total FIM scores compared to a cohort of 310 TBI patients without craniectomy (32.9 v. 53; p<0.001). At discharge craniectomy TBI patients had lower discharge total FIM scores compared to those without craniectomy (73.5 v. 85.9; p=0.003), but exhibited similar FIM efficiencies (1.3 v. 1.5; p=0.205). CVA patients with craniectomy also tended to also lower admission FIM scores (35.6 v. 50.5; p=0.001) and lower discharge total FIM scores (67.3 v. 80.6; p=0.010). Craniectomy CVA patients had longer LOS (29.1 v. 20.2; p=0.031) but identical FIM change per day.

Conclusions: Patients undergoing craniectomy enter rehabilitation at a lower functional level and are discharged at a lower functional level compared to patients who have not undergone craniectomy. Although craniectomy patients have a longer LOS, they display similar FIM efficiency.
Impact of Selective Glucocorticoid Receptor Blockade on Hippocampal Neurotrophic Response to Micro-Fluid Percussion Injury and on Histological and Cognitive Outcome

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Traumatic brain injury (TBI) is a major cause of mortality and morbidity. Cognitive and psychological sequelae of TBI have been attributed to selective vulnerability of the hippocampus. Research has demonstrated an interaction between the glucocorticoid stress response to TBI, and the hippocampal neurotrophin response, which is considered neuroprotective.

The study aimed to investigate the impact of pre-injury blockade of the Mineralocorticoid Receptor (MR), and Glucocorticoid Receptor (GR), on the neurotrophic response to experimental TBI, and on histopathological and cognitive outcome.

Methods: Adult Male Wistar rats were pre-treated with MR antagonist, Spironolactone (50 mg/kg, s.c.); GR antagonist, Mifepristone (25 mg/kg, s.c.); or inert Vehicle, one hour prior to moderate micro-fluid percussion injury (MFPI) or sham-injury. Four hours post-MFPI, expression of mRNA to Brain Derived Neurotrophic Factor (BDNF), Neurotrophin-3 (NT-3), Neurotrophin-4/5 (NT-4/5), and receptors TRK-B, TRK-C and p75NTR, was assessed by in situ hybridization. Spatial memory was assessed by T-Maze test, 24 and 48 hours post-injury. Histological outcome in hippocampus and adjacent cortex was assessed morphologically and immunochemically, by H&E staining; TUNEL staining; and antibody testing to Programmed Cell Death pathway enzymes (Caspase-3, PARP-1) and Annexin-1, a glucocorticoid-sensitive anti-inflammatory molecule. Semi-quantitative analysis of H&E-stained sections was performed by two observers blinded to treatment group. Statistical analysis was undertaken using analysis of variance and Kruskall-Wallis test.

Results: In situ hybridisation studies (n=36) demonstrated FPI increased ipsilateral hippocampal expression of BDNF, NT-4/5 and TRK-B mRNA (p<0.001;p=0.041;p<0.0001) and reduced expression of NT-3 mRNA (p=0.01). There was a significant interaction between FPI and hippocampal sub-region (all, p<0.0001), changes being particularly marked in dentate gyrus (DG). Significant interaction between injury and drug in DG was seen for BDNF mRNA (p=0.009), Mifepristone appearing to attenuate FPI-induced up-regulation. Histopathological analysis (n=72) demonstrated selective neuronal degeneration in ipsilateral hippocampal sub-regions CA1, CA3/2, CA3c, inferior DG (iDG), superior DG (sDG) and dentate hilus (DH) following micro-FPI, compared to sham-injury (p=0.008; p=0.059;p=0.015;p=0.002;p<0.001;p=0.002). Histological studies showed little evidence of hippocampal apoptotic change, suggesting neuronal degeneration 48 hours post-TBI resulted from non-apoptotic mechanisms. Apoptotic changes were seen in ipsilateral cortex. FPI significantly increased expression of Annexin-1 in ipsilateral cortex, but not hippocampus. Neuronal degeneration was significantly lower in FPI/Mifepristone animals compared to FPI/Vehicle animals in CA3/2 (p<0.001), CA3c (p<0.001), iDG (p=0.03), sDG (p=0.01), but not DH (p=0.05). FPI/Spironolactone rats demonstrated no differences in hippocampal neuronal degeneration compared to FPI/Vehicle animals, but showed increased neuronal loss in ipsilateral cortex (p=0.015). FPI impaired performance on T-Maze testing 24 hours and 48 hours post-injury (p<0.001; p=0.02). FPI/Mifepristone rats had higher T-Maze scores than FPI/Spironolactone or FPI/Vehicle rats, but differences were not significant.
Conclusions: GR blockade with Mifepristone significantly reduces hippocampal neuronal loss following FPI, but neuroprotection is not by up-regulating the neurotrophic response.
Role of Acculturation in Rehabilitation Outcomes

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – case reports/clinical research
Author's preference: Oral

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Ethnic minorities are quickly becoming a majority population in many regions of the United States of America (U.S.), and a significant portion of individuals with traumatic brain injury (TBI) come from minority backgrounds. Racial/ethnic minorities frequently experience healthcare disparities that lead to poorer outcomes in a variety of domains, and a growing body of research suggests that these disparities also exist in TBI rehabilitation. One of the inpatient rehabilitation units of the Rusk Rehabilitation TBI Model System is a Level One Trauma Center, New York City-run hospital that admits all individuals who present to the hospital regardless of ability to pay and U.S. residency status. As a result, the ethnic/racial composition of the inpatient rehabilitation unit provides the opportunity to investigate the differences in rehabilitation outcome with respect to race/ethnicity and acculturation. Over an 18-month period of time, 205 individuals with brain injury received inpatient rehabilitation at this hospital; 60% had experienced a TBI, 40% an acquired brain injury (ABI). The demographics of the population were: 53 average years of age; 69% male; 31% with 12 years or less of education; 26% Caucasian, 22% African-American, 14% Asian/Pacific Islander, and 32% of Hispanic origin; 41% single, 40% married, 15% divorced/separated/widowed. The use of the native language, English, or both was queried with respect to childhood, current use inside and outside of the home (asked separately), comfort with English, and what was the preferred language for communication with allied health care professionals. Language primarily used as a child and currently at home was 56% and 45% of the group, respectively. However, outside of the home, only 38% endorsed primarily using their native language. In communication with health care professionals, 39% expressed the desire for use of their native language, with 49% reporting a preference for English. Based upon these results, an inpatient education tool is being developed that will provide more culturally appropriate information and education with the aim of improving the retention of patients in the healthcare service network after discharge from inpatient rehabilitation. This presentation will further describe the information used to develop the intervention and describe the intervention itself.
“After my traumatic brain injury I was especially happy/unhappy, when...” – The patient perspective on life satisfaction within the ICF framework

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: Previous studies have examined quality of life among persons with TBI using quantitative measures and/or structured questionnaires. Recently some studies have focused on the patient’s own perception of TBI using their own words and the International Classification of Functioning, Disabilities and Health (ICF) as a framework to examine quality of life from a wider perspective of functioning.

The aim of this study is to examine:

1. What occasions do the participants report as the most happy or unhappy after TBI and how are these reflected as outcomes within the ICF framework?

2. How are these outcomes, as well as patient and injury characteristics, and emotional state associated with the patients’ quality of life?

Methods: A total of 270 Finnish TBI patients participated in the Wave 1 of the international QOLIBRI (Quality of Life after Brain Injury) validation study in 2004-2006. Of these patients, 223 responded to questions: “Finally, we invite you to describe an occasion since your brain injury when you have been especially happy or satisfied / unhappy or dissatisfied”.

The patients' own descriptions were linked to the relevant categories of the ICF. Frequencies of the first-level ICF categories for happy (n=277) and unhappy (n=242) occasions were calculated, and the most frequent categories (n > 9) were further analyzed by calculating the second-level ICF categories and using thematic analysis. Correlations and regression analysis were used to examine the association with perceived quality of life.

Results: The most frequently reported domain for both happy and unhappy occasions was d7 “Interpersonal interactions and relationships”. Other frequently reported categories were d9 “Community, social and civic life” in happy events, and b1 “Mental functions” and e5 “Services, systems and policies” in both happy and unhappy events.

Regression analysis showed that younger age, longer post-traumatic amnesia, fewer symptoms of anxiety and depression, happy occasion related to "Mental functions" and "Community, civic and social life", and unhappy occasion related to "Mental functions" and "Interpersonal interactions and relationships" were associated with higher perceived quality of life.

Conclusions: The results of this study are in line with previous studies that have shown activities and participation, emotional state, age, and injury severity as relevant components of quality of life after TBI. Additionally, this study informs clinicians about the life areas TBI patients themselves experience as most relevant and that are often missing from questionnaires. From the patient perspective rehabilitation should
focus on supporting the patient’s social relationships, participation in community activities, using services and helping the patients to cope with the demands of the environment.
Mild Traumatic Brain Injury and Very Early Clinical Magnetic Resonance Imaging Findings: A Prospective Cohort Study

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Background: Previous studies have shown that CT has limited sensitivity in detecting brain tissue damage in patients with mild traumatic brain injury (TBI), demonstrating that up to 30 % of patients with normal CT have intracranial lesions depicted by early MRI. Susceptibility weighted imaging (SWI) at 3 Tesla together with diffusion is considered to be the most sensitive imaging technique for detection of early traumatic brain injury.

Objectives: To study the frequency of intracranial findings on very early clinical MRI (within 72 hours) in a prospective cohort of patients with mild TBI, and to assess the frequency of findings in MRI in patients with normal CT.

Methods: Patients with mild TBI according to WHO criteria, seen at a level I trauma center and a municipal emergency clinic in Trondheim, Norway, were prospectively included during an 18-month period. 65% of the patients were treated without hospital admittance.

Exclusion criteria were: other major trauma, earlier complicated mild, moderate or severe TBI, developmental disorders, neurological disease, and severe psychiatric disease or drug/alcohol abuse affecting adherence to the research protocol.

CT was performed as a part of the initial assessment. MRI was performed at a Siemens Skyra 3 Tesla system, and included 3D T1, 3D T2, 3D FLAIR, diffusion and SWI.

Results: 163 patients (mean (SD) age 32 (13)) were examined with MRI at mean (SD) 52 (20) hours (88% < 72 hours, range 5-130). 96 % of the patients reported post traumatic amnesia; 63% for < 1 hour. 56% of the patients had loss of consciousness; 47% < 5 minutes. Median Glasgow Coma Scale score was 15. Injury mechanisms were fall (42%), bicycle accidents (18%), violence (12%) and motor vehicle accidents (7%).

21 (13%) patients had intracranial findings on MRI. Six had traumatic axonal injury (TAI) only, three had isolated contusions, four had both TAI and contusions, three had intracerebral hematomas and five had combined findings.

Out of 136 patients with both CT and MR, CT detected intracerebral lesions in 13 (9.6%), while MRI detected lesions in 20 (15%) patients. All intracerebral lesions detected with CT were also detected with MRI. Thus, 7 (5.7%) of the 123 patients with normal CT had positive MRI. Five of these had pure TAI and two had both TAI and contusions.
Conclusions: In this relatively unselected cohort of mild TBI patients, normal MRI was the principal finding even when performed with a comprehensive protocol at 3Tesla within 72 hours. In patients with normal CT, we found a substantially lower rate of positive MRIs than previously reported. This might be explained by the high proportion of patients not admitted to hospital, which is the standard care for most patients with mild TBI and normal CT.
Control of physiological variables by non-invasive vagus nerve stimulation aiming at ischemic stroke therapy

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: No preference

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Background: Ischemic stroke is the major cause of adult disability and cognitive deficit. To achieve true brain repair and regeneration of the damaged circuits, it is necessary to act directly on the molecular and physiological mechanisms of the neural cells responsible for the neuroprotection and neural repair processes. Besides direct genetical and pharmacological methods, neuromodulatory intervention by electrical stimulation of targeted peripheral nerves seems to be a viable alternative to control tissue regeneration by direct as well as indirect control of several physiological variables. Particularly, there is experimental evidence for the possible beneficial role of the vagus nerve in regulating cerebral blood flow (CBF), melanocortins and inflammation, glutamate excitotoxicity, norepinephrine and neurotrophic processes [1,2]. An increase of vagal activity results in inflammation reduction, vasodilation, increase in CBF and liberation of neuroprotective factors, all of them playing an important role in reducing stroke impact.

Objectives: Here we propose a novel method to improve the function of the neuroprotective and neuroregenerative processes in the neural tissue after stroke by means of the electrical stimulation of the auricular branch of the vagus nerve. Optimization will be performed by performing electrical stimulation with a defined set of stimulation patterns since we have shown their non-linear impact on vital physiological processes.

Methods: Auricular vagus nerve stimulation is performed using two needle electrodes in vagally innervated regions of the auricle in isoflurane-anesthetized Wistar rats and C57BL/6 mice of both sexes. Ischemic stroke is produced by transient middle cerebral artery occlusion with reperfusion after 1 hour under monitoring of different physiological parameters such as ECG, blood pressure, oxygen saturation and CBF. In parallel motor function will be assessed at the beginning, after 1 day and after 3 days. The stimulation starts with reperfusion. A preliminary measurement setup was already established.

Results: First results from our laboratory showed that vagal stimulation produced specific physiological effects [3-5]. For instance, total heart rate variability, a measure for vagal activity and autonomous nervous system action, tend to increase during stimulation, with this ongoing trend also after the end of stimulation. In addition, abrupt changes in heart rate variability were observed in response to on-off stimulation sequences, which were dependent on the amplitude and frequency modulation of the stimulation patterns.

Conclusions: First results are promising and support our hypothesis that therapeutic effects may be optimized by targeted modulation of stimulation parameters. The proposed study may allow - for the first time - a correlation of specific changes in assessed physiologic data, stroke outcome and patterns of auricular vagus nerve stimulation.

Cognitive Therapy With and Without Methylphenidate after Traumatic Brain Injury (TBI): Is Better?

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: Cognitive symptoms are among the most problematic sequelae of traumatic brain injury (TBI) in terms of negative effects on social, academic, and vocational functioning and quality of life. In particular, persistent deficits in memory, attention, and executive functions are frequently reported after TBI. The purpose of this multicenter prospective randomized controlled study was to evaluate the efficacy of a cognitive behavioral therapy (Memory and Attention Adaptation Training; MAAT) and methylphenidate (MPH), alone and in combination in treating cognitive symptoms after TBI.

Methods: This was a prospective, double-blind, randomized controlled trial (RCT) conducted at three sites. Participants included adults with a history of TBI of any severity at least four months prior to study entry, with either cognitive deficits on a neuropsychological screening battery or significant cognitive complaints as measured by the Multiple Abilities Self-Report Questionnaire (MASQ). In a 2x2 design participants were randomized to receive methylphenidate or placebo, and MAAT or Attention Builders Training (ABT), a manualized repetitive practice intervention with no active cognitive-behavioral component, to control for therapist time and attention. This resulted in four treatment combinations: MAAT/MPH (N=17), ABT/MPH (N=19), MAAT/placebo (N=17), and ABT/placebo (N=18). Assessments were conducted pre-treatment (baseline) and after six weeks of treatment (post-treatment). Outcome measures included scores on a neuropsychological battery focusing on memory and attention/executive functions and MASQ self-ratings. Statistical analyses were conducted in R-3.1.2 and utilized analysis of variance to examine the main effects of MAAT and MPH on change in measurement between the baseline and post-treatment visits. Analysis of covariance was used to examine post-treatment cognitive performance and MASQ self-ratings after adjusting for baseline values and controlling for time post-injury, treatment site, and medication adherence.

Results: Treatment groups did not differ statistically for gender, age, education, injury severity, time post-injury, or medication adherence. Statistically significant (p<0.05) treatment-related improvements in cognitive functioning were found for word list learning (MAAT/placebo>ABT/placebo), nonverbal learning (MAAT/MPH>MAAT/placebo and ABT/MPH), and auditory working memory and divided attention (MAAT/MPH>ABT/MPH). No statistically significant between-group differences were seen for reaction time, psychomotor/processing speed, reasoning, story memory, or MASQ.

Conclusions: These results are consistent with the hypothesis that cognitive-behavioral training (MAAT) and methylphenidate may improve aspects of memory and executive function after TBI, and that combined cognitive and pharmacological treatment may be more beneficial than either treatment alone in some cognitive domains. This is particularly noteworthy given the diverse nature of the cohort in terms of both injury severity and injury-to-treatment interval. The modest sample size of this study suggests that the results should be interpreted cautiously. However, these findings suggest that additional study of the interaction of pharmacotherapy and cognitive therapy for treatment of cognitive symptoms after TBI is warranted.
Developmental and Social Outcomes of Young Children after TBI

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: No preference

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Objectives: Infants and preschoolers are particularly vulnerable to the adverse effects of traumatic brain injury (TBI). Very young children need to both recover to their pre-injury level of functioning, and make developmental gains. Few studies have examined markers of developmental and social-emotional consequences of TBI sustained in early childhood.

Methods: This is a longitudinal, prospective cohort study of 159 children injured prior to 31 months of age. Children with mild, complicated mild/moderate, or severe TBI and orthopedic injured controls were prospectively enrolled from two large U.S. trauma centers. Mild TBI was defined by a Glasgow Coma Scale score 13-15 with no evidence of injury on neuroimaging. Complicated-mild TBI was defined by GCS scores from 13-15 with neuroimaging evidence of parenchymal injury. Moderate TBI was defined by GCS scores from 9 – 12 and severe TBI by GCS scores of 8 and under. Children with orthopedic injuries had a fracture and no evidence of alteration of consciousness or head injury. Pre-injury baseline developmental status was ascertained as soon as possible after injury. The Ages & Stages Questionnaires-3 and Social-Emotional scales were administered at 3 months post-injury.

Results: Children had a median age of 13 months (IQR: 6, 23 months), were 24% non-Caucasian and 29% Hispanic. There were 45 mild, 52 complicated mild/moderate, 19 severe TBI and 43 orthopedic injuries. Sixty-six percent of children were hospitalized.

Children in the severe TBI group had lower pre-injury ASQ-3 scores indicating difficulties relative to orthopedic controls in all domains except the Personal-Social domain, and were rated similarly to controls in social and emotional development of the ASQ:SE. Children in the mild and complicated mild/moderate TBI groups had similar preinjury ratings compared to orthopedic controls. After controlling for preinjury scores, children in the TBI group had evidence of developmental delay compared to the orthopedic group in Communication (p=0.02), Gross Motor (p = 0.03), and Personal-Social domains (p = 0.01). Socio-emotional development was also significantly worse in the TBI group compared to orthopedic group (p= 0.001). This finding was largely driven by the severe TBI group who scored lower (worse) than controls in Communication (mean difference -10.3 points, SE 3.35), Gross Motor (-10.9, SE 3.6), and Personal-Social (-9.3, SE 3.1) domains and higher (worse) in Social-Emotional development (20.4, SE 6.5). Further, 40% of children with severe TBI scored above the clinical cutoff on the ASQ:SE indicating problems compared to 9% of controls.

Conclusions: TBI has a significant effect on young children’s development that is apparent across developmental domains. Children’s social and emotional development is heavily impacted. Developmental tracking is important in young children after TBI with enrollment in appropriate pre-school rehabilitative services, particularly given the variability in outcomes in children with similar initial injury severity.
Heart Rate Variability and the Youth Athlete: Exploring the Relationship Between Sport Exposure and Post Concussion Symptoms

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Concussion is a common injury amongst Canadian youth. The implications of concussion in youth are unique as the developing brain is more vulnerable to concussive injury. Heart rate variability (HRV) is a non-invasive, neurophysiological marker emerging in the field of concussion research as a way to objectively monitor change in autonomic nervous system functioning along the recovery trajectory. The objective of this study was to explore the influence of demographic (i.e. age, sex) and concussion related factors (i.e. post concussion symptoms, history of concussion) on heart rate variability in youth athletes between the ages of 13-18 years old.

Methods: This prospective, repeated measures study examined pre-injury data obtained from youth athletes between 13-18 years of age (N=550) across various sports in the Greater Toronto Area. Youth athletes (N=55) who experienced a concussion were included in the concussion analysis with age and sex matched youth participants. Baseline demographics on sport exposure (e.g. times played/week, total years played), post concussion symptoms, and heart rate variability (over a 24-hour period) were collected. Data was analyzed with a multi-level model approach to account for multiple comparisons and heteroscedastic variance.

Results: Pre-injury/baseline analyses indicated a main effect of demographic variables (age and sex) on heart rate variability. Older participants displayed higher HRV compared to younger athletes in time domain measures. Males also displayed a higher HRV compared to females in both time and frequency domain measures. Concussion analyses (N=55) revealed main effects of post concussion symptoms and sport exposure. These results/analyses are part of an ongoing study and thus are still underway.

Conclusions: Concussion, even within a community sample, revealed changes in HRV when considering contextual factors such as sport exposure and post concussion symptoms. As youth athletes are a unique population, study of the pre-injury/baseline neurophysiological profile is warranted to further elucidate how baseline functioning may potentially impact HRV along the recovery trajectory and the clinical utility in using this objective measure.
Specific vocational and occupational rehabilitation program with a patient with cerebellum injury: case report

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Background: Cerebellum Injuries are associated with motor coordination. Recently, the idea of the Cerebellum as regulator of cognitive and conductual functions, has emerged. As in brain injuries, this affects their functional performance, interpersonal relationships, social participation and work reintegration. Return to Work is one of the main concerns within patients with brain injuries. However, little is known about Vocational and Occupational Rehabilitation in these subjects.

Objectives: To report the case of a Specific Vocational Rehabilitation Program (SVRP) in a patient with a Cerebellum Injury.

Methods: Mr. C., 33 year-old patient, suffered a cerebellum injury of unknown cause. At the beginning of the SVRP, Mr. C. had OT treatment focus on ADL, where he acquired independence in ADL (FIM: 117/126) and improved his performance within IADL (Lawton & Brody 15/24). He also had memory, attentional and executive impairments. The SVRP carried out, consisted of assessment, placement and training. Specific questionnaires were designed, including viso-analogic scales and structured questionnaires (work samples) according to the patient’s skills and work requirements.

Results: Thanks to the placement, Mr. C. was able to identify a new vocational interest. Through work samples, it was possible to identify achievements in the following items: Assistance, Supervision Acceptance, Security and Organization. He also improved the time during the performance of different tasks.

Conclusions: The development of a Specific Program that involves an objective assessment of the workstation, as well as structured questionnaires, enables to identify real limitations at the workplace. Therefore, Occupational Therapists can design the best strategies and appropriate interventions in order to fulfill the patient’s needs, working towards successful integrations.
Posttraumatic Epilepsy in a Acquired Brain Injury in a Neurorrehabilitation Hospital

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: Epilepsy can influence the management and prognosis of the traumatic brain injury (TBI) patients. Prevalence and characteristics of the posttraumatic epilepsy (PTE) are highly variable in the medical literature.

Our aim is to study prevalence and factors that can influence in the onset of epilepsy after TBI in an acquired brain injury unit of a neurorrehabilitation hospital.

Methods: We evaluated a cohort of TBI inpatients admitted in our institution for one year. Demographic characteristics, TBI severity, neurosurgical complications, concomitant risk factors of epilepsy, localization of the macroscopic lesions, presence of early and later seizures, use of antiepileptic drugs (as therapeutic, prophylaxis or other indications such as behaviour problems) and functional TBI scales were collected. A descriptive analysis was performed, adding a statistical approach to relationship demographical and clinical characteristics of the patients with the risk to develop PTE.

Results: One hundred and twenty-four patients were included in the study (females/males 23/101, average of age=38, average of initial Glasgow = 6, average of follow-up = 617 days). A total of 89 patients (71%) received antiepileptic drugs for different indications, 36 of them as prophylaxis at the admission. Sixty-one still keep it at the end of follow-up.

Early seizures had been reported in 5 patients (4%) and 18 patients showed late posttraumatic seizures. Younger age and the presence of thalamic lesions, early seizures or neurosurgical intervention for TBI complications were related with a higher risk of PTE.

Conclusions: Incidence of PTE is variable according with different studies, but we have observed a percentage of PTE in our cohort similar to the previously published in severe TBI in brain injury units.

A great number of patients were treated with antiepileptic drugs for causes other than epilepsy and most of them were admitted with antiepileptic prophylactic treatment. The effect of this frequent use of antiepileptic drugs in the incidence of PTE should be studied.
Anty-inflammatory effect of 3d biodegradable scaffolds produced by microstereolithography technique for neural tissue engineering in traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: Traumatic brain injury (TBI) occurs, as a result, of direct mechanical insult to the brain, and induces degeneration and death in the central nervous system (CNS). Neuro- and cell transplantation have become widely recognized as powerful experimental tools for studying structure-function relationships, development, neuroplasticity, and regeneration in the adult central nervous system and have recently shown promise in the repair of brain injury and in the restoration of function after traumatic brain injury. Unfortunately, TBI causes extensive loss of cerebral parenchyma; however, no strategy for reconstruction has been clinically effective. To identify new ways of parenchyma reconstruction we used 3D biodegradable scaffolds produced by microstereolithography technique.

Methods: 3D biodegradable scaffolds produced by microstereolithography technique from combination of the modified chitosan - alilchitosan (5-10%) and hyaluronic acid of high molecular weight. Biodegradability of scaffolds determined estimated time of degradation within 1-3 months and a mechanism, such as enzymatic hydrolysis. Modified chitosan - alilchitosan- hyaluronic acid scaffolds populated with adult stem cells from mouse (C57BL/6j) nasal olfactory lamina propria were transplanted into the lesion cavity of the injured cortex 7 days after TBI, and the mice were sacrificed 21 days after TBI. Sensorimotor function and spatial learning were measured using an array of function tests, and the brain tissue was processed for immunohistology analysis. The level of cytokines IL-2, IL-4, IL-6, IFN-γ, TNF-α, IL-17A, IL-10 was determined in the serum and dissociated cells of the cerebral cortex mice of the C57BL/6 using flow cytometry (FACSCanto II - BECTON DICKINSON, USA).

Results: The data show that scaffolds populated by neuronal stem cells from mouse nasal olfactory lamina propria improve learning and sensorimotor function, reduce the lesion volume, and provide the migration of stem cells into the lesion boundary zone after TBI in mice, reduce the formation of glial scar. In addition, modified chitosan - alilchitosan scaffolds reduces the amount of proinflammatory factors TNF-α, IL-6, IL-2 and normalize the content of anti-inflammatory cytokines IL-4, IL-10 locally in the brain, and on the system level. It is important to note that there was no activation of autoimmune processes, the level of IL-17A did not change after the reconstructive surgery.

Conclusions: Neuronal stem cells populated 3D biodegradable scaffolds produced by microstereolithography technique from combination of the modified chitosan - alilchitosan - hyaluronic acid may be a new way to reconstruct injured brain and improve neurological function after TBI. These data show that neuronal stem cells from mouse nasal olfactory lamina propria induce neurogenesis and contribute to restoration of brain tissue via trophic actions. Our experiments on mice may suggest that human olfactory tissue is a conceivable source of nervous system replacement cells. Treatment with 3D biodegradable scaffolds normalize the content of anti-inflammatory/ proinflammatory cytokines without activation of autoimmune processes.
Do Catatonic Features Predict Response to Zolpidem in Disorders of Consciousness?

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Objectives: Zolpidem is a selective GABA-A agonist that transiently improves consciousness in about 5% of persons with disorders of consciousness. Two controlled trials failed to identify demographic, clinical, or neuroimaging predictors of this response. In the absence of such treatment-response predictors, the vast majority of persons with disorders of consciousness (DOC) who receive treatment with zolpidem will fail to respond and be placed at needless risk of treatment-related adverse events and drug-drug interactions. Several clinical features of DOC overlap with those of catatonias associated with neurological and psychiatric disorders. Catatonic features (CF) are robust predictors of response to GABA-A agonists among individuals with catatonias due to other neurological disorders, but assessment for CF is not routinely included in the examination of persons with DOC. It is possible that CF in patients with DOC may predict zolpidem responsiveness. This case series was assembled for the purpose of preliminarily evaluating the soundness of this hypothesis, identifying specific CF (if any) associated with zolpidem response among persons with DOC, and lay the foundation for a prospective study of the usefulness of CF as predictors of zolpidem response among persons with DOC.

Methods: Our Behavioral Neurology & Neuropsychiatry (BNNP) Consultation Service is embedded in the Inpatient DOC Program at our institution. Clinical examination of persons with DOC by the BNNP Consultation Service routinely includes assessment with the 23-item Bush-Francis Catatonia Rating Scale (BFCRS). In the service of case finding and refining our preliminary hypothesis, medical records of three patients admitted to our DOC program and evaluated by our BNNP Consultation Service who received a trial of treatment with zolpidem to facilitate emergence from DOC were reviewed.

Results: Case finding identified three representative patients: two zolpidem responders and one zolpidem non-responder. Case 1: a teenage patient with severe traumatic brain injury presented in a minimally conscious state (MCS); CF included immobility/stupor, staring, posturing, rigidity, grimacing, dysautonomia (BFCRS = 10). Zolpidem produced temporary emergence from MCS and reduced CF. Case 2: a middle-aged man with multiple strokes presented in MCS; CF included immobility/stupor, staring, and stereotypy (BFCRS = 5). Zolpidem produced no appreciable changes in MCS or CF. Case 3: a middle-aged man with hypoxic-ischemic brain injury presented in MCS; CF included immobility/stupor, mutism, staring, posturing, grimacing, rigidity, negativism, gegenhalten, grasp, and dysautonomia (BFCRS = 23). Zolpidem, and subsequently lorazepam, administration produced temporary improvement in MCS and reduced CF.

Conclusions: In this hypothesis-refining case series, the presence of posturing, rigidity, and dysautonomia distinguished the two GABA-A agonist responders from the non-responder. This observation suggests the possibility that evaluation of persons with DOC for these CF may enhance identification of zolpidem responders. Prospective study of CF as predictors of zolpidem responsiveness in persons with DOC are warranted.
A randomised control trial of an assistive technology for cognition to support activities of daily living after brain injury

Status: Accepted Presentation type: Poster

Category: Technology – clinical research/applications

Author's preference: Oral

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Objectives: Difficulties sequencing actions to achieve goals typify executive dysfunction in brain injury. Guide is an example of an assistive technology for cognition, an interactive audio-verbal prompting system that emulates supportive carer questions and prompts. We aimed to develop and clinically trial Guide to scaffold the sequences of the morning routine and laundry, asking: Does interactive verbal scaffolding improve task performance? And does interactive verbal scaffolding facilitate learning task sequences?

Methods: To create the protocols for Guide, interactions between service users (n=6) and their support workers were audio-recorded for 32 trials and qualitatively analysed using nVivo 8. Once protocols had been piloted, n=40 participants with severe acquired brain injury (73% traumatic brain injury) were recruited and randomised to Guide or neurobehavioural rehabilitation as usual. Outcomes were study specific sequence performance scales, for morning routine and laundry, which recorded numbers of (1) support worker interventions, (2) errors made, (3) sequence deviations and (4) user satisfaction.

Results: All participants had severe acquired brain injury (73% traumatic brain injury); average premorbid IQ; borderline language and visuospatial function; and extremely low range memory and executive function. For the morning routine, in test, the Guide group required fewer support worker prompts (z=1.96, p=0.050); made fewer errors per trial (z=3.097, p=0.002) and made fewer deviations from the sequence (z=2.256, p=0.024). For the laundry task, the groups were unequal in baseline and this variance led to an underpowered comparison. There was a tendency for a learning effect on this novel task, with Guide users tending to make fewer errors at return to baseline (z=1.734, p=0.083). Satisfaction dropped after return to baseline for Guide users.

Conclusions: The study allowed development of an efficacious rehabilitation tool. Guide software has been recoded from the prototype system to Android and iOS compatible systems to allow sharing. Study methods have applicability to other rehabilitation studies and methods to decode sequences into component steps will be discussed. Studies of support of other behavioural sequences and in different populations are warranted.
Assessment of Blood-based Biomarker Concentrations and Executive Function Pre- and Post-concussion

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: No preference

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Background: It has been shown that both blood-based biomarker concentration changes and executive dysfunction exist post-concussion. To date, no study has assessed both simultaneously for possible correlations. The ability to detect executive dysfunction immediately resulting from a concussive injury, and confirm with follow-up analysis of blood-based biomarker concentrations can help improve athlete safety, and aid to expedite the recovery process.

Objectives: The main goals of this project were to (i) determine if blood-based biomarker concentrations Tau-A, Tau-C, and NF-L differ as a result of a concussion; (ii) determine the time-course for clearance of these proteins; (iii) determine if biomarker concentration levels correlated with performance on a task designed to assess executive function.

Methods: Given tau’s inability to cross an intact blood-brain barrier, this study utilized assays for two enzyme-cleaved fragments of tau, Tau-A (cleaved by A disintegrin and metalloproteinase 10) and Tau-C (cleaved by caspase-3). NF-L concentrations were measured through the use of the Simoa HD-1 Analyzer from Quanterix (Lexington, MA.) Novel, ultrasensitive assays were developed for the detection Tau-A and Tau-C protein fragments (Nordic Bioscience, Denmark) and NF-L (Neurochemistry Laboratory, Sahlgrenska University Hospital, Sweden). Any player sustaining a concussion subsequently provided follow-up samples at both 6 days and 14 days. Concentrations of Tau-A, Tau-C, and NF-L were quantified at all 3 time points, and analyzed for any significant differences. At all time points, each player also completed a task-switch paradigm designed to assess executive function. This was accomplished through the calculation of a switch-cost (SC).

Hypotheses: Hypothesis 1 – A greater SC will be observed at 6 and 12 days post-concussion when compared with baseline pre-season measures.

Hypothesis 2 – An increase in Tau-A and Tau-C concentrations will be observed at 6 and 12 days, with the greater concentration measured at 6 days

Hypothesis 3 – An increase in NF-L concentration will be observed at 6 and 12 days, with the greater concentration measured at 12 days

Conclusions: SC is a sensitive measure of executive function, with deficits reported up to two months following injury. The presence of a true executive dysfunction could potentially place the athlete at an increased risk of injury. The ability to detect deficits in executive function, and to confirm a concussion through a follow-up analysis of blood-based biomarker concentrations provides health-care professionals with tools of increased sensitivity in identifying a concussion, along with the progression of recovery.
Early Neuropsychological Findings in Mild Traumatic Brain Injury: A Prospective Cohort Study

Objectives: The nature and course of cognitive deficits early after Traumatic Brain Injury (mTBI) is not well understood. This study aimed to investigate cognitive function 2-weeks after mTBI and relate this to intracranial findings seen on MRI within 72 hours.

Methods: Patients aged 16 to 60 years satisfying the WHO criteria for mTBI were prospectively recruited from a regional Level-1 Trauma Center and a municipal emergency clinic in Trondheim, Norway. Exclusion criteria were: (1) other major trauma, (2) prior complicated mild, moderate or severe TBI, developmental disorders or neurological disease, and (3) severe psychiatric disease or drug/alcohol abuse affecting adherence to the research protocol. From April 2014 to September 2015, 147 patients underwent neuropsychological testing 2-weeks after injury and had a 3 Tesla brain MRI within 72 hours. 39 % of the patients were hospitalized. Median Glasgow Coma Scale score was 15 and the most common injury mechanism was falls (41%). 93 % of the patients reported post-traumatic amnesia, 63 % < 1 hour. 50 % of patients experienced loss of consciousness, the majority < 5 minutes. 15 % of the patients had intracranial findings on MRI, categorized as complicated mTBI patients.

Neuropsychological assessment consisted of subtests from Cambridge Neuropsychological Test Automated Battery (CANTAB). Test performance was compared with the CANTAB normative database. Mean z-scores and the proportion of abnormal scores (z ≤ -1.5) were calculated for fifteen outcome measures across Motor Screening Task (MOT), Big/Little Circle (BLC), Paired Associates Learning (PAL), Rapid Visual Information Processing (RVP), Spatial Recognition Memory (SRM), Spatial Span (SSP), Spatial Working Memory (SWM), and Reaction Time (RTI).

Patients were also dichotomized into complicated and uncomplicated mTBI and raw scores were compared between the groups for 21 outcome measures, i.e. PAL, RVP, SRM, SSP, SWM and RTI, as well as Attention Switching Task (AST) and Stockings of Cambridge (SOC).

Results: Only the RVP A (Rapid Visual Information Processing) test had a negative mean z-score (z = -0.23). All other measures had mean z-scores ranging from 0.15 - 1.00. The proportion of abnormal scores was generally low across outcome measures (0 % to 4.0 %). The exceptions were RVP A and SSP total errors with 14.3 % and 6.7 % abnormal scores, respectively.

No significant differences were seen for any of the 21 outcome measures between complicated and uncomplicated mTBI. The complicated mTBI group had longer duration of post-traumatic amnesia (p< 0.001), but no differences were seen in Glasgow Coma Scale scores or duration of loss of consciousness.

Conclusions: Normal cognitive function was found in the vast majority of mTBI patients 2 weeks after injury. Only a small percentage of patients demonstrated abnormal test scores. Intracranial abnormalities were not associated with neuropsychological test performance.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: Poster

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Objectives: Traumatic brain injuries are a major public health concern globally and are a leading cause of death and disability in the pediatric and adolescent populations. Children aged 0 to 4 years and older adolescents aged 15 to 19 years are among the population groups that are most likely to sustain a TBI. For example in the United States an estimated almost half a million emergency department visits due to TBI are made by children aged 0 to 14 annually in the US. Besides serious sequelae, TBI in these age groups are associated with significant mortalities.

Methods: Death certificate based information on all deaths in Austria between January 1st of 1980 and December 31st of 2012 was obtained from the Statistical Office of Austria and deaths that were a consequence of a TBI were selected for analysis based on ICD 9 and ICD 10 definitions of TBI. Data on population numbers required for the calculation of mortalities were derived from publicly available demographic data from the website of the Statistical Office of Austria. Five logical age groups were created and mortality trends were analyzed in context of introduction of seat-belts and child-seats as traffic accident preventive measures. Data for the years of 1980-2012 were analyzed.

Results: In Austria use of child safety seats has been obligatory in children up to 12 years since 1994. By its introduction the mean annual number of traffic related fatalities was reduced by 66% in ages 0-2, 72% in ages 3-5. Onwards from 1990 seat-belts have been obligatory on all passenger seats in Austria and this have brought a 67% drop in fatalities in ages 6-9, a drop of 73% in ages 10-14 and a 74% drop in ages 16-19. A total of 295,793 potential years of life lost (PYLL) can be attributed to TBI-related deaths in children and adolescents (0-19 years) in Austria for the period of 1980-2013.

Conclusions: Fatalities attributable to TBI have decreased significantly from the early 1980s towards 2012. Traffic accident preventive action such as introduction of child-seats and seat-belts contributed significantly to this decrease, although other factors such as improvements in car-safety and road infrastructure might have played a role, too.
The Correlation Between Neuropsychological Test Performance and ImPACT scores in Sports-Related Concussion

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: Sports-related concussion has been at the forefront of the national (and international) consciousness for at least the last 5 years. Concussion is a major problem, affecting an estimated 4 to 5 million individuals annually.

For the last decade, medicine has spent a great deal of time and effort attempting to assess the degree, severity, and cognitive and emotional repercussions of concussive events. Practitioners have already spent a large effort detailing the potential recovery curve of athletes affected, employing various measures in the process.

Methods: These measures include, but are not limited to, various neuropsychological instruments, including measures of processing speed and working memory (e.g., WAIS-IV) as well as tests of sustained attention/concentration (TOVA).

Additionally, the ImPACT test, developed by Dr. Mark Lovell at UPMC, with collaboration from others, is also very commonly employed. A computer-administered test taking approximately 30 mins, ImPACT has a vast and diverse research backing. Further, ImPACT’s comprehensive normative data includes more than 75,000 (and growing) results. ImPACT is in use by the majority of teams in MLB, NHL, NFL and WWE. More than 7,400+ high schools, 1,000+ colleges and universities, 900+ clinical centers, 475+ Credentialed ImPACT Consultants, 200+ professional teams and select military units use ImPACT.

In this study, a standard battery of fairly common neuropsychological tests were administered. A mix of computer and paper tests, the battery contained the following measures: TOVA, WAIS-IV – Working Memory and Processing Speed subtests, COWA-FAS, BDI-II, BAI, and WCST-64-CV. At the conclusion of each battery, the standard version of the IMPACT (taking approximately 30 minutes) was administered via computer.

This battery was administered to 32 (18 males) adult (18+) patients. These patients were no more than 3 months post sports-related concussive event (post-acute average = 24 days).

Results: revealed that select Impact scores of patients did correlate with select neuropsychological test performance, while others did not. Specifically, the Visual Motor Speed Composite and Reaction Time Composite subtests from the ImPACT did correlate significantly with Processing Speed component from the WAIS-IV. However, the ImPACT Memory composite scores did not correlate highly with memory performance on standard neuropsychological measures.

Conclusions: Potential clinical implications and research applications for these findings will be discussed.
Diffusion Kurtosis Imaging and Postconcussional Syndrome in Patients with Mild Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: No preference

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Objectives: Somatic and cognitive symptoms are frequently reported after mild traumatic brain injury (TBI), and when lasting > 3 months denoted post-concussion syndrome (PCS). White matter changes as depicted with Diffusion Tensor Imaging (DTI) have not been consistently linked to PCS. Diffusion Kurtosis Imaging (DKI) has the potential of assessing tissue complexity in greater detail, yet no studies have investigated the relationship between PCS and DKI.

Methods: Patients aged 18 to 60 years satisfying the WHO criteria for mild TBI were prospectively recruited from a regional Level 1 Trauma Center and a municipal emergency clinic in Trondheim, Norway. During 19 weeks in 2013, 38 eligible patients were identified and 30 (79 %) consented to participate. 24 patients had acute DKI scans (mean 68.6 hour) and 23 patients DKI 3 months (mean 82.1 days) after injury. DKI scans were processed with the FMRIB Software Library (FSL) and parameter maps were calculated using the Diffusion Kurtosis Estimator (DKE) for Fractional Anisotropy (FA), Mean Diffusivity (MD), Radial Diffusivity (RD), Axial Diffusivity (AD), Kurtosis Fractional Anisotropy (KFA), Mean Kurtosis (MK), Mean Kurtosis Tensor (MKT), Radial Kurtosis (RK), and Axial Kurtosis (AK). Patients were categorized according the ICD-10 research criteria for PCS. Age, gender, and multiple comparison corrected voxel-wise analysis of DTI and DKI measures from both time points were performed using Tract Based Spatial Statistics (TBSS). Uncorrected group comparisons were also performed across five regions of interest (ROIs) extracted from the white matter skeleton (splenium, body and genu of corpus callosum (CC), and anterior limb of internal capsule (IC) bilaterally) and from grey matter in each thalamus.

Results: Voxel-wise comparisons showed no differences acutely or at 3 months when comparing PCS (n=8) with no PCS patients. Acutely, in the ROI-based analysis, the PCS group had higher FA (p=0.04), lower MD (p=0.04) and RD (p=0.02) in the body of CC, as well as higher KFA (p=0.02) in the genu and lower AK (p=0.04) in the splenium of CC. At 3-months, PCS patients had lower RD (p=0.04) in the body of CC, lower MK (p=0.01) and RK (p=0.01) in the body of CC, lower MK (p=0.01) and RK (p=0.01) in the left IC, lower MK (p=0.03) and RK (p=0.007) in right IC, and lower MK (p=0.03), MKT (p=0.007), and AK (p=0.01) in the left thalamus, and lower MK (p=0.01), MKT (p=0.02) and RK (p=0.004) in right thalamus.

Conclusions: Development of PCS was associated with changes in DTI and DKI measures in several white-matter ROIs in the acute MRI. In the 3-month MRI, only RD in the CC, but several DKI measures in both white matter and thalamus were associated with PCS. These results point to DKI as a promising tool in identifying patients at risk for developing PCS and elucidating the complex etiology of this condition.
Traumatic Brain Injury as Disorder of the Connectome: Insights from Traumatic Contusions

Status: Accepted Presentation type: Oral
Category: Neurotrauma – basic research
Author's preference: Oral

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Objectives: Traumatic contusions are generally viewed as circumscribed brain lesions, without taking into account their neocortical, limbic or subcortical connections and related circuits. In the era of parallel/distributive theories of information processing in the brain and the Human Connectome Project it is important to understand these lesions as a network problem according to which a node is eliminated, leading to anterograde or retrograde degeneration of interconnected areas. Laying the foundations of this new type of neuropathology may assist in more accurate diagnostic formulations and help explain inter-individual variability in outcomes and prognosis.

Methods: Post-mortem human brains with orbitofrontal contusions examined using immunohistochemistry for the presence of protein markers of degeneration of neuronal cell bodies in connected neocortical, limbic, and subcortical sites. Maps of afferent and efferent connections of orbitofrontal cortex were drawn based on existing tract-tracing studies in non-human primates, with input by older reports of retrograde degeneration after leucotomy in humans and data from the human connectome project. We focused on major sources of afferent inputs and identified hippocampus (Ammon’s horn), amygdala (basal nucleus) and anterior or dorsal thalamus as target regions for investigation. Here we present initial data from a patient with contusions in medial orbitofrontal cortex who died six days post injury due to motor vehicle accident. Formalin-fixed blocks from the three sources of afferents were embedded in paraffin, sectioned (10 µm) and immunostained for amyloid precursor protein (22C11 antibody) and phosphorylated epitopes of heavy and medium-molecular weight neurofilament proteins (SMI 310 antibody). The first is an established marker of traumatic axonal injury. The second is a marker of retrograde degeneration based on previous work from our laboratory.

Results: Large numbers of phosphorylated NF-H/NF-M-immunoreactive, SMI 310 (+) neuronal cell bodies found in mediodorsal and adjacent ventral anterior thalamus, but not hippocampus or amygdala. Labeling in thalamus is robust and corresponds nicely to known afferents to primate orbitofrontal cortex from tract-tracing and retrograde degeneration studies, as well as published human connectome schemas.

Conclusions: In the first week after traumatic orbitofrontal contusion, retrograde degeneration is intense in predicted afferent sources from thalamus but not hippocampus or amygdala. Such a distinction may be due to biological differences among these sites but also the fact that thalamic connections are bidirectional and perhaps more prone to transsynaptic degeneration. This notion is presently tested in additional cases with orbitofrontal contusions and longer survival times post-TBI. In addition, we process cases with diffuse axonal injury (DAI) in the genu of corpus callosum and examine corresponding prefrontal cortical regions for degenerative changes. Together, these studies aim to "rewrite" neuropathology of traumatic contusions and DAI on the basis of impaired neocortical and limbic circuits that may better account for neuropsychiatric problems of individual patients.
Integrated Rehabilitation for a Case with Head Injury - Case Report

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Background: Traumatic brain injury (TBI) is one of the leading causes of death and disability in the world. The consequences of TBI are wide-ranging and include physical, cognitive, emotional and behavioural dysfunctions. This case report presents the integrated rehabilitation programme used with an individual with TBI. The rehabilitation team members included in this study were neurosurgeon, Physiotherapist, Occupational therapist, Speech therapist, Prosthetic and orthotic technician and a Psychologist. This case report is of a 19 year old boy who had a fall from bike one and half year back diagnosed as severe traumatic injury - diffuse axonal injury with GCS Score of 4/15(E1M2V1). He is undergoing integrated rehabilitation in a tertiary hospital. At present his GCS score is improved with scoring of 11/15 (E4M5V2).

Objectives: The main Objective of this integrated rehabilitation program is to provide functional activities to the individual within six months; which includes neck control, Independent sitting for 15-20 minutes without support, Improve communication for the needs, Improve hand function, Ability to stand without support for 3 minute, walk for 10 to 15 steps with minimal support of aids.

Methods: The methods using in this rehabilitation training for the individual includes a multidisciplinary approach. And the treatment procedures are stimulation of neck muscles, tilt table, trunk rotations, reach outs, neck exercises, increasing the tolerance of sitting with minimal back support, pelvic rotations, tilt table, Hand activities, Perceptual training, Oro-pharyngeal therapy, Facilitatory and Inhibitory techniques, using alternative communication training in speech therapy, Using splints for prevention and assistance, Care givers training. And also the patient is administered with baclofen 40 mg/day for reduction of spasticity.

Results: At present after two months of intensive rehabilitation the individual attained partial neck control, Able to reach and grasp objects, Move to sides without assistance, Sitting tolerance improved to 70% in a day, Obey commands, Use alternate methods for communication, Identifies objects, shapes, colors, able to chew and swallow the solid food, spasticity is reduced and voluntary control is gained in right side more than left side. The six month results will be reviewed in the mid of January 2016 for identifying the further progress of treatment.

Conclusions: There is a rapid improvement in physical function, cognition, behavioural aspect of the case after the multidisciplinary approach. This improvement is due to the coordinated work of the team members who meet in a case conference every two weeks to review and revise the treatment protocol.
0559

How sport can contribute to rehabilitation after traumatic brain injury?

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: Most patients with Traumatic Brain Injury (TBI) are teenagers and young adults who often get back physical autonomy. Sport seems to be a good way of rehabilitation, even for cognitive and behavior disorders.

Methods: Long-term neurorehabilitation is based on numerous guidelines. From recent literature and clinical experience, we selected six guidelines and applied them to two examples of rehabilitation though sport.

Results: The bio-psycho-social model: in the long-term, the biological predictors of re-entry decrease whereas the psychological and the social aspects increase in the genesis of the handicap.

Evidence-based medicine: We show the difference of scientific and quantitative data versus qualitative ones i.e. subjective aspects of the patient care.

The goal attainment concept is based on a clearly defined objective, together with a deadline, the human and material means to reach it and a final re-assessment.

Case management is based on the consistency of the multidisciplinary team and on a holistic view of the program. The case manager has to be the coordinator, with an open mind and training on medical, psychological, social, legal and cultural task components.

Neurosystemic provide an approach involving family them as a co-constructor of the project, take into account their needs.

New technologies, especially smartphone and telemedicine, may facilitate one individual's care

We applied those guidelines to two severely injured young adults: a sprinter and a weightlifter.

Conclusions: Psycho-social factors, goal attainment, case management, family involvement, and new technologies applied to training and competition act as a strong lever to rehabilitation.
Recreational therapy intervention in a patient with a traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Background: Mrs. M.I., 47 year-old female, had an automobile accident in 2012. As a result, she has cognitive behavioral and minimal motor impairments caused by a severe Traumatic Brain Injury (TBI). She has been doing Recreational Therapy along with her 7 year-old son for two years. Initially, MI shows predominantly apathetic behavior, lack of initiative, inhibited conduct with little affective communication.

Objectives: To strengthen and develop the relationship with her child, and improve the family environment through recreational, cultural and leisure activities, primarily promoting her initiative in her role as a mother.

Methods: Leisure interests inventory and Recreational Therapy Assessment: Scale of perception of subjective well-being in recreational and physical activities during free time.

To explore recreational, play and cultural activities, in order to facilitate leisure performance.

Play intervention. By infusing creativity into the game different expressions were observed, styles and choice of games to intervene within the context of the game; thus, promoting improvement in her behaviors.

Results: The Recreational Therapy intervention allowed improvement in affective communication. Sharing games with her son has facilitated the development of socialization, improving her self-image by questionnaires and wellness of interest in recreational and leisure activities.

Physical changes and gestures were observed with her and little autonomous control with the physical play with her son.

There have been changes in the adaptations of MI’s son after the accident. The intervention has allowed a reevaluation between the relationship of the mother and her child through physical signs of affection in the family environment.

Conclusions: Playing has allowed a transformation in how she sees her reality. She has become more flexible, able to adapt to her son’s interests and expressed emotions. To continue working on developing the leisure capacity and to develop meaningful activities with her son, while they share interests is the ongoing task of Recreational Therapy intervention.
0561

Adherence to the 2014 NICE Head Injury Guidelines in a UK Adult Inner City Trauma Centre

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: No preference

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Objectives: Traumatic brain injuries (TBI) must be identified early to stop progression to disabling and potentially fatal secondary brain injury. This is challenging as 6.6% of UK ED attenders present with a head injury (1.4 million patients pa) but less than 1 in 20 of these patients will have a clinically significant TBI (visible on computed tomography scan). The NICE Head Injury guidelines provide a clinical decision rule to assist in the rapid assessment of TBI by describing indications for urgent CT head scan. These were updated in January 2014 and their effect has yet to be assessed. The main objective was to assess whether the introduction of the 2014 NICE Head Injury guidelines had improved adherence to imaging of the head and cervical spine indications through a service evaluation of an adult emergency department in the UK.

Methods: Data from patients who presented to an ED with head injuries in the periods Nov/Dec 2013 (pre-implementation) and Nov/Dec 2014 (post-implementation) were collected. The ED cards were manually assessed for indications for imaging of the head and cervical spine in accordance with the guidelines. Indications were then compared to the imaging performed and adherence was calculated for both groups using SPSS 22 and Excel.

Results: 1117 patients were included in the study; 588 pre-implementation and 529 in the post-implementation group. Pre-implementation, the adherence rate for CT of the head was 88.4% (95% CI; 85.9 - 91.0). The post- group showed a higher adherence rate of 90.9% (95% CI; 88.5 - 93.4); however these results were not significantly different. When incorporating imaging of the cervical spine the overall adherence rates were as follows. The pre-guideline group had an overall adherence rate of 86.2% to the imaging guidelines (95% CI; 83.4 - 89.0) while the post-implementation group showed a marginal improvement with an adherence rate of 87.0 (95% CI; 84.1 - 89.2) albeit not significantly so.

Conclusions: This single centre study in an adult inner city trauma centre did not show a significant improvement in adherence pre and post guidelines introduction. The reasons behind this are complex and call to question the efficacy of guideline implementation strategies. However, the results in this study, both pre- and post- guidelines, remain significantly higher than those seen in other international TBI guidelines adherence studies.
The juvenile head trauma syndrome – diagnosis and clinical presentation at the Emergency Department

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: Annually in the Netherlands 14,000 children are admitted at the Emergency Department (ED) with traumatic brain injury (TBI). The clinical presentation of pediatric TBI at the ED can vary and subtypes of TBI are present, like juvenile head trauma syndrome (JHTS). Incidence rates are estimated approximately 4%, but the clinical presentation varies. As outcome can be fatal, early recognition of JHTS is essential. The purpose of this study was to outline the epidemiology and clinical features of JHTS in comparison to pediatric mild TBI (mTBI) without JHTS admitted at the ED.

Methods: From 2008-2014 data of 570 children (aged 0-18 years) admitted with mTBI at the ED of a level-one trauma center were retrospectively analyzed. Data concerning patient-, injury characteristics with mTBI (GCS score of 13-15), clinical presentation and JHTS especially were collected. A comparison was made between group 1) mTBI without JHTS and group 2) mTBI with JHTS. In addition, diagnoses by experienced neurologists were compared with the diagnosis of JHTS by physicians at the ED.

Results: 8% of the patients with mTBI were diagnosed with JHTS, of those patients 87% had a lucid interval followed by LOC and 24% an alternating consciousness. The JHTS patients were significant (p<0.01) younger (range: 1-10 years) compared to the mTBI-group (4.1 (SD:2.4) vs. 7.3 (SD:5.7)). Falls occurred significant (p=0.03) more often in the JHTS-group. Vomiting (42% vs. 22%, p<0.01) and changed behavior (29% vs. 1%, p=0.03) were significant more present compared to mTBI-group. The comparison between experienced neurologists and ED physicians showed a higher frequency of JHTS diagnosis by ED physicians whom less often used the appearance of a lucid interval or alternating consciousness for diagnosis.

Conclusions: Our results showed that JHTS is more common in younger children up to 10 years and provided clues for recognition of this syndrome. Risk factors concern fall as cause of injury, vomiting or changed behavior on presentation at the ED. These factors should be included in the decision for hospital admission or discharge.
Assessing the Rehabilitation Potential of persons with Acquired Brain Injury: What is the state of knowledge? Perspective gained from a Scoping Review.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Background: Clinical practice guidelines for the management of persons with acquired brain injury highlight that assessing a patient’s rehabilitation potential (RP) is an essential premise to determining appropriate rehabilitation interventions and referring patients to rehabilitation services. Although the term RP is frequently mentioned in the literature and widely used in clinical practice, the concept is rarely defined and operational definitions that could provide the basis for its measurement are not made explicit in practice guidelines. However, how can rehabilitation professionals be expected to assess RP if they do not know, with some degree of precision, what it is they need to measure? There is a need to better understand the concept of RP and how RP can be measured if we are to provide appropriate access to patients that may benefit from rehabilitation services.

Objectives: The general purpose of this work was to examine the scope and breadth of knowledge currently available regarding the concept of RP and its assessment. The specific objectives were to examine definitions of RP and identify key constructs to measure when assessing RP.

Methods: A scoping review was conducted based on Arksey and O'Malley’s methodological framework. A comprehensive literature search was conducted in Medline, CINAHL, Embase and PsychInfo databases for years 1946 through May 2015. A structured grey literature search was also performed in textbooks, websites and reference lists. Qualitative thematic analysis was used to examine and combine study findings.

Results: Three formal definitions of RP were found all referring to RP as being an estimate of a person’s capability of making functional gains. Clinician’s judgment was recognized as being central to the assessment of RP. Key constructs to consider are the patient’s potential for recovery, learning potential and potential to achieve rehabilitation goals. However, no clear indications were found on how to measure these constructs in clinical practice except for learning potential, for which dynamic testing protocols have been suggested. As for recovery potential, studies that examined patient-related factors most predictive of functional or rehabilitation outcome found initial injury severity, age, functional level and cognitive status post-injury to most consistently be good predictors of outcome. Various tools have been used to measure these factors but few studies have examined their predictive validity. Other factors clinicians’ need to consider are the various factors that have been found to influence goal attainment such as personal motivation, belief that the goal is attainable and support or barrier in the environment. However, very few standardized tools have been developed to measure these factors.

Conclusions: Assessing RP is a core feature of the work of rehabilitation professionals. It is however a complex concept and this scoping review provides insight into what this concept entails and its measurement.
Recurrent Mild Injurious Ischemic Insults: Enhanced Brain Injury Following Acute Compared to Subacute Recurrence in the Rat

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: No preference

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Background: A relatively short episode of cerebral ischemia can produce mild ischemic brain damage. There is a high risk of a second ischemic event occurring within the first day. Furthermore, with increasing revascularization treatments, the incidence of transient ischemic insults producing some brain injury is likely to increase. Despite its importance, we have a relatively poor understanding of the effects of transient ischemic attacks on brain damage and the effect of stroke recurrence, particularly with respect to the influence of recovery time between insults on the pathophysiology of multiple mild ischemic insults.

Objectives: To determine whether a subacute recovery time of 3 d compared to 1 d would potentially change the cumulative brain damage resulting from recurrent mild ischemic insults.

Methods: A mild transient episode of cerebral ischemia or a sham surgery was produced by surgically exposing the middle cerebral artery in 18 rats (6/group). Mild ischemic injury was produced by occluding the artery for 30 min producing scattered cell death. A second insult was produced 1 or 3 d later by again occluding the middle cerebral artery for 30 min. This was followed 7 d later by perfusion fixation and processing of the brain for histological assessment of brain damage. The effect of a single transient ischemia on the peripheral inflammatory response or brain was determined in additional animals investigated at 1 or 3 days post-insult (8/group).

Results: Brain damage with early recurrence (1 d) was substantially greater than that with subacute recurrence (3 d). This novel observation did not correspond to higher levels of injurious factors present at the time of the second insult such as BBB disruption or increased cytokines (tumor necrosis factor). However, microglial activation appeared greater at 3 d than 1 d and arterial blood analysis demonstrated acute transitory increases in granulocytes with greater levels present at 1 d compared to 3 d.

Conclusions: Multiple factors likely contribute to the greater susceptibility of the brain to damage with an early compared to a subacute second transient ischemia. Irrespective of the mechanisms, the results support urgency for determining and implementing optimal stroke prevention management early after a transient ischemic attack to avoid a second ischemic event. The time of recurrence of mild ischemic insults is crucial with early recurrence producing greater damage than with subacute recurrence (e.g. at 3 days post the first ischemia).
Eye disorders after severe brain injury, case report.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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**Background:** This article aims to provide a current evidence for rehabilitation of binocular vision after traumatic brain injury (TBI).

**Objectives:** Traumatic brain injury (TBI) is the most common cause of death and chronic disability in the under-35-year-old age group. Third cranial nerve palsy is usually associated with severe head trauma. The incidence of primary traumatic oculomotor nerve palsy in craniocerebral trauma is approximately 1.2%. No studies have investigated the possibilities of rehabilitation of binocular vision after brain injury. Some authors suggest waiting for at least six months before strabismus surgery, which permits the cause of oculomotor palsy to be evaluated and allows for possible spontaneous recovery.

**Methods:** This case-report shows good results in vision repair after severe brain injury (GKS 3p) with operated intracranial hematoma due to anisocoria (sin>dex). A previously healthy 31 years old male suffered from double vision, left mydriatic pupil, ptosis, homonymous hemianopsia on the right, cognitive impairment, right-sided moderate spastic hemiparesis and epilepsy. Team-principle rehabilitation and also a vision training were started at 30 days after brain injury by raising and fixation of left upper lid and tracking pictures for 30 min per day 5days per week with both eyes separately. On the 50s day after brain injury patient is able to fixate his left eye looking straight for 30 seconds, eyelid can be slightly open. Patient has left home and returned back on 75th day. There was partial n. oculomotorius paresis on left side with anisocoria and diplopia, homonymous hemianopsia on the right, mild right.sided hemiparesis and partial sensorimotor aphasia. We started with covering of non-paretic eye up to 6 hours a day. After 20 days of covering of right eye, patient is able to fixate the objects with both eyes for at least 30 minutes. 3 month later after head injury have a first visit to ophthalmologist, who diagnoses myopia (visus os -0,4-0,75 0,75=1,0), strabismus due to paralysis and stopped covering the eye. After one month of not covering paretic eye patient complained, that eyesight deteriorated considerably, headache started. So patient started covering of nonparetic eye again. One year later exophoria decreases in close 30-->25 b in and 14--> 8 b down os, far 25-->16 b in and 14-->8 b down os. The shortening of inferior and medial rectus muscles for correction of diplopia in primar position was made 1.5 years after brain injury.

**Results:** two years after severe brain injury patient has a binocular vision, but homonymous hemianopsia is remained.
Microstructural Brain Changes in College Football Players – A Longitudinal Diffusion Tensor Imaging Study

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: Football players are at high risk for repetitive concussive and subconcussive head impacts (RHI). Recent evidence suggests a link between RHI and brain alterations over the course of a play season. However, whether or not these changes persist after exposure to RHI has ceased is not known. This study evaluated the brain white matter (WM) microstructure in athletes over the course of a play season of college football as well as after a period of 6 months without exposure to RHI.

Methods: Nineteen male NCAA Division III football players (mean age 20.0 +/- 1 years) and 5 male non-athlete controls (mean age 20.9 +/- 1.1 years) underwent 3T MR diffusion tensor imaging prior to the start of the football season (T1), at the end of the season (T2), and after 6 months without exposure to RHI (T3). Helmet-based accelerometers (HITS, Simbex; Lebanon, NH, USA) were used to record head hits at all practices and games. Whole-brain tract-based spatial statistics (TBSS) were used to compare the direction and localization of WM changes at T1 to T2, T2 to T3, and T1 to T3. Individual diffusivity values, as obtained from the statistically significant clusters using TBSS, were correlated with head impact measures.

Results: The total number of recorded head hits during one season of play ranged from 48 to 1,850 per player. None of the athlete sustained a clinically symptomatic concussion during the study period. A significant increase in trace between T1 and T2 (0.00212 vs. 0.00226, p<0.05) was found for clusters located in the brainstem and the left temporal lobe. Trace significantly decreased from T2 to T3 in similar areas of the brainstem. A significant increase in FA was observed between T1 and T2 (0.688 vs. 0.681, p<0.05) in the left pericentral cortex. FA significantly decreased from T2 to T3 (0.585 vs 0.563, p<0.05) in a cluster also located in the left pericentral cortex. Within significant clusters, peak HITsp and HIC15 were positively correlated with trace, AD, and RD, and negatively correlated with FA. No significant changes in FA or trace were observed in the control group.

Conclusions: College football players show microstructural alterations of the white matter. Head impact measures were correlated with lower FA and higher trace/MD/RD suggesting an association of RHI and brain alterations. Partial remission of these alterations was observed after a 6 months period without exposure to RHI suggesting that athletes may benefit from periods without exposure to RHI.
Cortical Gray Matter-White Matter Junction Pattern of Retention of the Tauopathy Ligand 18F-T807 (Avid-1451) in Clinically Probable CTE

Status: Accepted Presentation type: Oral

Category: Technology – clinical research/applications

Author's preference: Oral

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Sam Gandy, Dara L. Dickstein, Karin Knesaurek, Jennifer Short, Mariel Pullman, Mary Sano, Ash Rafique, Barry Jordan, Heidi Bender, Martin Goldstein, Wayne Gordon, Kristen Dams-O’Connor, James Stone, Steven T DeKosky, Patrick Hof, Lale Kostakoglu. Icahn School of Medicine at Mount Sinai, New York NY; James J Peters VAMC, Bronx NY; Weill Medical College of Cornell University, New York NY; University of Fla, Gainesville FL; University of Va, Charlottesville VA. Molecular neuroimaging has enabled the study of cerebral proteopathy in the setting of Alzheimer’s disease (AD) and frontotemporal dementia (FTD). With regard to traumatic brain injury (TBI), two potential uses can be envisioned: (1) Amyloid imaging in the acute or chronic phase in order to assess the possibility of either post-traumatic AD and/or chronic traumatic encephalopathy. (While CTE is primarily a tauopathy, about 50 percent of CTE cases have cerebral amyloidosis, often in association with the APOE4 allele; Menon and colleagues have detected post-traumatic cerebral amyloidosis from 2 wk to 1 yr post TBI). (2) Tauopathy imaging in the chronic phase seeking to detect the signature lesions of CTE. We have embarked upon studies relevant to each of the two scenarios described above. For our investigation of acute post-traumatic cerebral amyloidosis, we have studied 6 high risk boxers from ages 29-42 using amyloid imaging with either [18F]florbetapir or [18F]florbetaben. The high risk boxer designation is assigned because of numbers of knockouts and/or duration of loss of consciousness. None of these boxers showed any immediately recognizable ligand retention. Further quantitative analysis is underway. For our investigation of tauopathy, we have studied six subjects with histories of either single severe or mild repetitive TBI. The two subjects with the greatest clinical psychological and/or cognitive impairment showed substantial retention of [18F]T807 (Avid-1451). In one subject, the pattern of ligand retention bore a striking resemblance to the distribution of CTE tauopathy; i.e., most intense at the gray matter-white matter junctions. These data support the possibility that [18F]T807 (Avid-1451) imaging may, in some cases, be useful in identifying the tauopathy of CTE during life. Further clinicopathological correlation will be required before the pathological underpinning of this ligand retention pattern can be established. Supported by ADDF & US Dept Veterans Affairs.
Lost of smell after Traumatic Brain Injury: the misterious relation between olfaction and our brain.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Traumatic Brain Injury is one of the causes of olfactory loss. The olfactory system is related to important brain networks involving several cognitive and behavioural functions but little is known about those relations or the potential of recovery with training. Therefore the objective of this study was to assess the presence of loss of smell in patients who have sustained a TBI and their potential smell recovery after olfactory training and its relationship with neuropsychological test performance.

Methods: Patients >18years and with less than 2 years after TBI were recruited from a neurorehabilitation unit to participate in a prospective randomized controlled study. Parameters associated with olfactory loss such as injury severity, type of cerebral lesion, functional status measured with the FIM and DRS were reported. The Wechsler Adult Intelligence test was administered as part of the neuropsychological examination. The Neuropsychiatric Inventory was also recorded. Those patients with a subjective loss of smell were assessed with olfactometry (BAST-24) and visual analogue scale (VAS). Patients with olfactory deficit were randomized in a experimental group and underwent on olfactory training during 3 months with the BASTAT-6 training box (phenyl-ethyl alcohol/rose, eucalyptol/eucaliptus, citronellal/lemon, eugenol/cloves, and vinegar).

Results: A total of 112 patients were included for the study. Mean age 33(SD 11.3), 33(28.4% female)Mean FIM 117.16(sd13.2).Olfactory deficit was found in 44(39.3%) patients. There were no differences in Verbal Comprehension Index, Perceptual Reasoning Index, Working Memory Index and Processing Speed Index were found. Eating disorders, behavioral changes and signs of desinhibition were more frequent in the olfactory deficit group. Compared to controls, trained TBI patients showed a significant increase in smell perception measured by VAS (77.8% vs 56.4%, p<0.05), after 3 months of training. This improvement was not sustained after the cessation of the olfactory training. No significant changes were observed in BAST-24 scores (olfactory detection, memory, or forced-choice identification.

Conclusions: A great number of patients with TBI have an olfaction deficit disorder as measured with the BAST-24. Neuropsychological test with the routine evaluation done in a TBI rehabilitation unit did not show statistically significative differences between both groups. There are more neuropsychiatric symptoms in the olfactory group. Training showed that a 3 month short term exposure to specific odours improves olfactory perception in patients with olfactory dysfunction after TBI.
Prognostic Markers for Neuropsychiatric Symptoms after Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: There are currently no prognostic markers for the development of neuropsychiatric symptoms after traumatic brain injury (TBI). The goal of this study was to identify protein and inflammatory markers obtained soon after injury that can serve as potential prognostic markers for neuropsychiatric symptoms at 3 and 6 months of injury.

Methods: We analyzed data from The Head injury Serum Markers for Assessing Response to Trauma (HeadSMART) cohort, a prospective cohort of TBI patients presenting to two urban emergency departments. Blood samples were obtained within 24 hours of injury and subjects were interviewed on the day of injury. Subjects were followed at 1, 3 and 6 months and underwent comprehensive psychiatric examination. Based on previous analysis and studies that have identified prognostic biomarkers implicated in brain injury markers chosen for the current analyses included brain derived neurotropic factor (BDNF) and metallothionein-3.

Results: A total of 151 subjects were enrolled between April 2014 and August 2015. The mean age of the sample was 52 (SD 21.6); mean education level 12.7 years (2.6); 55% of the sample were males and 47% Caucasians. The presenting GCS mean score of the sample was 14.6. Only 18% had an abnormal CT head. On unadjusted linear regression analysis there was a statistically significant negative association between BDNF and the Rivermead PostConcussion score at 6 months (b=-.345; p=0.024). After adjusting for age, education, race and gender, the relationship remained statistically significant. The adjusted linear regression analysis also revealed a statistically significant relationship between metallothionein-3 and scores on the Davidson Trauma scale (DTS) and Generalized Anxiety Disorder scale (GAD7) both at 6 months (b=-6.07; p=0.11; b=-.469; p=0.02, respectively).

Conclusions: This study provides preliminary evidence that BDNF can serve as a marker for persistent post-concussive symptoms and metallothionein-3 for anxiety symptoms. Further analyses of other serum biomarkers are needed to determine additional prognostic outcomes for neuropsychiatric symptoms.
Reducing head computed tomography after mild traumatic brain injury: screening value of clinical findings and S100B protein levels

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: The present prospective study was performed to investigate whether primary clinical findings and serum S100B concentrations at 3 and 6 hours posttrauma can contribute to the selection of patients for an initial CT scanning.

Methods: S100B was measured in serum samples obtained at 3 and 6 hours after the injury. Adjusted odds ratios (OR) and 95% confidence interval (CI) associated with demographics and clinical predictors of positive CT scan were calculated. Sensitivity, specificity, negative and positive predictive values were also calculated for S100B levels.

Results: A total of 158 adult patients suffering from isolated minor head injury fulfilled the inclusion criteria. We found that presence of loss of consciousness (OR, 2.3; 95% CI, 1.00-4.01; P = 0.008) and posttraumatic vomiting ≥2 episodes (OR, 1.8; CI, 1.08-3.29; P = 0.019) are factors associated with positive CT scan. In this study the best cutoff point of 0.115 µg/L for 3-hour S100B has sensitivity of 94.9% (95% CI, 86.8-98.3) with specificity of 35.4% (95% CI, 25.2-47.0) to predict intracranial injury on CT scanning. The corresponding results for 6-hour S100B > 0.210 µg/L were 98.7% (95% CI, 92.1-99.9) for sensitivity and 39.2% (95% CI, 28.6-50.8) for specificity.

Conclusions: Serum S100B measurement along with clinical evaluation of patients with MTBI has promising screening value to support selection of patients for CT scanning.
Effects of Repetitive Subconcussive Head Impact on Cognitive Function in Youth Athletes

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: Physical exercise is known to improve executive function. However, exposure to repetitive subconcussive head impact (RSHI) may lead to alterations in cognitive function. A sensitive detection and a better understanding of these alterations is key to prevent the development of long-term neurological disorders in individuals exposed to RSHI. The aim of this study was to examine the immediate and longer-term effects of physical training with and without exposure to RSHI on sensorimotor and cognitive function in youth athletes.

Methods: Sensorimotor performance (ProPoint task) and cognitive function (AntiPoint task) was measured in soccer players with exposure to RSHI while heading the ball (n=16; mean age=16.0 years) and control athletes without exposure to RSHI (swimmers and table-tennis players; n=14; mean age=15.2 years). Subjects were tested before and after the training session using an iPad application and headers performed during the training session were counted. Athletes performed up to 22 sessions across a 91-day period (average: 8.1 sessions across 19 days). ProPoint task: a center spot was touched using the index finger until a target appeared which had to be touched as quickly as possible. The target randomly appeared in 1 of 4 locations around the center spot (left, right, up, or down). AntiPoint task: the subject was instructed to touch the location opposite to the target location. Each trial (n=48 for each test) recorded the subject's response times (RTs).

Results: All subjects showed significantly lower mean RTs immediately after training sessions compared with pre-training testing in both the ProPoint and AntiPoint task. There was no group difference in the magnitude of this immediate improvement. However, over the course of all sessions, the improvement in RT was significantly lower in soccer players in both tasks (p<0.0001 and p=0.0006). In addition, the more long-distance headers soccer players accumulated, the less their improvement in RT.

Conclusions: These findings suggest that there was no detectable difference in athletes immediately following a workout with or without exposure to RSHI; however, when comparing the performance across a longer period of time, athletes with exposure to RSHI showed a significantly reduced improvement in sensorimotor and cognitive function compared to control athletes. Further, this study suggests an association of a reduced improvement with long-distance headers. The iPad application may be useful for sensitive detection of subtle alterations in cognitive function in athletes exposed to RSHI.
Eight week lifestyle education improves depression of stroke participants

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Conditions that decrease blood flow to the brain are known to trigger depression. Stroke have been implicated in increasing the risk of depression. The study assesses the impact that an 8-week education program that teaches lifestyle interventions in individuals suffering with stroke.

Methods: A medical clinic in Oklahoma trained and certified lay and professional people around the world in 3 continents. Those who chose to participate met once a week for 8 weeks for a 2 hour program. The program was available in Spanish and English. The Nedley Depression Recovery Program Assessment Test was used. It measured depression level based on DSM-5 [The Diagnostic and Statistical Manual of Mental Disorders Volume 5] criteria, demographics, and history of stroke. No questions were asked about individuals' treatment since it is an educational program. The depression was classified according to DSM-5 into 4 categories as none (0-6), mild (7-10), moderate (11-19) or severe (20 or more). The progress was quantified on the category they finished in. Every participant answered the questionnaire at baseline and completion. They were taught various healthy lifestyle concepts like nutrition, exercise, rest, bright light, sleep, avoiding negative thoughts among other things.

Results: From 5621 participants, 4% (n=224) had stroke (73% female) when the program started. At baseline their average depression was 13.3 (moderate), SD 7.4, SEM .5. At the baseline, the rest of the participants had an average depression of 12.3 (moderate), SD 7.5, SEM 0.1. By the end of the 8-weeks participants with stroke had on average a depression of 7.4 (none), SD 6.5, SEM 0.4. The rest of the group at the end of the program had on average a depression of 6.5 (none), SD 5.9, SEM .08.

Conclusions: The 8-week depression recovery program was safe and was associated with at least some degree of improvement in the vast majority (90%) of participants with stroke. In order to see if it was the cause of the improvement it needs to be compared to a control group that does not participate. It also needs to be evaluated if the improvement will last by doing a long-term follow-up study.
Effective return-to-work interventions after acquired brain injury: a systematic review

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: Less than half of the patients with acquired brain injury (ABI) return to work (RTW) after two years. It is hardly known how to assist patients with ABI to RTW. Therefore, the aim of this study is to gain insight in effective RTW-interventions for patients with ABI.

Methods: A systematic literature review was performed. The following databases were searched: PubMed, EMBASE, PsycINFO, CINAHL and the Cochrane Library. Both keywords and Medical Subject Headings were applied for ABI, interventions and RTW. The following inclusion criteria were defined for selection of relevant articles: publication between 2000 and March 2015; the study population comprised patients of working age, having non-progressive ABI and a paid job pre-injury; the outcome was RTW and the article reported research on interventions designed to facilitate RTW. The methodological quality of included studies was evaluated by a list containing criteria for internal validity, descriptive criteria and statistical criteria. RTW-interventions originating from studies with sufficient quality were, if possible, grouped according to their components. Evidence was classified qualitatively: strong, moderate or limited evidence, indicative findings or no evidence. Conclusions were based on the level of evidence for the effectiveness of RTW-interventions.

Results: 12 studies were included. The RTW-interventions in these studies comprised several components focusing on: work-related issues (work directed interventions); the patient (education/coaching); activity limitations (skills training), cognitive functioning, placement in work with support and a combination of these components. There is strong evidence that work directed interventions in combination with education/coaching are effective and there are indicative findings for the effectiveness of work directed interventions in combination with skills training and education/coaching.

Conclusions: For patients with ABI a combination of work-directed interventions, coaching/education and/or skills training are effective RTW-interventions.
A retrospective analysis of self-reported near-death experiences

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Objectives: Near death experiences (NDEs) have been defined as “profound psychological events with transcendental and mystical elements, typically occurring to individuals close to death or in situations of intense physical or emotional danger”. In contrast to the massive media-attention for the phenomenon, the number of scientific reports in the peer-reviewed literature remains limited. Consequently, there currently is no consensual or satisfying scientific explanation for NDEs. We here report retrospectively collected data obtained from individuals with self-reported NDEs who contacted our laboratory over a 7-year period.

Methods: Participants were recruited via our website (www.comascience.org), publications and appearances in local media of the International Association for Near-Death Studies (IANDS France and Flanders) and the Coma Science Group. Completion of an anonymized questionnaires was voluntary and taken as consent for participation in the survey. The study was approved by the ethics committee of the University of Liège. The questionnaire included demographic and clinical data and a standardized characterization of the NDE using the Greyson NDE scale: a validated 16-item multiple-choice tool (total score ranging from 0 to 32).

Results: 354 cases of self-reported NDE were collected from July 2008 to September 2015. Participants whose experience did not meet the accepted criteria of NDE (i.e., Greyson total score <7) were excluded from further analysis (n=42; 12%). 312 reports were included: 166 women (53%); aged 57±13 (mean, SD). Mean interval between interview and NDE was 24 y (range 1 month to 75 years); mean age at NDE was 33 years (range 1.5-80 y). Reported causes were traumatic brain injury (70; 23%); cerebral ischemia/anoxia (87; 28%); other/mixed (128; 41%) or occurring in the absence of any medical condition (e.g., during sleep, meditation, orgasm…) (26; 8%). 184 subjects self-reported the NDE to have occurred during a life-threatening event with prolonged loss of consciousness (59%). In this group, mean Greyson NDE total scores, quantifying the intensity of the event, was 15±6. The most reported features of the NDEs were 1) a feeling of peace or pleasantness (92%); 2) feeling separated from the body (77%); 3) seeing, or feeling surrounded by a brilliant light (74%). The feeling of a sense of harmony or unity with the universe was reported by 62%; seeing deceased or religious spirits was reported by 38% and extrasensory perception or awareness of things going on elsewhere in 33%. We observed no differences in intensity or content (i.e., NDE scale features) depending on etiology, loss of consciousness or the presence of near-death situations.

Conclusions: A large group of NDE experiences (128/312 in the current sample; 41%) seem to occur to individuals who are not in coma or close to death. Future studies should assess differences in characteristics disentangling “near-death” from “non-near-death” or NDE-like experiences.
Incidence, Characterization, and Predictors of Sleep Apnea in Consecutive Brain Injury Rehabilitation Admissions

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: Sleep disturbances are common among individuals with brain injury. Underlying sleep disorders, such as sleep apnea, may drive such disturbances and offer a new avenue for intervention. This study sought to prospectively examine the incidence, characterization, and potential risk factors for sleep apnea among a consecutive sample of acute brain injury rehabilitation admissions.

Methods: Participants were consecutive admissions to a comprehensive inpatient rehabilitation unit following acquired brain injury. Presence and characteristics of sleep apnea were assessed using polysomnography (PSG). Descriptive statistics regarding the incidence and characterization of sleep apnea among the sample were calculated. Logistic regression and hierarchical general linearized models were utilized to examine the relationship of traditional risk factors (i.e., Age, BMI, Hypertension, Diabetes, and Cognition) with presence and severity of sleep apnea.

Results: Nearly half (49%) of the sample was diagnosed with sleep apnea. Most commonly presentations were obstructive (OSA; 93%) and mild (52%), though a higher rate of moderate and severe cases were observed among the non-traumatic participants (35% each). For the full sample, univariate logistic regression revealed age (odds ratio [OR]: 1.08; 95% confidence interval [CI]: 1.04-1.11) and hypertension (OR: 7.77; 95% CI: 2.81-21.47) as significant predictors of sleep apnea diagnosis. When adjusted for all other predictors, only age (OR: 1.07; 95% CI: 1.02-1.13) as the only significant after adjustment for other predictors. Hierarchical generalized linear regression models for the prediction of apnea severity (i.e., apnea-hypopnea index; [AHI]) found that FIM Cognition Score (p=.01) and age (p<.01) were significant predictors. Following adjustment for all other terms, only age (p<.01) remained significant.

Conclusions: There is an inordinately high incidence rate of OSA within acute brain injury with a majority classified as mild. The presentation of apnea within this population is unique and traditional risk profiles for sleep apnea may not effectively screen for the disorder. Given the progressive nature of obstructive sleep apnea and morbidity associated with even mild OSA, early identification and intervention may address comorbidities influencing acute and long-term outcome.
Comparison of systemic inflammatory profiles in healthy athletes with and without a history of concussion.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: The chronic effects of concussion, a form of mild traumatic brain injury (mTBI), are not well understood. Post-injury, local brain tissue damage initiates a number of biological processes including central and peripheral immunological interaction, resulting in the recruitment of peripheral immune cells to the site of injury, and modulation of systemic inflammation. It has been hypothesized that a dysregulated immune response may underlie prolonged symptomology, and may contribute to the etiology of neurodegenerative disorders such as chronic traumatic encephalopathy (CTE). Therefore, evaluating immune markers in the peripheral blood may provide useful information regarding the pathological communicative process between the central and peripheral immune arms after brain injury. The purpose of this study was to characterize a broad panel of systemic inflammatory mediators in a samples of uninjured athlete and explore the following: (a) the relationship between self-reported history of concussion and systemic inflammatory mediators and (b) differences between male and female student-athletes.

Methods: Peripheral blood was sampled from 62 uninjured athletes (n = 35 male, n = 27 female), stratified into two groups based on previous concussion history (n = 30 yes, n = 32 no). Team therapists obtained relevant medical history during pre-season administration of the Sport Concussion Assessment Tool (SCAT) 3. An ultra-sensitive MULTI-ARRAY® immunoassay platform was used to allow for plasma analysis of 19 cytokines and 10 chemokines, and commercially available ELISA technology was used to assess 4 neuroinjury markers (s100B, GFAP, NSE, BDNF).

Results: Chemokines IP-10 and MCP-4 were significantly higher in healthy athletes with a history of concussion compared to athletes with no previous history of concussion. No significant differences in any cytokines or neuroinjury markers were observed between groups. Female athletes with a history of concussion had elevated MIP-1b and IL-16 levels compared to females with no previous concussion history. Male athletes with a history of concussion had elevated IP-10 and decreased Eotaxin levels compared to male athletes without a history of concussion.

Conclusions: Uninjured athletes with a history of concussion display an altered systemic immune profile compared to athletes with no previous concussions. While chronic low-grade inflammation is generally considered a health detriment, the role of the inflammatory response following concussive injury remains unclear.
Challenges in nursing practice for patients in a vegetative state

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: The vegetative state, also known as unresponsive wakefulness syndrome (VS/UWS), is one of the worst possible outcomes of acquired brain injury. Patients in VS/UWS are often relatively young and require intensive nursing care for prolonged periods of time. We aimed to shed light on nursing issues and challenges in VS/UWS in the long term care.

Research questions

1. Which nursing problems in caring for patients in VS/UWS in nursing homes are present? How frequent and severe?

2. What do nurses consider to be the biggest burden in care giving?

3. Which aspects would nurses prefer to be the subject of future research?

Design: Cross-sectional observational study

Methods: We approached the dedicated nurses of all patients in VS/UWS enrolled in an ongoing Dutch nursing home cohort study (n=8). Delphi method was used to construct a questionnaire containing 48 possible nursing care problems, assigned to Gordon’s health patterns with options whether a problem is present, how often and severe. Furthermore, nurses were interviewed in a semi-structured manner in order to assess which problems were interesting for further research and which aspects of providing care were considered to be the most burdensome.

Results: Response was 100%. Seven of the 8 nurses were female, in the age of 23-61 (mean 38), and each provided care for one patient in VS/UWS. Patients were on an average 52 years old (range 34-70), had been in VS/UWS for a mean of 8 years (range 1-19), mostly due to non-traumatic causes. Nurses and patients had been in a treatment relationship for on average 3 years (range 1-6). The results per research questions:

1) Apart from problems regarding total general functional dependence (e.g. maintain own health, self-care, immobility, incontinence, communication) nurses mentioned symptoms like constipation, moaning, frowning, contractures, impaired swallowing and intake, and difficulty of obtaining oral hygiene due to involuntary yaw clenching. Problems with regard to the possibility of the patient perceiving pain were experienced by 6/8 nurses. All nurses saw themselves confronted with feelings of powerlessness of their patients’ family members, and the majority of nurses witnessed ineffective feelings of hope, dysfunctional mourning patterns, contradicting wishes, disturbed family functioning and conflicts between nurses and family members.
2) Nurses considered the overall confrontation with VS/UWS to be the most burdensome aspect of nursing practice.

3) Research is needed concerning communication with VS/UWS patients and their family members (especially to conflicts and mourning processes), management of contractures, salivation problems, oral hygiene.

**Conclusions**: Nurses face very specific challenges while caring for patients in VS/UWS in the long term care and their families. The overall confrontation with VS/UWS is experienced as burdensome. Patients’ inability to communicate and their specific symptoms are considered the most important and deserve more scientific attention.
Location, Location, Location: Distribution of Traumatic Microbleeds Predicts Duration of Post-Traumatic Amnesia

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Background: Post-traumatic amnesia (PTA) affects over 95% of patients who sustain traumatic brain injury (TBI). In approximately 50% of cases, the duration is greater than one month. PTA greater than one month is among the strongest predictors of unfavorable long-term functional outcome. Current clinical and radiologic predictors of PTA duration are poorly defined.

Objectives: To determine whether traumatic microbleeds (TMBs) detected by gradient recalled echo (GRE) magnetic resonance imaging (MRI) are radiologic predictors of PTA duration. We hypothesize that the number of TMBs in specific neuroanatomic locations correlates more strongly with duration of PTA than the total burden of TMBs.

Methods: PTA data were acquired prospectively using the Galveston Orientation and Amnesia Test (GOAT), Orientation Log (O-LOG) or chart review in a single-center cohort of 350 patients treated for mild, moderate or severe TBI from 1999 to 2007. Sixty-eight of these 350 patients who underwent an MRI scan with the GRE sequence prior to emerging from PTA were retrospectively identified for correlation analysis. GRE was used to identify TMBs in neuroanatomic regions predisposed to hemorrhagic axonal injury. TMBs were counted throughout the entire brain and in regions that are prominent in memory function, including the hippocampus, fornix, thalamus, and corpus callosum, by a trained rater blinded to the PTA data. Associations between regional and global TMBs with PTA duration were tested using Spearman's correlation coefficient.

Results: Duration of PTA ranged from 0 to 240 days from injury. Total burden of TMBs was not associated with duration of PTA. However, the duration of PTA correlated significantly with the number of TMBs in the corpus callosum [r=0.31, p=0.01] and hippocampus [r=0.26, p=0.04], and there was a trend toward significance for TMBs in the fornix [r=0.23, p=0.06] and thalamus [r=0.24, p=0.06].

Conclusions: The burden of TMBs detected by GRE in the corpus callosum and hippocampus is associated with the duration of PTA and thus may serve as an important link to functional outcome. The widespread availability of MRI makes these radiologic biomarkers readily translatable to clinical practice. Validation of these findings in larger prospective studies is indicated.
The space between the arachnoid and pia mater, known as the subarachnoid space (SAS), is filled with cerebrospinal fluid (CSF) which stabilizes the shape and the position of the brain during head movements. Anatomically the interface between the skull and the brain consists of a series of three fibrous tissue layers, dura mater, arachnoid, and pia mater, and arachnoid trabeculae which are strands of collagen tissue.

Saboori and Sadegh (2014) have shown that the trabeculae within the subarachnoid space (SAS) can be found in a variety of shapes (rods, trees, plates, and networks). It has been proposed that each shape exists in response to a specific loading to the head for the purpose of attenuating the type of load in question. This work involved studying the flow within the SAS for different trabeculae structures being present. Specifically, the pressure gradients that exist within the CSF as the brain moves toward the skull were examined using a fluid-solid interaction approach. These different SAS models took one of three form: single trabeculae shapes distributed uniformly throughout the brain, single trabeculae shapes but distributed non-uniformly such that higher density areas were placed at locations associated with specific loadings, and mixed models where similar trabeculae shape clusters were located at positions around the brain where their presence was most effective (based on the single shape models). In all of these models the total trabeculae mass was the same, to allow valid comparisons to be made. A uniformly distributed mixed shape model was also used as a control, against which all results were judged.

All models of the SAS included the trabeculae and the cerebrospinal fluid (CSF) that was free to flow within the space and interact with the trabeculae thereby, in turn, affecting the trabeculae load transmitting abilities and the subsequent degree to which the trabeculae blocked the fluid flow within the SAS.

All models were constructed using COMSOL that allowed structural and fluid mechanic processes to be couples, thereby fully facilitating the creation of a fluid-solid interaction model. COMSOL also allowed any non-Newtonian fluid behavior to be included along with the non-linear material response of the trabeculae. Consequently, the results showed that the density and structure of the trabeculae played an important role in the relative motion of the brain with respect to the skull, thereby stabilizing the shape of the brain during an impact.

Visual Tracking and Visual Fixation as Diagnostic Signs for the Minimally Conscious State? An Integrative Review

An integrative review

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – basic research

Author's preference: Oral

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Objectives: Visual tracking (VT) and visual fixation (VF) are considered signs of purposeful behavior and therefore are compatible with the diagnosis of the minimally conscious state (MCS). Differentiating MCS from the vegetative state/unresponsive wakefulness syndrome (VS/UWS) is important regarding prognosis, pain management, intensive neurorehabilitation and medical-ethical decisions. Detection of VT and/or VF is important in making a diagnosis of MCS, since they have been associated with a transition from VS/UWS to MCS. Distinction between VS/UWS and MCS is difficult resulting in misdiagnosis of around 40%. A similar percentage of misdiagnosis was found in Dutch care facilities. Fifteen of 41 patients diagnosed as VS/UWS were in MCS. VT was present in 8 patients whereas 1 patient showed VF. The aim of this integrative review was to investigate the evidence of VT and VF as diagnostic signs of MCS.

Methods: We searched Pubmed, EMBASE and the internet for relevant articles, guidelines and reports from May 1994 till July 2015. Articles were considered relevant if VT and/or VF were related to the diagnosis of VS/UWS and/or MCS or if VT and/or VF were incorporated in a behavioral assessment scale. Quality of selection was assessed by a second reviewer. Disagreements and doubts about inclusion or exclusion were discussed. The integrative review method was used because inclusion of different types of articles was preferred to gain insight in the current evidence and existing controversies.

Results: We found 2010 potentially relevant articles, which consisted of empirical studies, reviews, expert opinions and editorials.

VT was incorporated in the diagnostic criteria of MCS because it was more prevalent in MCS patients compared to VS/UWS patients and were considered predictive for further recovery. Motivation for the incorporation of VF was not found. Discussion exists about the status of VF which was considered as an atypical feature of VS/UWS but also as a feature of MCS.

No general definitions about VT and VF were found. Assessment of VT and VF was done by different behavioral scales, with different operational criteria.

An overview of the relevant articles regarding definition, assessment and interpretation of VT and VF will be presented.

Conclusions: VT and VF have been considered important diagnostic criteria for MCS. Visual behavior was considered one of the most frequent detected sign compatible with a diagnosis of MCS. However, since no golden standard for behavioral assessment exists, different behavioral scales were used. These scales differ in the assessment of VT and VF and therefore the diagnosis of MCS can be dependent on the assessment method used. Questions remain about the diagnostic certainty of VT and VF. We recommend further research with the aim to reach consensus about definition, operationalization and interpretation of VT and VF as diagnostic signs of MCS.
Non-Pharmacological Interventions to Reduce Psychological Sequelae of Mild Traumatic Brain Injury in Adults and Children: a Systematic Review

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: No preference

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Background: The incidence of mild traumatic brain injury (mTBI) is high, with WHO estimating 600 cases per 100,000 adults in the US, and more in younger age groups and athletes. MTBI is synonymous with 'concussion' and symptoms include confusion, headache, loss of consciousness and post-traumatic amnesia. In the majority, symptoms will resolve within 3 months but they can persist in up to 25% leading to difficulties with social integration, education/work and psychiatric problems. Current management of patients with mTBI is variable but generally does not address the ongoing symptoms suffered by many.

Objectives: We conducted a review of the literature to establish the evidence base for non-pharmacological treatments for mTBI in all age groups.

Methods: We searched the literature for clinical trials of psychological interventions for mTBI. We searched 4 databases and hand-searched reference lists to ensure no literature was missed. We also reviewed abstracts of work presented at brain injury conferences to try and capture all current research. Relevant studies were selected by 2 authors and data extracted for analysis. Heterogeneity of studies precluded any meta-analysis.

Results: 2722 abstracts and 103 full text articles were reviewed. There were 46 relevant studies of which 25 were randomised controlled trials (RCTs), 18 were studies with a pre and post intervention design and 3 were case reports. Of the 25 RCTs only 4 included children and only one included children below the age of 6 years. The RCT's could be divided into early intervention to prevent persistence of symptoms (19 studies), and later interventions for patients with persistent symptoms (6 studies). For the purposes of this review we have focussed only on early interventions. Interventions included: Phone or text messaging support (4), web based information (1), Cognitive Behavioural Therapy (1), early follow up with treatment as needed (7), education and reassurance prior to discharge (5) and psychoeducational treatment (1). Outcome measures were variable but most included some measure of concussion or psychiatric symptoms. Ten studies showed improvement in intervention groups and nine studies showed no difference. There were methodological flaws and possible bias in many studies and some were limited by small sample sizes. Pre and post intervention studies generally showed improvement in symptoms but were limited by lack of comparison group and the high proportion of self-resolving symptoms seen in other studies.

Conclusions: Whilst there is some evidence in favour of psychological interventions, good quality evidence continues to be lacking. There is a particular shortage of studies in children which is surprising given their high incidence of injury and their need for different management strategies. The variation in study particulars makes comparisons between studies difficult and previous authors have called for standardisation of future mTBI research to enable conclusions to be drawn more easily.

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – activities and participation
Author's preference: No preference

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Objectives: Change in self-identity is a problem for many survivors of TBI and potentially linked with adverse rehabilitation outcomes. Specific interventions may be beneficial for reconstruction of self-identity but research in this area is hampered by a lack of tools with which to assess the effectiveness of interventions. The objective of this project is to validate a questionnaire assessing sense of self following TBI.

Forty five items examining aspects of sense of self threatened by TBI were developed, in three sections: egocentric, interpersonal and social. The items arose from a qualitative study, expert panel review and conceptual analysis of the literature, and were tested via cognitive interviewing, giving the questionnaire excellent face validity.

Methods: Face-to-face interviews were used to complete the Sense of Self questionnaire, demographic sheet, Glasgow Outcome Scale (Extended) and Sense of Coherence Scale with participants in New Zealand and UK. Responses were analysed using Rasch analysis, with RUMM 2030, and exploratory factor analysis using SPSS. Rasch analysis utilises a 1-parameter (item difficulty) probabilistic model to generate interval level data from ordinal counts and has been recommended as the most suitable measurement model for construction and validation of rating scales within social sciences. Unidimensionality is formally tested, a pre-requisite for summing scores to produce a total. The interval level scale generated supports parametric statistics and therefore change scores can be calculated, not strictly the case with scales validated using Classical Test Theory.

Results: 136 community-dwelling participants were recruited. The age range at injury was 17-75 years, 68.4% male; median time since TBI was 84 months. Severity of injury was classified as mild in 31 and moderate/severe in 105. Analysis confirmed multidimensionality in the data. Factor analysis suggested a valid three factor solution with significant overlap with the three theoretical domains of the questionnaire. Rasch analysis was then used to develop three separate, valid, unidimensional scales: Egocentric, 17 items, Social, 13 items and Interpersonal, 6 items. χ² item-trait interaction probabilities were all non-significant showing good model fit, with Person Separation Index (PSI) 0.92, 0.90 and 0.82 respectively.

Conclusions: Change in sense of self following TBI is multidimensional. We identified three interlinked but conceptually separate components that can be affected by TBI, and developed scales to measure these. Firstly, egocentric aspects of self, incorporating self-discrepancy, both new versus old self and own view versus others' views. Secondly, wider, social aspects: belonging, meaning, productivity, and existential issues. Items linked to close interpersonal relationships form a separate scale but this lacks coverage in key areas and needs further development. These new scales could be used to evaluate impact of TBI on sense of self over time, effectiveness of interventions on reconstructing self-identity and the relationship between self-identity and other rehabilitation outcomes.
Post-Concussion Neuromuscular Outcomes in Young Active Children

Objectives: Concussion is a common injury amongst young, active children who can experience a range of short and long-term neurobehavioral symptoms (e.g. cognitive, physical, etc.) post-concussion. To date, most concussion research focuses on the recovery of cognitive performance in adults or adolescents, with little focus on children and the neuromuscular impact of this injury. This is a critical gap in the literature as childhood is a time of rapid growth and development and an injury sustained during this time could significantly impact normal developmental trajectories, including neuromuscular performance. The goal of this research is to describe changes in post-concussion symptoms and neuromuscular performance (balance and strength) in child athletes (aged 9-13 years).

Methods: 18 active children (mean age = 11.54 ± 0.95 years; 12 females, 6 males) who sustained a sports-related concussion, participated in a multi-modal assessment at baseline (pre-injury) and post-concussion (post-injury). This assessment consisted of a concussion symptom scale (Post Concussion Symptom Scale for Children (PCSI-C)), a static balance assessment (modified Clinical Test of Sensory Integration and Balance) and an upper body strength test (hand dynamometer).

Results: Post-injury assessments were within 8 days post-concussion, with an average of 3.22 days. With respect to the post-concussion symptoms, the mean symptom score increased from 3.28 at baseline to 11.28 at post-concussion. The static balance assessment showed a higher sway index (decreased performance) post-concussion compared to baseline across all four conditions. Maximum handgrip strength on both dominant and non-dominant hands showed a decrease in upper body strength post-concussion compared to baseline.

Conclusions: Overall, this data is intended to describe post-concussion neuromuscular outcomes for active children between the ages of 9 and 13 years. This group is an often a neglected group within the concussion literature and this research may help health-care professionals better understand the recovery trajectory for this population. Further, this research will provide a foundation for more comprehensive, objective and accurate understanding of recovery from concussion for young active children.
Postural Stability in Youth Athletes Post-Concussion

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Postural stability is a recognized objective measure in the evaluation of athletes post-concussion. Previous studies have identified deficits in postural sway in symptomatic concussed collegiate athletes and have suggested that this deficit becomes more prominent in more challenging postural stances. Post-concussion deficits in postural sway found in college-aged athletes demonstrate the need to investigate how concussion affects postural changes in youth athletes. The objective of this study is to describe the differences in postural stability of youth athletes (13-18 years) post-concussion compared to their baseline pre-injury assessment.

Methods: Thirty-seven youth athletes (age: 15.07 ± 1.38 years; 28 female, 9 male) participated in a postural stability assessment at baseline (pre-injury) and post-concussion (post-injury). Postural stability was assessed using a modified Clinical Test of Sensory Integration of Balance (mCTSIB) on the BioSway Portable Balance System (Biodex). The Sway Index (a measure of postural sway) of each participant under four sensory conditions was measured during the mCTSIB at baseline and post-concussion. The Post-Concussion Symptom Inventory (PCSI) was used both at baseline and post-concussion to determine pre-injury and post-injury symptom scores.

Results: No significant differences were found between pre-injury and post-injury postural stability under all four conditions. Visual inspection of the data revealed decreased performance in 5 participants (3.60 ± 3.65 days post-injury, PCSIpost: 35 ± 14) across all four conditions and an increase in performance in 6 participants (5.67 ± 3.14 days post-injury, PCSIpost: 30 ± 18) across all four conditions. Twenty-six participants varied between increasing and decreasing performance across each condition, with condition 2 (eyes closed, firm surface) eliciting a decrease in performance in the most number of participants (60%). Only 19% participants had a decreased performance on condition 4 (eyes closed, foam surface), the most difficult condition.

Conclusions: Findings suggest that examining post-concussion outcome measures in youth requires a greater complexity than in adults, especially when comparing their post-concussion measures to pre-injury baseline measures. This study enhances our understanding regarding the unique physical profile of youth athletes and specifically, the variability in postural performance following concussion in youth.
Unexpected recovery of consciousness…and then?

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: It is generally accepted that recovery of consciousness from a posttraumatic Vegetative State/Unresponsive Wakefulness Syndrome (VS/UWS) is highly unlikely 12 months after brain injury. This case study describes a young man in a Dutch nursing home with unexpected recovery of consciousness following 13 months in a posttraumatic VS/UWS, and considers the difficulties of finding adequate care and treatment.

Methods: Living in a nursing home amongst elderly people, a 32-year-old man suddenly uttered some words ('au', 'hello') after 13 months in a VS/UWS following traumatic brain injury. Repeated, standardized neurobehavioral-assessments (CRS-r) and the expert opinions of neurologists and elderly care physicians had confirmed a diagnosis of VS/UWS and then of Minimally Conscious State. Due to health insurance restrictions, advanced neuroimaging techniques, available at a Belgian centre of expertise, could not be utilized. Nor could the patient be referred for specialist neurorehabilitation at the only Dutch specialist rehabilitation centre because this treatment is only reimbursed for patients up to the age of 25 years. As a consequence of the extent of the patient's functional impairment, lack of retention of attention, and behavioral problems, the rehabilitation specialist at a local rehabilitation centre considered the patient unsuitable for admission to regular rehabilitation.

Following commencement of rehabilitation by the multidisciplinary team in the nursing home, the patient's speech improved spectacularly: he recited the alphabet perfectly, sang songs, made jokes, asked questions and voluntarily moved his right arm to his head. His mobility did not improve and he remained wheelchair bound. Recovery of consciousness was monitored by the Post-Acute-Level of Consciousness-scale (PALOC-s).

Finally, the patient was accepted for short-term rehabilitation in a local rehabilitation clinic; however, his cognitive impairment and behavioral problems limited progression. Sixteen months post accident he could speak short sentences.

Results: Eighteen months post accident the patient was fully aware, remained wheelchair dependent, incontinent, needed help eating and required complete physical care. Generally, he adequately interacted with his environment.

After spending 4½ years amongst frail elderly people, the patient moved to a specialized nursing home ward, close to his family, that cares for the deaf and visually impaired. At present his family is still considering specialized wards for young patients with acquired brain injury outside their region.

Conclusions: Although recovery of consciousness more than one year after posttraumatic VS/UWS is unlikely, this case shows that it is possible, even during the chronic phase in a nursing home.
The case illustrates the plethora of problems that must be solved for patients with prolonged disorders of consciousness. These included the reimbursement of specialized neuroimaging and neurorehabilitation, and provision of suitably adapted accommodation. As such, we argue for the necessity of centers of expertise, particularly in the post-acute phase.
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**TBI Induced Spinal Cord Plasticity: The Endogenous Opioid System Mediates Trauma Effects On Motor Reflexes**

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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**Objectives**: The striking phenomenon of spinal cord plasticity induced by brain injury was discovered by Anna Di Giorgio in 1929. In these experiments, unilateral lesion to the cerebellum resulted in hind limbs postural asymmetry exhibited as ipsilateral hind limb flexion. The asymmetry retained after spinal transection suggesting side-specific plastic changes in the spinal cord. We here examined whether cortical TBI induces similar phenomenon and searched for underlying neurobiological mechanisms.

**Methods**: Unilateral CCI (controlled cortical impact centered on cortical hindlimb representation area) in rats. Behavioral and EMG analysis of postural asymmetry / reflexes. qRT-PCR, ddPCR, IH, ISH.

**Results**: CCI induced hind limb postural asymmetry that was fixed after transection of the spinal cord. The right-side CCI resulted in the left hind limb flexion. Administration of the general opioid antagonist naloxone or selective mu-antagonist beta-FNA but not selective delta-antagonist naltrindole to CCI animals before or after spinal transection inhibited formation of postural asymmetry. Surprisingly, administration of selective kappa-antagonist nor-BNI reversed the side of the flexed leg. The reversion was evident prior to and after spinal transection. U50488 or dynorphin (i.t.), selective kappa-agonists mimicked the effects of right-side CCI by inducing left limb flexion in naive animals. Consistently, lateralized expression of opioid receptors was revealed in the spinal cord.

**Conclusions**: The dynorphin-kappa opioid system is lateralized and as such may be involved in unilateral CCI-induced side-specific plastic changes in the spinal cord. These changes may underlie motor impairment while their targeting by kappa-antagonists may contribute to motor recovery.
Deep Vein Thrombosis Prophylaxis in Traumatic Brain Injuries: analysis of a multicentric dataset

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Objectives: Among many other complications of long hospitalization, patients sustaining severe traumatic brain injuries (TBI) are at high risk for developing episodes of vein thromboembolism. A review of the literature provides dishomogeneous figures, so that the reported incidence of deep vein thrombosis (DVT) ranges between 20 and 90%, and the one of pulmonary embolism (PE) ranges between 2.3 and 22% across different observational studies. We hypothesized that one of the possible reason for such a diverse outcome could lay on subjective management attitudes across different units towards the use of prophylaxis protocol for DVT in TBI patients.

Methods: We herein analyze the impact of starting a pharmacological prophylactic protocol with low molecular dose heparin within 36h from admission to A&E or from neurosurgical intervention. Among different units preliminary taken into account, an aggregate dataset representative of 6 consecutive months from only two centers that were found to systematically apply similar pharmacological prophylactic protocols was reviewed and analyzed. The diagnosis of DVT was considered only when a clinically suspected DVT was confirmed with Doppler US. All centers were considered for the same timeframe when calculating the risk of delayed post-traumatic hemorrhages.

Results: The incidence of documented DVT in TBI patients following administration of pharmacological prophylaxis within 36h from admission or neurosurgical intervention resulted inferior to 3% in the aggregated dataset. The risk of post-traumatic hemorrhagic complications in TBI patients ranged between 0.2% and 0.7% across all centers.

Conclusions: Historical data from the literature are not representative of current clinical practices, in fact only a comparison with recently acquired dataset can show the protective effect that a widespread use of pharmacological and mechanical prophylaxis protocols are having on reducing the incidence of DVT and PE. Interestingly, in those centers that are systematically applying DVT prophylaxis protocols the related risk of iatrogenic hemorrhagic complications is not significantly greater than the risk of delayed post-traumatic hemorrhagic complications recorded in other units. As such, the hemorrhagic risk of those protocols should not discourage from starting the pharmacological prophylaxis within 36h from admission.
The Physiological Basis of Fatigue after Traumatic Brain Injury

Author's preference: Oral

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Objectives: Fatigue represents one of the most common complaints of individuals following traumatic brain injury (TBI). The complaint of fatigue following TBI differs from fatigue experienced by uninjured individuals, suggesting an underlying physiological cause. There have been many theories of the basis of fatigue, none of which fully explain the phenomenon. The objective of this study was to explore the association between physiological, psychological, and physical factors contributing to fatigue in a small population of individuals following TBI, in order to determine foci for interventional trials.

Methods: Twelve subjects who were between the ages of 18-65, with a prior hospitalization for non-penetrating moderate to severe TBI that occurred at least 1 year prior, underwent a week-long evaluation including brief neuropsychological assessment, evaluation of resting energy expenditure using indirect calorimetry, serum electrolyte and hormone screening, MRI including resting state fMRI, activity monitoring and sleep monitoring using actigraphy, diet and exercise logs, all compared to subjective fatigue as measured by the fatigue subscale of the TBI-QOL.

Results: Increased fatigue as measured by the fatigue subscale of the TBI-QOL was correlated with greater resting energy expenditure [REE] (r = 0.6210, p = 0.0414), increased Cortisol (r = 0.63, p = 0.037) and increased score on the Depression Subscale of the Neurobehavioral Functioning Inventory (r = 0.721, p = .008). Trends were observed towards correlations between duration of wakefulness after sleep onset [WASO] (r= 0.5812, p = 0.0608) and increased IGF-1 (r= .57, p=0.06). We used LASSO (Least Absolute Shrinkage and Selection Operator) regularized linear regression, a method that automatically selects the variables in the model that contributes to the response (fatigue on TBI-QOL) through cross-validation. Contributing factors in this model that predicted Fatigue were serum Cortisol, Sleep Disturbance and the Depression Subscale score of the NFI. There was no association between physical activity and fatigue.

Conclusions: Fatigue following TBI is a multifactorial phenomenon, with Cortisol, Emotional Status (increased depression) and Sleep Disturbance being important contributors. Although an association was seen between REE and fatigue, this did not contribute significantly in the final model. Neither did IGF-1, which was additionally found to have an opposite relationship than reported in prior studies. It is felt that Cortisol may be elevated due to Stress or Anxiety, which has been reported to be associated with fatigue in other studies. These results lead to the suggestion that emotional factors strongly drive subjective fatigue, and actually may be related to the other variables, such as increased Cortisol due to endogenous stress, poorer sleep, and higher resting energy expenditure. These results will need to be confirmed in a larger study, and may form the basis for an interventional trial.
The Effects of Concussion History on Response Inhibition.

Status: Accepted Presentation type: Poster
Category: Neurotrauma – basic research
Author's preference: Poster

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Objectives: Research on the long-term cognitive effects of concussion history is mixed. However, we do know that executive functions such as response inhibition can be impaired transiently following a concussion (DeHaan et al, 2007, Neuropsychologia; Howell et al, 2013, Med Sci Sports Exerc). In this study we used a novel measurement of response inhibition to investigate the effects of concussion history.

Methods: 66 male football players (age: 19.61±1.51) were tested pre-season with an object hit-and-avoid (OHA) task that made use of bimanual robot technology. Based on the number of self-reported concussions previously sustained, participants were divided into either a "history" or "no history" group. The OHA task required participants to hit 2 specific shapes on a virtual 2D screen using robotic arms while avoiding 6 other distractor shapes that appear on-screen. Independent t-tests were used to assess the difference between these groups on various OHA metrics.

Results: 23 (34.85%) players self-reported having no history of a concussion and 43 reported having experienced at least 1 concussion in their lifetime (range: 1-16). Athletes with and without a history of concussion were comparable in age and IQ, as measured by the North American Adult Reading Test. We observed a trend towards more correct hits in those who had a history of concussion (t=6.87, p=0.079). When each hand was analyzed those who had a history of concussion hit more targets with their left hand than those without a history of concussion (t=3.8273, p<0.001); when only right-handed athletes were analyzed, the number of target hits with their left hand remained significantly different between the two groups (t=3.3144, p=0.0019). Athletes who did not have a history of concussion showed significantly more right hand bias than those with a concussion history (t=3.1808, p=0.002). There were no significant differences between the two groups for total number of distractors hit, median error, miss bias, right or left hand speed, right or left hand area, hand speed bias, or hand area bias.

Conclusions: This research suggests that a history of concussion does not have a long-term effect on response inhibition. Better task performance among athletes who have a history of concussion may be due covarying factors such as greater exposure and playing experience in this group.

Incidence and Management of Post-Traumatic Hydrocephalus in a series of 144 consecutive patients

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Objectives: Post-traumatic hydrocephalus (PTH) represents a serious complication following severe traumatic brain injury (TBI), and in this patient population is a well recognized cause for reoperation within 30-days from admission. Its incidence however varies greatly in the series reported in the literature, and this seems largely attributable to the different criteria used for its diagnosis.

Methods: The clinical database of a renowned Greek Trauma Center was retrospectively reviewed by a group of independent investigators; all patients admitted between 2002 and 2008 with GCS equal or lower than 8 were initially considered but only those without intraventricular hemorrhage were eventually included in this analysis. Upon identification of the subset of patients who developed PTH, their demographic, neuroimaging and clinical data were matched and our attention was focused toward their specific management. This analytic process attempted to identify meaningful correlation between the incidence of this complication and known risk factors such as post-traumatic subarachnoid hemorrhage (PT-SAHA), treatment with decompressive craniectomy (DC), size of the bony defect and its proximity to the midline.

Results: A total of 144 patients satisfying the inclusion criteria were analyzed, noteworthy 6.25% of this population developed PTH. A striking male predominance characterized this subgroup of patients, 22.2% were less than 18-year-old, 66.7% were in the age group 18-40-year-old, and 11.1% were more than 40-year-old. All of them were involved in high speed road traffic accidents. Prompt insertion of Ventriculo-Peritoneal shunt with medium pressure valve was the management strategy adopted in all of those cases. Our retrospective analysis found that PT-SAHA does not show any correlation with the incidence of PTH. On one hand, our study confirmed that initial treatment with large DC (more than 14cm²) represents a risk factor for this delayed complication; on the other hand, suggests that its proximity to the midline (inferior than 1cm versus more than 1 cm) did not seem to play a meaningful role.

Conclusions: The data obtained from this retrospective study confirmed the incidence rate of PTH previously reported by other groups, however failed to indentify a meaningful correlation between most of the hypothesized risk factors and this delayed complication. Whereas other authors have noticed that the proximity of the DC to the midline might affect venous drainage and therefore cerebro-spinal fluid reabsorption, this was not appreciated in our series. Noteworthy, all DCs performed in the studied timeframe had been performed using the vascular tunnel technique for preservation of venous outflow through bridging veins. Whereas the independent analysis and the length of timeframe considered certainly represent two major strengths of this study, the limited number of cases indentified from a single institution represents only a descriptive analysis and limits further inferences to the general population of severe TBI patients.
The Structured Assessment for Evaluation of TBI (SAFE-TBI): A New Instrument For Assessing Previous Exposure to TBI

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: Given the high prevalence of traumatic brain injury (TBI) in military personnel in recent conflicts, screening questions have been developed to identify individuals who might have had a TBI (e.g. the VA Level I and the Post-Deployment Health Assessment (PDHA) screens) who could then be further evaluated by clinicians. The limitations of self-report methodology and the subtle/subjective nature of the core indicators of mTBI (mild TBI) have raised concern that how questions are framed can influence the response and lead to inaccurate diagnosis. It is important to have an instrument to (1) improve and systematize the manner in which information about a potential mTBI is ascertained, and (2) increase the degree of confidence that someone had a mTBI.

Methods: The Structured Assessment for Evaluation of TBI (SAFE-TBI) is a semi-structured interview developed by investigators of the U.S. Department of Defense funded INTRuST consortium on Psychological Health and TBI to assess the core elements mTBI. The instrument takes approximately 20 minutes to complete, and is designed to be administered by either a research coordinator or TBI clinician, after a standardized training. An operationally defined scoring system allows for a determination of the level of evidence for exposure to a previous mTBI into four levels: Strong, Moderate, Weak, or No Evidence. The current study reports the preliminary results of inter-rater and test-retest reliability of the instrument in 3 cohorts of military personnel: (1) active duty personnel with a positive TBI on the PDHA (n=39); (2) veterans with a positive TBI screen on the VA Level 1 screen (n=115); and (3) active duty personnel evaluated within a few days of injury by expert clinicians at the Walter Reed Medical Center (n=55).

Results: Overall the instrument was easy to learn, and was well-tolerated by participants. Interview technique fidelity ratings showed good compliance with the intent of the instrument. Inter-rater and test-retest reliability showed moderate levels of agreement, which improved with greater strength of evidence for TBI. In the VA cohort, 23% of those who screened positive for MTBI were classified as showing Weak or No Evidence of TBI on the SAFE instrument.

Conclusions: These preliminary findings suggest that the SAFE-TBI instrument shows moderate test-retest reliability when used by both experienced TBI clinicians and trained research coordinators. Additional booster session trainings may improve performance metrics. Data from this pilot study suggest that the current screening questions such as the VA and PDHA are serving to identify an appropriately broad population of military personnel at risk for previous exposure to an MTBI, but that almost one in four (23%) of those who screen positive have Weak or No Evidence of TBI on more detailed examination with the SAFE-TBI.
Beyond the Bars: Traumatic Brain Injury (TBI) and Incarceration

Status: Accepted  Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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According to the International Centre for Prison Studies’ World Prison Population List, over 10 million people are incarcerated worldwide. With over 2.2 million of those imprisoned reported in the United States of America (U.S.), the U.S. ranks as having the highest incarceration rate amongst 244 countries globally (Wamsley, 2013). As the U.S. and worldwide prison populations grow, research analyzing and defining the underlying causes, issues, and behaviors of this vulnerable population is increasingly imperative.

Previous studies have uncovered an increased risk for TBI within the prison population. Approximately 25 - 87% of inmates reported a history of TBI in comparison to an estimated 10 - 39% of reported TBIs in the U.S. general population (Shiroma et al., 2010; Farrer and Hedges, 2012). Meta-analyses estimate more than half of the prison population (approximately 60%) disclosed a history of TBI either prior to or during incarceration (Shiroma et al., 2010; Williams, 2010).

The Traumatic Brain Injury Model System (TBIMS) Pre-Injury questionnaire documents patient incarceration due to felony with analyses showing 8.5% of TBIMS participants endorsing felony incarceration history. Expanding the questionnaire to incorporate history of misdemeanors/overnight stays, a study of one public metropolitan hospital indicated 31% of TBIMS participants endorsing misdemeanor convictions. Overall, 33% of the TBIMS population reported having at least one criminal history event (either a felony conviction or a misdemeanor).

Incarcerated populations have higher exposure and risk of victimization and violence that may lead to a cycle of recidivism and TBI. Damage to the frontal lobe, common to TBIs, often results in cognitive and behavioral impairments, such as impulsivity, aggression, disorganized thought, and confusion. The 2004 U.S. Survey of Inmates in State Correctional Facilities reported 32% of inmates endorsing a violent encounter or accident-related injury during their incarceration. Additional reports claim a prevalence of violence-related injuries at 14 times greater during incarceration (Sung, 2010) that can be attributed to a higher-risk of inmate/correctional staff violent clashes (The Institute for Criminal Policy Research International Prison News Digest, 27th Ed., May- June 2015). Applied to the global incarcerated population, additional research efforts to further understand the prevalence of TBI prior to and during incarceration worldwide can support the design and implement community and correctional interventions to interrupt the cycle of TBI and incarceration.

In addition, proper diagnosis and treatment of TBI in the community may lower incarceration rates, helping to curb overcrowding, a well-recognized problem (ICPR, 26th Edition, 2015; Shiroma et al., 2010).

Objective #1: To describe the cycle of TBI risk within the incarceration system and the implications for unrecognized TBI.

Objective #2: To describe the difference between felony and misdemeanor incarceration history in the TBIMS and its implications for examining long-term outcomes of TBI.
Does grip strength decrease following a concussion in an athletic youth population?

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Youths participating in organized sports are at increased risk of sustaining a concussion. Current return to play protocols focus on subjective rating of symptoms, which may not be sensitive enough to detect underlying injury. Handgrip, a measure of upper limb neuromuscular strength, has been shown to reflect neurological deficits in moderate and severe traumatic brain injury. This study explores the effect of acute concussion on individual grip strength baseline values.

Methods: Thirty-nine youth participants (13-14 years, n=23; 15-17 years, n=16) who had previously completed baseline assessment returned for testing upon sustaining a concussion. The participants completed 3 grip strength (kg) measures for both the right and left hands using a handgrip dynamometer. Maximum grip strength was the highest value obtained during the 3 trials, while the average was a calculation of the mean values across the 3 separate trials. Each participant completed the Post-Concussion Symptom Inventory (PCS-I) to determine the presence and severity of post-concussion symptoms. In order to determine association between individual characteristics and grip strength, a Pearson R coefficient correlation was utilized. A paired sample T-test was used to compare baseline to post-injury maximum and average dominant and non-dominant grip strength scores (statistical significance was set at p < 0.05).

Results: The 13-14 years old group (age: 13±1 years) were assessed 6.2±6.2 days following injury and exhibited mean PCS-I scores of 20.4±15.2. While 15-17 years old group (age: 16±1 years) were assessed 3.8±2.5 days post injury and reported mean PCSI scores of 31.4±16.8. The initial baseline test was completed on average 104±104 and 125±83 days prior to participants' post-injury assessment in the 13-14 and 15-17 year old group, respectively. Significant positive correlations were found for weight, height, and age with maximum and average dominant and non-dominant handgrip strength for both groups. There was no significant difference in dominant and non-dominant grip strength measures between baseline and post-concussion in the younger group. In the older group there was a significant decrease in dominant (p=0.041) and non-dominant (p=0.045) handgrip strength in comparison to baseline.

Conclusions: This research describes changes in maximum and average dominant handgrip strength in older children following concussion suggesting a potential role for this measure in concussion assessment protocols.
Are resting state networks affected in subjects with persistent symptoms 3 months after concussion?

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Five to 15% of concussed patients have persisting symptoms beyond 3 months. Post-concussion symptoms (PCS) are often diffuse and involve physical, cognitive and emotional domains. The impact to specific regions in the brain or brain networks after concussion, and the approach of explaining ongoing symptoms is still debated. Resting state functional magnetic resonance imaging (rs-fMRI) and the investigation of global networks has been suggested as a biomarker in diseases with cognitive deficits, suggesting a link between increased activation in prefrontal areas from rs-fMRI and cognitive function.

Aim: The purpose of this study is to explore the impact of resting state (rs) -networks after concussion in subjects with PCS, compared to a group of healthy subjects.

Methods: Preliminary data from 10 subjects with PCS, 3 months after concussion, and 10 healthy controls are compared. Participants were scanned on a Skyra, 3T Siemens scanner, with a rs-fMRI protocol along with clinical and diffusion scans. The degree of PCS was assessed by the Rivermead post-concussion questionnaire (RPQ). All subjects with concussion had a RPQ score above 20. Inter component analysis (ICA) were carried out with MELODIC from the Functional MRI of the Brain (FMRIB) Software Library (FSL). Significantly increased activation (p < 0.05, corrected for multiple comparisons) in the subjects with concussion where visually inspected in 20 rs-networks, using the “dual-regression” approach in FSL.

Results: Probabilistic ICA defined 20 components representing group-averaged networks of brain regions with BOLD fMRI signals, which were temporally correlated. Especially the network involved in cognition (component map number 4, 6 and 15) revealed a significant activation in the subjects with concussion compared to healthy subjects.

Conclusions: We found a significant increase in several rs-networks. The networks involved in cognition showed to be more activated in subjects with concussion than healthy subjects, suggesting a link between PCS and increased neural activation.

Perspective: Sensitive biomarkers are essential in understanding pathogenesis and treatment of PCS. Rs-fMRI could potentially add further knowledge into this area. Further studies are needed to investigate the link of increased activation in rs-networks and PCS, but also the possible neural mechanisms behind.
Promises Of Accuracy For Non-Invasive Intracranial Pressure Monitoring: Are We Ahead Of The Curve Yet?

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Background: Despite still contrasting evidence that it could be realistically associated with better outcome, Invasive Intracranial Pressure Monitoring (I-ICPM) in NeuroIntensive Care Units (NICU) represents an invaluable tool for the prevention, management, and understanding of secondary injuries after traumatic, neoplastic or cerebrovascular accidents. For Non-Invasive ICP Monitoring (NI-ICPM) to eventually become a reliable alternative in the near future to the state-of-the-art I-ICPM is just a matter of reaching a comparable accuracy.

Methods: Challenging the preliminary results from previous laboratory and preclinical studies on a new model of NI-ICPM (based on advanced signal-processing algorithms analyzing acoustic trans-cranial stimuli), IRB approval was granted to test it on all patients with survival expectancy >72h undergoing I-ICPM at our NICU. A statistical analysis (Pearson Correlation and ROC Curve analysis) was performed on all testing session of continuous monitoring which lasted 1.5-6h.

Results: A total of 2795 continuous parallel recordings were analyzed showing a good accuracy of the device tested: a differential pressure <6mmHg in 95%, and <3mmHg in 70% of total data points was found between the NI-ICPM and I-ICPM (Pearson r: 0.49 with 95% CI: 0.46 - 0.51 and P value < 0.0001). A ROC Curve analysis was performed for all measurements (≥ 15mmHg cutoff) showing an area under ROC curve of 0.853.

Conclusions: Given the promising potential in quantitative ICP monitoring of the NI-ICPM device tested further algorithm optimization and clinical validation are certainly warranted, nonetheless the shift from experimental setting to daily bedside use seems now closer than ever.
Evidence and Neurotrauma Guidelines - Achilles’ Heel

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author’s preference: Oral

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Objectives: Guidelines for the treatment of severe traumatic brain injury (TBI) are important as support for the daily practice of neurosurgeons and neuro intensive care specialists. We aimed to summarize the evolution of evidence regarding the treatment of TBI taking into account 3 periods, before 2000, between 2000 and 2007 and from 2007 to the present day. Our particular interest was in the presence of high-quality evidence.

Methods: We analysed published articles used to develop the Brain Trauma Foundation Guidelines, comparing the 2000 and 2007 versions. We then performed a broad Medline, Embase, Google Scholar search from 2007 to 2015 to examine the new evidence of the last 8 years. We classified the overall quality of each study from I (high) to III (low) according to the Brain Trauma Foundation criteria 2007. Two independent reviewers (VV and IK) analysed the eligibility of the articles and three independent reviewers assigned classes of evidence to the articles (VV, IK and MC).

Results: We identified 4846 potentially relevant articles published since 2007. The results show a preference for certain research areas, such as ICP monitoring (n= 10 new studies included between 2000 and 2007) and brain oxygen monitoring and treatment (n= 10 between 2000 and 2007) and less interest in, for example, hyperosmolar therapy with mannitol (n= 0 between 2000 and 2007). Furthermore, most of the evidence was classified as class III, with scarce class I evidence (n= 1 up to 2007). Between 2000 and 2007, only 1 class I and 5 class II studies appeared. Only 1% of the articles were actually relevant to guideline development both between 2000 and 2007 and between 2007 and 2015.

Conclusions: The evidence underlying currently available guidelines for TBI is fairly weak. Large-scale studies of high-quality are required to provide the evidence required for precision medicine: the right treatment for the right patient.
Response to Text-Based Social Cues in Adults with Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: Adults with traumatic brain injury (TBI) may have impairments in Theory of Mind (ToM), the ability to infer others’ mental states and use those inferences to predict others’ behaviors. ToM has been tested primarily in the context of stories in which mental states are inferred from story content, but we also infer mental states from words themselves and the structure of sentences. For example, if a speaker refers to a group as “those” people rather than “these” people, we infer that the speaker has an emotionally distant relationship to the group. Likewise, if a speaker says, “I like Sarah and Joe” vs. “I like Joe and Sarah,” we infer he likes Sarah better in the first sentence than the second, because in the first sentence she’s closer to the subject of the sentence. These examples illustrate immediacy cues, implicit social cue originally described by Mehrabian (1968) that indicate closeness of a speaker to the object of his or her communication. Response to immediacy cues is part of social cognition, and failure to respond to these cues could affect social interactions. The aim of this study was to compare adults with vs. without TBI in response to immediacy cues.

Methods: Participants were 58 adults with TBI (24 women) and 50 uninjured adults (28 women), who completed two immediacy tasks as part of a larger study of social outcome after TBI. Task 1 was a comparison task, in which participants indicated which of two people, objects, or actions were liked more by an imaginary person. Task 2 was a rating task, which also involved liking but was based on pairs of sentences that differed only in immediacy cues identified by Mehrabian. We hypothesized that adults with TBI would show less sensitivity to immediacy cues, indicated on Task 1 by less accurate liking judgments and on Task 2 by lack of an effect of cue immediacy differences between sentence pairs.

Results: On Task 1, comparison group accuracy scores were significantly higher ($M = 13.58$, $SD = 1.82$) than those in the TBI group ($M = 12.60$, $SD = 1.86$); $t(106) = 2.75, p < .01, d = 0.53$. On Task 2, the comparison group showed significant context effects ($p < 0.001$ for all combinations of immediacy cues, corrected for multiple comparisons), and the TBI group did for all but one immediacy cue combination ($p = 0.052$, corrected for multiple comparisons).

Conclusion: Results provide preliminary evidence that adults with TBI may miss word- and sentence-level implicit social cognition cues, which could have social penalties.

Neuroendocrine disturbances years after traumatic brain injury and subarachnoid hemorrhage – Is there a reason for screening of hypopituitarism years after injury?

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: Brain damage caused by traumatic brain injury (TBI) or subarachnoid hemorrhage (SAH) might lead to hormonal disturbances.¹ Neuroendocrine disturbances in the acute phase are mostly adaptive reactions to critical illness. In the chronic phase, hypopituitarism might occur with a prevalence rate of about 27% in patients after TBI. Even higher rates have been reported for SAH. But less is known about the risk of hypopituitarism in patients even years after TBI or SAH. Is a screening for hypopituitarism necessary and meaningful even years after injury?

Methods: We present data from the Structured Data Assessment of Hypopituitarism after TBI and SAH Patients. N=13 centers in Germany and n=1 center in Austria participated in this observational cohort study. A total of 1242 patients after TBI and SAH were included into this data base. We selected a subgroup of 351 patients who suffered from TBI (n=245) or SAH (n=106) at least one year (range 1-55 years) before endocrine assessment. Basal hormonal values as cortisol, fT4, testosterone in men and estradiol in women and IGF-I were evaluated.

Results: The highest prevalence of neuroendocrine disturbances was observed 1 to 2 years after injury. It decreased over time only to show another maximum in the long-term phase in patients with brain injury occurring 5 or more years prior to assessment. Lowered sex hormones and lowered IGF-I values indicative of gonadotropic and somatotropic insufficiency were most common.

In the subgroup of patients 1 to 2 years post-injury (n=126), lowered testosterone values were the most common hormonal disturbances (19%). Lowered IGF-I values were documented in 11.5%, lowered cortisol values were present in 9.2% and lowered fT4 values in 3.3%.

In patients five or more years after brain injury (n=89), the prevalence of lowered IGF-I values indicative of somatotropic insufficiency increased up to 24.1%, while lowered cortisol values and lowered fT4 values became less frequent (2.5% or 0%, respectively).

Conclusions: Our data show that neuroendocrine disturbances are frequent even years after TBI and SAH in a cohort of patients who are still on medical treatment. Hormonal assessment is recommended in these patients even years after brain injury.

Clinical Practices Surrounding Friendship Following TBI

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – basic research
Author's preference: No preference

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Objectives: People with TBI report feeling rejected and less close to their friends. Despite this, there is little known about how Speech Pathologists (SPs) assist in maintaining and developing friendships. Therefore, the aim of this study was to gain foundational knowledge about the extent to which SPs assist with the development and maintenance of friendships.

Methods: Australian SPs who work with TBI were surveyed. The online survey included 37 items covering current practices, barriers to working with friends, SPs attitudes toward working on friendship and their perceptions surrounding why some friendships succeed post TBI. Both open and multiple choice questions were used. Descriptive statistics and content analysis were used for analysis.

Results: 68 SPs responded. 27/68 (39.71%) reported that they did work with friends. The main approach involved providing friends with education (23/27). Friends were more directly involved through inclusion in or observation of therapy. SPs' rationales for working with friends were to prevent psychosocial issues and for therapeutic benefit, such as providing functional contexts to work within. Overall, SP's believed that working on the area of friendship is within their scope of practice, particularly given the close relationship between adequate communication skills and the ability to maintain friendships. The major reasons SPs did not work with friends, was due to difficulty with access to friends and time constraints. The International Classification of Functioning (ICF) was used to demonstrate the vast factors that SPs identified as contributing to successful friendships. Severity of impairments, ability to participate in activities that were mutually enjoyed by the person with TBI and their friend, as well as personal factors associated with both the person with TBI and their friend were considered to affect the likely success of friendships post TBI.

Conclusions: While some SPs in this sample did include friends in a variety of tasks in rehabilitation programs for TBI, there remain barriers to maximising the inclusion of friends in TBI rehabilitation programs. Given the positive attitude that SPs had toward work surrounding friendship, as well as the acknowledgement of the benefits to working on friendship, there is potentially scope to build upon current practices of SPs, within the area of friendship.

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Evaluating the Acceptability and Feasibility of Problem Solving Therapy for Suicide Prevention Among Veterans with Moderate to Severe TBI

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: Increased attention within the field of traumatic brain injury (TBI) rehabilitation has focused on the benefits of interventions which are grounded in theory and are empirically-based. One type of intervention employed has been problem solving therapy (PST), which is focused on improving executive functioning of individuals with TBI through targeted problem solving techniques. In addition to the need for TBI interventions focused on problem solving deficits, current research has shown that individuals with TBI are at an increased risk for suicide following their injury. Moreover, literature suggests that PST has the ability to mitigate suicide risk along with decreasing depression and hopelessness in individuals without a history of TBI. The current project aimed to study the implementation (acceptability, feasibility) of a novel group intervention, PST for Suicide Prevention.

Methods: The manualized group psychotherapy which combines PST and Crisis Response Planning was provided over ten sessions to sixteen Veterans with moderate to severe TBI in eight small pilot groups. Participants completed the Client Satisfaction Questionnaire-8 (CSQ-8) and the Narrative Evaluation of Intervention Interview (NEII). Attendance was also documented.

Results: Feasibility was supported by high attendance. There were no study withdrawals. Thirteen Veterans (81.2%) attended at least half of the sessions, twelve (75%) attended at least 80% of sessions, and seven (43.8%) attended all ten sessions. Data also support the acceptability, with a mean CSQ-8 score of 27.8 out of 32 (n=13, SD 4.78, median 29, range 14-32). Quantitative results are supported by findings from the qualitative interviews (NEII).

Conclusions: Results from the trial support both the acceptability and feasibility of delivering the program to Veterans with moderate to severe TBI. Findings support a Phase II randomized controlled trial of this PST for Suicide Prevention.
Why do some friendships succeed following traumatic brain injury (TBI)?

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Background: People with TBI identify changes to friendship post TBI. Friendships appear to change in a number of ways. Both the amount that friends see one another post TBI, as well as the quality of the friendship can deteriorate, leading to social isolation. Despite this, there is little known about friendship following TBI from the perspective of friends who have maintained or developed friendships with someone post TBI. Therefore, the aim of this study was to develop a preliminary theory to explain why some friendships succeed post TBI.

Methods: Four participants with severe TBI that presented with communication impairments were asked to identify at least 1 friend. Nine friends were identified and interviewed using semi-structured interviews. Data was transcribed verbatim and analysed using a grounded theory methodology, including open, focused and theoretical coding. Member checking and memo writing was conducted to establish trustworthiness.

Results: A preliminary theory was developed: Actively placing self within the friendship. In this sample, friends appeared to simply find a place in the friendship through authentic commitment and engagement in the friendship. They were able to do this by finding out about the consequences of TBI and maintaining normality in the friendship. Friends identified consequences such as care, changes secondary to impairments and managing new life events. To find out about such consequences, the participants responded directly to changes, thought deeply about these changes and gained support from family. Friends maintained normality in the friendship by helping the person with TBI and acknowledging that this help was reciprocated by the person with TBI or their family. They also continued to engage with the person with TBI in ways that friends would usually, such as, socialising, sharing, providing advice and participating in activities of shared interest. Participants were able to use strategies to enable them to manage changes secondary to TBI, which therefore allowed them to maintain normality in the friendship. The contextual factors of the friendship, including duration, closeness, connectedness and the presence of a friendship group also appear to influence the success of friendship post TBI.

Conclusions: Some friendships are maintained or developed post TBI. This preliminary theory may provide insight into how these friendships are maintained or developed. It appears that some friends have an innate ability to develop ways to find a place in the friendship.

Reference: Tennille Thomasz, ttho7210@uni.sydney.edu.au
The Curious Case of Trephine Syndrome with Associated Partial Seizures in a Patient with Bicoronal Hemicraniectomies: A Case Report

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: A 54 year-old male with diffuse subarachnoid hemorrhage; bilateral cerebellar, frontal, and temporal hemorrhagic contusions; and a right subdural hemorrhage following a mechanical fall presented to an inpatient brain injury rehabilitation unit status post bicoronal hemicraniectomies. A few weeks into his rehabilitation admission, he was noted to have clinical worsening in which he was found to be less interactive, exhibited motor slowing, increased aggression, and new onset of bilateral low frequency hand tremor with brief periods of unresponsiveness while on divalproex sodium for mood lability. Physical exam revealed progressive sinking in of the skin above his bicoronal hemicraniectomy sites. Neurology was consulted, and he was clinically diagnosed with partial seizures. EEG was unsuccessfully performed as he did not tolerate lead placement. Infectious and metabolic work-ups were negative. Imaging showed stable intracranial pathology except for interval flattening and concavity of the brain contour with mass effect on the bilateral frontal lobes consistent with trephine syndrome. Lorazepam was used for acute seizure management, and divalproex sodium was increased for seizure prophylaxis.

Methods: The leading diagnosis for this patient was trephine syndrome. This diagnosis was consistent with his clinical presentation and imaging findings, and other causes for neurologic deterioration were excluded. Neurosurgery was informed, and a bilateral cranioplasty was scheduled at a sooner date than originally planned at the time of admission to the inpatient rehabilitation facility. The patient improved in all domains following cranioplasty and was able to return home. Trephine syndrome is a rare complication following decompressive hemicraniectomy, in which the skin above the craniectomy site sinks down and is believed to allow for the transmission of atmospheric pressure onto the brain. This atmospheric pressure is greater than the intracranial pressure and is hypothesized to cause decreased cerebral blood flow which can lead to symptoms such as motor and language deficits, headaches, mood disturbances, seizures, and paradoxical herniation, which if unrecognized could lead to coma and death. It typically occurs a few weeks to months following the procedure. In this particular case, it occurred two months following the bicoronal hemicraniectomies. The only definitive treatment for trephine syndrome is early cranioplasty with the symptoms typically reversing following cranioplasty, as illustrated with this patient.

Conclusions: Decompressive hemicraniectomies are a clinical scenario that is commonly encountered in traumatic brain injury. Trephine syndrome, subsequent seizures, and other neurologic complications can occur during the hospitalization course of these patients; and therefore, all practitioners who care for traumatic brain injury patients should be aware of this possible complication when caring for them.
Practical Aspects of Monitoring Sleep in Patients with Moderate to Severe Traumatic Brain Injury [TBI] on an Inpatient Rehabilitation Unit.

Objective: To determine the feasibility of monitoring sleep in the subacute period of recovery from moderate-to-severe traumatic brain injury (TBI) on an inpatient rehabilitation unit.

Methods: Ten participants admitted to an acute inpatient brain injury rehabilitation unit in post-traumatic amnesia [PTA] were enrolled in the study. Actigraphs [Respironics Actiwatch 2], which measure sleep efficiency [SE], were placed within 24 hours of admission to the rehabilitation unit. Additional data collected included the: Makley Sleep Scale [MSS], Orientation Log [OLOG], Toronto Test of Acute Recovery after TBI [TOTART], AM/PM Agitated Behavior Scale [ABS] scores, and level of restraint were obtained prospectively. Nursing staff recorded hourly sleep logs on participants [MSS] used the event marker on the actigraph to mark the beginning and ending of the designated sleep period. Data were collected for one week after clearance of PTA. Nightly SE was calculated from Actigraphic analysis with Respironics Inc: Actiware version 5.57. Actigraph SE data were analyzed for sleep period using one of three methods: autoscored [the device automatically scores beginning and ending of sleep period]; nursing designated sleep period [nursing staff pressed the actigraph event marker to signal the start and end of sleep period]; and a set sleep period of 2300 – 0700.

Results: Eight participants completed the study, producing 114 sleep observation periods. Median GCS on admission to the ED was 9 [range 6-13]. Participants entered the study at a median of 22 days post injury. Sixty-three percent had impaired SE on admission to the rehabilitation unit and 75% had impaired SE over the first three days of admission. The observed sleep ratings with the MSS were completed for 60% of the hourly observation periods. Actigraph ratings of SE were obtained for 96% of the studied nights within the set sleep period, and 92% within both the actigraph autoscoring algorithm and the individually adjusted procedure. The median SEs per day were: autoscore 79.8% [range 22.8%-96.6%]; set sleep period 82.0% [range 30.8%-99.9%]; and individually designated 80.0% [range 27.7%-95.6%]. The three actigraphy methods for calculating SE were significantly correlated with each other and with the longest number of observed contiguous hours of sleep on the MSS.

Conclusions: Disrupted sleep is highly prevalent on an inpatient TBI rehabilitation unit and can be difficult to objectively measure. Given the nursing demands on a unit with confused, medically acute patients, hourly sleep logs were impractical for fully measuring sleep. Actigraphy is a feasible and clinically useful technology to objectively monitor sleep following TBI in an inpatient rehabilitation setting.
Characterizing alcohol craving, mental health and cognitive outcomes among veterans with alcohol use disorder and co-occurring PTSD and mTBI.

Status: Accepted

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: To characterize alcohol craving among veterans with alcohol use disorder (AUD) only relative to those with co-occurring AUD and post-traumatic stress disorder (PTSD+AUD) as well as co-occurring mild traumatic brain injury, PTSD and AUD (mTBI+PTSD+AUD). Secondary outcomes including depression and anxiety symptoms as well as information processing speed were also characterized among these veterans.

Methods: This was a preliminary, pilot, prospective study. Veterans were assessed for AUD using the Alcohol Use Disorder Identification Test, Consumption questions and the Structured Clinical Interview for DSM-5 (SCID-5). Veterans were further classified using structured interviews for mTBI (Pape, under review) and PTSD (Clinician-Administered PTSD Scale). Veterans completed self-report questionnaires regarding mental health symptoms including the Beck Depression Inventory-II (BDI-II) and the Beck Anxiety Inventory (BAI) as well as alcohol craving including the Penn Alcohol Craving Scale (PACS). Neuropsychological assessments including the Wechsler Adult Intelligence Scale (WAIS-IV) Coding and Symbol Search subtests were completed in order to calculate Processing Speed Index (PSI).

Results: This pilot sample included 4 veterans classified as AUD only, one with PTSD+AUD and one with mTBI+PTSD+AUD. All veterans met DSM-5 criteria for severe AUD. The PACS scores for the veterans with co-occurring conditions were elevated (PTSD+AUD=11, AUD+mTBI+PTSD=14) relative to the AUD only average (8.5±7.0). BDI-II and BAI scores for the veterans with co-occurring conditions (PTSD+AUD BDI-II=19, BAI=12; mTBI+PTSD+AUD BDI-II=18, BAI=19) were also elevated relative to the AUD only average (BDI-II=12.5±4.9, BAI=6.3±9.0). The PSI for the PTSD+AUD veteran was 86 (95% confidence interval 79-96) indicating that this veteran performed better than approximately 18% of the general population. The PSI for the mTBI+PTSD+AUD veteran was 97 (95% confidence interval 89-106) indicating that this veteran performed better than approximately 42% of the general population.

Conclusions: These preliminary, pilot findings suggest that veterans with co-occurring PTSD+AUD or mTBI+PTSD+AUD may experience elevated alcohol craving, depression and anxiety symptoms relative to those with AUD only. The inclusion of additional participants with co-occurring conditions and comparisons with other neuropsychological assessments will provide insight about interpreting findings. Additional research on characterizing the relationships between addiction, mental health and cognitive outcomes will inform treatment needs.
Kimberly Ann Fisher's journey back to life alone.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Oral

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My objective is to return to as normal as a life possible. Did not wish to do this alone that is the way it worked out in my case. My methods are to some unrealistic, but my condition and fighting for my life, so to speak would also be unrealistic in today's world. In my case their are no neurologist or primary care physician, and so I have embarked on this journey alone. It has been about 3and 1/2 years since diagnosed with severe traumatic brain injury at Shands in Gainesville Florida, and was in a coma at least 3days. Then released to start my battle back to life, plagued with seizures made it all the more difficult for me, and loved ones. Tried their seizure medications and was having adverse side affects that to me were worse than the seizures in some cases. I have been home medicating, first with alcohol (vodka), relaxed my stiffened muscles but mood swings were intense. Then tried marijuana to help cope with my focusing and lack of appetite. Worked wonders for appetite and anger issues but not so much with stiff muscles and had very weird off the wall thoughts and sometimes voices. Will continue more if want to hear from me or help. Looking also for a doctor who likes a challenge and won't give up!
Quantitative Outcome Assessment of Motion Based Gaming for Brain Injury Rehabilitation

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Oral

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Objectives: Affecting almost 10 million people around the world annually, traumatic brain injury (TBI) will surpass many other diseases as a major cause of disability and death based on the World Health Organization prediction. The US Center for Disease Control and Prevention (CDC) recognizes that brain injuries (BI) are a major public health issue. Mild TBI (mTBI) also has been identified as a signature injury for veterans returning from recent combats. It is often challenging to motivate rehabilitating BI patients to engage in the repetitive exercises. Commercial motion based-gaming (MBG) have been used as an effective exercise motivators in other populations. Hence, the objective of the study was to implement MBG in combination of standard therapy in mTBI patients to evaluate the effect of MBG on physical activity level, postural stability, compared to standard therapy (Control) alone.

Methods: The study will randomize 40 mTBI patients into Control and MBG and groups. MBG group had an additional 30 min gaming session at the end of standard therapy twice a week for 4 weeks. mTBI patients with a Functional Independence Measure (FIM) score between 3 and 7 were recruited and categorized into High FIM (5 - 7) and Low FIM (3-4). The High FIM subjects played a Kinect Super Saver game while the Low FIM subjects played a Wii Table Tilt game. Baseline and follow up assessments included gait using GaitRite and physical activity and balance using wearable sensor technology (PAMSys, BalanSens BiosensicsR). Multiple Romberg's test were administered for balance in eyes open (EO) and eyes closed (EC) conditions.

Results: 12 patients have completed the study till date, of which 7 subjects with matched age, height, and FIM score (5 Controls and 2 MBG, 38±5 years, 170.8±5.2 cm, 89.1±11.8 kg, and 5, respectively) were selected for preliminary analysis. Compared to baseline, the center of mass (COM) sway area in the EC condition at week4 decreased by 47% and 23% (p>0.05) in Controls and MBG, respectively. Standing and walking times measured by PAMSys decreased in both Controls (-15% standing, -8% walking, n=5) and MBG (-7% standing, 0.01% walking, n=2).

Conclusions: Both Controls and MBG groups show positive trends in preliminary analysis of balance and physical activity improvement. The study is currently ongoing and additional subjects may help to determine if MBG has significant impact on rehabilitation of mTBI.
The Ability of Four Computerized Neurocognitive Assessment Tools to Distinguish Between Soldiers With and Without Mild Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: With over 300,000 diagnosed brain injuries in the U.S. military since 2000, there is a need for efficient assessment of cognitive functioning. Numerous computerized neurocognitive assessment tools (NCATs) are available for this purpose. Initial studies suggest these batteries are able to detect differences between healthy controls and individuals with mild traumatic brain injury (mTBI). However, as with traditional neuropsychological tests, performance on NCATs can be influenced by factors other than brain injury (e.g. age, education level, IQ, etc.). This study examined four NCATs in Service members from Fort Bragg with and without mTBI to determine the extent that mTBI contributes to group variance in NCAT scores.

Methods: Our sample included 272 healthy controls and 231 participants within seven days of mTBI. Two of four NCATs were randomly administered: ANAM-4, CNS Vital Signs (CNS-VS), CogState, and ImPACT. Participants flagged as putting forth suboptimal effort were omitted from analyses. Two primary analyses were completed: 1) Group equivalence across demographic variables (i.e., age, gender, race, marital status, education, IQ, head injury history, and military service characteristics) via contingency tables and t-tests; 2) Group comparisons via multiple regressions to determine the amount of variance group status (control versus mTBI) accounted for in NCAT scores, controlling for inequivalent demographic variables where indicated.

Results: Group equivalence analyses indicated the control and mTBI groups were statistically different for the majority of demographic variables (i.e., age, gender, education, rank, lifetime number of head injuries, and IQ). Comparisons based on group alone indicated statistically significant differences (p<0.05) for the following: all 7 ANAM-4 subtests and composite score, all 11 CNS-VS domain scores and composite score, 3 of 4 CogState subtests and composite score, and 3 of the 4 ImPACT domain scores. Multiple regressions for all four NCATs indicated demographic differences were significantly affecting the group comparisons. When controlling for demographics, IQ, and history of head injury variables, the proportion of variance uniquely accounted for by mTBI status (R² change) was generally statistically significant but had small effect sizes (f²<0.15).

Conclusions: A cursory look at the data may suggest NCATs have utility in distinguishing between healthy controls and individuals with mTBI. However, a large portion of the variance was accounted for by demographic variables. After controlling for demographics, sustaining a recent mTBI accounted for a statistically significant, albeit very small, portion of the variance. This suggests the clinical utility of these tests for identifying individuals with residuals of mTBI may be limited. Further, the four NCATs performed similarly across analyses, suggesting that no NCAT battery is superior to the others.
Cerebral Fat Emboli Syndrome: A Case Series of Neuroimaging Correlations and Clinical Rehabilitation Outcomes

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Cerebral Fat Emboli Syndrome [CFES] is a rare complication of multi-trauma injury and is often mistaken for traumatic brain injury [TBI] related diffuse axonal injury [DAI]. In this poster we will review the relevant literature and the clinical and neuroimaging findings associated with this condition.

Methods: A retrospective chart and neuroimaging review of a series of patients treated in a comprehensive designated Acquired Brain Injury rehabilitation program from 2009 - 2015. Included was an independent review of MRI imaging by a trained neuroradiologist to confirm the diagnosis of CFES. Representative MRI imaging will be presented. Outcome measures included Functional Independence Measure [FIM] and Glasgow Outcome Scale [GOS].

Results: Patients were admitted to the acute trauma center after poly-trauma accidents whether without a documented TBI or with mild to moderate TBI characterized by a GCS of 13-15. All subjects had associated orthopedic injuries including but not limited to long bone fractures. All patients had an acute decline in mentation after repair of their orthopedic injuries. All patients displayed significant discrepancies in their acute CT imaging and their post operative clinical presentation. Subsequent MR imaging showed diffusion and susceptibility weighted imaging findings that were consistent with a diagnosis of CFES which will be discussed.

Conclusions: In poly-trauma patients with the clinical history of an initial high GCS scores with subsequent acute decline in mental status following surgical repair of long bone fractures should raise suspicion for the diagnosis of CFES. Sensitive MRI techniques are useful in confirming the diagnosis and useful in differentiating from DAI pathology related to TBI. Clinicians should be careful not to prognosticate a poor outcome based on radiographic features of this syndrome as the patients in this series has a Moderate-Good recovery as measured by FIM and GOS.
Emotion Recognition of Older and Younger Adults with Traumatic Brain Injury

Status: Accepted  Presentation type: Oral
Category: Neurorehabilitation – case reports/clinical research
Author's preference: No preference

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Objectives: Traumatic brain injury (TBI) often affects emotion recognition. Emotion recognition data are largely from young and middle-aged adults, however, the TBI effects on emotion recognition in older adults are unknown. There is evidence that social cognition declines in normal aging, and the interaction of aging and TBI may put older adults at risk for significant impairments. The objective of this preliminary analysis was to compare facial emotion recognition of younger and older adults with and without TBI.

Methods: Participants were six older adults (≥65 years) and six younger adults (≤30 years) with mild-complicated-to-severe TBI and a comparison group (CG) of twelve sex-, age-, and education-matched peers without TBI. Participants completed the Emotion Recognition Task (ERT; Frigerio, Burt, Montagne, Murray, & Perrett, 2002) for which they viewed morphed video clips of facial expressions at varying emotional intensities (40%, 60%, 80%, 100%) then selected an appropriate emotion label: happy, angry, disgusted, sad, surprised, and fearful. The outcome variable for each intensity condition was the number of correct labels selected (max = 24). We hypothesized that older and younger adults with TBI would score lower than age-matched peers and older adults with TBI would score worse than younger adults with TBI.

Results: Kruskal-Wallis H Tests indicated that groups' distributions of ERT scores differed in the 40% (X²(3) = 11.55, p = 0.01) and 100% (X²(3) = 8.65, p = 0.03) conditions and were similar in the 60% (X²(3) = 7.05, p = 0.07) and 80% (X²(3) = 4.74, p = 0.19) conditions. Post-hoc Mann-Whitney U tests were conducted to further examine group differences in the 40% and 100% conditions. A liberal 0.05 alpha criterion was set given the study's exploratory nature. In the 40% condition, the TBI Old group scored significantly lower than the TBI Young (U=5.00, p = 0.04) and CG Young (U = 4.00, p = 0.02) groups, but similarly to the CG Old group (U = 7.00, p = 0.09). The two younger groups scored similarly in the 40% condition (U=13, p = 0.49). In the 100% condition the TBI Old group scored significantly lower than the CG Old (U=4.00, p= 0.03) and CG Young (U=2.00, p = 0.01) groups. The TBI groups did not significantly differ in the 100% condition (U=8.00, p = 0.13), nor did the TBI Young and CG Young groups (U=10.5, p = 0.24).

Conclusions: Results provide preliminary evidence that older adults with TBI may have impairments in recognizing subtle affect displays compared to younger adults with and without TBI. They may also be less accurate than their uninjured peers in the recognition of overt facial emotions. These findings support further investigation of social cognition in old adults with TBI.
Avoiding Pain: Compromised Pain Processing after Combat Trauma

Status: Accepted  Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: Combat trauma often results in mild traumatic brain injury (MTBI) and posttraumatic stress disorder (PTSD), both of which increase vulnerability for the development of pain-related conditions. We have recently shown that women with PTSD and MTBI due to intimate partner violence show dysregulated functional brain activity during experimental pain processing that was explained by the avoidant symptoms in these women. The aim of this study was to examine whether similar brain behavior is observed in men who sustained MTBI during combat.

Methods: Seventy male Veterans performed validated experimental pain paradigm that was administered twice during simultaneous acquisition of functional magnetic resonance imaging (fMRI). 46/70 subjects reported history of MTBI during combat and 26/46 also met criteria for PTSD. The three groups did not differ in age and/or education level. Brief thermal heat stimuli were repeatedly applied to the left volar forearm. Change in brain activity to repeated application of temperature stimuli was examined with the linear mixed effects model with group (-MTBI/-PTSD, +MTBI/-PTSD, +MTBI/+PTSD) and administration (time1, time2), entered as fixed factors and subjects entered as a random factor.

Results: Significant group by time interaction to repeated administration of thermal pain was observed within bilateral anterior insulas and right posterior insula and several frontal and parietal regions. Post-hoc examination of the interaction showed that within all of these regions control participants (-MTBI/-PTSD) showed increased activation over time, while trauma groups behaved differently. Within bilateral anterior insulas, both trauma groups showed decreased activation over time and this decrease was significantly different from controls but not between the two trauma groups. Importantly, decrease in the right anterior insula activation over time was significantly predicted by avoidance symptoms in both trauma groups in that those with highest avoidance symptoms also showed highest decrease within right anterior insula activation over time.

Conclusions: The current study provides evidence for the hypothesis that combat trauma interferes with normal processing of acute pain whereby repeated exposure to even brief painful stimuli results in attenuation of insula activation over time that significantly relates to avoidance symptoms. This behavior seems to be trauma and gender, as well as task independent suggesting a generalized mechanism of maladaptive pain response following traumatic experiences.
Work-Related Mild Traumatic Brain Injury: Profiling Injured Workers in Ontario, Canada

Status: Accepted Presentation type: Oral

Category: Neurotrauma – prevention and public health

Author's preference: No preference

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Objectives: To profile the demographic and injury characteristics of workers with mild traumatic brain injury (wrTBI). Further, through a descriptive analysis of self-reported data, we aimed to understand whether workers perceived their injuries to be preventable, and whether they considered their job and health and safety training adequate for their occupation.

Methods: We prospectively collected data in this cross-sectional study. Participants (n = 47) were recruited from an outpatient clinic at a large, urban teaching hospital in Ontario, Canada, to which they were referred for persisting symptoms related to brain injury. Participants completed an in-depth questionnaire designed to understand the nature and causes of wrTBI. The questionnaire also asked participants to report on the perceived adequacy of job and health and safety training and injury preventability.

Results: In our sample, 53.3% of study participants were male. On average, participants were 13.1 months post-injury (SD = 14.4) at the time of recruitment. Nearly half of all participants (48.8%) were over 50 years of age, with an age range of 20-64 years; most participants were 55-59 years of age at the time of injury. The majority of participants (86.7%) identified as being White/Caucasian, with the remaining participants self-identifying as Black, Asian, European, or Aboriginal. With respect to education, 20.1% of participants either completed some or all of a high school degree, while (64.4%) completed some or all of a university/college degree. Further, mechanism of injury was distributed as follows: falls (34.8%), struck by/against object (39.1%), assault (15.2%), and other (10.9%). The education industry constituted the largest number of wrTBI (25.0%), followed by the manufacturing/warehousing (20.5%), retail (13.6%), and healthcare industries (11.4%). Injuries most often occurred in the winter (32.6%) and during the afternoon (30.9%). On average, participants were employed for 153.9 months (SD = 132.4) at the time of injury, and 48.9% reported working more than 40 hours in the week prior to their injury. Further, 84.4% and 68.9% of participants reported receiving job and health and safety training, respectively. The majority of participants (91.7%) considered their injuries to be preventable. Additionally, 77.3% and 77.8% of participants indicated that they were told to take time-off after their injury and rest after their injury, respectively, while half reported that they were informed about the risks of re-injury.

Conclusions: We report that most injured workers believe their injuries to be preventable. A considerable minority of study participants did not receive job or health and safety training or instruction to take time-off or rest after their injury. Ensuring all employees are adequately trained prior to entering the workforce may reduce rates of injury, while providing concussion management education to workers and employees may reduce rates of re-injury by ensuring the initial injury is managed appropriately.
Sex differences in work-related traumatic brain injury due to assault

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: Poster

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Objectives: To examine the extent of work-related traumatic brain injury due to assault in Ontario, Canada over the course of one year.

Methods: Cross-sectional study using data abstracted from the Ontario Workplace Safety and Insurance Board claims files. Descriptive analyses were conducted to determine the distribution of worker/employment/incident characteristics.

Results: The study identified 66 claims with brain injury due to assault. Work-related traumatic brain injury (TBI) due to assault was more common among women, primarily in the health care/social service sector. Most of the injuries were classified as consumer/client-related assault. Forty five percent of injuries occurred among workers with less than 3 years of employment.

Conclusions: This research described profiles of male and female workers and workplaces for targeted preventive efforts. Sex appeared implicated in patterns of victimization at the workplace causing TBI by various mechanisms. Future studies are needed to further address risk factors by sex and outcomes such as length of disability and health care cost.
Mild traumatic brain injury in the workplace: Exploring the vulnerabilities of workers

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: Our objective was to explore perceived worker vulnerabilities to work-related brain injury.

Methods: Qualitative study using semi-structured interviews. Participants were recruited through a neurological clinic at a large urban rehabilitation hospital in Ontario, Canada. Twenty-three workers (women=12, men=11) 35-64 years of age participated, representing various industries including home care, education, construction and transportation. They were referred to the clinic for mild work-related traumatic brain injury. All participated in either a telephone or face-to-face interview to explore their perspectives of the nature and cause of work-related brain injuries.

Results: The findings identify factors of vulnerability, which were causally linked to the occurrence of work-related brain injuries. These consisted of: insufficient training (not receiving job- or health and safety-specific training and/or a change in work task without the provision of training); privileging the safety of the service user over the service provider; inattention to the conditions of the physical environment of the workplace; insufficient staffing at worksite to prevent workplace injury; and fear of reprisals for demanding better working conditions (e.g. immigrant workers).

Conclusions: Our analysis of the experiences of work-related injury across various industries underscores significant vulnerabilities of workers and a direct link between such vulnerabilities and workplace brain injuries. Our findings suggest that implementing better training, addressing unsafe aspects of the physical environment, and improvements in the enforcement of safe working conditions and fair treatment for immigrant workers will be pertinent in mitigating traumatic brain injuries in the workplace and in promoting a culture of health and safety at work.
Cerebroprotective Effect of PAR1 Antagonist Intransient Brain Ischemic Insult in Hypercholesterolemic Rats

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Protease activated receptors (PARs) are upregulated in in ischemic rat brain. Human can be subject to global cerebral ischemia as in open heart surgery, cardiac transplantation and shock. We investigated whether blocking PAR1 receptors induce a cerebroprotective effect in rats subjected to global cerebral ischemia reperfusion injury (I/R).

Methods: Adult male Wistar rats were fed high cholesterol diet (8 weeks) and then subjected to global cerebral ischemia for 20 min using two-vessel occlusion model. PAR1 antagonist SCH9797 was given 15 min before ischemia and immediately after reperfusion (25 ug/kg). Brain edema, histological examination were performed to assess neuronal injury and neuronal protection by SCH. The oxidative and antioxidant status were assessed by measuring malondialdehyde (MDA) and glutathione (GSH), respectively. Brain sections were immunostained with p53 and BCL2.

Results: A significant increase in brain water and appearance of pyknotic cells in the hippocampal CA1 area in ischemic animals were detected. Higher levels of MDA and lower levels of GSH in ischemic brains were reported. Brain tissue showed marked expression of p53 but not BCL2 in ischemic brains. SCH administration reduced brain edema, preserved CA1 viability and reversed the oxidative statusBCL2 was markedly expressed in brain parenchyma and blood vessels.

Conclusions: SCH can be promising in global brain I/R injury possibly due to its anti-oxidant and anti-apoptotic effect.
Socioeconomic Status: A Confounder for Concussion Incidence and Recovery Outcomes in Adolescent Athletes?

Status: Accepted  Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Background: The goal in providing a comprehensive assessment and management paradigm for concussed athletes requires understanding the factors that may put the athlete at risk and increase the likelihood of poor outcomes. Pre-injury environment may: predispose athletes to deficits on neuropsychological tests; result in variations in injury reporting and prolong recovery following concussion. Clinicians need a thorough understanding of concussion management strategies and recovery outcomes in various socioeconomic populations.

Objectives: Identify the incidence and recovery of concussive injuries in high and low socioeconomic (SES) interscholastic athletes. Determine the effect of SES on neuropsychological test scores. Study Design: Prospective between-groups cohort design.

Methods: High school athletes (N= 596) were administered a computerized neuropsychological test battery (ImPACT®) during baseline assessments. Participants were divided into groups based upon SES (high n= 292 and low n= 304). Participants were tracked throughout the season to determine concussion occurrence (high n= 30 and low n= 28) and time loss following injury to establish recovery curves. ImPACT® composite scores and time loss served as dependent variables. Comparisons of groups were calculated using a One-Way ANOVA. All statistical analyses were conducted utilizing SPSS 21.0. Significance levels were set a priori at 0.05.

Results: 10.0% of the high SES group sustained a concussion while 9.2% of low SES group sustained a concussion. Statistically significant differences existed between SES groups on composite verbal memory (F=8.28, p=0.006), composite visual memory (F=23.13, p>0.001), and composite visual motor speed (F=25.27, p>0.001). Those athletes in the higher SES group performed better than the low SES group. A statistically significant difference existed for time loss (F=19.36, p>0.001), with athletes in the lower SES group returning to participation before the high SES group.

Conclusions: We found an incidence rate of high and low SES at 10% and 9.2% respectively. While the low SES group had statistically significantly lower neuropsychological test scores post-injury on composite verbal memory, composite visual memory and composite visual motor speed, this group was able to return to full participation on average 7 days sooner than their high SES counterparts. Various explanations can be provided for poorer test performance and a quicker return to play, however findings may be mediated by SES. This study is one of the first to examine SES as a modifying agent for concussion recovery outcomes. These findings support low SES environments provide a unique clinical population with decreased medical, administrative and familial support that can hinder management and recovery outcomes. Future research should be conducted to understand the mechanism of SES in concussion assessment and develop novel clinical paradigms for adolescent athletes in varying socioeconomic populations. CIRP at Nationwide Children's Hospital supported this study through Grant Number 1R49 CE002106 from the Centers for Disease Control and Prevention.
The Pittsburgh sleep quality index as a screening tool for sleep dysfunction with emphasis on application in the traumatic brain injury: a systematic review and meta-analysis

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Objectives: To synthesize evidence to appraise the process of development and measurement properties of the Pittsburgh sleep quality index (PSQI), gauging it's potential as a screening tool for sleep dysfunction in the non-clinical and clinical populations in general, and in the chronic TBI population in particular; to compare non-clinical and clinical populations in terms of PSQI global score.

Methods: A search of MEDLINE, EMBASE, PsycINFO, and HAPI databases was conducted. Critical appraisal of the measurement properties of the PSQI was performed using the COnsensus-based Standards for the selection of health Measurement INstrument.

Results: Relevant information was provided by 35 studies. Of these, 27 examined construct validity, 14 - known-group validity, eight - internal consistency, and three - test-retest reliability. Study quality ranged from poor to excellent, with the majority designated fair. Internal consistency was good (Cronbach's alpha, 0.63-0.80). Discrepancies were observed in results of factor analytic studies. In non-clinical and clinical samples with known differences in sleep quality, the PSQI global scores differed significantly.

Conclusions: The best evidence synthesis for the PSQI showed strong reliability and validity, and moderate structural validity in a variety of samples, suggesting the tool fulfills its intended utility. In a sub-acute TBI sample the rate of agreement of the PSQI with the DSM-IV diagnosis of insomnia was 94%, with a sensitivity of 100% and a specificity of 96%. Community-based TBI respondents were found to have significantly poorer sleep quality compared with sex-matched controls, after adjustment for anxiety and depression.
Identifying patterns of clinically meaningful recovery of NBF in persons in states of disordered consciousness due to TBI

Status: Accepted
Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Few studies have described the recovery trajectory of neurobehavioral function (NBF) in patients following severe traumatic brain injury (TBI). In part, this work has been limited by the lack of indices of meaningful change for NBF assessments. The DOCS-25 is a reliable and valid tool for evaluating NBF in patients in states of disordered consciousness. Recent literature indicates that a 6-unit DOCS change represents a clinically meaningful change in function. The purpose of this study is to describe the recovery trajectory in patients receiving standard post-acute care (PAC) rehabilitation during the first 6-weeks after admission to PAC.

Methods: Participants included 87 patients with in states of disordered consciousness evaluated using the DOCS in the first 3 weeks of PAC. Of these, 34 were evaluated in the first 6 weeks of PAC.

Analysis: DOCS measures were calculated using the Many-Faceted Rasch Model (MFRM) to account for differences in rater severity across assessments. Change in DOCS measures were calculated for each week, from baseline to week 3, and from baseline to week 6. Patients were categorized as: a) declined more than 1 Minimally Clinically Important Difference (MCID); b) did not change; or c) improved more than 1 MCID.

Results: Average DOCS measures at each week show little change over time (Week 1, 49.1; Week 2, 47.8; Week 3, 49.8). Specific trajectories were identified. Specifically, 26 (29.9%) of patients declined more than 1 MCID during the first 3 weeks, 39 (44.8%) were unchanged; and 22 (25.3%) improved more than 1 MCID. Within patients showing decline at 3 weeks, 7 meaningfully declined in the first week and then did not change, 6 meaningfully declined in the 2nd week, 4 declined in the first week but then improved in the 2nd week, 4 improved in the first week but declined in the second. Similar personalized trajectories were identified for patients who improved and for patients for whom 6 weeks of data were available.

Conclusions: Average measures of NBF over time can mask specific differences in recovery trajectories. This is the first study to describe these trajectories based on empirically established MCIDs in patients with disorders of consciousness during post-acute care. Advanced medical care saves and sustains the lives of persons incurring severe TBI and there is a growing body of evidence indicating that this devastating injury is modifiable. Standard neurorehabilitation for persons in states of seriously impaired consciousness involves the provision of sensory stimulation and off-label pharmacological interventions. However, there are few treatments that have been demonstrated to induce or accelerate functional and adaptive recovery for survivors of severe TBI. Describing change in NBF that is beyond empirically established MCIDs is an important step in advancing treatment for patients with severe TBI.
Neural connectivity data in general and traumatic brain injury (TBI) data in particular are commonly analyzed by t-tests or ANOVA approach. These statistical approaches do not, however, address various types of correlations such as spatial, temporal or multiple comparisons to analyze complex neural connectivity data. As a result, the overall type 1 error rate or false positives in the process is inflated. The Bonferroni corrections for multiple comparisons make the inference process conservative, and hence many significant findings remain undetected. Mixed-effects models can be used for multimodal (e.g. fMRI, DTI) neural connectivity data addressing the above mentioned correlations. Parameters of such models are used to compare multiple groups (e.g. vegetative state, minimally conscious state) at different connectivity levels. Benjamini Hochberg approach can be used to control the false discovery rate in multiple comparisons because it orders all p values and selects only a portion of significant comparisons at the desired level. In addition, we will examine the efficiency of machine learning approaches such as Support Vector Machines and Random Forest to successfully discriminate multiple groups based on neurobiological marker identified by mixed-effects analysis. Using Severe TBI and Mild TBI data sets, the advantages and limitations of these methods will be illustrated by providing different sets of results according to the methods used. Data interpretation, limitations, biases and errors related to each set of results will be discussed.
Circulating Vascular Adhesion Protein-1 and Syndecan-1 are Elevated after TBI in Relation to Sympathetic Hyperactivity

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: Vascular endothelial disruption plays a central role in both primary and secondary injury mechanisms after traumatic brain injury (TBI). This study aimed to investigate the relationship between the soluble endothelial-derived glycoproteins, syndecan (SDC)-1 and vascular adhesion protein (VAP)-1, in relation sympathetic nervous system activation and 6-month neurological outcome after moderate-to-severe TBI.

Methods: Peripheral blood was drawn from 80 TBI patients on hospital admission and 24-h post-injury; matching control samples were collected from healthy consented volunteers (n=15). Mean (±SEM) plasma concentrations of endothelial markers (SDC-1, VAP-1) and catecholamines (Epi, NE) were quantified using commercially available competitive immunoassays according to the manufactures’ instructions. Mortality and neurological outcome were assessed using the extended Glasgow Outcome Scale.

Results: On hospital admission, TBI patients showed significantly (p<0.05) higher levels (ng/ml) of both SDC-1 (85.7±8.4) and VAP-1 (367.2±12.6) molecules compared to healthy values (23.4±3.1 and 211.2±18.8, respectively), which remained elevated 24 h post-injury. High admission levels of both Epi and NE were correlated with increased SDC-1 (r=0.48, p<0.001 and r=0.60, p<0.001, respectively) and VAP-1 (r=0.48, p<0.001 and r=0.42, p<0.01), respectively). In addition, elevated levels of both SCD-1 and VAP-1 were associated with unfavorable 6-month neurological outcome and mortality.

Conclusions: The acute period following moderate-to-severe TBI is characterized by alterations of circulating endothelial-derived SDC-1 and VAP-1 reflecting vascular injury/activation. These markers are associated with poor outcome at 6-months, and appear to be mediated by enhanced sympathetic activation immediately after injury.
0636

**Muscle Activation Assessment During Robotic Exoskeleton Gait Training for Inpatient Stroke Rehabilitation**

Status: Accepted  Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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**Objectives:** The aim of this study is to objectively quantify bilateral muscle activation patterns in individuals with acute stroke during a single session of inpatient robotic exoskeleton (RE) gait training.

**Methods:** Five participants with acute stroke and unilateral hemiparesis were recruited for RE gait training during inpatient rehabilitation in conjunction with traditional therapy. Data was collected during a single gait training session while participants ambulated with and without the RE over level surfaces with the assistance of a physical therapist. Mean iEMG, EMG amplitudes, and temporal activation of six lower extremity muscles (tibialis anterior [TA], gastrocnemius, soleus, rectus femoris, vastus lateralis and biceps femoris) were measured and compared within subjects with and without the RE. All EMG data was normalized to 100% for standardization during analysis.

**Results:** Temporal activation patterns revealed muscle activation on the affected and unaffected limb with and without the RE for all the collected muscles. Temporal activation patterns varied during each phase of gait throughout the gait cycle. For the TA, a crucial muscle for foot lift during gait, demonstrated no significant differences during IDS, SS, and TDS on the affected side when comparing with and without the RE, but showed a significant difference during swing (p=0.005). There was no significant differences between the affected and unaffected limbs with the RE (p≥0.05). Without the RE, there was no significant differences in EMG activation during TDS and SW, conversely there was a significant difference in IDS, and SS when comparing the affected and unaffected limbs (IDS: p=0.026, SS: p=0.045, TDS: p=0.061, SW: p=0.099) respectively. There was no significant differences in TA EMG with and without the RE for the unaffected limb (p≥0.05).

**Conclusions:** This exploratory investigation demonstrated that with the RE there was active muscle contraction for all the collected muscles during walking over level ground. During gait training the presence of EMG activation is important because it may be an indication that hemiplegic side of the body is actively working during treatment and not just moving along the robot trajectory. With the RE the TA muscle on the hemiplegic side demonstrated a phasic pattern with appropriate temporal activation. This TA activation is a confirmation that RE did not interfere with the gait pattern on the unaffected limb and was able to facilitate affected TA muscle activation that more closely represented the unaffected limb. Further research in robotic exoskeletons for acute stroke should evaluate changes in neuromuscular recovery and activation as compared to traditional gait training during inpatient rehabilitation.
An innovative approach to co-develop home-monitoring technologies with persons having sustained a traumatic brain injury: a pilot study

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Objectives: Individuals with severe traumatic brain injury (TBI) are expected to live an average of 50 years with the consequences of their injuries, including loss of independence in everyday activities. This loss of independence leads to an important daily need of assistance and supervision. An innovative Canadian project started in 2013 created an alternative housing resource to maximize the social participation of TBI residents with various home-monitoring technologies. This project was framed in the context of a living laboratory in which all stakeholders (patients with TBI, caregivers, clinicians, researchers) take an active part in all steps of the community-based project. However, specific guidelines as to how to efficiently involve residents with TBI in the process were lacking. Therefore, the objective of this study was to put forth an innovative approach for the co-development of home-monitoring technologies with persons suffering from severe TBI and test its feasibility.

Methods: An innovative research approach based on best practices in technology development (e.g. user-centered design) and participatory action research was tested with 3 residents with severe TBI.

Results: An innovative model to co-develop technology with persons suffering from TBI in a living lab was organized around three main themes: needs analyses, iterative conception of technology, and exploration of the effectiveness of the technology. In this paper, only results from the two first themes are presented. The three residents participated in sessions aimed at identifying their specific needs of assistance during meal preparation. They also participated in technological conception sessions and gave an iterative feedback on the way this assistance was presented to support meal preparation. Participants had varying levels of awareness of their needs and expectations regarding their participation in the research process. One participant was very eager to participate and showed increased awareness of his everyday difficulties throughout the sessions. Two other participants considered that they did not need assistance and one of them first refused to participate in the needs assessment sessions. However, when they were approached as research partners, they were happy to participate “to help others” and gave very valuable information to improve the technological assistant.

Conclusion: Home-monitoring technologies in TBI should be co-developed according to best practices and based on an active participation of all stakeholders, including persons with TBI. The present study introduced an innovative and promising approach that will be further tested in the following years as an effective model for home-monitoring development in TBI.
The Utility of an Oculomotor Screening Battery in Baseline and Post-Concussion Testing

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: Current sport concussion practices frequently include the use of symptom reports and neuropsychological (NP) testing. However, these measures may not capture the full range of impairments and functional complaints associated with concussions. As such, the value of additional objective measures is being investigated, including vision assessments. The purpose of this study was two-fold: (1) To identify potential differences in vision abilities between healthy and concussed athletes, and (2) To compare the recovery trajectory of vision abilities to those of cognitive function and physical symptom reports.

Methods: A cohort of healthy collegiate athletes (CTL, n = 284) completed an oculomotor screening battery prior to the start of their athletic season as part of a standardized baseline concussion assessment, which also included the Automated Neuropsychological Assessment Metrics (ANAM), and the Sport Concussion Assessment Tool 3 (SCAT-3). Fifteen athletes sustained concussions and completed the testing protocol at the following time points: i) within the first five days following injury, ii) bi-weekly until return-to-play (RTP), iii) at the time of RTP, and iv) one month following RTP. Post-concussion scores for each time point were compared to the concussed athletes’ own baseline scores, as well as the CTL group’s averages.

Results: Post-concussion symptom scores were significantly higher at the first post-concussion assessment when compared to CTL scores (P < 0.0001), but not when compared to the concussed athletes’ own baselines. Impairments in ANAM performance were seen in the first week following concussion (P = 0.002) when concussed athletes’ scores were compared to their own baseline scores (pre-injury scores). Both ANAM impairments and elevated symptom scores resolved prior to medical clearance. Group-level analyses of post-concussion vision test scores compared to CTL scores revealed differences on tests of near point of convergence (NPC) (P < 0.0001) and binocular accommodative facility (BAF) (P = 0.018). Both of these impairments resolved prior to time of medical clearance. When concussed athletes’ scores were compared to their baseline scores, impairments were observed in right eye acuity (P = 0.016) and NPC (P = 0.034), with these differences also resolving prior to medical clearance.

Conclusions: The test of near point of convergence is an easy-to-administer vision assessment that appears to be sensitive to impairment following concussion. The results of this study provide support for the ability of vision tests to identify dysfunction following concussion.
Effects of Hyperbaric Oxygen on Symptoms and Quality of Life among U.S. Military Service Members with Persistent Post-Concussion Symptoms: A Randomized, Double-Blind, Sham-Controlled Trial

Status: Accepted Presentation type: Oral
Category: Neurotrauma – case reports/clinical research
Author’s preference: Oral

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Objectives: Due to innovations in body armor and advances in trauma medicine, military personnel serving in Iraq and Afghanistan are surviving injuries that in previous conflicts would have been fatal. Among the injuries being sustained by current service members, traumatic brain injury (TBI) has become recognized as a “signature” wound. Individuals who sustain mTBI may experience a range of post-concussive symptoms (PCS), including headaches, dizziness, fatigue, problems concentrating and remembering, irritability, difficulties managing stress, and sensory deficits. While for most individuals, these symptoms resolve within three months post-injury, a subset of service members continue to endorse PCS long after the injury event. Treatments targeting multiple PC symptoms are limited. Based on previous work for neurologic conditions, interest emerged in hyperbaric oxygen (HBO) as a treatment for chronic PCS. However, the efficacy of HBO as a supplemental treatment for PCS has not been rigorously evaluated.

Methods: This was a multicenter double-blind randomized trial of 72 active duty U.S. Service Members with persistent symptoms at least four months after deployment-related mild traumatic brain injury. Participants, all of whom were all receiving routine care for PCS were randomized to either 40 HBO sessions administered at 1.5 atmospheres absolute (ATA), 40 sham sessions of room air at 1.2 ATA, or no supplemental chamber sessions. The primary outcome measure was the Rivermead Post-Concussion Symptoms Questionnaire. Secondary measures included other patient reported outcomes (i.e., the SF-36 and the PTSD Checklist [PCL]) and the Automated Neuropsychological Assessment Metrics (ANAM).

Results: The chamber sessions were well tolerated. Compared to the routine mTBI care group, both groups undergoing chamber procedures showed improvement in symptoms on the RPQ (mean change score, 5.4; 95% CI, -0.5 to 11.3; p = .008 in the HBO group and 7.0; 95% CI, 1.0 to 12.9; p = .02 in the sham group). No difference between the HBO and sham group were observed on the RPQ (p = .70) or on secondary outcomes of PTSD symptoms, depression, anxiety, sleep, health related quality of life or neurocognitive testing.

Conclusions: Data showed there were no additional short-term benefits to the participants who received hyperbaric oxygen compared to those who received pressured oxygen. Both intervention groups showed improvements in some symptoms compared to those who received routine care alone. Improvements were most likely due to participant expectations coupled with intensive involvement with the research team as part of the chamber procedures.
Cognitive Reserve and Cognitive Leisure Differentially Protect Against Cognitive Decline in TBI

Objectives: The theory of cognitive reserve (CR) has been shown to explain the inconsistency between pathological damage and clinical expression of disease/injury in various clinical populations, including Alzheimer’s disease, multiple sclerosis, and, more recently, traumatic brain injury (TBI). Preliminary TBI studies have begun to establish that CR attenuates the negative impact of injury on cognition. However, these studies have varied in their selection of CR proxy and cognitive outcome variables, making synthesis of findings challenging. The goals of the current study were to: 1) evaluate whether CR moderates the relationship between neuropathology and cognitive status; 2) explore how CR as a moderator changes with changing selection of variable components of the CR equation (CR, biomarker for neuropathology, cognitive performance).

Methods: Subjects included 30 individuals with moderate to severe TBI (24 males, 40.5±13.8 years old; 9.1±7.2 years since injury). Individuals completed a comprehensive neuropsychological battery, from which two proxies of CR were obtained: cognitive leisure and a composite of educationally-based variables. Subjects also underwent structural imaging; diffusion tensor imaging values were derived for major white matter tracts. Stepwise multiple regressions were performed for verbal and visual memory, executive function, attention, and processing speed. In each regression, neuropathology was entered into step one, CR into step two, and the neuropathology by CR interaction in step three. Various DTI metrics for different white matter structures, and both proxies of CR, were evaluated. Interaction terms of the resulting regressions were evaluated for significance. Corrections for multiple comparisons were not made given the focus of identifying overall patterns of significance across the data.

Results: CR moderated the relationship between neuropathology and cognitive status. However, this finding was dependent upon the specific combination of CR, neuropathology and outcome variables utilized. In general, a distinct pattern of protection emerged for educationally-based CR versus cognitive leisure. Whereas educationally-based CR protected against decline in verbal and visual learning and memory, cognitive leisure protected processing speed. The CR composite protected specific structures (e.g., fornix, thalamus, sagittal stratum, hippocampus), whereas other white matter structures were specifically protected by cognitive leisure (corpus callosum, internal capsule, cingulate, uncinate fasciculus). However, these overall patterns shifted when utilizing different DTI metrics (i.e., fractional anisotropy vs. axial diffusivity). Interestingly, in some cases, a distinct laterality pattern emerged.

Conclusions. Findings demonstrated preliminary support for the moderating relationship of CR between neuropathology and cognitive function in TBI. A differential protective effect by educationally-based cognitive reserve and cognitive leisure suggests that cognitive leisure is not dependent upon intellectual enrichment acquired during development and offers hope for targeted areas of cognitive rehabilitation treatment. The observation of differential protection of specific white matter tracts will be discussed. Future research is needed to confirm study findings with larger samples.
Management and outcome of TBI patients in the State University Hospital of Haiti during a 2 years period Gerald Jonace, Marc-Felix Civil, Josephe Archie Honorat, Bernard Pierre Faculty of Medicine and Pharmacy, State University of Haiti (Universite d’Etat d’Haiti)

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author’s preference: Oral

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Objectives: Traumatic brain injury is one of the leading causes of death and disability worldwide. In developing countries, the mortality rate is even higher due to non-availability of material and human resources. In this study, we investigated the effects of lack of appropriate resources for the management of TBI patients on their outcome.

Methods: Across-sectional and retrospective study was realized in a single institution: State University Hospital of Haiti. We reviewed the charts of TBI patients from the department of surgery between January 2013 and December 2014. The relationship between death rate and availability of resources for standard care was assessed.

Results: The patients were divided into two groups according to availability of appropriate resources for standard management. Group I comprises the patients who received standard care; Group II was made of patients who did not. 8 patients out of a total of 43 constituted the group I. 75% of them were discharged from the hospital, 25% died. From the 35 patients of the group II, 91 % of them died; only 9% were discharged from the hospital. The difference was highly significant according to Chi-square statistic (= 17.365 superior to the critical value of chi2 =3.8 for α=0.05). The most common cause of injury was motor vehicle accident (70%). 81% were male and the majority of the patients were between 20 and 40 years old.

Conclusions: The availability of resources significantly reduced the risk of mortality in TBI patients at the State University Hospital in Haiti. A politic to reinforce the hospitals by supplying them with appropriate materials and trained personals will have a positive impact on the outcome of the patients with TBI.
A Complex Dynamical Systems Approach to Analysis of Conversational Discourse in Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: No preference

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Objectives: A hallmark of traumatic brain injury (TBI) is impaired social communication, defined as the “social, cognitive, and language skills necessary for contextually appropriate, meaningful, and effective interpersonal communication” [1]. Impairments in social communication are most evident in conversation, and contribute to social isolation, unemployment, and decreased life satisfaction. Given the potential impact of these impairments, it is essential to accurately analyze them in order to identify the most appropriate targets for intervention.

Unfortunately, traditional methods used to analyze discourse in conversation suffer from two major limitations. First, they focus exclusively on the individual with TBI. Second, they aggregate communication behaviors over time. As a result, these methods oversimplify the complex, interactive, and time-dependent nature of conversation and discard valuable data that could more accurately characterize the social communication impairments resulting from TBI.

The current study addresses the limitations of traditional methods by using a complex dynamical systems approach to discourse analysis. This approach quantifies how both communication partners in a conversation interact on a moment-to-moment basis. It is hypothesized that this approach will better differentiate individuals with TBI from control participants and will correlate more strongly with measures of conversation outcome.

Methods: Conversation samples were obtained from an existing corpus [2]. 50 adults with TBI and 50 age- and gender-matched control participants each engaged in a 15-minute unscripted conversation with an experimenter. Samples were transcribed and traditional discourse analysis measures (e.g., productivity, cohesion, coherence) were calculated. Acoustic data from audio files and lexical data derived from transcripts were analyzed using recurrence quantification analysis, a method of nonlinear time series analysis. This method quantifies the number and duration of recurrences of a dynamical system, and produces a set of measures that can be used to characterize the interaction of conversation partners. Conversation outcome was measured via third-party ratings of rapport between conversational partners and quality of conversations.

Results: Data analysis is currently in progress. Results of traditional discourse analysis and nonlinear time series analysis will be presented, as will correlations between results of both analyses and third-party measures of rapport and conversational quality. It is predicted that nonlinear time series analysis will better differentiate individuals with TBI from control participants and will correlate more strongly with ratings of rapport and conversational quality.

Conclusions: Conversation is a complex, time-dependent process co-constructed by multiple interacting individuals. As such, it is anticipated that a complex dynamical systems approach to conversational discourse analysis will be superior to traditional methods in identifying social communication impairments resulting from TBI.

Objectives: The lack of sensitive measurement tools is a primary reason for the paucity of research related to specific neurologic impairments following concussion in children/adolescents. The objective of the current research is to evaluate the utility of prism lenses as a concussion diagnostic tool. An earlier study showed significantly less modulation of the Vestibulo-Occular Reflex (VOR) while wearing prism lenses with repetitive reaching to a target in brain injured young adults versus psychiatric patients or normal healthy young adults. When healthy older adults wore prism lenses while throwing balls at a target, a greater number of throws were required for VOR modulation as well as return to pre-prism performance versus young adults. It is hypothesized that history of concussion or acute concussion negatively impacts VOR modulation when prisms are worn while throwing balls at a target in children/adolescents. Specifically that an increased number of throws are required for VOR modulation following concussion.

Methods: This is a cross-sectional study. Children/adolescents with and without a history of concussion and those with acute concussion are being recruited, 3 groups of 40. Subjects throw 29 balls (covered in Velcro numbered 1 to 29) at a target (distance of 2 m) under 3 conditions: no prisms, wearing prisms (diopter of 30), and upon removal of the prisms. Subjects are instructed to maintain their focus of attention on the target, balls are handed to them in numerical order, and a measure of each balls distance from the target recorded. The measure of prism adaptability is the number of throws required for VOR adaptation.

Results: Data includes 40 children/adolescents (36 males, 4 females) ranging in age from 11-15 [13(1), mean (std.)] without concussion and 12 (7 males, 5 females) ranging in age from 12 – 14 [13(1), mean (std.)] with a history of concussion. VOR modulation in children/adolescents with not history of concussion occurs after approximately 9-10 throws. The level of variability in VOR modulation in subjects with a history of concussion is similar in both the no prisms and prisms removed conditions, however variability increases in the wearing prisms condition.

Conclusions: The results provide further evidence of the enhanced level of neural plasticity associated with the developing brain. In general, the number of ball throws to modulate the VOR by children/adolescents (9-10) is less than previously reported for young adults (12-13) and older adults (18-19). Subjects with a history of concussion show a greater level of variability associated with ball throws when the central nervous system is taxed as when wearing prisms. This is preliminary evidence that concussion may have a negative impact on VOR modulation.
Use of the Near Point Convergence Test During Chronic Post Concussion Recovery

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: Although it has been identified as an important indicator of protracted recovery from head injury during the acute and sub-acute phases, there continues paucity in the literature to document the value of the near point convergence assessment as related to the physical and neurocognitive impairment common to chronic post-concussion syndrome (CPCS). The purpose of our study was to characterize the relationship between near-point convergence insufficiency (NPCI) and other symptomology common to persons with CPCS.

Methods: Repeated measures observational cohort design. Twelve participants (Males/Female = 10/2) with a history mTBI were recruited for this study and provided informed consent according University research guidelines. Inclusion criteria was age over 18 years, binocular vision and head injury within the past 12 months. Exclusion criteria included ocular pathology, visual acuity ≥ 20/200 and spinal trauma or pathology. All participants received a simple medical screening which included visual and neurocognitive testing. Participants were tested twice over a 3-week period to confirm stability of test results. Variables of interest were: Total Concussions (CON_Score), Total Symptom Score (TSYMP), Near-Point Convergence Test score (NPT), Visual Memory Score (MEM_Vis), Verbal Memory Score (MEM_Verb), Cognitive Reaction Time (RT), Visual Motor Processing Speed (VM_Speed), Static Visual Acuity (STATIC_Acuity) and Visual Perception time (PERCEP_Time). Descriptive statistics were performed using IBM SPSS vs. 22.0 statistical software. Nonparametric statistics included the Spearman Rho Coefficient, the Kruskal Wallis ANOVA and a Linear Multiple Regression to characterize multivariate relationships and predictive associations. Alpha level was 0.05.

Results: Males (n=10) and females (n=2) were average age of 24.95 +/- 4.01 yrs, BMI of 26.18 +/- 4.24 and a concussion history of 1 to 5 concussions within the past 12 months (n=7) or longer (n = 3). Eye function was assessed using the InVision® Computerized System (NeuroCom) for static visual acuity (average -0.2717 +/- 0.045 LogMAR) and perception time (average 36.90 +/- 8.12ms), at 3 meters. Average NPT was 6.72 +/- 5.22cm. Neurocognitive function was assessed using the ImPACT® computerized system to quantify MEM_Verb (average 58.78 +/- 32.09%), MEM_Vis (average 55.63 +/- 25.39%), VM_Speed (average 36.90 +/- 8.12ms), and RT (average 0.432 +/- 0.276) ms. TSYMP was significantly related to both CON_SCORE (r = 0.586, p= 0.007) and STATIC_ACUITY (r= 0.608, p= 0.007). There was a significant group difference for NPT are related to CON_SCORE (F = 4.310, p = 0.014). Lastly, TSYMP and CON_SCORE were able to significantly explain 57% of the variance in NPT (p < 0.001).

Conclusions: Preliminary results indicate that the near-point convergence test is a valid clinical assessment even during the chronic phases of recovery from mTBI. Rehabilitation specialists should consider use of the simple, yet effective near-point convergence test to help document recovery progression.
The Influence of Posttraumatic Stress Disorder (PTSD) on Perceptions of Physical Injury Among US Veterans Deployed to Iraq and Afghanistan

Objectives: High rates of physical injuries and PTSD co-morbidity in Iraq and Afghanistan Veterans highlight the importance of understanding how co-occurring affective responses to trauma influence cognitive processes (e.g., beliefs, perceptions) that have been shown to predict recovery and functioning following mTBI and other deployment injuries. Thus, this study was designed to examine the impact of PTSD on perceptions and beliefs about physical injury in Veterans with a history of deployment mTBI or non-TBI injury (e.g., orthopedic injuries). The primary aim of this study was to examine whether the impact of PTSD on perceived outcomes of injury (i.e., consequences) was different for those with a history of mTBI compared to those with non-TBI injuries. Secondary aims were to examine whether the impact of PTSD on both emotions experienced as a result of injury (i.e., emotional representations) and degree of understanding of injury (i.e., coherence) depend on the type of injury sustained. Exploratory aims (post-hoc) were to examine whether the impact of PTSD symptom severity on three outcomes of interest was different for Veterans with deployment mTBI compared to Veterans with non-TBI deployment injuries.

Methods: A 2x2 factorial design was used to explore the effect of injury type (mTBI versus non-TBI) and PTSD (present or absent) on injury beliefs and perceptions. The research team screened 822 individuals for this study. Of these individuals, 101 consented to participate in the study. A total of 80 (79.2%) participants were eligible and completed the study visit.

Results: Diagnosis of PTSD did not impact beliefs or perceptions Veterans held about their deployment injuries. Instead, symptom severity of depression, pain and PTSD, were significantly associated with the perceived consequences and emotional representations of injury. Moreover, the nature of these associations did not differ across the injury groups. On the other hand, findings showed that the type of injury did matter with respect to injury coherence such that the severity of PTSD symptoms influenced understanding of injury for those who sustained a deployment mTBI, yet PTSD symptoms did not significantly impact understanding for those with a non-TBI injury (p=.04).

Conclusions: Veterans with mTBI were more likely than those with a non-TBI injury to have difficulty making sense of their injury. Although a diagnosis of PTSD did not change the nature of this association, a different picture emerged when PTSD symptom severity was used in the model instead of PTSD diagnosis. The higher one’s PTSD symptoms, the harder it was to make sense of one’s TBI, yet the severity of PTSD symptoms had a negligible impact on how one made sense of a non-TBI injury.
Functionally Significant Executive Dysfunction Persist After Emergence From Posttraumatic Amnesia

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Duration of posttraumatic amnesia (PTA) robustly indexes severity of traumatic brain injury and predicts near- and long-term rehabilitation outcomes. Although resolution of PTA marks a significant milestone in early recovery from TBI, difficulties with complex attention, memory retrieval, processing speed, and executive function persist immediately after emergence from PTA. We previously suggested that the constellation of cognitive deficits presented immediately after emergence from PTA comprises a posttraumatic dysexecutive syndrome. This syndrome is characterized by impaired intrinsic executive function (i.e., conceptualization, information organization, strategy generation, set shifting, problem solving, response inhibition) as well as impaired executive control of elemental cognitive functions (i.e., attention, working memory, declarative memory, language, and motor function). We also suggested that the severity of executive function deficits immediately after emergence from PTA is out of proportion to, and more functionally limiting than, residual co-occurring elemental cognitive impairments. The present study was designed to test the hypotheses that: 1) executive dysfunction predominates in the period immediately following emergence from PTA; and 2) executive dysfunction during that period better predicts functional limitations at rehabilitation discharge than do general cognitive impairments.

Methods: Medical records of 83 persons consecutively admitted to an inpatient brain injury rehabilitation unit were retrospectively reviewed. Inclusion criteria were: TBI (nonpenetrating) by American Congress of Rehabilitation Medicine criteria with TBI-consistent intracranial neuroimaging abnormalities; age 20–79 years; primary language English; non-aphasic; at least 6 years of education; emerged from PTA, defined by Galveston Orientation and Amnesia Test scores > 75 on at least two consecutive days; and complete Frontal Assessment Battery (FAB) and Mini-Mental State Examination (MMSE) data were recorded. FAB and MMSE served as measures of executive function and general cognition, respectively. Descriptive data, including Functional Independence Measure (FIM) scores, were extracted from the medical records of participants meeting inclusion criteria. FAB and MMSE scores were Z-transformed using previously published community-based normative data. Hypothesis 1 was tested via dependent t-test of FAB and MMSE Z-scores, and hypothesis 2 was tested using general linear modeling of the proportion of variance in discharge FIM scores accounted for by FAB Z-scores and MMSE Z-scores.

Results: 38 participants (28 men, 10 women, age 44 +/- 17 years, with 13.6 +/- 2.5 years of education) met inclusion criteria. Post-PTA FAB Z-scores was -4.6 +/- 3.5 and MMSE Z-score was -1.8 +/- 1.9 (t=5.1, p<0.0001). FAB Z-score, but not MMSE Z-score, predicted cognitive FIM scores at rehabilitation discharge (multiple R-squared=0.13, p<0.03).

Conclusions: Severe executive deficits persist immediately after emergence from PTA, are disproportionately severe relative to general cognitive impairments, and predict functional cognition at rehabilitation discharge. These observations support our suggestions that emergence from PTA marks a transition into posttraumatic dysexecutive syndrome. Prospective characterization of the posttraumatic dysexecutive syndrome is warranted.
Lateralized Response in Endogenous Pathogenic Peptides Dynorphins Caused by Traumatic Brain Injury: Relevance for Human Psychopathology

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – basic research

Author's preference: Oral

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Objectives: The dynorphins, endogenous opioid peptides when excessively produces or mutated can cause neurodegeneration in human brain. To gain insight into the pathophysiological role of dynorphins in traumatic brain injury (TBI), we analyzed short and long-term changes in dynorphins in the frontal cortex, hippocampus and striatum induced by unilateral left- or right-side cortical TBI in mice. We also characterized patterns of dynorphin expression in human brain.

Methods: TBI Mouse model; analysis of postmortem human brain specimens (ACC, dl-PFC, caudate and putamen); RIA, qRT-PCR, dd-PCR, HPLC, IH, ISH, WB.

Results: TBI induced short- and long-term responses of two types. In the hippocampus, dynorphin levels were predominantly altered in hemisphere ipsilateral to the injury. In the striatum and frontal cortex, injury to the right hemisphere affected dynorphin levels to greater extent than that to the left side. Right-side injury induced similar changes in both hemispheres. In the human brain, the endogenous opioid system displays robust lateralization gions. Opioid mRNAs and peptides and five “classical” neurotransmitters were analyzed in postmortem tissues from 32 human subjects. Leu-enkephalin-Arg and Met-enkephalin-Arg-Phe, preferential mu-/delta- and kappa-/mu-opioid agonists demonstrated marked lateralization to the left and right anterior cingulate cortex, respectively. Dynorphin B strongly correlated with Leu-enkephalin-Arg in the left but not right anterior cingulate cortex suggesting different mechanisms of conversion of this kappa-opioid agonist to mu-/delta-opioid ligand in the two hemispheres; in the right anterior cingulate cortex dynorphin B may be cleaved by PACE4, a proprotein convertase regulating left-right asymmetry formation.

Conclusions: Trauma may reveal differences in the lateralization of dynorphin-expressing neural circuits or in the ability of these systems to recover following TBI. In human brain, region-specific lateralization of neural circuits expressing these peptides may underlie lateralization of higher functions including processing of positive and negative emotions. The lateralized circuits affected by left- or right-side brain injury may differentially contribute to TBI-induced mood disorders.

Combining noninvasive cortical stimulation with operant learning: Novel paradigms for Neurorehabilitation

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Oral

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Noninvasive cortical stimulation techniques such as repetitive transcranial magnetic stimulation (rTMS) or transcranial direct current stimulation (tDCS) are capable of increasing and decreasing cortical excitability and thereby might be clinically relevant for rehabilitation of neurological and neuropsychiatric disorders. However, the induced after-effects are usually too short-lasting to be clinically relevant. In a series of studies we have demonstrated that combining specific cortical stimulation protocols with operant learning can induce long-lasting after-effects not achievable neither with cortical stimulation alone nor with operant learning alone.

These long-lasting effects have been so far shown in the somatosensory cortex (Karim et al., 2006; J Cogn. Neurosc.), in patients with poststroke aphasia (Khedr et al., 2014; Neurorehab. & Neural Repair) and in patients with Alzheimer's disease (Khedr et al., 2014; Frontiers in Aging Neuroscience).

A conceptual framework for the efficiency of combining cortical stimulation with operant learning can be derived from the Bienenstock-Cooper-Munro (BMC) theory of bidirectional synaptic plasticity. According to this theory the change of synaptic efficiency during learning processes is dependent on the preactivation level of the involved neural network, suggesting that high-frequency rTMS or anodal tDCS can transiently decrease the threshold for the induction of LTP-like effects and thereby gate practice-dependent plasticity while subjects perform the task.

Our findings provide important and innovative implications for the use of rTMS and tDCS as therapeutic tools for neurorehabilitation.
International Dilemmas of Providing Services for Individuals with ABI.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – public policy and advocacy

Author's preference: Oral

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Objectives: Identify appropriate rehabilitation health care networks for optimal rehabilitation for individuals with ABI. Identify gaps in the rehabilitation delivery systems for individuals with ABI.

Methods: Through case studies and provider and accreditation observations will provide information on current state of rehabilitation health care networks for individuals with ABI.

Results: Cultural, political, health, and financial issues continue to limit development and use of rehabilitation health care networks for individuals with ABI. Providers must continue to advocate for services and new delivery systems. Acceptance and full inclusion of individuals with ABI is result desired.

Conclusions: Although there is a rich history of providing a variety of services for individuals with ABI there continues to be gaps in the provision of services in many countries. Individuals who do survive face many obstacles to be included and participate in full life in the community. Individuals aging with ABI also find a lack of health and human services to deal with the aging process as well as the ABI. Potential solutions will be discussed.
Open traumatic brain injury is a strong predictor for aseptic bone necrosis after cranioplasty surgery: a retrospective analysis of 219 patients

Status: Accepted Presentation type: Poster
Category: Neurotrauma – case reports/clinical research
Author's preference: No preference

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Objectives: The aim of the study is to investigate whether independent predictors of complications after cranioplasty are identifiable.

Methods: Parameters which could possibly predict the occurrence of complications were retrospectively analysed. The endpoint of the study was the explantation of the bone flap

Results: Two hundred nineteen of the identified patients with a mean age of 42.8 (SD 17.89) years were included. History of trauma and especially open traumatic brain injury was associated with a higher complication rate. Fragmented bone flap resulted in more frequent occurrence of bone flap necrosis. The risk of complications following cranioplasty was higher if a VP shunt was simultaneously placed. Longer duration of cranioplasty procedure was significantly associated with higher postoperative complication rate. Subsequent rehabilitation is more frequent if patients develop a complication.

Conclusions: In order to avoid complications after cranial vault reconstruction, indications for simultaneous VP shunt implantation should be carefully evaluated. The implantation of fragmented bone flaps should be avoided. Patients after open TBI should either primarily be treated with an allogenic graft or they should be carefully followed up since those patients are prone to develop aseptic necrosis.
The role of shuntography in diagnosis of mechanic complications after implantation of ventriculoperitoneal shunt in patients with normal pressure hydrocephalus: a retrospective clinical evaluation.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: This retrospective, longitudinal clinical study investigated the risks and benefits of contrast-enhanced visualisation of implanted ventriculoperitoneal shunt (shuntography) in patients with normal pressure hydrocephalus (iNPH) in relation to mechanic complications.

Methods: We identified 69 patients who underwent shuntography for suspected shunt failure in the time period from 2000 to 2014. The following criteria were used to assess the clinical evaluation: width of the ventricle, radiographically detected obstruction or disconnection along the ventriculoperitoneal shunt, need of revision surgery or reprogramming of the valve, Kiefer score before and after the treatment resulting from the findings of shuntography. The percentage of procedure-associated complications was evaluated.

Results: 42% of the total patient population showed radiographically detected underdrainage owing to shunt dysfunction: mechanical obstruction was found in 36% of the patients and disconnection of shunt components in 6%. Obstructions of ventricle catheter and the abdominal catheter occurred nearly in the same frequency (17% and 18%). Shuntography without any pathological finding was conducted in 16% of the patients.

According to the results of shuntography 36% of patients underwent reprogramming of the valve and 39% underwent revision surgery.

38% of all patients showed clinical benefit after treatment (at least one point of the Kiefer score).

Conclusions: Contrast medium enhanced shuntography showed a satisfactory clinical performance in diagnosis of mechanic complications after implantation of ventriculoperitoneal shunt in patients with normal-pressure hydrocephalus.

The majority of patients with diagnosed mechanical complications needed revision surgery and showed clinical benefit after treatment.
Public Health Policy Implications of a Cognitive Neuropsychology of Language and Movement in Neurorehabilitation of Integrative Brain Function

Status: Accepted  Presentation type: Poster

Category: Neurorehabilitation – public policy and advocacy

Author's preference: Oral

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Objectives: We argue that motor and cognitive processes are not separate, but most likely share similar evolutionary history. This is supported by data showing that some brain regions play a similar function in both motor and cognitive functions. We also argue that cognitive processes play a role for the generation of complex motor output, supported by data from TBI, stroke, and Parkinson’s disease.

Methods: We review data that motor processes can contribute to cognitive function, as found by many training programs.

Results: Motor and cognitive processes have dynamical bidirectional relationships.

Conclusions: We endeavor to integrate the Neurosciences, Cognitive Psychology and Biomechanics in providing a fundamental understanding of the relation between intention, decision-making, and movement in the context of functional connectivity, awareness, attention, and action. Animals move so that they can obtain food, and eat so that they can then move; they move so that they can perceive, and perceive so that they can move. Perception and action are interdependent—and motor cognition lies at the heart of how the two interact. The mediating link between perception and action is representation: the shared coding in the brain of perception and action, and that the contents of both perceptions and intentions, the mental plans designed to achieve a goal through action, depend on perception and motor integration. While different brain areas support different motor processes. Evidence suggests that the premotor, M1, and supplementary motor areas do not always operate in a prescribed sequence, but instead interact in complex ways. Nevertheless, different brain regions play different roles in the conception, initiation, and control of action. We know that the SMA is involved in the organization of motor sequences based on plans, and that PM is involved in the preparation of a specific action. But the prefrontal cortex is involved in the initiation and in the temporal organization of action, and the cerebellum is involved in the temporal control of action sequences. All these regions show anticipatory activity in relation to a forthcoming action. In fact, connections from one area to another typically are mirrored by feedback connections from the “receiving” area to the “sending” one; information runs in both directions, which presumably allows the areas to coordinate their processing. In short, motor cognition relies on a multicomponent system, with many distinct processes that occur simultaneously, and these processes occur in different brain regions that support different neural networks. TBI impairs this integratory activity. Additionally, the lack of movement represented in office work and youngsters fettered to video games reduces the ability to formulate effective connectivities. Public Health implications are discussed for return to work after head injury and for developmental disabilities.
Early decompressive craniectomy in severe head injury with clinical and imagenological evidence of intracranial hypertension

Status: Accepted  Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: Severe traumatic brain injury is a major cause of death and disability in the world. The control of elevated intracranial pressure (ICP) is fundamental to the management of these patients and the literature published to date does not reveal definitive evidence regarding the effectiveness and indications of decompressive craniectomy (DC).

Methods: We have conducted a case control study, in 249 patients admitted to the intensive care unit of "Roberto Rodríguez" General Hospital in Moron, Ciego de Avila, Cuba, with severe head injury (Glasgow coma scale (GCS) < 8), within the period from January 2003 to December 2014. In Group I were included patients treated with decompressive craniectomy and in Group II were included patients with medical treatment.

Results: The initial GCS score was found to have relation with GOS. Difference in the outcome was observed between patients with GCS 6-8 points and GCS 4-5. In initial CT scans, non-evacuated mass lesions were predominant in both groups. DC efficiently reduced the elevated ICP in 73.34% of patients. Pneumonia and fluid, electrolyte, acid-basic imbalance were the general predominant complications in both groups. In Group I, 60% of the patients had satisfactory results in comparison with the 30.43% in Group II. Mortality was 20% in Group I and 34.78% in Group II.

Conclusions: Early DC seems to have a satisfactory effect on the outcome improving the quality of life.

Key words: Decompressive craniectomy, severe traumatic head injury, Intracranial pressure monitoring.
Changes in Brain Metabolism (18-FDG-PET) after Transcranial Direct Current Stimulation (TDCS) in TBI Patients with Disorders of Consciousness (DOC)

Status: Accepted Presentation type: Oral

Category: Technology – clinical research/applications

Author’s preference: Oral

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Objectives: The Unresponsive Wakefulness Syndrome (UWS) and the Minimally Conscious State (MCS) are severe disorders of consciousness (DOC) in which patients show either none (UWS) or sporadic (MCS) signs of consciousness. Cerebral metabolism measured with 18FDG-PET has shown higher metabolism in posterior midline areas in patients with MCS, compared to those with UWS. Recently, the terms “MCS minus” (MCS-) and “MCS plus” (MCS+) were established to distinguish between patients in MCS who can follow verbal commands or not. When scanned with [18F]-fluorodeoxyglucose-PET (18FDG-PET), patients in MCS+ showed increased metabolism at the left cerebral cortex, compared with patients in MCS-.

Methods: Four patients with a DOC (MCS-) due to traumatic brain injury (TBI), and two patients with a DOC (UWS) due to anoxic encephalopathy were treated with multiple (range: 10-20) daily sessions of anodal transcranial direct current stimulation (tDCS) (25 cm² sponge electrode, 2 mA, 30 minutes) over the left primary motor area of the hand, while they received verbal movement commands. All patients were evaluated for changes in brain metabolism with 18FDG-PET scans, and for clinical improvement with the JFK Coma Recovery Scale - Revised (CRS-R) before and after tDCS.

Results: 18FDG-PET revealed significant metabolic increases at posterior midline areas in all TBI (MCS) patients irrespective of clinical outcome, as well as significant metabolic increases in the left cerebral hemisphere only in those patients who showed clinical improvement after tDCS. The two patients with UWS due to anoxic encephalopathy did not show any clinical or brain metabolic changes after tDCS.

Conclusions: Changes in cerebral metabolism after tDCS in patients with DOC are consistent with previously known correlates of cerebral metabolism and DOC status. Cerebral metabolic measures with 18FDG-PET may be valuable in the assessment of therapeutic effects of tDCS in patients with DOC.
Supporting the basic learning skills of children with acquired brain injury: Cognitive neurorehabilitation as a long-term remediation

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Epilepsy is one of the acquired brain impairments that often cause attention and visuospatial deficits in children. Attention is a key element in acquiring new information and visuospatial impairment for one has been associated with difficulties in mathematics. Therefore, using modern and attractive neurorehabilitation methods is crucial in remediation. Rehabilitation designs should enable training different components of cognitive functions and provide long-lasting improvements. Our aim was to investigate the short and long-term rehabilitation effects for children with partial epilepsy (PE) after neurocognitive training.

Methods: 27 children with PE: 16 in study group (mean age=10.07 yrs, SD=1.149) and 11 in waiting-list control group (mean age=10.51 yrs, SD=1.766) participated. Study group received individual supervised rehabilitation twice a week during 5 weeks with attention and visuospatial modules from FORAMENRehab software (Sarajuuri et al, 2000; adapted for children by authors). Waiting-list group received no training during this period. Immediate intervention effect for study group and control performance for waiting-list group was evaluated comparing baseline tasks before and after 5-week period. Long-term follow-up assessments with baseline tasks were conducted for 9 children in training and 7 in waiting-list group 1.36 years (SD=0.391) after the intervention. Results were analysed with Wilcoxon signed rank sum test.

Results: Noticeable improvements were seen for study group after intervention. At first there were no significant differences on baseline levels between study and waiting-list group (p>0.05). After training, the study group showed statistically significant improvements in complex attention and tracking functions (p<0.05). Also in visual organization, visual attention and visuospatial perception tasks (p<0.05). Waiting-list group only performed better in one aspect of visuospatial perception task (p<0.05). In long-term follow-up the study group showed sustained significant improvements in various attention and visuospatial functions. In focused attention task reaction time to visual stimuli was significantly quicker (p<0.05). In sustained attention task trend showed faster solving time (p=0.055). In all complex attention tasks they gave more correct responses (p<0.05), had less omission errors (p<0.01) and total mistakes (p<0.05). In tracking task they had more correct responses (p<0.01) and less total mistakes (p<0.01). In visual recognition task they were more accurate (p<0.01). In visual organization and visual attention tasks they performed more correctly (p<0.05) and attended faster to stimuli (p<0.05). In visuospatial perception they had faster solving time (p<0.05) and less wrong moves (p<0.05). Waiting-list group only performed better in one complex attention task and in few aspects of visuospatial tasks (p<0.05).

Conclusions: Our multifaceted neurorehabilitation design with FORAMENRehab is effective for children with PE. Significant immediate improvements were seen in various attention and visuospatial functions. Furthermore, long-term positive effects also persisted in these domains. We recommend modern computer-assisted neurocognitive intervention for supporting basic learning skills for children with acquired brain injury and cognitive impairments.
The TESS study, Traumatic epilepsy and seizure study

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: Oral

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Objectives: (1) to determine the risk factors for post-traumatic epilepsy, beyond the known factors and the impact this has on the patient, society and service provision. (2) To create a model to determine the risk factor for an individual patient post TBI.

Design: Longitudinal observational study

Subjects: All patients with traumatic brain injury referred to Addenbrooke’s hospital Cambridge Neurosurgical department, requiring a CT head scan, aged 17-70 years, without a diagnosis of dementia. All patients must be registered with a general practitioner, speak English sufficiently to complete the questionnaires and be an UK resident.

Methods: Data summarising the injury, treatment and past medical history will be collected for 4000 patients. These patients will then be followed for 5 years to determine who has had a seizure. A Health related quality of life battery would also be sent to the patients over the 5 year period.

Results: The study is awaiting ethical approval before starting.

Conclusions: This study will determine the risk factors for posttraumatic epilepsy for an individual patient; the impact on the patient’s quality of life and the economic impact of posttraumatic epilepsy.


The Cardiac Autonomic Response to Differing Efforts in Children at the Chronic Phase Post Severe Traumatic Brain Injury.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Background: It has been noted before that children three months to one year post-severe TBI, the cardiac autonomic system is less efficient at rest and less adaptive to exercise and activity as compared to TD children.

Objectives: To assess heart rate (HR) and heart rate variability (HRV) at rest and during exercise in children at the chronic phase post severe traumatic brain injury as compared to age-matched typically-developed controls. Setting: Out-patient rehabilitation department. Participants: Ten children (3 girls, 7 boys), at least two years post-severe traumatic brain injury (TBI), aged 7-11 years with residual deficits and 18 typically-developed (TD) children matched for age and gender. Interventions: HR and HRV were determined at rest, during the step test for three minutes, walking on a treadmill and walking outdoors on an incline for six minutes at each stage. An accelerometer attached to the child's thigh was used for assessing the distance covered in each walking stage. Main Outcome Measures: HR and HRV parameters include: time and frequency domains.

Results: Children post-TBI demonstrated higher mean HR values and lower HRV at rest compared to controls (p<0.05). During exercise a significant increase in HR and significant decrease in HRV was noted in both groups. A significant interaction was noted (p<0.01); the HRV parameters at rest were significantly higher among the controls as compared to children post TBI, in addition, the HRV parameters during activity were lower among the controls.

Conclusions: The findings of this study suggest that among children post-severe TBI at the chronic phase, the cardiac autonomic system is less efficient at rest and less adaptive to exercise and activity as compared to TD children, although when compared to children about one year post event, the cardiac autonomic reaction appears to be improving over time.
The Long Term Gait Deficits of Children Post Severe Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: Traumatic brain injury (TBI) is a leading cause of disability in children. It has been noted that ambulatory children 3-12 months post-severe TBI had decreased balance performance, decreased gait velocity and increased step variability as compared to age-matched healthy controls. The aim of the current study was to assess the long term deficits in gait parameters in this group of children.

Methods: The study comprised 10 children (3 girls, 7 boys), at least two years post-severe traumatic brain injury (TBI) aged 7-11 years and 18 typically-developed (TD) children matched for age and gender. Gait velocity, spatial and temporal parameters of gait were recorded using a pressure sensitive mat, the ‘GAITRite1’ system. Walking endurance was assessed by the six minute walk test on a treadmill as well as outdoors. In addition the functional reach test and the timed up and go test were used for balance performance. Lower limb muscle strength using hand held dynamometer was also assessed.

Results: Gait velocity as measured by the ‘GAITRite1’ system was not significantly different between groups, although the distance covered while walking outside for six minutes was significantly lower; children post TBI covered 315±64 m while TD controls 380 ±44 m p=0.02. In addition, step time variability in children post TBI was almost twice as high as compared to TD controls (8.8±4.1 vs 4.9±3.0, p<0.01). Balance performances were significantly lower and hip adductors and knee flexors were significantly weaker among children post TBI; both were strongly associated with gait and endurance among children post TBI.

Conclusions: Children two years or more post TBI, although walking as fast as their peers for short distances still exhibit low tolerance, reduced balance and increased step variability during gait. It seems that balance training and muscle strengthening programs are the key factors for further interventional studies.
The Effect of a Home-Based Walking with a Metronome Program on Gait Dynamics in Children Post Severe Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: To assess the effect of a home-based program of walking with rhythmic auditory cues on gait symmetry in children post severe traumatic brain injury. Design: Case study; ABA and AAA model.

Participants: Nine children aged 6-16 years, post severe traumatic brain injury who could walk unassisted participated in the study. Interventions: After a baseline assessment each subject received a pedometer and was instructed to walk with it on a daily basis for a month (A), starting from 10 minutes and increasing to 20 minutes a day. In the second period, a random sample of the participants (5 out of 9) received a metronome set at a tempo of the child’s preferred walking speed. The child was asked to continue daily walking for 20 -30 minutes a day for another month. The third assessment followed the intervention and the fourth was conducted one month later.

Methods: Gait velocity, step-time symmetry, step variability were assessed by the GAITRite walkway, and walking balance by the ‘timed up & go test’.

Results: The program was found to be feasible; the children fulfilled 70% of their planned program. Gait velocity improved significantly after the first as well as the second training period (median improvement of 12 ±5 cm/sec and 17±5 cm/sec respectively) in all participants. Step-time symmetry and step-time variability improved during the second training period among three of the five children who trained with the metronome; no such improvement was noted among the controls.

Conclusions: It seems that a home based walking activity as such is effective and adding a metronome may have an additional benefit on gait parameters for children post TBI.
Paediatric neurological melioidosis: a rehabilitation case report

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Background: Melioidosis is a rare condition, endemic to northern Australia and south-east Asia, caused by an infection with the bacterium Burkholderia pseudomallei. The largest epidemiological review to date describes 540 cases of melioidosis seen at Darwin hospital, (Northern Australia) over a 20 year period. Of these, 14 (less than 3%) presented with neurological manifestation, with three deaths. Reports of paediatric cases of meliodosis are rarer. In a review of paediatric cases in Northern Australia only eight cases were identified in 10 years. Three of these presented with neuromelioidosis of whom, two died in hospital. Whilst the literature refers to prolonged periods of hospitalisation for survivors, the trajectory of functional recovery and process of rehabilitation has not been described.

Objectives: The purpose of this case report is to document the functional recovery and rehabilitation process. Knowledge of the recovery pathway is important to add to the understanding of natural history and treatment of this rare disease.

Methods: This is a case report describing a 14 year old boy with acute neurological symptoms (vomiting, severe headache, ataxia, cranial nerve VI and VII palsy) who was referred to the tertiary paediatric hospital in Perth from a remote community in Western Australia. Cranial MRI showed an extensive infiltrative lesion in the posterior fossa and hydrocephalus. Diagnosis of neurological melioidosis required isolation of the pathogen by brain biopsy through sub-occipital craniotomy. Medical treatment included surgical management of hydrocephalus, parenteral antibiotic treatment and then oral cotrimoxazole, enteral feeding and tonal management with levodopa/carbidopa and botulinum toxin A injections. Significant neurological symptoms (bradykinesia, tremor, dysphagia, aphasia, hypertonia, squint) required intensive rehabilitation addressing the severe functional deficits and to promote independence. Occasions of service and functional assessments were recorded prospectively.

Results: Nine hundred and thirty two hours of inpatient therapy with 934 occasions of service were delivered across physiotherapy, occupational therapy and speech pathology over nine months of an inpatient admission. Initial WeeFIM© was 18/126, indicating complete dependence in all physical and cognitive domains. Following intensive rehabilitation the WeeFIM© was 55/126 indicating significant residual disability. This proved to be a challenge for discharge planning back to a remote region of Western Australia.

Conclusions: Paediatric neuromelioidosis can lead to significant disability and long term dependence despite the provision of lengthy intensive rehabilitation. This case report highlights the challenges and complexity of the rehabilitation services required to optimise outcomes for this patient and achieve a safe discharge to a remote community where limited support services are available.
Neuromuscular electrical stimulation in oropharyngeal dysphagia secondary to traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: To evaluate the effectiveness of neuromuscular electrical stimulation (NMES) treatment in patients with oropharyngeal dysphagia secondary to severe traumatic brain injury (TBI). Patients and

Methods: Six patients with neurologic oropharyngeal dysphagia after TBI were enrolled in a prospective, randomized, blinded for patients and assessment, study. Inclusion criteria were: patients with TBI able to understand and follow necessary verbal instructions to collaborate in the treatment, patients had to have a Rancho Los Amigos level of cognitive functioning scale (RLFC) > 4; videofluoroscopic demonstration of tracheal aspiration; medically stable and follow-up less than 6 months since insult. 3 patients underwent NMES and conventional swallowing therapy and 3 patients underwent sham electrical stimulation (SES) and conventional swallowing therapy. Both groups completed 20 sessions. At baseline, at the end-of-treatment (1 month) and at 3-month follow-up, clinical, video fluoroscopic and esophageal manometric analysis were done blindly. Feeding swallowing capacity was evaluated using the Functional Oral Intake Scale (FOIS).

Results: Mean disability rating score (DRS) was 16 (range: 14-20) and mean score of RLFC was 6 (range: 5-7) for the NMES group and for the SES group the mean scores were 15 (13-19) and 6 (5-8) respectively. The medium FOIS score before treatment was 2 for the NMES group and 2.3 for the SES group. After treatment the NMES group increased by 2 points (4 points) compared to only 0.7 point (3 points) for the SES group. At 3 months follow-up the medium scores were 5 and 4.6, respectively; thus, both groups improved but without statistical significant differences. At this point in time (3 months) tracheal aspiration persisted in 1 patient in NMES and in 2 in the SES group. Also, a significant increase in pharyngeal amplitude contraction was observed at the end of treatment (1 month) in the NMES group when compared to the SES group.

Conclusions: NMES significantly accelerates swallowing function improvement in patients with oropharyngeal dysphagia secondary to traumatic brain injury.
Inter-rater reliability of the Chedoke arm and hand inventory for use with people with acquired brain injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: The purpose of this study was to estimate the inter-rater reliability of 4 versions of the Chedoke arm and hand inventory (CAHAI) when used with persons with acquired brain injury (ABI).

Methods: The research design was an observational parameter estimation study. Sample size was calculated based on the expectation of obtaining a one-tailed lower 95% confidence interval and an inter-rater reliability of 0.90 with a lower confidence limit of 0.70. Participants were recruited from an in-patient ABI rehabilitation program. The administration of the CAHAI was video taped for six persons with ABI. The videos were then assessed separately by six different clinicians (three Physiotherapist's and three Occupational Therapist's) for a total of 36 assessments in order to estimate inter-rater reliability. A Latin square design was used to balance the order the raters evaluated the videos. A repeated measures ANOVA was performed and the variance components were used to calculate an intra-class correlation coefficient (ICC) and standard error of measurement (SEM) with 95% confidence intervals (CI).

Results: Inter-rater reliability was high for the CAHAI-13 (ICC=0.96, 95% CI: 0.87-0.99, SEM 3.35). The inter-rater reliability was high for each of the shortened versions as well (CAHAI-9 ICC=0.95, 95% CI: 0.85-0.99, SEM 2.65; CAHAI-8 ICC=0.96, 95% CI: 0.90-0.99, SEM 2.72; CAHAI-7 ICC=0.96, 95% CI: 0.89-0.99, SEM 3.48).

Conclusions: These results suggest that all 4 versions of the CAHAI, although designed for use in the stroke population can be used reliably by clinicians in the ABI population. The discussion will highlight some of the challenges to using the CAHAI in the ABI population and will suggest future directions for both research and utilization of standardized outcome measures such as the CAHAI with persons with ABI.
Human Metapneumo Viral Encephalitis in adult: A case report of poor neurological recovery.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: To describe the severe functional deficits of a 32-year old Chinese Gentleman who suffered from Human Metapneumo Viral Encephalitis and the poor neurological sequelae that followed.

Methods: Studies suggested Human Metapneumovirus Infections are associated with severe morbidity in children of all ages however severe brain injury in infected adults who were immunocompetent remained rare. This 32 year old Chinese Gentleman Mr. K presented in September 2014 with one day history of back pain and fever. He was brought to the hospital on 11 September and desaturated the following day. Mr. K was treated as for Type I Respiratory failure from pneumonia and intubated in the medical intensive care unit(ICU). His CT chest on 12 September 2014 revealed interlobar septal thickening and consolidation predominantly in the upper lobes with pulmonary venous congestion. Mr K. underwent bronchoscopy and bronchoalveolar lavage on 12/9/14 and PCR from BAL revealed positive for metapneumo virus. Despite on treatment with acyclovir and ribavirin, 10 days of ampicillin and ceftrixone, Mr K Gasglow Coma Scale remained low at E2VTM2, gradually improved to E2VTM4 on 22/9/14. MRI Brain (23/9/14) revealed interval increase in the prominence and number of previously noted signal abnormality and enhancement in the supratentorial and infratentorial brain.

Results: Mr. K received 4 months of hospital rehabilitation however neurocognitive recovery remained poor. On Functional Independence Measure(FIM), his cognitive and motor FIM were both 18 on admission and discharge. He was totally dependent on helper for basic Activities of Daily Living and has poor level of arousal. During the awakening hours he demonstrated poor sustained attention and only obey 1-2 steps command with verbal cues in 50% of the therapy time. There was poor communication with therapists and caregiver. Mr. K was not able to retain new information despite various therapy strategies offered. No pharmacological therapy was offered to Mr. K from neurorehabilitation point of view. At one year, Mr. K remained in severe functional disability.

Conclusions: Severe brain injury from Human Metapneumo Virus infection are uncommon in the adults. Neurorehabilitation of Human Metapneumo Viral Encephalitis remained challenging for adults with related severe brain injury.
Connectomic and surface-based morphometric correlates of acute mild traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: To examine the relation between symptoms severity and alterations in structural connectivity and cortical surface area, thickness, and volume in acute mild traumatic brain injury (mTBI) and to elucidate interrelationships between white (WM) and grey matter (GM) alterations.

Methods: Fifty-one patients were cross-sectionally assessed with multimodal neuroimaging and clinical methods exclusively within 7 days following mTBI and compared to 53 controls. Whole-brain connectivity based on diffusion tensor imaging was subjected to network-based statistics and features based on T1-weighted MRI scans were investigated using surface-based morphometric analysis.

Results: Reduced connectivity strength within a subnetwork of 59 edges located predominantly in bilateral frontal lobes was significantly associated with higher levels of self-reported symptoms. In addition, cortical surface area decreases were associated with stronger complaints in five clusters located in bilateral frontal and postcentral cortices, and in the right inferior temporal region. Correlation with cortical volume revealed similar clusters, while thickness did not show any association with self-reported symptoms. No significant relationships between symptom severity and structural alterations were observed in the controls group. Alterations in WM and GM were localized in similar brain regions and moderately-to-strongly related to each other. Furthermore, the reduction of cortical surface area in the frontal regions was correlated with poorer attentive-executive performance in the mTBI group. Finally, group differences were detected in both the WM and GM, especially when focusing on a subgroup of patients with greater complaints, indicating the importance of classifying mTBI patients according to severity of symptoms.

Conclusions: This study provides evidence that mTBI affects both the integrity of WM networks by means of axonal damage and the morphology of the cortex. These anomalies might be greater in the acute period that previously believed. The dysconnected subnetwork suggests that mTBI can be conceptualized as a dysconnection syndrome. The involvement of frontal brain regions was consistently pronounced in both findings and is in agreement with many mTBI neuroimaging studies regarding structural and functional alterations. It remains unclear whether reduced WM integrity is the trigger for changes in cortical surface area or whether tissue deformations in the form of area reductions are the direct result of mechanical forces acting on the brain. Whether these early structural markers have predictive value over longer periods of time needs to be tested in longitudinal studies. For the practice, the findings suggest that the rapid identification of high-risk patients with the use of clinical scales and if possible a concomitant DTI or T1-weighted scan should be assessed acutely as part of the mTBI protocol.
**Consistency of psychometric properties of the Child and Adolescent Scale of Participation (CASP) in a national sample (USA) of children with TBI across a 3-year period.**

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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**Objectives:**
1. To examine associations between scores from the Child and Adolescent Scale of Participation (CASP) and two other measures (Pediatric Quality of Life Scale–PedsQL; Adaptive Behavior Assessment Scale–ABAS) across a 3-year period.
2. To examine internal consistency of the CASP and its four subsections across a 3-year period.
3. To examine the factor structure of the CASP across a 3-year period.

**Methods:** Data were examined from a longitudinal prospective cohort study that included 926 children ages 0-17 years, with TBI (n=729; classified as mild, moderate or severe) and arm injury (comparison group, n=197), male (64.6%) and female (35.4%) from diverse racial and ethnic backgrounds. Three measures were administered at 3, 12, 24, and 36 months following TBI: 1) CASP (Bedell, 2004), the primary measure, was initially designed to assess participation of children with traumatic and other acquired brain injuries in home, school and community life; 2) PedsQL (Varni, & Limbers, 2009) to assess health-related quality of life; and 3) ABAS (Harrison, & Oakland, 2003) to assess adaptive living skills.

Pearson correlation coefficients were sued to examine associations among scores from the three measures. Cronbach’s alphas (α) and exploratory factor analyses (varimax rotation) were used to examine the CASP’s internal consistency and structure, respectively. Analyses were conducted at each time period and compared for consistency.

**Results:** Associations between the CASP and the PedsQL and ABAS scores were found to be moderately high (r = 0.479 - 0.650; p < 0.01) at all time periods. The internal consistency of the CASP was found to be high (α = 0.900 - 0.956) as was each of the CASP sub-sections (α = 0.738 - 0.956), with a gradual increase in α over time. Factor analyses indicated a clearer distribution of four factors at 12 and 24 months that closely resembled the four CASP sub-sections.

**Conclusions:** The consistent moderately high correlations between the CASP and PedsQL and ABAS scores across time provide evidence of the CASP’s convergent validity. The high internal consistency is consistent with prior research (Bedell, 2009; McDougall, Bedell, & Wright, 2013). The gradual increase in internal consistency over time is a new finding that might reflect parents’ greater familiarity with their child’s participation and/or increasing stability of the child’s participation over time. Although results from factor analyses indicated a four factor solution at 12 and 24 months, results were less clear and consistent at other time periods suggesting that prudence be taken if considering use of factor scores.

The results contribute to the current psychometric evidence of the CASP and support its use to assess participation of children with TBI over time. This evidence is important to consider when selecting participation measures for use in research and practice.
Successful Transition for Adults with ABI from Rehabilitation to Employment via a Non-Traditional Sheltered Workshop

Status: Accepted  Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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The purpose of this research is to showcase the effectiveness of transition from rehabilitation to a non-traditional sheltered workshop/vocational center, versus a traditional sheltered workshop for adults with ABI (Acquired Brain Injury). According to the Centers for Disease Control and Prevention, over 1.7 million people sustain a ABI every year in the United States, and nearly 1.3 million are treated in an emergency facility, and then released back into the community. The physical, emotional, and cognitive impairments that are associated with sustaining an ABI in adulthood has left a population of individuals without meaningful employment opportunities or sense of productive purpose.

Unique Options, LLC was designed to provide long-term employment solutions for the ABI community, with the goal of placing injured clients back into the community alongside meaningful jobs and fulfilling careers. As our program expanded over the past 10 years, our data has shown that while the adult ABI community is eager and willing to engage in productive work, they are not as receptive on stepping back into the employment sector of mainstream society. Our most recent data shows that 88% our current clients have been with us for a year or longer, and the average number of clients in our program have been employed with us between 3 to 6 years. This data is supported largely in part by Unique Option's approach to providing more competitive employment advantages than a traditional sheltered workshop.

These advantages include: one job coach for every three clients, a support team to include Limited License Psychologist, Registered Nurse, a Occupational Therapist, and several Masters level Vocational Rehabilitation Counselors, only working with other ABI clients, real work (i.e., sorting, packaging, inspection, data entry, custodial training), Michigan minimum wage ($8.15 per hour), and the ability to earn higher wages. Our clients do not participate in arts and crafts, they earn paid holiday bonuses, and pay into the Social Security system. Our data documents the skills, they entered our program with, they acquired, and whether their skills allowed them to be recommended for a Unique Options, LLC enclave placement or our Community Placement Program. Information regarding productivity rates and accuracy is tracked on every client for every job, as are inappropriate conduct and core work behaviors.

Our research supports the thesis that Unique Options, LLC offers successful solutions while providing realistic long-term employment opportunities, for adults who have sustained ABI's and are looking to transition from rehabilitation into a satisfying, long-term, and successful employment setting.
Successful Transition for Adolescents with ABI from High School to Employment via a Non-Traditional Sheltered Workshop

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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The purpose of this research is to showcase the effectiveness of transition from high school to a non-traditional sheltered workshop/vocational center, versus a traditional sheltered workshop for adolescents with ABI (Acquired Brain Injury). Traumatic Brain Injury (TBI), or otherwise known as ABI, is the leading cause of disability and death in children and adolescents in the U.S. According to the Centers for Disease Control and Prevention, the two age groups at greatest risk for TBI are ages 0-4 and 15-19. The physical, emotional, and cognitive impairments that are associated with sustaining an ABI in adolescents cause teenagers to face additional challenges when seeking gainful employment.

With over 10 years of data, Unique Options, LLC has been able to provide adolescents with ABI the ability to transition from a school environment to a supportive employment environment in a non-traditional vocational setting, by offering more competitive advantages than a traditional sheltered work. These advantages include: a job coach and support team (Limited License Psychologist, Registered Nurse, Occupational Therapist, and Masters level Vocational Rehabilitation Counselors), only working with other ABI clients, real work (i.e., sorting, packaging, inspection, data entry, custodial training), Michigan minimum wage ($8.15 per hour), and the ability to earn higher wages. Unlike several other programs who state they provide Vocational Rehabilitation, our clients do not participate in arts and crafts, earn paid holiday bonuses, and pay into the Social Security system. Our data documents the skills they entered our program with, the skills they acquired, and whether their skills allowed them to be recommended for a Unique Options, LLC enclave placement or our Community Placement Program. Information regarding productivity rates and accuracy is tracked on every client for every job, as are inappropriate conduct and core work behaviors.

Our research indicates that Unique Options, LLC offers more successful options and prospects for providing realistic long term employment opportunities for adolescents who have sustained ABI's and are attempting to transition into the real world of work, as opposed to a traditional sheltered workshop. Our data supports the thesis that with supported vocational rehabilitation, quality and long term successful employment opportunities are possible for adolescents who have sustained ABI's.
What can the Virtual Classroom Teach Us about the Attention Deficits Profile of Children with ABI

Status: Accepted Presentation type: Poster

Category: Technology – clinical research/applications

Author's preference: Oral

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Objectives: Attention disorders are usually assessed using standardized neuropsychological assessments. However, everyday failures may be sensitive to impairments that are not evident in a laboratory setting, which might preclude assessment of the full spectrum of real-world dysfunction. The Virtual Classroom (VC) is a virtual reality system that was developed for the assessment of attentional skills in an environment that simulates a real world classroom. The aim of this study was to describe the attention deficits profile of children with ABI in an ecologically valid situation using the VC task, and to study discriminant and concurrent validity of the VC in this population, as well as factors influencing performance in the VC.

Methods: Forty-one children with ABI and 35 matched controls, aged 8-16, were assessed using the VC. The reaction patterns of the participants in the VC were recorded and documented using four measures representing four attention components: 1. Sustained attention- total correct hits; 2. Impulsivity-commission errors; 3. Reaction time –measured in ms. and 4. Hyperactivity: measured by head movements tracker.

The results of the VC were compared to The Test of Everyday Attention for Children (TEA-Ch), The Conners’ Parent Rating Scales- Revised: Short (CPRS-R:S) questionnaire and to demographic and injury severity variables.

Results: In the VC task, the performance of the ABI group was significantly lower than that of the control group for the total correct hits, with 45.2% of children with ABI performing more than 1 SD below the mean of the control group. Significant inter-correlations were found between the VC measures (r=.30-.48, p<.001). Significant correlations were found between the VC variables and some subtests of the TEA-Ch, and with the CPRS-R:S. The total correct hits (r=.34, p<.05), the commission errors (r=.33, p<.05) and reaction time (r=-.50, p<.01) correlated significantly with age (older patients perform better). A significant correlation was found between the commission errors and the cranial radiotherapy dose that the children with malignant brain tumors (n=12) received. The linear regression revealed that for the entire sample (N=74) the total correct hits of the VC was able to predict 9.7% (p<.008) of the variance of the ADHD index.

Conclusions: Children with ABI in this study displayed significant impairments in various aspects of attention, with sustained and divided attention being the most impaired. The discriminant and concurrent validity of the VC was relatively good in a sample of children and adolescents with ABI. The attentional performance was found to be related to age, age at injury/diagnosis and treatment (radiotherapy dose). The VC appears to be a sensitive, objective, short, easy to use and ecologically valid assessment tool for use in the diagnosis of attention deficits among children and adolescent with ABI.
Re-Emergence of Head Control is Associated with Resolution of Disorder of Consciousness during Inpatient Rehabilitation in Children with TBI.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: During inpatient rehabilitation, identifying important markers of recovery in children admitted with Disorders of Consciousness (DOC) can be challenging. The Physical Abilities and Mobility Scale (PAMS) is a 20-item measure that was developed to quantify progress towards physical therapy goals during acute rehabilitation. Each item is scored 1-5, with 1 indicating markedly limited participation/capability and 5 indicating independence within parameters of the given measure. The objective of this study is to determine whether the return of head and trunk control, as measured by the PAMS, is associated with emergence to a conscious state (CS) in children with DOC following traumatic brain injury.

Methods: 10 children/young adults (8-20 years of age) who sustained a TBI and had a DOC at admission to inpatient rehabilitation were included. As part of clinical care, the PAMS was administered upon admission and approximately every 2 weeks until discharge. Emergence to CS by discharge was determined based on medical record review. T-tests were conducted to examine differences in the PAMS head and trunk control ratings between children who emerged to a CS and those who did not. Two ratings (Time 1, at admission, and Time 2, 2-3 weeks after admission) were utilized. Additionally, qualitative analysis was conducted.

Results: Five children (50%) emerged to a CS by discharge. Children who emerged to CS at discharge had higher head control scores at Time 2 compared to children who did not emerge to CS (p = <.05). There were no significant differences between groups for head control ratings at Time 1 or trunk control ratings at either time point. Qualitatively, the two children who did not show any improvement in head control by Time 2 did not emerge to CS at discharge. Similarly, the three children with a head control score of >3 (maintained head up for a minimum of 10 seconds) at Time 2 resolved to a CS. The remaining five children demonstrated a change from 1 (unable to maintain head up) to 2 (maintained head up for < 10 seconds) on the head control item, and two emerged to a CS (40%).

Conclusions: The return of head control, but not trunk control, as rated on the PAMS is associated with emergence to CS by discharge from an inpatient pediatric rehabilitation facility. Head control appears to be an important marker of recovery in children with DOC. Further research with a larger sample is needed to better understand the relationship between the development of head control and emergence to a CS.
An audit of moderate to severe acute head injury patients in Chris Hani Baragwanath Academic Hospital

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: No preference

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Objectives: Head injury is a devastating condition in developing countries like South Africa, contributing significantly to mortality and morbidity. The factors affecting outcome like age, gender, mechanism of injury, clinical, radiological findings and treatment is reported. Their relation to outcome (Glasgow Outcome Score) of treatment is analyzed.

Methods: This is a retrospective, descriptive and demographic profile study. The sample group consists of moderate to severe head injury patients admitted in the neurosurgical unit of Chris Hani Baragwanath hospital from January 2011 to June 2012. The data includes age, gender, nature of head injury (scalp, skull, intracranial), mode of injury (fall from height, road traffic accident, fire arm injury, assault, blast injury), condition at presentation [Glasgow Coma Scale (GCS)], pupillary reaction, Computed Tomography (CT) scan findings, treatment received and outcome [Glasgow Outcome Score (GOS)] of treatment.

Results: A total of 292 patients was enrolled in the study, 258 males (88.3%) and 34 females (11.6%). In the age distribution 50 patients were below 19 years, 161 patients were between 20 to 39 years, 60 patients 40 to 59 years and 21 patients above 60 years. The various mechanisms of injury noted were assault in 127 patients, pedestrian vehicular accident in 50 patients, motor vehicular accident in 33 patients, motor bike accidents in 4 patients, train accidents in 2 patients, gunshot injury in 6 patients, fall from height in 35 patients and struck by heavy object in 5 patients. 123 patients had a GCS between 3-5, 72 patients GCS between 6-8 and 97 patients GCS 8-12. 192 patients had equal and reacting pupils after the head injury, 52 patients unilateral fixed pupils and 10 patients bilateral fixed pupils. The Computed tomography (CT) of the brain showed 287 patients with focal intracranial findings, 107 with diffuse brain injury and 168 patients with features of raised intracranial pressure. 129 patients (44.1%) were surgically treated and 163 patients (55.8%) treated conservatively with medical treatment. The variables age, mechanism of injury, GCS, pupillary reaction, raised intracranial pressure and type of management was compared to GOS and found to be statistically significant.

Conclusions: The outcome of patients with moderate to severe head injury has no effect on gender but has a significant relationship between age and mortality. The mechanism of head injury has a direct effect on the prognosis with gunshot head having the worst outcome. The important prognostic factors affecting the outcome include: age of patients, severity of head injury (GCS), pupillary reactivity to light and the pathology of the brain CT scan. The unfavorable prognostic factors are: old age, non-reacting pupils to light, severe head injury (low GCS) and raised ICP after head injury. Medical or surgical management have similar mortality rate.
The Effectiveness of Physiotherapy and Coma Duration in Patients with Severe Traumatic Brain Injury in Acute and Post acute Rehabilitation

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: to evaluate the effectiveness of physiotherapy depending on the duration of coma in patients with severe traumatic brain injury.

Methods: We assess 52 TBI patients with the level of consciousness according to the Glasgow Coma Scale (GOS) ranging from 3 to 8 scores, a mean age of 44.4 (years SD, 11.9) in acute rehabilitation 14 days (Neurosurgery department) and post acute rehabilitation 54 days (Neurorehabilitation department). The patients were divided into 2 groups according to duration of coma: the 1 group of patients who were in coma up to 1 week, the 2 group - patients who were in coma for more than 2 weeks. The recovery of patients' mobility was evaluated according to the Motor Assessment Scale, and the recovery of mental status, according to the Mini-Mental State Examination.

Results: Mobility: supine to side lying, supine to sitting over side of bed, balanced sitting, sitting to standing, walking, upper arm function, hand movements, advanced hand activities, and general muscle tone in patients who were in coma up to 1 week recovered significantly better after physiotherapy than those who were in coma for longer than 2 weeks (P<0.05). The evaluation of the recovery of mental status showed that the patients who were in coma up to 1 week the tasks associated with orientation in time and place, attention, naming a pencil and a watch, and repetition of some words performed significantly better than those who were in coma for longer than 2 weeks (P<0.05).

Conclusions: Recovery of motor and mental status of the patients in the acute rehabilitation was significantly better for those who were in coma for the shorter period. We did not find correlations associations between coma duration and recovery during post-acute rehabilitation.
Long-term life goals of patients with acquired brain injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Poster

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Background: It is well known that rehabilitation after acquired brain injury (ABI) is more successful and motivation increases when personally important goals are set, which are concurrent with one’s life goals. Furthermore, attainment of important life goals has shown to be associated with better long-term quality of life. So, it is important to identify the patient’s long-term goals in an early stage of the rehabilitation process. To identify these long-term goals mostly questionnaires, to complete via self-report or semi-structured interviews are used. Yet, it is not known whether the use of open questions versus self-report questionnaires is of influence on the type of goals or the themes/domains of goals that patients report.

Objectives: The aim of this study was to investigate (1) which long-term goals patients with ABI formulate using open questions, (2) to compare the central themes or the domains to which these long-term goals belong with (a) the domains that were identified in previous literature using standardized questionnaires and (b) using open questions in ABI patients.

Methods: Data were collected from a prospective clinical cohort study of 148 patients with ABI after discharge home (mean time since injury = 15 weeks). During a telephone interview patients were asked to give the three most important, most valuable long-term goals, based on their current situation to achieve in about a year. Goals were then specified and made measurable but not reviewed clinically to measure likelihood of achievement. Each goal was first coded by naming the central theme of this goal and next classified into a goal domain. Coding and classification was executed by the two authors separately and then reviewed until consensus was reached. Domains were compared with the domains reported in previous research using descriptive statistics.

Conclusions: At time of submission data are being analysed and will be known by the end of January 2016.
Early Reach-in Rehabilitation Service of Lymphoma Patients with Cognitive vs Mobility Impairment: A Pilot Study

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: Lymphoma is the fifth most common cancer in Singapore. Due to aggressive nature of disease and complications from treatments, adverse effects such as physical deconditioning and cognitive impairment are common, which can be improved with rehabilitation. We herewith compare the preliminary rehabilitation data among lymphoma patients discussed during oncology rehabilitation multidisciplinary team initiative service.

Methods: 30 lymphoma subjects admitted to Singapore General Hospital (SGH) were divided into cognitive (CG) vs mobility impairment groups (MG). We describe age, gender, reason of admission, length of hospital stay (LOS), ambulation-functional status at initial rehabilitation consult, walking distance on admission and discharge, functional independence measures (FIM) outcomes between 2 groups.

Results: 8 patients have cognitive impairment (5 were male vs 3 were female) and 22 (13 males vs 9 females) have mobility impairment. Mean cohort age for cognitive and mobility impairment groups were 62 yrs ± SD 12 vs 60 yrs± SD 15. 7 (88%) were admitted for cancer treatment in cognitive whereas 12 patients (55%) in mobility impairment group. Only 1 (12%) from cognitive but 10 patients (45%) from mobility impairment group were hospitalised for complication from previous cancer treatment. Mean total LOS were 30 days ± SD 33 vs 25 days ±SD 19 in cognitive vs mobility group. Their ambulation functional status at initial rehabilitation consult between 2 groups showed 3 (37.5%) were independent and 5 (62.5%) were assisted in CG, 6 (27%) were independent and 16 (73%) were assisted in MG. Walking distance in cognitive group revealed 20. 8 meters (M) ±SD 25.0 at initial rehabilitation team consult and 33.5 M ±SD 49.1 upon discharge which was comparable with mobility impairment group in which 19.6 M ±SD 32.9 and 34.5 M ±46.4 respectively. Admission and discharge motor FIM (35 ±SD 22.0 and 40± SD23.0) and cognitive FIM (16± SD 6.0 and 18.6 ± SD 9.4), motor FIM gain (4.5 ±SD 17.0) and cognitive FIM gain (1.5± SD 8.4) were in CG. Admission and discharge motor FIM (42± SD 18.0 and 40± SD 22.0) and cognitive FIM (31.1± SD 7.2, P is <0.00 and 26.1 ± SD 11.3), motor FIM gain (-0.9 ± SD 16.3) and cognitive FIM gain (-4.9 ± SD 10.8) were in MG.

Conclusions: Our preliminary data highlighted that the CG has comparable outcomes as MG despite those with cognitive issues are known to be more complex and challenging in rehabilitation. However FIM assessment tool may not be specific enough to measure rehabilitation outcomes in lymphoma population. Choice of other assessment tools such as Montreal cognitive assessment (MOCA), grip strength and 6 minute walk test may reveal different functional outcomes in this population. Future studies in SGH oncology subjects are needed to better select clinically relevant outcome measures.
Estimated life time savings from specialist rehabilitation following acquired brain injury: a large multi-centre cohort analysis from the UK.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: To evaluate the cost-efficiency of specialist in-patient neurorehabilitation in patients with acquired brain injury in three groups of dependency, through estimation of the life-time savings in the costs on ongoing care.

Methods: The UK Rehabilitation Outcomes Collaborative national clinical database collates episode data for all specialist in-patient rehabilitation services in England. Recorded on admission and discharge, the Northwick Park Dependency and Care Needs Assessment (NPDS/NPCNA) calculates the estimated savings in ongoing care-costs in the community. The Functional Independence Measure (FIM) is recorded within the UK Functional Assessment measure.

Life expectancy adjusted for brain injury was computed in 4 groups defined by FIM scores at discharge: ‘Walks well alone’, ‘Some walking ability’ and ‘Unable to walk: self-feeds or fed by others’.

- Percentage reduction life expectancy following TBI (was calculated from the US mortality figures (Shavelle 2007) and applied to national UK projected life expectancy data, to derive the remaining years of life expectancy.

- Life-time savings were then individually calculated as 'mean saving in ongoing care cost/year x remaining years of life expectancy'

Between 2010-2015, 4182 admissions for rehabilitation in 67 centres had complete NPCNA and FIM data. The remaining life expectancy, mean savings in ongoing care costs and mean lifetime savings were analysed for the group as a whole and in three groups of dependency, based on NPDS scores on admission. ‘High dependency’ (NPDS >25) requiring 2 carers for most care tasks; ‘Medium’ (NPDS 10-25) requiring 1 carer, and ‘Low’ (NPDS <10) requiring incidental help only

Results: For the whole sample, the mean age was 47 (St Dev ±12.8) years and the mean length of stay 91 (±67) days. The mean reduction of care costs was £515 (±£801) per week (£26,780/year). The mean remaining life expectancy was 28.9 (±12.9) years. Estimated life savings in ongoing care costs were £863,697 (±1,425,324) per patient, totalling £3.6 billion for the analysed population (n=4183).

When broken down by dependency group:

- The remaining life expectancy was shortest in the high-dependency group (26.3 (±12.3) years, compared with 32.1 (±12.2) and 36.1 (±12.7) in the medium- and low- dependency group respectively
But the mean savings in ongoing care costs were greatest in the high-dependency group £650 (±877), compared with £378 (SD 627) in the medium- and £109 (±482) in the low-dependency groups (see separate abstract for more detail).

The mean life-time savings were greatest in the high-dependency group £1,066,121 (±1,563,551) compared with £678,866 (±1,135,127) in the medium- and £210,513 (±901,127) in the low-dependency group.

Conclusions: Whilst specialist rehabilitation may appear at first sight to be an expensive intervention, the savings in ongoing care costs computed over a life time are very substantial indeed, especially for highly dependent patients.
Cost-Efficiency of In-Patient Specialist Rehabilitation Following Acquired Brain Injury: A Large Multi-Centre Cohort Analysis From the UK

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: To evaluate the cost-efficiency of specialist in-patient neurorehabilitation in patients with complex disability following acquired brain injury in three groups of dependency.

Methods: The UK Rehabilitation Outcomes Collaborative national clinical database collates episode data for all specialist in-patient (Level 1 and 2) rehabilitation services in England. These services predominantly tertiary services take a highly-selected caseload of patients with complex needs for rehabilitation that are beyond the scope of their local (Level 3) rehabilitation services.

Within the dataset, the Northwick Park Dependency and Care Needs Assessment (NPDS/NPCNA) is used to calculate cost-efficiency as the time taken to offset (TTO) costs of rehabilitation through estimated savings in ongoing care-costs in the community. Functional Independence Measure (FIM) efficiency is calculated as FIM-gain/Length of stay.

Length of stay, rehabilitation costs, mean reduction in NPCNA-estimated care costs, TTO rehabilitation cost and FIM-efficiency were analysed in three groups of dependency, based on NPDS scores on admission:

- ‘High dependency’ (NPDS >25) requiring 2 carers for most care tasks;
- ‘Medium’ (NPDS 10-25) requiring 1 carer, and
- ‘Low’ (NPDS <10) requiring incidental help only.

Results: Between 2010-2015, 4182 admissions for rehabilitation in 67 centres had complete NPCNA and FIM data. The male:female ratio was 62:38% and aetiologies were: stroke/vascular accident 36%, trauma 22% and hypoxia/inflammatory 15%, progressive 11%, tumour 6%, other 10%.

For the whole sample, the mean age was 47 years (St Dev ±12.8); mean length of stay 91 (±67) days, and mean episode cost £43,054 (±£33,473). The mean reduction of care costs was £515 (±£801)/week (£26,780/year), and the mean time taken to offset the cost of rehabilitation was 19.2 months.

When broken down by dependency:

- The high-dependency group had longer lengths of stay (mean 108 (±70) days) compared with 66 (±53) and 52 (±47) in the medium- and low-dependency groups respectively.
· The mean costs of rehabilitation were correspondingly greater at £51,309 (±34,351) in the high dependency, compared with medium: 30,860 (±26,258), and low: 25,023 (±26,028).

· But the mean savings in ongoing care costs were greatest in the high-dependency group £650 (±877), compared with medium £378 (±627) and low £109 (±482).

· So that the mean time to offset rehabilitation costs was shortest in the high-dependency group 15.0 months compared with 25.6 and 28.8 months respectively.

· Meanwhile the FIM efficiency was highest in the medium-dependency group (0.56 compared with 0.40 (high) and 0.38 (low), reflecting floor and ceiling effects of the FIM.

Conclusions: Specialist neurorehabilitation can be highly cost-efficient, especially in high-dependency patients. This is important because highly dependent patients are frequently denied rehabilitation in health systems that require the prediction of a significant change in FIM-score as an eligibility criterion for admission to rehabilitation programmes.
The role of goal adaptation in acceptance and subjective quality of life after an acquired brain injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Objectives: Individuals with an acquired brain injury (ABI) show large variability in subjective quality of life (QOL) and life satisfaction, that is not accounted for by objective indicators of the seriousness of brain injury, and it has been shown that acceptance is better predictor [1]. As it is the case with other chronic conditions, flexible goal adaptation might be an important predictor of acceptance and life satisfaction. Goal adaptation [2] consists of two components: (1) disengagement from valuable, but unattainable goals, and (2) reengagement to new, more feasible goals. The aim of this study is to examine the relative impact of both factors. Moreover we investigated whether the relationship between goal adaptation and QOL is mediated by experienced helplessness.

Methods: Seventy-six individuals (18-65 years of age) with an ABI completed a battery of questionnaires. Rehabilitation professionals estimated their impairment on a 7-point scale. Associations between goal adaptation (Wrosh Goal Adaptation Scale), optimism (LOT; Life Oriëntation Test), disease-specific QOL (EBIQ; European Brain Injury Questionnaire), life satisfaction (SWLS; Satisfaction with Life Scale) and acceptance and helplessness (ICQ; Illness Cognitions Questionnaire) were investigated by means of regression analyses.

Results: After controlling for demographic factors and illness characteristics goal reengagement was positively associated with acceptance, life satisfaction, mental aspects of wellbeing, and disease specific quality of life. There was no effect of goal disengagement on any of these variable. Helplessness mediated the relationship between goal reengagement as predictor and acceptance, life satisfaction and mental aspects of QOL as outcomes.

Conclusions: In patients with an ABI, reengagement towards new goals seems to be a far more important factor than disengagement from earlier unattainable goals. Helping people to formulate and strive towards new goals may reduce feelings of helplessness. This may lead to more acceptance and subjective wellbeing.

**Fatigue in patients 3-10 years after aneurysmal and angiographically negative subarachnoid haemorrhage**

**Status:** Accepted  **Presentation type:** Poster

**Category:** Neurotrauma – basic research

**Author's preference:** No preference

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**Objectives:** Fatigue has been reported as one of the most frequent complaints after subarachnoid haemorrhage (SAH) and is likely to interfere with daily life functioning. To date, specific features of fatigue (i.e. the nature and impact of fatigue) have not been investigated after SAH. Therefore, we aimed to examine the most important factors of fatigue after SAH and compare profiles of fatigue between patients with angiographically negative SAH (anSAH) and patients with aneurysmal SAH (aSAH). Furthermore, we investigated associations between fatigue, work status and mood in both groups.

**Methods:** 54 patients with anSAH (mean age 62 years) and 169 patients with aSAH (mean age 60.5 years) were investigated in the chronic phase (on average 6.8 years post-SAH). Fatigue was assessed using the Dutch Multifactor Fatigue Scale (DMFS), a questionnaire with five subscales, designed to measure the nature and impact of fatigue, comorbid signs and complaints, and coping with fatigue after acquired brain injury (ABI). The Hospital Anxiety and Depression Scale (HADS) was used to examine depression and anxiety. Patient groups did not differ significantly in age, but the aSAH patient group contained significantly more women than the anSAH patient group.

**Results:** Within the profile of all patients with SAH, physical fatigue and difficulty coping with fatigue were highest. Furthermore, correlations between scores on the five DMFS subscales and the HADS score were moderate (r = between 0.17 and 0.64, p < 0.01). Patients with aSAH experienced significantly greater mental fatigue and impact of fatigue than patients with anSAH. Patients with anSAH and aSAH did not differ significantly in mood and work status. However, work status was related to mental fatigue in patients with anSAH and to physical fatigue in patients with aSAH.

**Conclusions:** In the chronic phase after SAH, patients reported mainly physical fatigue and problems in coping with fatigue. However, the profiles of patients with anSAH and aSAH clearly differed and work status and fatigue were differently related in both patient groups. It is important to assess fatigue after SAH, preferably with a scale specifically developed for patients with ABI, in order to identify the specific nature of fatigue. Fatigue after SAH manifests itself in different ways and can have various adverse consequences for daily life functioning. Recognizing the different profiles of fatigue in patients with anSAH and aSAH can be beneficial in targeting rehabilitation to individual needs.
Ethics in neurotraumatology

Status: Accepted  Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: Human face of neurosurgery is determined by ethics.

Methods: More than 5000 confirmed cases of acute traumatic brain injury (TBI) and its sequelae at the Burdenko Neurosurgery Institute and more than 50 years’ experience of the author in head injury management.

Results: Modern neurotraumatology became more accurate and effective due to neuroimaging techniques, intensive care, minimally invasive surgery and neurorehabilitation. However new controversies are also being emerged which need to be resolved:

1) Making a fetish of visual data vs anamnesis, clinical picture and personality of a patient;
2) Abundance of sophisticated methods and techniques vs lack of general theories and concepts;
3) Following recommendations of the so-called evidence-based medicine vs individual efficacy of treatment;
4) Risk of surgery vs a risk of natural history;
5) Common sense vs scientific knowledge;
6) A hope for saving life vs a need for harvesting organs for transplantation;
7) Professional duty vs commercial temptations;
8) Great technical possibilities vs limited financial resources;
9) Sanctity of life vs quality of life.

Medical ethics is very important for their true solution which would take into consideration interests both of the patient and the society.

There are significant obstacles for implementation of principle of medical ethics especially in neurotraumatology due to:

1) Lack of time in severe TBI;
2) Loss of consciousness by a patient;
3) Need of urgent triage and transportation in mass injuries;

4) Lack of diagnostic and treatment facilities.

That is why ethical dimension in acute neurotrauma is extremely important.

**Conclusions**: Neurotrauma specialist should be not only Homo sapiens but also homo moralis. This is a key point of humanism of modern neurotraumatology.
A prototype Paediatric Rehabilitation Ingredients Measure (PRISM) for use in studies of severity-adjusted outcomes and rehabilitation treatment received

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Poster

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We are developing methods for a planned cohort study relating severity adjusted outcomes after paediatric ABI to rehabilitation received (www.futuresrehabproject.info). Drawing on the lessons of adult stroke studies such as the Post Stroke Observation Project and CERISE, we have been critically evaluating previous approaches to the quantitation of rehabilitation "dose" and "ingredients". We describe preliminary work on an observation schedule (Paediatric Rehabilitation Ingredients Measure, PRISM) including the theoretical basis for our approach, and the rationale for scope and design decisions.

We have completed consultation on the overall measurement model into which PRISM should fit and its construct validity, and initial inter-rater reliability data. At present the tool is particularly focused on the detail of "hands on" therapy sessions but it has a heirarchical, modular design so that future development could add ability to study interventions in other areas in more detail (e.g. interventions aimed at equiping parents to become therapists)
**Fit After Stroke (FAST@HOME): a project on the development and evaluation of an integrated e-health intervention in stroke rehabilitation**

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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**Objectives:** The number of e-health applications targeting different aspects of health of patients with stroke is rapidly increasing. Little is however known on how these interventions can best be used by patients and health care providers in daily practice. Therefore the aim of the FAST@HOME study is to develop and evaluate the (cost) effectiveness of a digital rehabilitation platform (DRP) that integrates a set of potentially effective e-health interventions (physical and mental gaming, digital information provision, an e-exercise program and ambulatory activity monitor) in terms of self-reported mobility and health care usage.

**Methods:** The DRP will be developed by linking the needs of stroke patients, their caregivers and health professionals (preferences, features and conditions for use) to currently available state-of-the-art e-health applications, including the use of ambulatory activity monitoring. The needs will be explored using qualitative focus groups interviews and a subsequent survey among larger groups of stakeholders to rank the importance of the identified needs. The number of components in the DRP will be tailored to patients’ individual situation. After pilot-testing and adjusting the resulting DRP, its (cost) effectiveness will be evaluated in comparison with usual care using a pre-post intervention design. In this trial, 300 participants will be recruited during two periods of maximum 12 months (before and after the implementation of the DRP) from 2 rehabilitation centers (4 study sites), with an implementation period of 3 months in between. In the second study period, all eligible patients are offered the FAST@HOME intervention 2 weeks after inpatient or outpatient admission.

**Results:** Assessments of patients included in the two study periods will be done at admission, discharge and 3 and 6 months thereafter. The primary outcome is the mobility domain of the Stroke Impact Scale. Secondary outcomes include: physical and mental functioning, participation, quality of life and self-management. Moreover, a process evaluation regarding the frequency and duration of the execution of unsupervised rehabilitation exercises and assignments by patients (both study periods) is done, and an evaluation of the usage of and satisfaction with the technology among patients and health care providers will be executed in the second period. An economic analysis alongside the trial will be conducted from the societal and health care perspectives.

**Conclusions:** The main aspects of the DRP FAST@HOME intervention are the integration of various existing e-health interventions addressing different targets in stroke rehabilitation and the inclusion of the perspectives of both patients and health care providers. We hypothesize that the introduction of the DRP leads to a greater frequency and duration of exercises and assignments executed by stroke patients, thereby improving their mobility and other functional outcomes, with equal or lower usage of health care.

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Role of S100B and Neuron-Specific Enolase as mortality predictors in severe traumatic brain injury patients

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: No preference

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Objectives: To determine temporal profile and prognostic ability of S100B protein and Neuron-specific enolase (NSE) for prediction of short/long term mortality in patients suffering from severe Traumatic Brain Injury (sTBI).

Methods: 99 patients with sTBI admitted to the NeuroCritical Care Unit (NCCU) of the Virgen del Rocio University Hospital were included in the study. Blood samples were drawn on admission (<6 h of the accident) and on subsequent 24, 48, 72 and 96 h to determine S100B and NSE.

Results: 15.2% of patients died in NCCU, and 19.2% died within 6 months of the accident. S100B concentrations were significantly higher in patients who died compared to survivors at all the sampling time analyzed. NSE levels were different between the groups just at 48 h of the trauma. In the survival group, S100B levels decreased from the 1st to the 5th sample (p<0.001), and NSE just from the 1st to the 3rd (p<0.001) and then stabilized. Values of S100B and NSE in non-survival patients did not significantly vary over the 4 days post sTBI. ROC-analysis showed that all S100B samples were useful tools for predicting mortality, the best the 72 h sample (AUC 84.8% for discharge mortality, 85.5% for 6-month mortality). NSE ROC-analysis indicated that just the 48 h sample predicted mortality, and with poorer capacity compared to S100B (AUC 73.3% for discharge mortality, 72.0% for 6-month mortality).

Conclusions: S100B protein showed higher prognostic capacity than NSE to predict short/long term mortality in sTBI patients.
Post-Traumatic Stress Symptoms and Anxiety Following Pediatric Injury: Relation to Salivary Biomarkers of Stress Reactivity

Status: Accepted Presentation type: Oral

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: Very little is known about how injury to the brain and other body regions affects stress response systems. To date, there are no clinical studies examining reactivity of hypothalamic-pituitary-adrenal and noradrenergic stress systems after pediatric injury. To examine biological systems contributing to neuropsychiatric sequelae in children sustaining physical injuries, we collected biomarkers of each stress system during a stress induction procedure in children with different injury types.

Methods: Participants. Children ages 8-16 hospitalized with mild, moderate, or severe TBI (n=40) or extracranial injury (EI; n=24) caused by vehicular accidents were enrolled in a longitudinal study. Biomarker profiles were compared with those of healthy children (n=24).

Procedure. The Child PTSD Scale, Screen for Child Anxiety Related Emotional Disorders, and The Trier Social Stress Test for Children were administered 6 months after injury. The Trier is an established laboratory procedure involving oral speaking and mathematical calculation that typically produces time-linked elevation in both cortisol and alpha amylase. Cortisol is a steroid hormone that provides an index of activation of the hypothalamic pituitary adrenal axis. Alpha amylase is a digestive enzyme regarded as a marker of adrenergic sympathetic nervous system stress reactivity. Saliva samples were collected 20 minutes before, right before, immediately after, as well as 20 and/or 40 minutes following stress induction.

Results: Generalized linear models with a negative binomial distribution and log link function were used to examine the effects of group, saliva collection time during the Trier, age, and their interactions on cortisol and alpha amylase values. Cortisol reactivity did not vary by group. The age x group interaction for alpha amylase was significant (p < .05); levels were elevated in adolescents, but not children with TBI, relative to other groups. Spearman partial correlation coefficients controlling for age were used to examine the relation of Child PTSD Scale and anxiety scores with the biomarker area under the curve (AUC) values. Cortisol AUC was not related to stress scores for either group. The relation of alpha amylase AUC differed significantly between the TBI and EI groups for the anxiety, avoidance, and arousal scores (ps<.03). Higher anxiety and stress scores were significantly associated with lower AUC levels for TBI and with higher AUC for participants with EI.

Conclusions: Alpha amylase, but not cortisol, reactivity was elevated following stress induction in patients with TBI, particularly in older children and adolescents. Lower stress reactivity was associated with more stress and anxiety symptoms after TBI and with fewer symptoms after EI. Additional research is needed to examine divergent relations of stress system biomarkers with stress symptoms in youth with TBI and EI.
Cost-Effectiveness of Prehospital Intubation in Severe TBI patients in Colombia

Status: Accepted  Presentation type: Poster
Category: Neurotrauma – health services and outcomes
Author's preference: Oral

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Objectives: Traumatic Brain Injury (TBI) is a worldwide public health problem. In Colombia, TBI-related death and disability increases costs to the society because the most affected group is the economically active population. The aim of this study is to analyze the cost-effectiveness of the early intubation in severe TBI patients, comparing two different strategies: prehospital intubation versus emergency room (ER) intubation using a rapid sequence intubation (RSI) protocol, evaluating impact on outcome 6 months after injury.

Methods: A model was design to compare costs and outcomes linked to prehospital and ER- RSI. Costs were obtained from local standards and the Extended Glasgow Outcome Scale (GOS-E) adjusted to three health states (level I, level II and death) 6 months after injury was used to evaluate outcomes. The effectiveness of each alternative was obtained from existing clinical literature. From the clinical information, the Ratio of Incremented Cost Effectiveness was calculated. A cost/utility model, extreme value scenarios and a Monte Carlo procedure with 10,000 iterations sensitized the utilized model.

Results: According to the only clinical trial available in the literature and comparing the strategies 50.47% of the patients with prehospital care intubation and 38% of the patients with ER intubation were in level I neurological outcome (GOS-E 5 to 8), 14.37% of the patients with prehospital care intubation and 22% of the patients with ER intubation were in level II neurological outcome (GOS-E 2 to 4). Death was the outcome in 35.16% of prehospital intubated patients and in 39.2% of ER intubated ones. According to local health care costs in Colombia, and after adjustments by outcome groups, the strategy of prehospital intubation is less expensive than the ER strategy, saving USD$10.379 per patient. Training and equipment required by an ambulance in Colombia to perform appropriate prehospital intubation will cost USD$9.000 per ambulance. The actual cost of a severe TBI death patient in Colombia is USD$201.255, including health care and health insurance costs. In 2013, around 1.500 ambulances were offering trauma prehospital care service in the entire country. The same year near to 2.000 patients die with severe TBI and inappropriate prehospital care including failures in the airway management. The calculated cost of capacity building for appropriate prehospital intubation in Colombia will be around USD$13.500.000. The actual cost that the system is paying for TBI death patients without advanced prehospital care is USD$402.510.000.

Conclusions: In Colombia, the prehospital intubation strategy surpasses the ER strategy since it’s favored by the cost/effectiveness ratio, and has demonstrated its higher likelihood of providing more satisfactory neurological outcomes.
The Effect of Oxiracetam on Neurogenesis in the Hippocampus after Traumatic Brain Injury

Status: Accepted
Presentation type: Poster
Category: Neurotrauma – basic research
Author's preference: Poster

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Objectives: To investigate the effect of oxiracetam on neurogenesis in the hippocampus after traumatic brain injury (TBI).

Methods: The SD rats were trained by Morris Water Maze (MWM) test then were divided into control group, NS group and oxiracetam group. Rats with TBI in the NS and oxiracetam groups were established by a fluid percussion device. The rats of NS or oxiracetam groups were injected with 1ml NS or 1ml oxiracetam (200mg/kg) at 1 to 14 days post-injury (dpi) through caudal vein. The rats of control group were not administered. Place navigation test were performed at 15 to 18 dpi then probe trial test were performed at 19 dpi. The newborn neuronal progenitor cells in the dentate gyrus were observed by DCX immunofluorescence at 20 dpi. The cholinergic neuron in the septal area and Meynert basal nuclei were detected by ChAT immunofluorescence at 20 dpi. The level of ACh in the hippocampus was detected by ELISA kit at 20 dpi. The level of ATP in the hippocampus was detected by ATP kit at 20 dpi.

Results: MWM test showed that the cognitive function of rats in the oxiracetam group was improved more significantly than that of NS group. A few DCX+ neuronal progenitor cells were found in the dentate gyrus of control group. Many DCX+ neuronal progenitor cells were found in the dentate gyrus of oxiracetam and NS groups but the number of DCX+ neuronal progenitor cells of oxiracetam group was than that of NS group. Many cholinergic neurons were found in the septal area and Meynert basal nuclei of control group. The number of cholinergic neurons in the oxiracetam group decreased slightly and was more than that of NS group. The level of hippocampus ACh in oxiracetam group was less than that of control group but more than that of NS group. The level of hippocampus ATP in oxiracetam group was less than that of control group but more than that of NS group.

Conclusions: Oxiracetam could promote the endogenic neurogenesis of hippocampus in the adult rat after TBI and improve the cognition recovery. Oxiracetam could protect the basal forebrain cholinergic system from TBI and promote the ACh secretion to enhance the neurogenesis of hippocampus. Oxiracetam also could improve the level of ATP in astrocytes and enhance the astrocytes cytoactive involved the process of neurogenesis.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: No preference

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Objectives: It is known that mitochondria play the important role in the mechanisms of brain cells damage and death following traumatic brain injury (TBI). However, the relationship between the severity of brain damage following TBI and mitochondrial dysfunction are not well defined. The aim: to study activities of NADH-dehydrogenase (NADH-D) and succinate dehydrogenase (SDH) of peripheral blood lymphocytes in children with TBI of varying severity and different outcomes; to determine ATP content in lymphocytes.

Methods: respiratory chain enzymes activities were evaluated in 72 patients with TBI and age-matched control subjects (N=27) by quantitative cytochemical method, based on ability of p-nitrotetrazolium violet to form insoluble formazan granules during enzymatic reduction in lymphocytes. The intensity of the reactions was examined in lymphocytes by measuring as median integrated optical density (IOD) and square formazan granules per cell using VideoTest-Morphology image analysis system (VideoTest, Russia). The outcome was assessed using the Glasgow Outcome Scale (GOS). All patients were divided into favorable (N=51; GOS: 4-5), unfavorable (N=16; GOS: 2-3) prognosis groups and patients with fatal outcome (N=5; GOS: 1). All parameters were determined in the dynamics of one month following TBI into all groups of patients. Intracellular ATP measurements were performed in 15 patients with different outcomes of TBI by the luciferin-luciferase bioluminescent assay.

Results: we found that during 1 week after injury NADH-D activity was no significantly different between the favorable prognosis group and controls. Beginning from the 7th day activity of the enzyme increased in children with TBI (GOS:4-5). In this group of patients the high NADH-D activity remained in the first month of TBI. Group with poor outcome is characterized by decreased NADH-D activity throughout the post-traumatic period. In the first 24 hours changes in the activity of SDH had no significantly different in controls and in both groups of patients. Starting from 2d day we revealed decreased SDH activity in group with poor outcome during 3-5 days both the IOD and square, which increased and returned to near-normal level by the second week after injury. In group with favorable outcome the significant decrease of SDH IOD only in the end of 1 week after injury we observed. The greatest decrease in these parameters was observed in patients with severe traumatic brain injury and fatal outcome. A direct correlation was found between the indices of dehydrogenases activity and ATP content in lymphocytes (r=0.97, p=0.005). Conclusion: there is the relation between activity of mitochondrial dehydrogenases of peripheral blood lymphocytes and clinical outcomes after traumatic brain injury in children. The high values of activity mitochondrial dehydrogenases improve the prognosis of favorable outcome after TBI. These results suggest that determination of activity mitochondrial dehydrogenases may be used in the clinical assessment of the primary damage and prediction of outcome after severe traumatic brain injury in children.

Conclusions: The study is supported by Russian Humanitarian Research Foundation (grant №15-06-10952).
Network Of Previcational Rehabilitation For Patient After ABI

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Objectives: Previcational rehabilitation is performed by members of the interprofessional rehabilitation team to get a functional assessment of the psychosensomotor potential of patients for employment.

Methods: Based on the initiative and methodological guidance of the Department of Rehabilitation Medicine (DRM) a project was established, which was funded by the European Social Fund and from the state budget of the Czech Republic entitled "Initiative of the EQUAL EU - Rehabilitation-Activation-Work (RAW)." This project was conducted from 2005 until 2008. Six inpatient rehabilitation departments participated in this project in cooperation with the competent Labour offices and employment agencies.

We have divided previcational rehabilitation to the first and second tier methodologies.

First tier methodologies were selected so that they are sufficiently broad and cover most of the work activities. First tier methodologies included tests to evaluate physical exercise, balance, dexterity, orientation in unfamiliar situations, cognitive functions, working position, working equipment etc.

Second tier methodologies were used only by selected facilities based on their experience and focus on the age groups or for various functional diagnoses. Second tier were more variable, more detailed, more time consuming and intended for more complex cases in patients with severe and very severe disability.

The EQUAL project continued by a project "Regional networks of cooperation in prevocational and vocational rehabilitation (PREGNET). The tender was announced by the Ministry of Labour and Social Affairs (MLSA) as a continuation of the RAW project. The objective was to create prevocational rehabilitation in each region, we have 13 regions, with standard personnel, material and supply equipment. At the end of the project, we proposed that the MLSA issue accreditations for facilities that will perform prevocational rehabilitation, based on standardization of the methods. The prevocational rehabilitation is reimbursed from the resources in the employment field.

Standard methodologies were divided into basic, recommended and special methods for determining the psychosensomotor potential for employment.

The basic methodology has been selected such that the prevocational rehabilitation centres are uniformly equipped and that these methodologies require a one-time investment.

The prevocational rehabilitation centres need not own the recommended methodologies, but if necessary, they should ensure their availability.

Special methodologies are among the optional equipment of the prevocational rehabilitation centres according to their specialization. DRM selected special methods for patients after ABI for example
FIM, Rivermead Behaviour Memory Test, Prevocational assessment according to Jacobs, Canadian model of employment, General office test.

**Conclusions:** The prevocational evaluation is sending to Labour office and should not contain any confidential medical information and includes positive employment recommendations and work restrictions. This report may contain recommendations for further education or retraining. The Labour offices follow the conclusions. According results they continue with vocational rehabilitation. Vocational rehabilitation is focused on particular employment and concrete job positions.
The Effect of Pharmacologic Treatment of Depression on Number of Clinician Visits for Persistent Post-Concussion Symptoms – A Retrospective Review

Objectives: Studies have shown that premorbid depression is a risk factor for prolonged concussion recovery. No literature exists on whether pharmacologic treatment of depression at the time of sustaining a concussion affects time to symptom resolution. This study aims to identify whether or not, amongst patients with depression, pharmacologic treatment of depression at the time of sustaining a concussion results in fewer clinician follow up visits for post-concussion symptoms, compared to depressed patients not on pharmacologic depression treatment at time of concussion.

Methods: Using Mayo Clinic’s Advanced Cohort Explorer (ACE) program, a retrospective chart review of patients 18-60 years old evaluated at Mayo Clinic was performed. Patients with a history of depression who then sustained a physician documented concussion were identified. Those with a history of migraine, prior concussion, fibromyalgia, any chronic pain syndrome, skull fracture or intracranial bleed diagnosed concurrently to their concussion were excluded. Clinician visits (physician, mid-level provider, neuropsychologist, psychiatrist) specifically for post-concussion symptoms (not present prior to concussion) at 3, 6, and 12 months were counted. Number of visits in depressed patients on pharmacologic depression treatment at the time of concussion were compared to the number of visits in depressed patients not on pharmacologic depression treatment at the time of concussion. Data was analyzed using a between subjects design with independent samples t-test.

Results: A total of 103 patients fulfilled inclusion criteria. There were 72 patients in the treated depression group (mean age 48.4yrs, 50 male, 22 female) and 31 patients in the untreated group (mean age 41.8yrs, 21 male, 10 female). In the treated group, mean number of clinician visits for post-concussion symptoms was 2.5 visits (±0.3) at 3 months, 3.1 visits (±0.9) at 6 months, and 3.4 visits (±1.4) at 12 months. In the untreated group, mean number of visits was 5.5 visits (±0.5) at 3 months, 12.5 visits (±1.5) at 6 months, and 18.3 visits (±2.3) at 12 months. Differences between the two groups in number of visits at 3, 6, and 12 months were all statistically significant (p<0.001). When controlling for treatment group, there was no statistically significant difference between groups for sex or age.

Conclusions: In patients that have a history of depression and then sustain a concussion, pharmacologic treatment of their depression results in a significantly lower number of clinician visits for post-concussion symptoms compared to depressed patients that are not pharmacologically treated for their depression after sustaining a concussion. This highlight the extreme importance of early pharmacologic treatment of depression in depressed patients that sustain a concussion. Pharmacologic treatment of depression after sustaining a concussion is associated with decreased clinician visits, allowing these patients to return to their pre-injury health state sooner and preventing an unnecessary burden on healthcare.
A Comparative Analysis of the Legal Process and Compensation Systems for Paediatric Acquired Brain Injury Cases Across Europe

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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A comparison of legal systems in European Union Member State countries to consider the best forum and method for bringing legal proceedings on behalf of injured children with acquired brain injuries. The presentation will consider the legal process, including pre and post litigation steps required, in 4 EU Member States to explore how the legal system can assist in:

1. achieving faster access to rehabilitation;

2. obtaining interim payments to help to try and improve the injured person's quality of life;

3. achieving a reasonable level of compensation as quickly as possible; and

4. accounting for possible future deterioration in injuries and losses.

The presentation will also consider the differing levels of compensation awarded in 4 different EU Member State countries, how the costs of the legal process are dealt with, and the options available for the injured Claimant when considering where to litigate to ensure the legal process is as effective as possible.
Multi Disciplinary Team Working and the Use of Functional Outcomes Measures in Paediatric Neurorehabilitation

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – basic research

Author's preference: No preference

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Objectives: The objective of the study was to identify suitable functional outcome measures that could be utilised by AHP’s working within neuro-rehabilitation in paediatrics. It is hoped that the outcome measures would then provide a robust evidence base and measure the effectiveness of neuro-rehab AHP interventions offered.

Methods: Rehabilitation providers are facing increasing pressure to provide evidence of improved function as part of meeting rehabilitation goals (Kothari et al, 2003). The aim of study was therefore to examine the effectiveness of AHP neuro-rehab interventions for children referred to the in-patient service with an acquired or traumatic brain injury. It is hoped that it would increase credibility and value of AHP interventions offered in an increasingly medical model, by building an evidence base.

The Paediatric Evaluation of Disability Inventory (PEDI)(Haley, 1992), Rehabilitation Complexity Score (Turner Stokes, 2007) and Goal Attainment Score (GAS) were identified as appropriate measures and were completed at admission, approx half way through interventions and then on discharge. The measures were completed by all AHP’s involved in the patient’s care. The scores and information gained from the measures were used to inform goal setting, which was completed jointly with patients, family and AHP colleagues.

Results: Outcomes scores and analysis of the final data would indicate an improvement in numerous area of the child’s function. Feedback from AHP’s using the outcomes measures suggested easier goal planning.

Conclusions: It is hoped that the functional outcomes measures will be identified as a suitable measure for use within neuro-rehab in paediatrics and subsequently be able to used within practice.


Recuperation of prenatal as well as postnatal valproic acid-induced autistic behaviour, biochemistry & blood brain barrier impairments in rats by a possible inhibition of microglial activation Bhupesh Sharma* and Hariom Kumar

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Recuperation of prenatal as well as postnatal valproic acid-induced autistic behaviour, biochemistry & blood brain barrier impairments in rats by a possible inhibition of microglial activation

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Objectives: Autism is a neurodevelopment disorder. One percent worldwide population suffer from autism and males suffer more than females. Microglia plays an important role in neurodevelopment, neuropsychiatric and neurodegenerative disorders. The present study has been designed to investigate the role of minocycline in prenatal as well as postnatal valproic acid-induced autism in rats.

Methods: Experimental autism was induced in animals by using two models (prenatal valproic acid and postnatal valproic acid). These animals were assessed for social behavior (three-chambers social behavior apparatus), spontaneous alteration (Y-Maze), exploratory activity (Hole board test), locomotion (actophotometer), anxiety (elevated plus maze), intestinal motility, serotonin levels (both in prefrontal cortex and ileum), prefrontal cortex mitochondrial complex activity (complex I, II, IV), brain oxidative stress (thiobarbituric acid reactive species, glutathione, catalase), brain nitrosative stress (nitrite/nitrate), inflammation (both in brain and ileum myeloperoxidase activity), brain calcium and blood-brain barrier permeability.

Results: Animals with prenatal/postnatal valproic acid have reduced social interaction, spontaneous alteration, exploratory activity, intestinal motility, serotonin levels and prefrontal cortex mitochondrial complex activity. Furthermore, prenatal/postnatal valproic acid-treated animals have shown an increase in locomotion, anxiety, brain oxidative stress, nitrosative stress, inflammation, calcium and blood-brain barrier permeability. Treatment with minocycline (dose 1, dose2 and dose 3) significantly attenuated prenatal/postnatal valproic acid-induced reduction in social interaction, spontaneous alteration, exploratory activity intestinal motility, serotonin levels and prefrontal cortex mitochondrial complex activity. Furthermore, minocycline has also attenuated prenatal/postnatal valproic acid-induced increase in locomotion, anxiety, brain oxidative and nitrosative stress, inflammation, calcium and blood-brain barrier permeability.

Conclusions: It may be concluded that prenatal/postnatal valproic acid has induced autistic behavior, biochemistry and blood brain barrier impairments in animals, which were significantly attenuated by the
possible inhibitor of microglial activation, minocycline. Minocycline and other microglial activity modulators should be explored further for their therapeutic benefits in autism and related conditions.

Key words: autism, microglial inhibition, intestinal motility, mitochondrial complex, blood brain barrier permeability, serotonin
A new conceptual framework to facilitate return to paid work following a brain injury.

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Objectives: In Western industrialised societies and cultures paid work is valued and it is accepted that being employed is good for an individual's health. Paid work provides benefits such as a financial income, improved emotional wellbeing, increased self-esteem, independence and a sense of identity. Those unable to return to paid work are more likely to have poorer general and mental health and to become depressed. Only one third of the brain injury population currently return to paid work. Those that do return, do so at a lower level, on fewer hours and most for less pay. Due to current poor return to paid work success rates in England and the social and financial consequences for these individuals this warranted exploration. This PhD research explored the factors impacting the return to paid work of individuals following an acquired or traumatic brain injury with the objective of improving return to paid work rehabilitation.

Methods: Following ethical approval, a qualitative, descriptive phenomenological research approach was used. Phase one of the research collected face to face interview data from sixteen individuals who had experienced a traumatic or acquired moderate to severe brain injury and that had returned to paid work. Phase two collected face to face interview data from eleven employers who had experienced the return to paid work of individuals following a traumatic or acquired moderate to severe brain injury. Descriptive phenomenological analysis of all of the lived experience data established a general situated structure of the phenomenon. The deeper meaning of the phenomenon was then explored using free imaginative variation, responsive reflective writing and categorial intuition.

Results: Four themes emerged from the general situated structure; occupational needs, experiencing loss, grief and adjustment, self-identity and social inclusion and return to the workplace. A return to paid work conceptual framework was developed and emerged from evaluation of these research findings.

Conclusions: This new conceptual framework to facilitate return to paid work rehabilitation of individuals following acquired or traumatic brain injury provides an evidence based approach to help these individuals, employers and professionals to facilitate a more successful return to paid work experience. Vocational rehabilitation would be enhanced with inclusion of occupational needs assessment, loss and grief counselling and the provision of coping strategies to inform employers and individuals following a brain injury regarding how to manage loss and adjustment in the workplace. Addressing challenges to self-identity would help brain injured individuals to come to terms with their changing identity in addition to the provision of education about brain injury to employers and work colleagues to tackle discrimination and social exclusion in the workplace.
Microglia Activation Triggers OPC Apoptosis via HSP60

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Reactive microglia is present in lesions of myelin-related white matter disorders resulting in injuries to oligodendrocyte precursor cells (OPC). Therefore, protection of OPC from injury of excessive activation of microglia is very important in treating these diseases. Heat shock protein 60 (HSP60) has been proven to be released extracellular in the failing heart upon stress or injury. However, the role of HSP60 in the CNS and whether it participates in the toxic effects of microglia on OPC is still unknown. In the present study, we showed that HSP60 could be released extracellular by LPS activated microglia then HSP60 could bind to OPC triggering OPC apoptosis. When pretreated with TLR4 antibody, the viability of OPC increased and the expression of NFκB and caspase3 and the release of proinflammatory cytokines caused by HSP60 decreased significantly. These results suggest that HSP60 may mediate the OPC apoptosis through binding to TLR4 on the surface of OPC so to activate TLR4-NFκB signaling pathway. HSP60 may be a potential target for treatment of myelin-related neurodegenerative diseases that are accompanied by microglia activation.
Road Rage and Traffic Accidents Among Adults with a History of Traumatic Brain Injuries

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: This study examines the associations between lifetime traumatic brain injury (TBI), driver aggression, and motor vehicle collisions among a population sample of adults who reside in the province of Ontario, Canada.

Methods: A cross-sectional sample of 3,993 Ontario adults, aged 18 to 97 were surveyed by telephone in 2011 and 2012 as part of Centre for Addiction and Mental Health’s ongoing representative survey of adult mental health and substance use in Canada. A second cross-sectional sample was based on a 3-year cumulated cross-sectional sample of 6,048 Ontario adults, aged 18 and older who were surveyed by telephone in the 2011, 2012 and 2013 cycles of the CAMH’s Monitor. TBI was defined as trauma to the head that resulted in loss of consciousness for at least five minutes or overnight hospitalization.

Results: An estimated 17% (95% CI: 15.6, 18.6) of adults reported a TBI in their lifetime between 2011 and 2012. An estimated 91% (95% CI: 90.0, 91.9) of individuals in this sample held a valid Ontario driver's license at the time of testing. Among those 16.7% reported a lifetime TBI and 83.3% reported no TBI. The prevalence of TBI was higher among men than women. Relative to licensed adults without TBI, adults with lifetime TBI had significantly higher odds of engaging in serious driver aggression in the past 12 months, such as making threats to hurt another driver, passenger or their vehicle (AOR=4.39). These individuals also reported significantly higher odds (AOR=1.74) of being involved in a motor vehicle collision that resulted in hurting themselves, their passenger(s) or their vehicle. Odds ratios for roadway aggression were significantly higher among drivers (OR=2.65) compared to non-drivers, between 2 to 4.5 times higher among individuals aged 18 to 29, 30 to 39, 40 to 49 and 50 to 64 years compared to adults over 65 (OR=3.12, 4.49, 3.19, 2.20, respectively), higher among adults with TBI than without (OR=2.05), and men (OR=1.54) than women. Among respondents with lowest, but not highest, levels of education, aggression was predicted by a history of TBI.

Conclusions: This is the first population-based study to demonstrate a relationship between a history of TBI and higher rates of serious driver aggression and collision involvement. Given the large proportion of adult drivers with a history of TBI, these individuals may account for a disproportionate burden of all traffic safety problems. Whether the increased road safety risk of adults with a history of TBI is reflective of neurocognitive deficits or is merely evidence of a cluster of unsafe activities produced by a higher risk lifestyles requires further research attention.
Effective professional Process of Vocational Rehabilitation for Clients with Higher Brain Dysfunctions

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Objectives: This study aimed to clarify effective professional process of Vocational rehabilitation (VR) for clients with Higher Brain Dysfunctions (HBDs) caused by brain injury. In Japan, rehabilitation services and social supports for dysfunctions in activities of daily living and social activities among clients with brain dysfunctions were started in 2011. The numbers of institutions which provide VR services and social supports are currently increasing. However, many clients persist in medical rehabilitation and those services were not effectively used by clients with HBDs.

Methods: Individual semi-structured interviews were administered for professionals who engaged in VR for clients with HBDs, working in institutions with histories of supporting those clients in the Tokyo area. Interview contents were 1) duties and achievements, 2) important aspects which the individual thought were important concerning VR for clients with HBDs, 3) partners and subjects in professional collaborations. We recorded dialogs during interviews. The dialogs were input to Microsoft Excel. Using qualitative content analysis, dialogs concerning processes between onset and returning to jobs were extracted and then written on cards. These cards were grouped according to similarities. Formed groups were given names which reflected contents and then made as categories. Categories were compared and converged, and then given keywords (process).

Results: There were 12 participants from whom informed consent was obtained, including seven people who assisted reinstatement and reemployment, and four people assisted only reinstatement, and one person was responsible for assessments and case managements. Each individual had over ten years of experience as professionals in VR for clients with HBDs in public institutions. Interviews were administered in institutions where the participants belonged between August 2014 and August in 2015. Interviews took between 45 and 120 minutes. On the basis of interview contents, 183 cards and 22 categories were extracted. The following 11 processes were created: ‘Medical and vocational assessments,’ ‘Analysis of client’s needs,’ ‘Construction of supports,’ ‘Arranging clients’ abilities and occupations,’ ‘Ensuring environmental accessibility,’ ‘Education and support to families,’ ‘Field work at work sites,’ ‘Showing clients their strengths rather than their dysfunctions,’ ‘Keeping client’s motivated,’ ‘Treatment other problems caused by HBDs,’ ‘Supporting employment’.

Conclusions: We found 11 processes, including the professional effective process of VR for HBDs by a qualitative analysis. As many clients have various dysfunctions along with the HBD, the components of this process are getting the clients to notice their disorder while constructing VR supports from detailed assessments, keeping their motivation and arranging clients’ abilities and occupations, ensuring environmental accessibility, and education and support to families. In addition to this result, we clarify a recovery process of VR for HBDs and make a leaflet about VR for HBDs and improve transition from medical rehabilitation to VR.
HEJ! The Dutch Pediatric Brain Injury Network, an Example of Good Practice

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – public policy and advocacy

Author's preference: No preference

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Objectives: In the Netherlands, a nationwide network (HEJ) for children with acquired brain injury was set up five years ago. HEJ is an acronym for Hersenletsel En Jeugd or in English, Brain Injury and Youth.

HEJ brings together parents, professionals (in the field of neurology, psychiatry, rehabilitation, education, long term care) and researchers.

The aim of the HEJ network is to create awareness, share knowledge, advance research and implement best practices.

In this paper we present the structure of the network, an overview of tangible results so far and critical success factors in organizing and maintaining the network.

Methods: HEJ's national steering committee has 6 taskforces covering the fields of acute care, rehabilitation, education, long term care, family support and research & development.

Each taskforce consists of experts, and has its own chair. These chairs form the steering committee. The steering committee has an independent chair and is supported by the Netherlands Brain Foundation.

Results: In the five years since its formation, HEJ has produced and implemented pediatric ABI guidelines in neurology, cognitive rehabilitation, education and long term care.

A nationwide inventory and monitor of R&D activities has been created. The exchange of knowledge as well as various collaborations has so far resulted in three joint research projects.

Every year HEJ organizes a symposium to share new insights and create a meeting place for professionals in the field and for parents. A website was launched.

Finally, HEJ coordinated the publication of a “standard of care” for children and young adults with TBI. From the patients perspective it describes minimal requirements for good care. It is also a strong tool to create awareness by policy makers and healthcare insurers.

Another result, albeit less tangible, is that HEJ has nurtured an enthusiasm within the whole chain of care for children with ABI and their families to join forces and work together.

Conclusions: The HEJ network enables mutual understanding and trust, an exchange of knowledge and collaboration opportunities. This has resulted in an efficient joint effort to optimize awareness, treatment, care and education for children with ABI and their families.
Some critical success factors are: commitment of organizations; representative and multidisciplinary taskforces and networking chairs; a dedicated and independent chair of the steering committee; relevant international contacts and support by the Netherlands Brain Foundation.

We conclude that setting up the national HEJ network has paid off- with both tangible and non-tangible results.
Selective Inhibition Of Factor XIIa Enhances Blood-Brain-Barrier Stability And Reduces Inflammatory Responses In Experimental Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: No preference

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Objectives: Traumatic brain injury (TBI) is a result of an outside force causing mechanical disruption of brain tissue. In addition, delayed pathogenic events occur, which collectively exacerbate the injury. Although TBI is a devastating neurological condition and a frequent cause of permanent disability in young adults, causal treatment of the prominent symptoms of TBI such as brain swelling and inflammation processes is lacking. Coagulation factor XII (FXII) is the starting point of the contact-kinin system resulting in bradykinin formation, which comprises well-known proinflammatory and blood-brain-barrier-destabilizing features. We recently showed that genetic FXII deficiency results in an amelioration of outcome following experimental TBI. We therefore investigated the drugability of a selective FXIIa inhibitor in a mouse model of focal brain trauma.

Methods: Male, 6-week old C57Bl/6 wild-type (WT) mice were subjected to experimental focal TBI using a cortical cryogenic lesion model. Pharmacological inhibition of activated FXII (FXIIa) was achieved by intravenous administration of 200mg/kg recombinant human albumin-fused Infestin-4 (rHA-Infestin-4; provided by CSL Behring GmbH, Marburg) 1 hour after trauma. Plasma concentrations of bradykinin were measured by ELISA immediately after trauma induction. Lesion size was determined by volumetry from brain slices stained with 2,3,5-triphenyltetrazolium chloride. To assess blood-brain-barrier damage, intracerebral Evans Blue extravasation was measured by photometry. Western Blot was performed to assess protein expression of tight junction proteins. The amount of proinflammatory cytokines was measured by ELISA and the amount of infiltrating immune cells was quantified in immunohistochemical stainings.

Results: Two hours after trauma, bradykinin plasma levels were increased in control mice, whereas bradykinin remained at lower levels in animals treated with rHA-Infestin-4. One day as well as 3 days after trauma induction, a significant reduction in lesion size could be observed in mice treated with rHA-Infestin-4 when compared with controls. Preserved integrity of the blood-brain-barrier as well as a reduction of local inflammatory processes could be identified as underlying mechanisms.

Conclusions: We here show that FXII critically mediates tissue damage after TBI by enhancing inflammation and BBB disruption. Targeted inhibition of FXII might become a novel approach to ameliorate secondary lesion growth in the injured brain.
The Additional Effect of Transcranial Direct Current Stimulation (tDCS) in Post-stroke Sub-acute Aphasia.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Transcranial Direct Current Stimulation (tDCS), a non-invasive technique that stimulates the brain by modifying cortical excitability, is a promising new treatment to optimize regular aphasia rehabilitation. Since 2008 several small studies have shown an additional effect of tDCS on language functioning (i.e. naming) when applied during aphasia therapy in chronic stroke patients. The aim of the present pilot study is to evaluate the application of tDCS in the sub-acute stage of post-stroke aphasia, in regular aphasia rehabilitation programs. Potential effects of tDCS on language functioning and its feasibility in a clinical setting, including drop-out rates and side effects, will be evaluated. Results will be used to outline the design of a double-blind randomized-controlled trial.

Methods: Five participants, enrolled at the Rijndam inpatient and outpatient rehabilitation, matched with the inclusion and exclusion criteria and were willing to participate in the study. All patients had an ischemic stroke in the left hemisphere. Regular aphasia therapy was adapted for either one week or two separate study weeks. During a study week, the regular aphasia treatment was replaced by a daily 45-minute session of aphasia therapy either combined with anodal tDCS over the left inferior frontal gyrus or sham-tDCS (i.e. inactive stimulation). Before and after each study week, the Boston Naming Test was assessed. Immediately after the tDCS session, participants rated discomfort on the Wong-Baker FACES pain rating scale, a visual description scale designed for patients with limited verbal skills.

Results: All participants completed the study week. No side effects were reported on the Wong-Baker FACES pain rating scale. Three participants received anodal tDCS stimulation and two participants received sham stimulation. When comparing these two groups, the recovery patterns on the Boston Naming Test show a potential benefit for the anodal tDCS stimulation group. Two participants underwent and completed a second study week, after a 2-week pause of regular aphasia therapy. The second week and the extra testmoments gave us more insight in the recovery pattern.

Conclusions: Results show that tDCS is a user-friendly and feasible instrument to apply in a regular aphasia rehabilitation program in sub-acute stroke patients. The observed effect on language functioning should be interpreted cautiously because of the small sample size and the individual variability. The additional effect of tDCS in the sub-acute phase will be studied further in a double-blind randomized-controlled trial. For the design of this trial, two separate intervention weeks are preferred; this will provide more detailed information about the individual tDCS-induced recovery pattern.
The Default Mode Network Connectivity Predicts Cognitive Recovery in Severe Acquired Brain Injured Patients During a Period of Intensive Neurorehabilitation

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Severe Acquired Brain Injury (sABI) is a neurological disorder derived from vascular or traumatic accident resulting in a period of altered consciousness leading to motor and cognitive deficits. Few studies investigated the alteration of Functional Connectivity (FC) in sABI patients, focusing mainly on the role of the DMN in the genesis of conscious perception, but did not investigate these alterations after the recovery of consciousness in relation to cognitive deficits.

Methods: A group of 15 sABI patients underwent four resting state sessions of fMRI: one after the admission to our intensive neurorehabilitation unit and one after three months. We performed seed based FC analysis focusing on two central hubs (de Pasquale, 2013): the posterior cingulate cortex and the supplementary motor area belonging to the DMN and motor networks respectively. The intensity of the connectivity was correlated with a set of neuropsychological clinical scores classified into four cognitive domains: short and long term memory, attentional and executive functions.

Results: We observed two patterns of connectivity changes in the DMN. In a group of patients we found both an increase of average connectivity within the DMN and a recovery of its spatial topography (RECO group = recovery group). Differently, a second group (NO-RECO group= no significant recovery) of patients showed some increase of the internal DMN connectivity but a stable spatial topography. Interestingly we found a correspondence between changes in connectivity of DMN and in neuropsychological domains. Notably, strongest changes in functional connectivity significantly correlated to consistent clinical and cognitive recovery. We found a global restoration of cognitive functions in the RECO group.

Conclusions: The changes observed in DMN during the intensive neurorehabilitation program might represent a potential biomarker for the cognitive recovery in sABI patients. This might drive the design of rehabilitation protocols and development of new drug therapies based on information derived from measures of functional connectivity.
Classification of Traumatic Brain Injury and Problem Drinking and its Association with Mental Health, Behavioral conduct Problems and Victimization in a Provincial Sample of Canadian Adolescents

Status: Accepted Presentation type: Oral
Category: Neurotrauma – prevention and public health

Author's preference: Oral

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Objectives: This study describes categorization by history of traumatic brain injury (TBI) and current problem drinking, and its relationship with mental health and behavioral issues among Canadian adolescents.

Methods: A cross-sectional sample of 3130 Ontario adolescents attending grades 9 through 12, were surveyed in 2013 as part of CAMH’s OSDHUS, a survey assessing the mental health and substance use of Ontario adolescents. TBI was defined as trauma to the head that resulted in loss of consciousness for at least five minutes or overnight hospitalization. Recent TBI were injuries incurred in the past 12 months. Former TBI were injuries that incurred during lifetime but not in the past 12 months. Current problem drinking classification was assessed using the 10-item Alcohol Use Disorders Identification Test (AUDIT).

Results: An estimated 11.8% (95% CI: 10.1, 13.8) reported a history of former TBI (lifetime but not during last year) but not but did not screen positive for hazardous drinking; 4.0% (95% CI: 2.9, 5.5) reported recent TBI (during last year) but did not screen positive for hazardous drinking; 13.7% (95% CI: 12.3, 15.3) were identified as problem drinkers but did not have a history of TBI; 4.1% (95% CI: 2.9, 5.8) were identified as problem drinkers and reported former TBI; and 2.2% (95% CI: 1.6, 3.0) were identified as problem drinkers and reported recent TBI. These classifications differed by grade but not sex. Two patterns are imminent in the data. Firstly, with the introduction of problem drinking to the TBI classifications most odds for reporting mental health, conduct behaviors and reporting victimization increase. Secondly, individuals who classified as problem drinkers with former TBI had more numerous and higher odd-ratios for conduct behaviors than problem drinkers with recent TBI even when sex, school grade and the complexity of the design were statistically controlled. The reversed pattern was observed for mental health problems.

Conclusions: The combined effect of having had a history of TBI and currently screening positive for hazardous drinking leads to increased number of mental health comorbidities, conduct behavior, reports of victimization among adolescents. These results emphasize that integrating prevention efforts to reduce TBI and problem drinking in this population is critical.
Energy drinks, alcohol, sports and traumatic brain injuries among adolescents - opportunity for prevention

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: Oral

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Background: Information on the prevalence, mechanisms and adverse correlates of traumatic brain injuries (TBI) among teens is limited. Yet the associations and synergies between TBI and substance use, energy drinks consumption, and academic performance represent important considerations when assessing and recommending treatment for these conditions.

Objectives: To describe the lifetime and past 12 months prevalence, the mechanisms of injury, and adverse correlates of self-reported TBI among one population samples of 7th-12th graders in Ontario, Canada.

Methods: Data were derived from the Centre for Addiction and Mental Health’s 2013 Ontario Student Drug Use and Health Survey (OSDUHS). This population-based cross-sectional school survey included 10,272 (ages 11-20; mean=15.22 years) who completed anonymous self-administered questionnaires in classrooms. The survey was based on a two-stage cluster design and analyses include appropriate adjustments for the complex sample design.

Main Outcome Measures: Head injury that resulted in being unconscious for at least 5 minutes or being retained in the hospital for at least one night due to its symptoms. Causes of self-reported TBI, prevalence estimates and past 12 months incidence and odds according to substance use, cannabis consumption, energy drinks, risk behaviors and school grades are presented.

Results: Among all students, 22.4% (95% CI: 20.7, 24.1), 6.0% (95% CI: 5.1, 7.1) reported TBI in the past 12 months, and 16.3% (95% CI: 15.1, 17.3) reported TBI in their lifetime but not in the past 12 months. Sports injuries were the most likely cause of self-reported TBI (45.5%, 95% CI: 41.0, 50.1). Logistic regression showed that students who reported drinking alcohol occasionally/frequently, used cannabis 10 or more times, and consumed energy drinks in the past 12 months had significantly higher odds of reporting TBI in their lifetime (but not the past 12 months) than students who reported abstinence (ORs = 1.78, 1.95, and 1.67 respectively). Consumption of energy drinks mixed with alcohol in the past 12 months was significantly associated with TBI. Students who reported overall poor grades at school (below 60%) had higher odds of reported lifetime (excluding past 12 months) TBI, or past 12 months TBI compared to students who reported grades at or above 90% (OR = 3.43 and 5.88, respectively).

Conclusions: This study confirms TBI continue to remain a harmful common condition among adolescents, it is most frequently acquired during sports, and has important adverse educational and behavioral associations.
Traumatic Brain Injury and Inpatient Rehabilitation Components: The Influence of Age

Status: Accepted Presentation type: Poster
Category: Neurotrauma – health services and outcomes
Author's preference: Poster

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Objectives: Inpatient rehabilitation is one of the main elements in the continuum of care in patients with TBI. Occupational Therapy (OT), Physical Therapy (PT), Speech Language Pathology (SLP) are the main professional disciplines in inpatient rehabilitation program for these patients. Although large numbers of epidemiological and population-based studies have been conducted on TBI patients, there is a lack of evidence on the effect of age on components and outcomes of IR in patients who were treated in Canadian settings. We sought to investigate the differences in inpatient rehabilitation components and functional outcome by age in TBI patients who were treated in Canadian setting.

Methods: Data on 150 TBI patients (≥14 years) that consecutively admitted to Canadian setting in Toronto between 2008 and 2011, were obtained from Practice-Based Evidence (PBE) project. Patients were stratified by their age into four sub-groups (30≥, 30-45, 45-65, and ≥ 65 years). Points of care (POC) forms were used to document specific contents of intervention for each discipline and the Functional Independence Measurement (FIM) was the primary outcome measure accordingly.

Results: There were significant differences in demographics and clinical characteristics between age groups. Falling was the main cause of TBI in older patients. They had a longer Length of Stay (LOS) and longer time from injury to inpatient rehabilitation admission (p≤.05). Although Older patients received more percentages of OT and PT, this amount was not significant different by age groups. All groups showed significant higher FIM at discharge from IR program (p≤.05).

Conclusions: All TBI age groups rehabilitated successfully. Older and younger TBI patients received almost same amount of therapy from each discipline. More analysis is warranted to examine the effects of comorbidities on LOS among older TBI patients, and also investigate the differences between age groups in type and intensity of activities/Interventions in each discipline.
Adenosine A2A receptors activate GSK-3β to exacerbate neuronal tauopathy in a mouse model of traumatic brain injury

Status: Accepted  Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: Blockade of adenosine A2A receptors, either by caffeine or gene knockout (KO), alleviates cognitive dysfunction after traumatic brain injury (TBI). Tau is a microtubule-associated protein, while oligomeric and phosphorylated tau proteins are considered as neurotoxic inclusions. Hyperphosphorylated tau increases significantly in cognitive dysfunction diseases including neurotrauma and neurodegeneration. Our previous study has shown that A2AR activation exacerbates cognitive impairment via promoting tau protein's hyperphosphorylation. Our objective was to elucidate the mechanism that how A2AR activation induced hyperphosphorylation of tau.

Methods: In this study, in a moderate controlled cortical impact model of mice, phosphorylation level of tau and cognitive impairment were significantly alleviated in A2AR KO group. Additionally, phospho-GSK-3β (P-GSK-3β) at Tyr216 site and phospho-PKA (P-PKA) at Thr198 site were found increased in contralateral hippocampus at 1 and 4 weeks after TBI demonstrating activation of these two kinases. Moreover, P-GSK-3β at Ser9 site increased and P-PKA at Thr198 site decreased significantly in A2AR KO mice 7d and 4w after TBI, demonstrating inactivation of these two kinases. It has been reported that tau became a more favorable substrate for GSK-3 when it was prephosphorylated by PKA. In cultured primary hippocampal neurons, OA induced hyperphosphorylation of tau and this effect was exacerbated by CGS21680(agonist of A2AR). While tau hyperphosphorylation and axonal injury of neurons induced by OA and CGS21680 were alleviated by ZM241385(antagonist of A2AR), H89(antagonist of PKA) and SB216763(antagonist of GSK-3β) separately. A better protection effect were achieved by combination of H89 and SB216763 administration.

Conclusions: These data provide an important experimental evidence for elucidating a novel mechanism of cognitive dysfunction induced by A2AR activation through increasing the phosphorylation level of tau proteins indirectly by PKA /GSK-3β manner after TBI and a promising therapeutic and prophylactic strategy.

Key words: traumatic brain injury; Tau; Adenosine A2A receptor

Reference: National Natural Science Foundation of China No. 81471109 and No.81201461 and Natural Science Foundation of Chongqing China(No.CSTC2012jjA10107).
The effectiveness of outlying inpatient rehabilitation after traumatic brain injury: a case study

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: In the developed contries brain trauma is one of the major reasons of mortality and disability. Among younger than 45 years old people mortality rate of post-acute brain injury ranks first. A lot of researchers in the world notes that early rehabilitation is very important after having brain trauma. It gives a better life quality for the people. It is stated that the maximum likely application of rehabilitation measures on the loss of biosocial functions regeneration achieved during the first year after the injury.

Methods: This study assesses outlying stationary rehabilitation effectiveness in 23 years old patient who feel from the 5th floor. Early rehabilitation wasn't given because of the serious trauma: multiple injuries, severe brain injury, pulmonary and cardiac contusion and tears, who were treated surgically. After hospital treatment patient were receiving care in the hospital. After a year, the were former cranial decompression done for the patient. In neurosurgery section there was performed cranioplasty. Later patient was directed to Department of Neuro-rehabilitation, which used a complex rehabilitation that includes medication, multisensory stimulation program, physiotherapy, occupational therapy, logotherapy, psychotherapy, and a social worker - total 54 days. During rehabilitation patients adjusted both legs and left arm flexed contracture. With the right hand patient was trained to eat, use the TV remote control, to ask to go to the bathroom, write simple sentences. Patient's relatives were trained in physiotherapy, occupational therapy, logotherapy exercises which will be carried out at home on their own.

Conclusions: People who have a severe brain trauma, the comprehensive inpatient rehabilitation can be effective not only in the acute period of the disease, but also the residual effects during the period. This case clearly suggests it.
Longitudinal Change in Communication Functions after Acquired Brain Injuries in Children and Adolescents: Evidence from Parent Reports

Status: Accepted
Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: A comparative follow-up study is reported of 30 school-aged children and adolescents who have sustained an acquired brain injury, either with (n=14, the CETI- group) or without (n=16, the CETI+ group) severe communication impairments.

Methods: Functional communication outcome was assessed at both 12 and 24 months post injury, after the conclusion of an individualized communication training programme applied in the home environment. The assessments comprised parent ratings on the Communication Effectiveness Index (CETI). Standardised intellectual measures (IQ, language comprehension data and neurological data) were clinically evaluated at baseline.

Results: There was a significant increase ($p < .01$) in mean scores of daily communication skills at follow-up. The main improvement occurred in the CETI- group ($p < .01$). However, children belonging to both groups (n=21) had remaining communication impairments in particularly challenging everyday dialogues, i.e. participating in a conversation with strangers. Furthermore, in 7 cases, a deterioration in communication functions was reported, compared to results at baseline. The effect of the injury on communication functions was significantly associated with language comprehension and Verbal IQ. Both latter domains were clinically impaired among children and adolescents in the CETI- group, whereas the CETI+ group performed close to the normative mean.

Conclusions: Results point to the benefits of systematic follow-ups of communication outcome in children with impaired daily communication functions after ABI, applying a triangulation of methods including CETI evaluations. The use of longitudinal parent ratings of real world communication skills can enable a more precise identification of children in need of further interventions and involve the family's expertise in the rehabilitation process.
Impairments In Working Memory And Processing Speed: Do They Interpret Difficulties In Academic Skills In Children Treated For A Brain Tumor?

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Children treated for a brain tumor are at risk of getting suppressed IQ and cognitive impairments in executive function, memory and attention. However, little is still known how these impairments relate to children’s academic performance later on. The purpose of this retrospective study is to explore how children treated for a brain tumor perform on tests of working memory and processing speed and how these skills are related to children’s reading and arithmetic skills one year after the treatment.

Methods: The study will be based on medical records, involving 45 children between 7 and 18 years of age who met the inclusion criteria of speaking and reading Swedish, IQ above 70, and without major linguistic or motor difficulties after the treatment. The children were seen for a neuropsychological assessment and academic evaluation at the outreach rehabilitation team, Astrid Lindgren Children’s Hospital, Karolinska University Hospital during 2010-2014. In the neuropsychological assessment, children's working memory was tested with subtests Digit Span, Letter-Number Sequencing and Arithmetic, and their processing speed with Coding and Symbol Search from the Wechsler Intelligence Scales and Trail Making 1-4 from D-Kefs. The academic tests included reading comprehension, reading speed, spelling, and basic arithmetic skills.

Results: Our preliminary results from an earlier study analyzing academic skills show that children treated for a brain tumor perform below the standard norms in reading speed, spelling and basic arithmetic skills. We plan to investigate whether children's results in working memory and processing speed are correlated to their academic skills. Furthermore, children's results on the complete battery of neuropsychological tests and questionnaires to the children, parents and teachers are going to be analyzed and possible correlations to the academic performance are investigated over time.

Conclusions: The preliminary results suggest that children treated for a brain tumor have difficulties in academic skills. Next, our interest is to gain a better understanding of the underlying neuropsychological mechanisms of these difficulties in order to improve early interventions that support children's development in academic skills.
A Systematic Review on Implicit Motor Learning in People with Stroke: Is there any Evidence?

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – basic research
Author's preference: Oral

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Background: After stroke, many patients undergo intensive rehabilitation therapy to reacquire motor skills like walking or grasping. Observational studies suggest that therapists predominantly rely on so-called explicit motor learning strategies during this rehabilitation period. Explicit motor learning may not be the optimal learning strategy for these patients however, as it places significant demands on patients' often compromised working memory capacity. It has often been argued that implicit motor learning may be more suitable for stroke patients. Theoretically, implicit learning requires minimal working memory involvement, thus resulting in more automatized motor control. Notwithstanding its potential, it is unclear whether implicit motor is actually preserved post-stroke, and whether patients benefit more from implicit than from explicit motor learning. This systematic review set out to answer these questions.

Objectives: To systematically review studies into implicit motor learning post-stroke.

Methods: We comprehensively searched electronic (MEDLINE, Cochrane library, Embase, PEDro, and PsycINFO) and grey literature databases, and trial registries to identify relevant reports. Studies were assessed for their risk of bias with the Newcastle-Ottawa Scale (NOS). When feasible, meta-analyses were performed.

Results: Of the 2177 reports that were identified, 22 were included in this systematic review. Only 1 study investigated learning on a relatively complex, whole-body task (balancing on a balance board). All 21 other studies concerned (variants of the) serial-reaction time paradigm, with most of these focusing on learning with the unaffected hand (N=13) rather than the affected hand or both hands (both: N=4). Four of the 22 studies compared explicit and implicit motor learning post-stroke. Overall, the studies included in this systematic review exhibited a high risk of bias. This was for a large part due to lack of detail on participant screening and selection, a lack of assessment of and correction for confounding factors, and lack of comprehensive testing and/or reporting on the amount of participants' explicit movement-related knowledge.

Meta-analyses suggest that patients show unimpaired implicit motor learning with their unaffected side (mean difference (MD) = 69 ms, 95% CI [45.1, 92.9], p<.00001), except for patients with subcortical lesions (MD = 28 ms, 95% CI [-42.8, 97.9], p=.44). Implicit motor learning seemed more impaired for the affected side (standardized MD = -.11, 95% CI [-.45, .25], p=.56). Finally, implicit motor learning may be equally effective as explicit motor learning post-stroke (SMD = -.54, 95% CI[-1.37, .29], p=.20).

Conclusions: At this point, it is impossible to draw conclusions regarding the effectiveness of implicit motor learning post-stroke, due to the overall high risk of bias, small study populations, and limited clinical relevance of most studies. There is a very urgent need for adequately powered, high quality studies, which contrast the effectiveness of implicit and explicit motor learning within clinically relevant contexts.
From Return-To-Play Towards Return-To-Academics for Student-Athletes Concussion Neuroimaging Consortium, USA

Status: Accepted Presentation type: Oral

Category: Technology – clinical research/applications

Author's preference: Oral

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Objectives: Based on current best practice established by the Concussion in Sports Group for Return-to-Play (RTP), most student-athletes are cleared for full sports participation within 10 days post-injury. However, this period is more than double the time compared to when student-athletes return to the classroom. Furthermore, previous studies indicate that history of mTBI has the ability to affect academic performance in student-athletes that stems from more than just physical symptoms. This is consistent with the collective findings that the Concussion Neuroimaging Consortium (CNC) has demonstrated using advanced neuroimaging techniques. The CNC documented alterations in functional connectivity in the sub-acute phase of injury in student-athletes asymptomatic yet cleared through RTP, and a 4 months after a competitive season.

Methods: In order to study the effects of mTBI on academic performance, we have initiated a pilot study investigating student-athletes with and without history of mTBI while monitoring grade point average (GPA). We followed a cohort of 26 NCAA Division 1 varsity student-athletes who were diagnosed with mTBI and tracked their GPA from three semesters (before, during and after mTBI). In addition, we performed resting-state functional magnetic resonance imaging (fMRI) in 5 of the injured student-athletes during the chronic phase of injury (30 and 90 days).

Results: Our results showed that mTBI has a significant impact (p=0.04) on GPA. Specifically, we observed an average decrease of 0.29 (on a 4.0 scale) in GPA from the semester prior (3.20) to mTBI compared to the semester (2.91) of injury. GPA did rebound the semester following mTBI (p=0.16) when compared to semester before mTBI. Student-athletes without mTBI revealed no significant changes between semesters and when compared to pre-mTBI semester GPAs. RS-fMRI at 30 days post-injury showed a decrease (p<0.1 FDR) in functional connectivity of the left parahippocampal gyrus and left hippocampus with bilateral poles and the left amygdala. The 90 day scans revealed decrease (p<0.1 FDR) in functional connectivity of the medial prefrontal cortex (MPFC) with the right frontal orbital cortex and left inferior frontal gyrus. Concussion student-athletes also had persistent functional connectivity deficits (p<0.1 FDR) in the right parahippocampal gyrus from 30 to 90 days post-injury.

Conclusions: Similar to the previous findings by the CNC that have shown deficiencies in attention, memory, executive functions and problem solving after concussion, we demonstrated a drop in academic performance. Furthermore, rs-fMRI revealed altered functional connectivity fMRI long-after clinical symptoms resolution. It is well-known, that hippocampus and MPFC are important in memory, attention and executive function, as well as being integral pars of the default mode network. Decrease in these areas may help explain the decline in GPA after mTBI. Given these findings and remembering that student-athletes are student first, establishing evidence-based Return-to-Academic (RTA) criterion is needed.
Renegotiation of Identity after a Brain Injury Using Immersive Virtual Environments

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: Identity issues on the consequences of a brain injury have been addressed in research for the last 20 years. However, concrete suggestions for how to implement the issues in practice are still insufficient. This paper addresses how avatar-mediated interactions in immersive virtual environments facilitate re-establishing a weakened identity in social and cultural contexts where the linguistic and communicative development are secondary, yet present.

Methods: A case study embracing two pilot courses in an immersive virtual environment, Second Life, will be presented. The first course is a pedagogical course for speech therapists, and the other is a rehabilitation course for persons suffering from aphasia. The courses were conducted by speech therapists at The Institute for Speech, Language, and Brain Disorders in Aalborg, DK, from 2011 to 2012. The data comprise interviews, video recordings and workshops collected in relation to the authors Ph.D. thesis. The approach of the study is qualitative and phenomenological, with the intention of giving a voice to persons with aphasia.

Results: The research demonstrates that putting rehabilitation into a socio-cultural framework, using non-verbal and verbal communication offers the potential to focus on the WHO’s recommendations to consider impairment as the limitation of opportunities for participation in society. Learning and re-learning language in a social-cultural perspective demands that the rehabilitation activities take place through social interactions with others and is dependent of the feedback people receive from others. Immersive virtual learning environments accommodate a suitable setting for this. Interacting with variety of ICT-mediated and multimodal communication tools and by meeting a variety of perception modes in media-rich web-based social communities, a virtual environment, like Second Life, facilitates cognitive training, renegotiation of identity, and alternative ways and compensation strategies for telling your story and presenting whom you are. Moreover, avatar-mediated interaction in immersive virtual environments contributes to a strengthened renegotiation of identity through shared experiences, a joint repertoire, joint culture and heritage, narratives, and communication. Through embodied interactions, persons suffering from aphasia have shown to be capable of immersing themselves in the interactions and scenarios of Second Life to great extent, leading them to experience a high degree of presence. Furthermore, the settings have shown to be of great importance. The pilot courses took place in a part of Second Life that is designed as a copy of a Danish Town, known from a very popular TV series. The familiarities of the setting revealed to trigger the participants’ autobiographical memory, and made them able to tell their own stories, learn new things, have cultural experiences, and renegotiate their identities.

Conclusions: Avatar-mediated learning has shown to add important possibilities for addressing renegotiations of identity in the rehabilitation of people suffering fromaphasia.
Children with severe ABI occurring before 3 years: clinical, functional and cognitive outcome at subacute phase and at one year follow-up

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Acquired brain injuries (ABI) are a leading cause of disability and mortality in early childhood and they represent a major public health issue. In this study we aimed to describe the outcome in a sample of 107 children with severe brain lesion of different etiology occurring early in childhood (<3 years), in order to:

- provide a description of the clinical and functional picture during the first hospitalization;
- describe the clinical and the functional outcome at 1 year follow-up after a program of rehabilitation;
- compare the difficulties in the three samples of patients grouped on the basis of the origins of the brain lesion (TBI, infectious, vascular, anoxic).

Methods: Outcomes were investigated at two different time points: we collected clinical and functional picture on admission, and cognitive picture as soon as possible (T0) and at 12 months from the pathological event (T1), after rehabilitation program.

Results: At T0 more than an half of our sample presented with motor, linguistic and cognitive deficits. Patients with anoxic lesions showed the most unfavorable motor and visual outcome; patients with infectious lesions showed most frequently a global delay in motor development; patients with traumatic lesions showed less impaired functional outcome. Regarding cognitive profile at T0, 69.2% of the total sample presented with so severe a cognitive impairment that they could not be evaluated; furthermore patients with anoxic lesions were less likely to be evaluated. At T1, the proportion of non-evaluable patients decreased to 45%. We set out that at T1 the 15% more of the patients became evaluable, but with an impaired cognitive level: maybe these patients were globally more compromise. While the IQ of the small group of 24 patients already evaluable at T0 didn’t change over time. Probably these patients had a better clinical and functional condition at the beginning.

Conclusions: Considering the severity of the clinical picture and the age range of the patients, our group is more consistent and larger than any other included in published studies. We set out that patients improved in several domains at 1 year from the insult, but with different trajectories of recovery depending on the etiologies of their lesions too. At one year from insult half of our sample could undergo to a cognitive evaluation and presented a borderline cognitive level. Nevertheless more than half of our patients, in particularly post anoxic patients, showed persistent deficits, therefore they need specific aids and support for their daily living independence.
Evolution Of The State Of Consciousness In A Sample Of Children And Adolescents With Severe Acquired Brain Lesions During The Inpatient Rehabilitation.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Acquired brain injuries are a main cause of disability and mortality in childhood and adolescence and they can result from a variety of etiologies. Children who sustained severe brain insults show in most cases residual cognitive and functional impairment and long-term deficits that have the potential to significantly interfere with development. Furthermore, research on outcome after severe brain lesion shows that one third of children with moderate to severe brain injury live a period of prolonged reduced responsiveness. In some cases, Vegetative State (VS) and Minimally Conscious State (MCS) are possible outcome and they are included in the group of disorders of consciousness (DOC). However few studies have examined the evolution of VS and MCS and the recovery of consciousness in children and adolescents.

Young patients with acquired brain injury of different etiology refer to our Scientific Institute for early and multidisciplinary rehabilitation. The present study aimed to: describe the emergence to a conscious state (CS) in a sample of 82 children and adolescents with severe brain lesion of traumatic and non-traumatic etiology during the post-acute rehabilitation, as assessed by the Rappaport Coma/Near Coma Scale (CNCS); compare the evolution of the state of consciousness in patients with brain lesions of traumatic etiology and in patients with brain lesions of non-traumatic etiology; describe the relationship between the emergence of CS and some relevant clinical variables.

Methods: Inclusion criteria were: (i) age at assessment between 0 and 18 years; (ii) documented evidence of a severe acquired brain lesion of traumatic, anoxic, vascular or infectious etiology, as confirmed by a Glasgow Coma Scale score ≤8 at insult; (iii) medical records sufficiently detailed to determine the injury severity and neurological findings.

We collected demographic and clinical data for all patients and we administered CNCS three months after the pathological event (T0) and six months after the insult (T1).

Results: Our results show that after six months most patients improve: about three-fourths of children in SV at T0, reach MCS or emerge from unconsciousness at T1, while about 50% of young patients who were in MCS at T0, at T1 reach consciousness.

Within six months we can see significantly improvements both for each parameter and for the average CNC score. Traumatic patients have a better outcome than non-traumatic patients.

Conclusions: These findings are coherent with current literature. Within a group of children and young adolescents with DOC after severe brain injury, most improve and emerge to CS during inpatient rehabilitation, and patients with traumatic brain injury have most favorable recovery.

More studies about the course of recovery in these patients are needed to predict recovery itself and to define efficient and more specific guidelines for rehabilitation.
0726

Life chance 5%

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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n/a, n/a, South Africa

On the 5th February 1986 I had a life-changing experience. I was in matric in that year (i.e. the final year of secondary-education). I pulled off in front of my house in order to go to a Grade VIII drama-lesson ... before I was to go to a drama rehearsal at school (for which I had the leading role). I never made it to either of them because a speeding taxi connected with me and that knocked me flying across the face of two houses. I must add this: it had been raining ..so the roads were wet ... and I didn't expect anyone to be speeding on the roads in that condition.

"Fortunately" our home was in the same suburb as the University of Pretoria and a Medical Doctor who happened to be specialising in Neurosurgery was passing by the scene-of-the-accident AT THAT TIME so he stopped and delivered first aid on me. As he didn't have any medical equipment with him in the car ... all he could do was stabilize my position on the road and open my airway. Thank goodness he did that because I'm sure that that is a major reason why I can type this today.

I was given a 5% chance of surviving the first night I spent in ICU. Apparently the Doctor in ICU who treated me told my parents that the moment he managed to stop my brain bleeding in one part ... it started bleeding in another part! I therefore had global brain damage and he didn't think that I was going to survive that night.

Well, I survived (obviously). After about 6-months of me laying in a coma, they discharged me because there was nothing more that they could do for me, medically speaking. After I was at home and in a familiar environment in which I felt safe, I regained consciousness. (I wish I could remember the reaction of my mothers music-pupil when I greeted her - after I'd lain in a coma for 7 months).

I've since got my matric (which included me taking 3 'new' subjects that I never took previously- so who says that people can't learn anything new after they've acquired brain-damage? I've also achieved 4 University degrees in the Humanities, released a motivational CD "5%" and I've been delivering inspirational speeches since 2004 - whenever I can find an audience, that is!

I think that the reason I struggle to find audiences is stated in the Cognitive Dissonance theory, that was introduced by the psychologist Leon Festinger in the late 1950's. It's the clearest explanation of why people haven't accepted my recovery!
The difference between left versus right unilateral spatial neglect. An exploration in multiple domains.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Oral

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Objectives: Unilateral spatial neglect (USN) occurs frequently after stroke and is linked to poor motor recovery, higher disability and poor responses to rehabilitation. It can occur after both right and left hemisphere damage, but it is unclear whether consequences differ between left versus right-sided USN. The primary aim of the current study was to investigate the distinctions and similarities between left and right USN in a large cohort of stroke patients, regarding cognition, physical functioning and activities of daily life (ADL). The secondary aims were to compare USN severity, occurrence of region specific USN (i.e. peripersonal, extrapersonal) and lesion characteristics and location between left versus right USN.

Methods: Patients were selected from a database of stroke patients admitted for inpatient rehabilitation. A screening for USN was conducted as standard care. Overall cognition, communication, search organization, motor function, mobility, self-care, and balance were assessed. USN severity was measured with a shape cancellation test, line bisection test and the Dutch Catherine Bergego scale. All neuropsychological neglect tests were presented in peripersonal as well as extrapersonal space. Information regarding lesion side, focality and volume was collected. Finally, for each USN group, lesion locations were compared with the no USN group by voxel-based lesion symptom-mapping.

Results: A total of 388 patients were screened for USN, with 55 left USN, 31 right USN and 213 patients without USN. Regarding cognition, visual search was less organized in left USN compared to right and no USN. In contrast, a lower cognitive ability was observed in right USN compared to left and no USN. No differences in communication, motor function, mobility and self-care were found between left and right USN. In right USN, balance was poorer compared to left USN. Compared to patients without USN, mobility and self-care at admission was poorer in right USN, whereas in left USN, poorer self-care at discharge was observed. On average, left USN was more severe compared to right USN, as measured with neuropsychological USN tasks and observations of USN in ADL. Left USN patients showed USN in both peripersonal and extrapersonal space more often compared to right USN. Finally, in left USN more often right hemisphere damage and larger lesions were observed compared to right and no USN. Compared to no USN, the right frontoparietal grey matter was more often damaged in left USN. No differences between lesion location in right and no USN were seen.

Conclusions: Left and right USN are both common after stroke. Differences in left and right-sided USN should be taken into consideration in rehabilitation of USN, as left USN is more severe. However, both left and right-sided USN are associated with poorer cognition, physical functioning and ADL and should be assessed and trained in rehabilitation.
Regaining Mobility Skills 3 Years Post Traumatic Brain Injury (TBI): A Case Presentation.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Background: Regaining mobility is key for parents of children undergoing rehabilitation following TBI. Research shows that 80% regain some form of mobility usually within the first 2 years of treatment (Cash 2012, Ponsford et al 2014). Research predominantly evaluates outcomes during the acute in-patient phase of rehabilitation Katz et al 2004. Ponsford et al reported that difficulties evident at 2 years post-injury remained so at 10 years.

This case presents a child who had significant improvements in mobility skills 3 years post TBI.

HPC: 13yo boy suffered severe TBI in 2012; ventilator dependant for 4 months; tracheostomy for total of 8 months; craniectomy, hemispherectomy and titanium cranioplasty. Received long-term inpatient rehabilitation between April 2013 and June 2015. Admitted to the Portland hospital for cosmetic cranial surgery and further rehabilitation in June 2015.

Objectives: Dense right hemiplegia dependent for all activities of daily living. Assessment suggested he had more potential than current abilities. Able to sit independently, transfer bed to chair with assistance of two therapists and mobilise <10m with assistance of two therapists. Had been therapeutically standing and mobilising with gaiter, frame and two therapists but unable to maintain standing due to weakness and lack of control in right leg. Cognitively able to follow commands and maintain conversation difficulty with sustaining concentration and disruptive behaviour.

Methods: Provided with right knee ankle foot orthosis (KAFO) and left heel raise to assist with swing of right leg. Twice daily physiotherapy in conjunction with multidisciplinary rehabilitation to work on standing balance, weight transfer in standing and gait re-education.

Results: Over a period of 8 weeks he developed the ability to mobilise 50m with assistance of one therapist and a tripod stick. Shoe raise removed as no longer needed. Able to sit to stand and transfer with one therapist. Able to maintain independent standing for 10 seconds. Still needing one therapist to maintain balance in walking; awaiting delivery of a walking frame to assess independent mobility. Working towards independent transfers for toileting and using standing for washing and dressing. Psychology also observed improvements in cognitive scores, behaviour and concentration.

Conclusions: This case highlights the possibility of children gaining motor skills beyond the initial 2yr post-injury phase and the importance of reassessment and functional training to improve independence.


Repeated mild traumatic brain injury produces an anxiety-related phenotype and spatial memory deficits in mice.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Repetitive mild traumatic brain injury (rmTBI) produces acute sensorimotor deficits, cognitive impairment and emotional disturbances. In a subset of individuals experiencing rmTBI, these may transition to chronic and functionally limiting problems and neurodegenerative changes. We developed a controlled cranial impact (CCrI) model with which to examine the behavioral and histopathologic consequences of rmTBI in C57BL/6J mice. We hypothesized that acutely after injury; mice receiving rmTBI would have greater cognitive and behavioral deficits than sham controls. We also hypothesized that mice receiving rmTBI would have greater histopathologic changes than mice receiving single mTBI or sham injuries.

Methods: CCrI events were produced using an electromagnetic-guided, rubber tipped impactor. Injury consisted of impacts delivered to the scalp of mice every 48 hours for either one (smTBI) or five (rmTBI) events. A sham procedure was identical to CCrI except that the impactor did not contact the skull. The effects of smTBI and rmTBI were assessed using measures of motor performance (Rotarod Test [RT]); anxiety (Elevated Plus Maze [EPM] and Open Field [OF] tests) and spatial memory (Morris Water Maze [MWM]) within 12 days of the last procedure. Astrocytosis and microglial activation was assessed in separate groups of mice using GFAP and IBA-1 immunohistochemistry assays of brain samples obtained 24 hours after the final procedure.

Results: smTBI or rmTBI did not alter motor performance. By contrast, mice exposed to rmTBI demonstrated impaired spatial memory when compared to smTBI and sham groups. Specifically, in the MWM, mice in sham and smTBI groups required less time to find the hidden platform than did rmTBI mice ($t(871) = -3.61, p = 0.0003$). In addition, the sham group spent longer time in the target quadrant than the rmTBI group (Wilcoxon $z = 3.55, p = 0.0004$). rmTBI was also associated with an anxiety phenotype. Specifically, the time spent within open arms of the EPM was significantly longer in the sham group than in the rmTBI (Wilcoxon $z = -3.32, p = 0.0009$). Similarly, in the OFT, rmTBI mice traveled the smallest relative distance in the inner field when compared to the smTBI and sham groups (rmTBI vs. sham: $z = 4.11, p < 0.0001$, rmTBI vs. smTBI: $z = 3.07, p = 0.0021$). Finally, the rmTBI group had higher GFAP and IBA-1 immunoreactivity (i.e. percent area of field of view) than the sham and smTBI groups (GFAP CA1: Kruskal-Wallis $\chi^2 (2) = 9.38, p = 0.0092$; GFAP DG: $\chi^2 (2) = 9.50, p = 0.0087$; IBA-1 CA1: $\chi^2 (2) = 9.50, p = 0.0087$; IBA-1 DG: $\chi^2 (2) = 9.50, p = 0.0087$).

Conclusions: These preliminary findings suggest that rmTBI produces acute cognitive and affective disturbances that might be related to acute inflammatory responses in the hippocampus.
Extinguishing aggressive behaviors of brain injured clients using a person centered behavioral approach

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

Colin King
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When clients who are diagnosed with a traumatic brain injury and display extreme aggressive behaviors are admitted for treatment, if appropriate, they are placed on a level's program. Such a program provides clients with structure and supervision in a safe community based setting. A levels program also helps to reduce maladaptive behaviors and affords clients the opportunity to transition from a very structured residential setting to a less structured one. A Levels program can be administered by professional or para professional staff with minimum amount of training. The purpose of the program is to assist professional or para professional staff with treating brain injured clients with dignity and respect while at the same time helping them to self monitor and reduce maladaptive antisocial behaviors.
Facilitating Sexual Expression as a Means of Diminishing Aggressive Behaviors

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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The display of aggressive behavior by traumatic brain injured (TBI) clients due to repressed sexual satisfaction poses a challenge to direct care staff, referring case managers, and treatment providers. Frequently, staffs are given the uncomfortable choice of either providing a means of self-expression or preventing what is termed "inappropriate sexual behaviors." Clients, depending on the intervention, tend to aggress against staff, engage in public display of sexual activities, or simply demand an inordinate amount of time and attention until their needs are met. This poster presentation summarizes the findings from a study that was done with twenty four-five brain injured clients looking at reduction of aggressive behaviors if sexual outlets were provided.
Vocational Outcomes from the New South Wales Brain Injury Rehabilitation Program: A Multicentre Study

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: The resumption of employment is a key parameter for rehabilitation. The New South Wales Brain Injury Rehabilitation Program (BIRP) comprises a specialist service network providing sub-acute and community-based rehabilitation for people with severe traumatic brain injury. The current study investigated vocational outcomes for adult clients of the program.

Methods: All active clients of the 11 community adult rehabilitation teams were included in the study. The BIRP accepts all clients resident in NSW who have sustained a TBI between the ages of 0-65 years. A protocol was devised to collect data on premorbid and post-injury vocational status as well as demographic and injury details.

Results: The 900 active clients were reviewed. Data on 721 clients who sustained their TBI as an adult were reported. The 179 clients who sustained the TBI < 16 years (n=64) or an acquired (non-traumatic) brain injury (n=115) were not included in the analysis. Age (39±14 years), sex (78% male) and injury circumstances (61% road accidents) were typical of rehabilitation samples. The majority (86%) of clients had sustained severe to extremely severe injuries and 53% were more than 2 years post-injury.

Premorbidly, 75% of the sample had been working. At the time of the study, 207 (29%) of clients were in open employment, of whom 70% were working with their pre-injury employer, and the remainder in new employment. Most return to work occurred within the first year post-injury (70%), with the balance accessing employment for the first time between 1 and 10 years post-injury. The time of return to work post-injury was significantly longer for people seeking new employment (median 13 months) compared to people returning to their pre-injury employer (median 5 months). There was also a significant shift from full-time to part-time employment (pre-injury 22%, post injury 59% part-time employment respectively). Another 97 clients had worked at some time post-injury but were not currently employed, reflective of poor work retention. Factors associated with loss of work included more severe injury, substance abuse, psychological distress, and securing new work rather than returning to a pre-injury employer. Forty-one percent (n = 294) of clients had participated in VR services post-injury. Of these, 198 clients (67%) had achieved open employment, while only 24% of the remaining 419 clients achieved employment without vocational intervention.

Conclusions: Employment rates were consistent with the existing literature regarding rates for return to work to open employment following severe TBI. Results of this study will be used to inform recommendations for improved vocational rehabilitation services for clients across NSW.
Cognitive performance and brain white matter in TBI: Are there any differences among diffusion-tensor indexes?

Status: Accepted  Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

Blanca Navarro-MAIN, Marcos Ríos-Lago, Jose Antonio Períañez, Genny Lubrini, Alfonso Lagares, Jose Ignacio Quemada, Juan Alvarez-Linera

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Background: The integrity of white matter microarchitecture in the brain is linked to the performance in neuropsychological tests after traumatic brain injury, particularly in the case of tests that assess memory, executive function and, especially, attention and information processing speed. The appearance of new neuroimaging techniques such as diffusion tensor imaging (DTI) has provided a basis for the study of fiber tracts through the diffusion of water molecules within the brain. By mean of DTI, different indexes could be obtained: Fractional Anisotropy (FA), Relative Anisotropy (RA), Mean Diffusivity (MD), Radial Diffusivity (Dr), Axial Diffusivity (Da) or Volume Ratio (VR). Although FA is the most used DTI index to study brain anatomy and cognitive performance, it is not clear weather this index is the most convenient to describe white matter integrity and its relation to cognitive performance.

Objectives: To describe the relation between DTI indexes (FA, RA, MD, Dr, Da, VR) and the cognitive performance in two classical neuropsychological tests with a significant weight in information processing speed, attention and executive functions.

Methods: A mixed sample of 27 participants was recruited for the study (13 TBI patients and 14 healthy controls). All participants were assessed by two neuropsychological tests: Trail Making Test (TMT) and Stroop Test. They all underwent DTI-MRI scans performed on a 3.0T Signa HDx MR scanner (GE Healthcare, Waukesha, WI). 20 axial slices were obtained along 15 directions with b-value=1000 s/mm2. Matrix=128x128; TE=76; TR=5800; flip angle=90; FOV=24x24; slice thickness=5mm. In addition, a T2 image was acquired (b0). DTI images are analysed with specific software (DTI-Studio and SPM12) and simple regression analyses were carried out.

Results: FA is quite sensitive but less specific describing the integrity of brain white matter. Other indexes bring different anatomical patterns that could be associated with myelin status (Dr) or the axonal microstructure integrity (Da). Besides, the different indexes studied also show a different spatial pattern in relation to cognitive demands of the test.

Conclusions: Results support the idea that FA is not sufficient to characterize lesion extension after TBI. The use of other indexes extends the information provided by a single magnetic resonance sequence and allows the study of not only the extent of white matter lesions, but also its relation to cognitive performance.
Impact of Social Work Interventions on Family Adaption Following Paediatric Acquired Brain Injury

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – case reports/clinical research
Author's preference: Oral

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Objectives: There is a gap in current understanding of what is effective social work intervention for families who have a child with an acquired brain injury (ABI). Existing research highlights the association between a family's functioning and a person's rehabilitation outcomes following an ABI. Social Work in rehabilitation services has an important role in supporting families as they make adaptations to their functioning to meet the needs of their injured child during the early stages of recovery and community reintegration. The study compares adaptation outcomes of families who receive "usual care" social work services with families who receive family therapy based social work interventions during the inpatient rehabilitation phase of care.

Methods: The study recruited two groups of families (usual care n= 24 and intervention n= 25) who had children admitted to inpatient rehabilitation services using a sequential, comparison group design. Family demographics using the Psychosocial Assessment Tool (PAT 2.0) and information about the child's injury characteristics were obtained from the two groups. Family adaptation outcomes were investigated with respect to: family functioning using the Family Assessment Device - General Functioning (FAD-GF) and Family Management Measure (FaMM); family resources (demographics, community resources and general health); changes in family pattern (adjustment to child's injury); family appraisals (trauma, grief, injury perception and impact on siblings); and family problem solving and coping (burden of care and family needs). Assessment was conducted at inpatient rehabilitation admission, inpatient rehabilitation discharge and six weeks post discharge.

Results: This paper will present preliminary data on the first group that received "usual care" social work services. The study sample will be described according to injury characteristics of the child and family demographics (PAT 2.0). Findings on family adaptation outcomes at 6 weeks post-discharge with respect to family functioning (FAD-GF) and family management (FaMM) of the child's injury will be discussed.

Conclusions: The results will contribute to understanding how the current "usual care" social work practices assist families adapt during their child's inpatient rehabilitation and during the first weeks at home. In order to evaluate and compare the effectiveness of social work family interventions in rehabilitation, it is important to have information about how the "usual care" social work practice approach influences family functioning outcomes. This evaluation will have implications for social work services within paediatric rehabilitation settings.
Cdk5 phosphorylation of STAT3 is involved in axonal regeneration after peripheral nerve injury

Objectives: Cyclin-dependent kinase 5 (Cdk5) activity is known to regulate diverse pathophysiological neural function. Yet, its function in the regenerative processes of axons after nerve injury is not known. Here, we investigated the role of Cdk5 activation in regenerating axons after nerve injury.

Methods: Rat sciatic nerve was given crush injury and the regeneration of in vivo axons was analyzed by immunofluorescence staining. DRG sensory neurons were prepared from rats given preconditioning sciatic nerve injury, and the neurite outgrowth was analyzed by immunofluorescence of cultured cells. Changes in the production of target molecules such as Cdk5, STAT3, stathmin, and α-tubulin in the regenerating sciatic nerve or cultured cells were investigated by western blotting and immunofluorescence methods, and the possible interaction among them by immunoprecipitation method. To determine the regulation of Cdk5 and its interaction with other molecules, DRG neurons were transfected with plasmid constructs expressing dominant negative form of Cdk5 and pseudophosphorylated STAT3, or treated with inhibitor drugs, and, after fixation, were further treated for immunofluorescence analysis. Neurite length of fluorescence-labeled DRG neurons was quantified by the digital image analysis program.

Results: Cdk5 protein was induced in the sciatic nerve axons after injury. Phospho-STAT3(S727) as a substrate of Cdk5 was also increased in the injured nerve. Signals of Cdk5 and phospho-STAT3(S727) and phospho-STAT3(Y705) proteins were clearly seen in the DRG neurons which were prepared from the rats given preconditioning sciatic nerve injury. Here, the abrogation of phospho-STAT3(S727) production in the cells by overexpression of dominant negative forms of Cdk5 and pseudophospho-STAT3(Y705F or S727A) decreased neurite outgrowth. Treatment of inhibitors hampering Cdk5 activation and STAT3 phosphorylation similarly prevented neurite growth. Immunoprecipitation analysis of the protein extracts at the injury area showed the interaction of phospho-STAT3(S727, Y705) with stathmin, one of the regulatory proteins of microtubule dynamics. Interestingly, stathmin induction after nerve injury was restricted to the distally regenerating area.

Conclusions: The present study indicates that Cdk5 activity, which is induced from the injured peripheral nerves, phosphorylates STAT3 and then phospho-STAT3 interacts with stathmin. Phospho-STAT3, which is activated locally at the regenerating nerve portion, may be involved in the dynamic regulatory processes of microtubule assembly or disassembly for axonal elongation.
We don't just want an app: information needs of children and youth with an acquired brain injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

Lorna Wales, Carolyn Dunford, Clair Cobbold, Ian Ray
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Objectives: Acquired brain injury (ABI) is the most common cause of death and disability in UK. There is a growing population of children/youth living with long-term effects of brain injury who lack accessible resources. Children/youth are capable of expressing views and have a right to do so in matters affecting them. Question: what are the information needs of children/youth with an ABI?

Methods: On-line survey of content and delivery methods: Focus group, Interviews, A priori thematic coding, and Ethical approval:London/Fulham

Results: Survey n=16. 11<16 years; 5>16 years

- Content – information about own injury;feelings/behaviour;brain structure(youth)
- Delivery – books;tablet;parents(younger children);health professionals(youth)

Focus group n=5 children/youth

Interviews n=3; 1 email conversation

Themes included:

1. Stage and age

I think as I was recovering I would have liked to have more information to know what was happening and what operations I would have to help me. I didn’t know that much because my brain was a little bit muddled.

When I was a bit older because I think when I was actually told I might have been a bit too young to like understand it.

2. Education

Some of the immediate things like I get help at school and obviously I won’t get help at work

3. Friendship and peers

You’re not ... thick ... as your mates may call you.

no one really knows I’m injured, because they all think I’m the same and then they wonder why I’m off school so much
4. **Means of delivery**

   *Somebody talking to me*

   I don’t know, maybe people who have been through it could make a quiz for the people who have just had it happen to them.

5. **Content**

   *For me I find that my brain injury to me is more important but it is interesting to hear about other people’s brain injuries and what they’ve been through compared to me.*

   *But also like to know like what parts of my brain had been damaged.*

**Conclusions:** Children/youth with ABI were able to express views about their information needs and were engaged in the process. They want information on brain injury in general and specific to their own injury, along with strategies for overcoming problems.

Children/youth want different amounts of information at different times. This relates both to their age and where they are on their own journey.

Children/youth want friends and teachers to have more information.

Children/youth want information delivered in a range of ways including books, apps and board games. They want to hear others’ experiences of brain injury and how they coped with everyday challenges in the form of videos. Brain injury services must work together to meet information needs of children/young people.
Ultra-sensitive single molecular array (Simoa) technology for the detection of tau and GFAP in traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Technology – clinical research/applications

Author's preference: Oral

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Objectives: Methods for measuring the brain protein Tau in serum and plasma have until recently been unavailable and have commonly been measured in cerebrospinal fluid (CSF). However, the highly sensitive and specific measurement of peripheral total Tau is now available via Single Molecule Array (Simoa™) digital immunoassay.

Methods: Simoa total tau assay reagents were developed for a paramagnetic bead-based ELISA for use in the Simoa HD-1 Analyzer. Anti-total tau capture beads were prepared by covalent coupling of antibody to carboxy paramagnetic microbeads and the detector antibody was biotinylated by standard methods, and an enzyme conjugate was prepared by covalent coupling of streptavidin and beta-galactosidase.

The HD-1 Analyzer first performs sandwich immunoassay using 42 µL of serum or plasma sample, then transfers washed and labeled capture beads to a Simoa disc where the beads are singulated in 50-femtoliter microwells, sealed in the presence of substrate, and interrogated for presence of enzyme label. A single labeled tau molecule provides sufficient fluorescence signal in 30 seconds to be counted by the HD-1 optical system. For the developed tau assay is the limit of quantification is 24 fg/ml.

Results: In a number of different clinical studies of traumatic brain injury (TBI)/ concussion and neurodegeneration, total tau in either plasma or serum was measured. This includes the acute phase of sport-related concussion in ice hockey players and assessment of total tau in the chronic phase post-TBI in returning veterans. In sports-related concussion, tau in blood is acutely elevated and appears to correlate with return-to-play. Using Simoa technology, total tau in blood has also been shown to correlate with number of TBIs and outcome in the chronic phase post-TBI in veterans.

Conclusions: This is the first time that a ultra-sensitive and specific assays for total tau in blood has been developed. The presented case studies highlight the clinical significance of measuring total tau and GFAP in blood in traumatic brain injury. In addition to total tau other CNS-relevant and ultra-sensitive assays have been developed on Simoa. These assays can also be multiplexed and allow for an easy transfer of existing ELISAs to improve sensitivity.
Extending Functional Outcome Measurement To Support International Comparison Across Different Rehabilitation Settings For Patients With Acquired Brain Injury: A UK-Australian Pilot Study

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Objectives: Basic functional measures (eg FIM™) are widely used to compare outcomes from rehabilitation, but provide little information beyond basic independence in self-care. The UK Rehabilitation Outcomes Collaborative is extending its battery of measures to include participation. Tools should be feasible for routine practice and applicable across a wide range of healthcare systems and rehabilitation settings.

We present a pilot prospective cohort study, using two extended outcome measures to describe and compare outcomes from two contrasting rehabilitation programmes for younger adults with complex disabilities following acquired brain injury:

1. a sub-acute tertiary specialist inpatient rehabilitation unit in the UK
2. a post-acute community-based residential rehabilitation unit in Western Australia.

Methods: Patients were routinely assessed on admission and review (at discharge or 1-year, whichever was shorter), using both the UK Functional Assessment Measure (UK FIM+FAM) and the Mayo-Portland Adaptability Inventory (MPAI-4).

Items were examined for their comparative content and mapped onto domains of activities and participation. Changes in subscale and total scores were examined using Wilcoxon tests. Total and subscale FIM+FAM and MPAI T-scores were compared between the two groups using Median(IQR) and Mann-Whitney U tests.

Results: Both instruments were timely to apply (20-25 mins each) and covered self-care, mobility, communication, cognitive, emotional, psychosocial factors, domestic activities including financial management and employment. However, they were gratifyingly complementary in the level of detail provided in each area.

The demographics were broadly similar in the sub-acute (n=23) versus post-acute (n=32) cohorts:

- Mean age: 39.7 versus 43.9 years
- Males:females: 70:30% versus 75:25%.
- Both samples consisted of mainly of strokes and traumatic brain injury (totalling 70% vs 85%)
Lengths of stay were significantly shorter for the sub-acute sample 20 (range 13-24) vs 82.5 (range 50-111) weeks.

Within each sample all subscales in both measures changed significantly between admission and review (Wilcoxon p<0.001), but we expected (and found) the two samples to be very different:

- The subacute patients were more disabled on admission in both FIM+FAM-Motor: (19(17-32) versus 74(57-97): z=-4.6,p<0.001) and Cognitive function 33(24-35) versus 59(40-70): z=-2.6,p=0.007)

- By discharge they had made substantially greater change, being on a faster trajectory for recovery: Change in total FIM+FAM score: 67(35-83) versus 6(1-31); z=-5.0,p<0.001)

- MPAI T-scores were significantly higher (ie worse) for Ability 65(58-72) versus 55(49-61) z=-2.9,p=0.004) and Participation 64(59-73) versus 58(49-65) z=-2.4,p=0.01); but similar for Adjustment 55(45-63) versus 54(48-59) z=0.03,p=0.98)

- Again the subacute group changed more in total MPAI T-score: -13(-8,-21) versus -3.5(-9,+1): z=-4.1, p<0.001)

**Conclusions:** The UK FIM+FAM and MPAI provide complementary assessment across a wide range of patient experience including ability, adjustment and participation. This study demonstrates their applicability to compare and describe baseline and change across these two very different patient groups. The differences resonated with clinical experience.
Public, teacher and healthcare professionals’ understanding of traumatic brain injury.

Status: Accepted  Presentation type: Poster  
Category: Neurorehabilitation – activities and participation  
Author's preference: Poster  

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Background: Perceptions of Traumatic Brain Injury influence attitudes and behaviours towards those with the condition. Survivors of TBI face discrimination and prejudice in areas such as education, work and housing. The World Health Organisation acknowledges this reality and has called for educational interventions to prevent isolation and facilitate social integration. A great deal of international research has been published which explores this issue, however, little appears to have changed over the intervening years.

Objectives: To bring together research from the United Kingdom, United States and New Zealand on the topic of public understanding of TBI. To make recommendations to improve lay understanding of TBI.

Methods: A scoping review of qualitative and quantitative research studies was undertaken to determine whether lay perceptions of TBI differed on the basis of nationality. Electronic searches of Pubmed, Web of Science, Cinahl and Embase were conducted. Two authors independently reviewed study titles and abstracts, applying prespecified inclusion criteria to each. The included studies assessed perceptions, knowledge/understanding of the public, teachers and healthcare professionals.

Results: The reviewed evidence (n = 12 studies) suggested that members of the public, teachers and healthcare providers hold many misconceptions about the causes and consequences of TBI. One study noted that educator knowledge in relation to children with TBI had not significantly improved in over 25 years. Experienced healthcare professionals were shown to hold more prejudicial attitudes than newly qualified members of staff. Some of this misunderstanding may be explained by the differing terminology used (brain injury, head injury, concussion), which was shown to be confusing for many members of the public who held little and inaccurate knowledge of TBI.

Conclusions: Greater efforts to educate the public, teachers and healthcare professionals are needed to reduce prejudice and discrimination towards children and adults with TBI, improve practice, and ultimately improve patient outcomes. Educational interventions which seek to increase understanding are needed if we are to see a positive change in attitudes towards survivors of brain injury.
A Comparison Of Functional Gains At Different Stages Of Recovery In Adults With Acquired Brain Injuries Participating In A Residential Community Rehabilitation Programme

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Objectives: Outcome measurement is critical to demonstrate the effectiveness of rehabilitation. However, the goals areas change as the patient progresses down the path to recovery, so different measurement tools may be required at different stages. The UK Functional Assessment Measure (UK FIM+FAM) focuses primarily on disability while the Mayo-Portland Adaptability Inventory (MPAI) extends assessment to aspects of participation.

The Brightwater Oats Street Rehabilitation facility in Western Australia offers a phased community rehabilitation programme in 10 defined stages. In this cohort study, we compared change in both measures between three groups of patients admitted to the programme at different stages of recovery. We hypothesised that the UK FIM+FAM would change more in the early stages, and the MPAI more in the later stages.

Methods: On admission, all patients are assigned to a graduation stage from 1 (total care) to 10 (consistent community independence) and move through stages as they progress. The UK FIM+FAM and MPAI, are routinely assessed on admission and repeated on review at discharge or after 1 year.

For this analysis, the 32 patients were grouped according to their admission stage:

A. Stages 1 and 2: Maximum support in all areas (N=13).

B. Stage 3: Moderate assistance with self care but moderate/maximum assistance with household activities (N=13).

C. Stages 4,5,6: Minimal support in self care with moderate/minimal assistance for household and community activities (N=6).

Change in total and subscale scores were tested with Wilcoxon signed-rank tests (SPSS-v22). Radar charts were created to examine item-level functional changes for each group.

Results: Demographics: 75% male; mean age 44 years with strokes (44%), traumatic (44%), and other (12%) acquired brain injuries, admitted between November 2011-July 2014. The time between assessments averaged 53 weeks, range 16-76. Between admission and review:

• Groups A and B made significant changes in FIM+FAM Total score (z=-3.1,p=0.002 and z=-2.0,p=0.04 respectively) reflecting significant changes in the Motor (but not the Cognitive) subscale, whilst Group C did not change significantly in total score (z=-1.0,p=0.293) or subscales.
• Groups A and B also made significant changes in MPAI Participation T-score ($z=-2.8, p=0.005$ and $z=-2.6, p=0.009$ respectively).

• Group C, however, made significant changes in MPAI Ability T-score ($z=-2.0, p=0.04$), whilst Groups A and B did not.

Reflecting item differences between measures, improvements in personal care and motor activities were more clearly evident on the UK FIM+FAM than the MPAI, whereas the opposite was so for psycho-social issues, including depression, self-awareness, memory, attention and problem solving, which improved notably for some clients at later stages.

**Conclusions**: Taken together, the UK FIM+FAM and MPAI-4 provide complimentary evaluation across a wide range of functional tasks, ranging from basic self-care to participation. This pilot study supports their combined use for longitudinal outcome evaluation in community residential rehabilitation services.
Radiation-Induced Brain Damage And The Need For Predictive Biomarkers

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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This presentation will review the literature on radiation-induced normal tissue injury in the context of treatment of primary and metastatic brain tumors on mechanisms of injury, current approaches to mitigation, and emphasize the need for predictive biomarkers to improve treatment outcome and quality of life (QOL). Brain tumors remain a significant challenge for patients, their families, the physicians treating them, and researchers seeking more effective treatments. Current treatment of brain tumors involves combinations of radiotherapy with surgery, chemotherapy, and molecularly targeted agents. Radiotherapy is likely to remain as a cornerstone of the treatment of brain tumors for the foreseeable future. As patient survival improves with advances in treatment, there is an increasing concern for the cognitive deficits that may become apparent months or years after treatment some of which are related to radiation-induced brain damage. Unraveling the mechanisms of radiation-induced cognitive deficits is imperative for the development of mitigators. Extrapolating from this, new opportunities to identify and develop putative predictive biomarkers of radiation-induced brain damage can be explored. Predictive biomarkers of radiation-induced brain injury may enable stratifying patients for customization of treatment and thus aid in improving the QOL and possibly prolonging survival. The challenges involved in leveraging recent advances in radiation-specific biomarker discovery, development, and translation to the clinic will be discussed.

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Absence Of Spontaneous Blood Pressure Variability In Patients With Acute Brain Injury After Out-Of-Hospital Cardiac Arrest During The Post-Cardiac Arrest Syndrome

Status: Accepted Presentation type: Poster

Category: Technology – clinical research/applications

Author's preference: Poster

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Objectives: Brain injury after out-of-hospital cardiac arrest (OHCA) is the leading cause of death in industrialized countries. Although more patients have return of spontaneous circulation (ROSC), the overall prognosis has not improved and only a minority of patients survive with favourable neurological recovery. The amount of brain damage strongly depends on recovery of cerebral circulation, but ROSC does not automatically restore normal circulation. Under normal circumstances, cerebral blood flow (CBF) and mean arterial pressure (MAP) exhibit rapid spontaneous fluctuations. To what level CBF variability is dependent on pressure variability is unknown in patients after cardiac arrest.

The main objective of our study is to investigate spontaneous variability of cerebral blood flow velocity (CBFV) and MAP after cardiac arrest and to compare dynamic CBF regulation patterns after cardiac arrest with those in controls.

Methods: We performed a prospective observational study in 10 patients with acute brain injury after OHCA. In the first 72 hours after admission MAP and CBFV of the middle cerebral artery were measured. In the time domain the coefficient of variation (CV) of MAP and CBFV were calculated. In the frequency domain the variation was calculated using the power over three frequency bands. We compared patients after cardiac arrest to normal controls and patients with septic shock and after cardiac surgery.

Results: We included 10 OHCA patients. CV of MAP immediately after the arrest was significantly lower in patients compared to controls, patients with sepsis or cardiac surgery (1.59±0.80 versus 5.67±4.20, 2.60±1.40 and 2.42±0.99%, p<0.05). CV of CBFV after cardiac arrest was significantly lower compared to normal controls (4.00±2.28 versus 8.97±5.43, p=0.01). The loss of normal variation after cardiac arrest restored towards normal values during admission. The total power of MAP was significantly lower in the cardiac arrest group compared to normal controls (p<0.01) with significantly lower low frequency and very low frequency power spectra (p<0.01).

Conclusions: The spontaneous MAP and CBF variability were significantly reduced in patients with acute brain injury after cardiac arrest. This lack in variability was restored during admission and may be related to an (temporary) autonomic dysfunction in these patients. In the future this might provide a therapeutic target and thereby improve outcome.
Evaluation Of A Four Month Rehabilitation Program for Subjects with Balance Problems and Binocular Visual Dysfunction Following Stroke - A Pilot Study

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: To evaluate the effect of a four-month rehabilitation program for individuals with balance problems and binocular visual dysfunction (BVD) after a stroke.

Design: Pre-post interventions study

Subjects: Twenty-nine individuals with stroke, aged 18-70 years, with stroke and balance problems and BVD.

Methods: About 40 sessions of 1.5 hours duration over four months with visual therapy and balance rehabilitation, was provided to all participants in groups of 7-8 individuals. Several measures for BVD, balance, gait, Health Related Quality Of Life (HRQoL) and functional recovery were used at baseline (BL), the end of training and at a six-month follow up (FU).

Results: We found significant improvements in stereopsis, vergence, saccadic movements, burden of binocular visual symptoms, balance and gait speed, fatigue, HRQoL and functional recovery. Moreover, 60% of the participants were employed at the 6 month FU, compared to only 23% before training. All improvements were sustained at the six-month FU.

Conclusions: Although a control group is lacking, the evidence suggests that the positive improvement is a result of the combined visual and balance training. The combination of balance and visual training facilitates changes at a multimodal level affecting several functions important in daily life.
Problems with balance and binocular visual dysfunction are associated with post-stroke fatigue. A validation study

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: Fatigue after stroke and its relation to balance, gait and Binocular Visual Dysfunction (BVD).

Design: Subgroup analyses in an intervention study.

Participants: Subjects with stroke (n=29), age 18-67 years.

Methods: Subjects were tested with the Modified Fatigue Impact Scale (MFIS), and objective and subjective BVD measures, Balance Evaluation Systems Test, Ten Meter Walk Test and Health Related Quality of Life, before and after intervention and at three- and six-month follow-ups. We used principle component analysis to extract underlying factors of MFIS. Associations between MFIS factors and patient characteristics were analyzed by repeated measures ANOVA. The association between MFIS factors and physical measures were assessed using pairwise correlations.

Results: Four components were extracted from MFIS, explaining 71% of variance: Cognitive fatigue, Physical fatigue, Arousal and Physical Discomfort. We found that women register higher MFIS scores than men. There was a strong association between level of Cognitive and Physical Fatigue and BVD, between Arousal and balance, and between Cognitive Fatigue and gait.

Conclusions: We extracted four meaningful components of MFIS. Especially the arousal component revealed interesting results, in studying fatigue. It separates from both cognitive and physical fatigue and may add valuable information for treatment and research.
Approaches to Establishing Validated Cut-off Scores on the Rivermead Post Concussion Symptoms Questionnaire (RPQ).

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: To investigate the specificity and sensitivity of a measure of postconcussional symptoms, the Rivermead Post-Concussion Symptoms Questionnaire (RPQ), establish an optimal cut-off score for the RPQ and examine classification accuracy for other suggested classification methods using this measure.

Methods: Healthy adult controls (n=46) were compared with individuals with persistent postconcussional symptoms (PCS) at least six months after mild-moderate TBI (n=61). Total scores based on the full RPQ score and proposed subdivisions (RPQ-13/RPQ-3, and cognitive, emotional and somatic symptom groups) were investigated using receiver-operating characteristic (ROC) curve analysis, and compared on their ability to accurately distinguish individuals between the groups. Additional methods previously used to dichotomously identify PCS based on other combinations of symptoms on the RPQ were also considered.

Results: Using ROC analysis, an optimal cut-off point of 16 or more for the total RPQ score was selected, with an associated sensitivity of 97% and specificity of 87%. The full version of the RPQ was shown to have high classification accuracy, as well as the abbreviated versions, with the RPQ-13 and cognitive symptoms showing similar classification accuracy to the full RPQ. Alternative methods based on various combinations of mild symptoms showed high false positive classification rates of healthy controls. Raising the endorsed symptoms’ severity to moderate with these methods resulted in improved specificity, at relatively modest cost to sensitivity.

Conclusions: At least in terms of identifying symptoms associated with persistent PCS from those reported in the general population, the RPQ can be used to reliably distinguish between the two, but higher thresholds than previously used may be needed.
Differences in Disease-Specific and Generic Health Related Quality of Life between Contrasting Patient Groups after Traumatic Brain Injury.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: No preference

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Objectives: Disease-specific and generic health-related quality of life (HRQOL) is assessed predominantly via self-rating, since patients are considered experts of their own wellbeing. Many factors that are associated with TBI can impair patients' HRQOL. The sensitivity of HRQOL instruments to detect such effects is underexplored. This study therefore compared the capacity of the disease-specific QOLIBRI and the generic SF-36 instrument to identify significant differences in HRQOL between patient groups with different severity grades of trauma, recovery, clinical, demographic and psychosocial characteristics.

Methods: A sample of 795 TBI patients after TBI was internationally recruited in six languages. Participants self-rated both HRQOL questionnaires and other information was collected via interview, questionnaires and patient record forms. ANOVA analyses were applied. Furthermore, using a generalized Wilcoxon-Mann-Whitney approach, univariate and multivariate (Wei-Lachin) nonparametric analyses were conducted. The innovative Wei-Lachin procedure provides a highly efficient global test that considers between variable correlations and controls alpha levels for the ensemble of a multivariate analysis, calculating standardized effect sizes to be easily interpreted.

Results: Both HRQOL instruments were sensitive to group differences, with varying effect sizes. There was a strong association of HRQOL and patients' reliance on others, depression, anxiety and recovery status; whilst smaller differences were found for living arrangements and participation in leisure activities. When total/summary scores were examined, the sensitivity of QOLIBRI and SF-36 was mostly comparable. QOLIBRI total scores distinguished better for patients' reliance on others and participation in leisure activities than was SF-36. The investigation of subscales showed that a greater number of strong effect sizes of differences between specified patient groups were detected by QOLIBRI subscales than by SF-36 subscales. In total for 104/114 comparisons (91.2%) of QOLIBRI subscales and for 126/152 comparisons (82.9%) of SF-36 subscales at least a small significant effect sizes was identified.

Conclusions: It can thus be concluded that discrimination between different patient-groups after TBI was more refined using the disease-specific QOLIBRI instrument in comparison with the generic SF-36 instrument. This finding is likely explained by the disease-specific character of the instrument, providing improved insight in the specific consequences important for TBI survivors.
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Early Resumption Of Physical Activities And Persistent Post-Concussive Symptoms Following Pediatric Concussion

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: Guidelines for initial pediatric concussion management recommend both physical and cognitive rest, however little is known on the ideal timing of physical activity re-introduction to maximize recovery. While early physical activity has proven benefit in conditions such as stroke, it has not yet been studied in concussion. The objectives of this study were: 1) to assess physical activity in the first 28 days following acute pediatric concussion; and 2) to investigate the relationship between resumption of physical activity within 7 days post-injury versus conservative rest and the occurrence of persistent post-concussive symptoms (PPCS).

Methods: Children aged 5-18 years with acute concussion (preceding 48 hours) were enrolled across 9 emergency departments (EDs) of the Pediatric Emergency Research Canada network in a prospective, multicenter cohort study. Enrollment occurred August 2013 through June 2015. Participation in physical activities and degree of post-concussive symptoms were rated using standardized self-report questionnaires at baseline and at 7, 14, and 28 days follow-up. PPCS was defined as ≥3 persistent symptoms on the validated Post-Concussion Symptom Inventory at 28 days post-injury. The impact of early exercise on PPCS at four weeks post-injury was examined using propensity-matched logistic regression analysis.

Results: Of 3063 participants, 2413 (79%) provided complete information on early exercise and persistent symptoms at four weeks post-concussion. PPCS occurred in 678 (30%) of participants. The majority of children performed light to heavy exercise at one week post-triage (n=1677, 70%). In unadjusted analyses, early exercise was associated with reduced persistent post-concussive symptoms at 4 weeks post-triage [24% (n=414) versus 44% (n=320), OR=0.42, 95%CI=0.35-0.51; p<0.001]. In further analyses of 1294 patients matched by propensity scores, early exercise remained associated with reduced persistent post-concussive symptoms (OR=0.59, 95% CI=0.47-0.74, p<0.001). The propensity matched groups were balanced on all measured baseline characteristics.

Conclusions: Early exercise was associated with reduced persistent post-concussive symptoms at four weeks post-injury. A future randomized clinical trial is urgently required to confirm the benefit of earlier return to physical activity. If proven effective, this will result in a paradigm shift in concussion management, while at the same time mitigating the undesired effects of physical and mental deconditioning associated with current treatments.
Clinical Risk Score for Persistent Post-Concussion Symptoms in Pediatrics

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: Approximately one-third of children experiencing acute concussion suffer a combination of ongoing somatic, cognitive, psychological and/or behavioral symptoms known as persistent post-concussion symptoms (PPCS). However, validated and pragmatic tools enabling clinicians to identify risk for PPCS do not exist. The primary objective of this study was to validate a clinical risk score for PPCS in children with acute concussion using readily available clinical features.

Methods: Predicting and Preventing Post-concussive Problems in Pediatrics (5P) was a prospective, multicenter cohort study. Enrollment occurred August 2013 through September 2014 (derivation phase), and October 2014 through June 2015 (validation phase). Participants completed follow-up 28 days post-injury. The setting was nine Canadian pediatric emergency departments within the Pediatric Emergency Research Canada (PERC) network. Eligible patients were aged 5.00 through 17.99 years, presented with a head injury occurring within the preceding 48 hours, and met Zurich consensus concussion diagnostic criteria. Consecutive patients were offered enrolment during recruitment hours; consent rate was 74%. The primary outcome measure was PPCS defined as ≥3 new or worsening symptoms compared to recalled pre-injury baseline at 28-days using patient-reported Post-Concussion Symptom Inventory.

Results: In total, 3,063 patients (median age=12.0 years, interquartile range:9.2-14.6) were prospectively enrolled [derivation: n=2,006; validation: n=1,057] of which 2,583 patients [derivation: n=1,701 (85%); validation: n=883 (84%)] completed follow-up. PPCS was present in 801 (31.0%) [derivation: n=510 (30.0%; 95%CI:27.9-32.2%); validation: n=291 (33.0%; 95%CI:30.0-36.1%)]. A 12-point derived risk score to identify low- and high-risk PPCS categories included: female sex, age ≥8 years, personal migraine history, previous concussion symptoms lasting >1 week, headache, noise sensitivity, fatigue, answering questions slowly, and ≥4 errors on Balance Error Scoring System tandem stance. In validation, sensitivity=93.5% (95%CI:90.0-95.8%) with negative likelihood ratio=0.36 (95%CI:0.23-0.58) for low-risk patients (≤3 points); for high-risk patients (≥9 points), specificity=93.4% (95%CI:91.1-95.1%) with positive likelihood ratio=3.00 (95%CI:2.06-4.37). Compared to physicians’ prognostication, the model better predicted PPCS (p<0.001).

Conclusions: A validated clinical risk score can be employed to stratify risk of PPCS amongst children presenting with acute concussion. This knowledge should be employed to provide evidence-based guidance, to direct novel interventions, and to advance research to prevent PPCS.
Impact of Persistent Post-Concussion Symptoms on Pediatric Quality of Life

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: Persistent post-concussive symptoms (PPCS) have the potential to impact patients’ quality of life across various domains: impaired cognition, memory and attention, affect school attendance and performance, mood and social engagement, and physical performance. The objective of this study was to determine the impact of PPCS on pediatric quality of life in order to provide a new standard of care focusing on the patient’s physical, mental, and social well-being.

Methods: Children aged 5-18 years with acute concussion (preceding 48 hours) were enrolled across 9 emergency departments (EDs) of the Pediatric Emergency Research Canada network in a prospective, multicenter cohort study. Enrollment occurred August 2013 through June 2015. Patients completed the validated Pediatric Quality-of-Life (PedsQL) Inventory at 1 and 3 months post-injury. PPCS was defined as ≥3 persistent symptoms on the validated Post-Concussion Symptom Inventory at 28 days post-injury. The primary analysis compared total PedsQL score of participants with and without PPCS using Mann-Whitney U tests.

Results: Out of the 5229 patients screened for eligibility, 2006 children aged 5 through 17 years were enrolled, of which 1667 (83.1%) completed the primary outcome at 4 weeks. PPCS occurred in 510 (30.6%) of participants. After a linear mixed effects random coefficients model adjusted for possible confounders, children with PPCS had significantly lower PedsQL Total Score (70.0) than children without PPCS (80.3), mean difference -10.3 (95% CI: -9.4 to -11.2). The PPCS group scored significantly lower on physical, emotional, social, and school Peds QL subscales when compared to the non-PPCS group at each follow-up time point (week 4, 8, and 12).

Conclusions: Children with PPCS have significantly lower overall quality of life at one month from the date of the concussion injury as compared to children without PPCS. Deficits in quality of life are pervasive across physical, emotional, social and sleep domains. This insight into the burden of pediatric concussion should encourage the provision of extra support, anticipatory guidance regarding expectation management, and coping mechanisms for patients at high risk of PPCS. There is a need for future interventional research to target concussion’s impact on quality of life.
Rewards and Challenges from Nursing Perspective on Caring for Patients in the Vegetative State or Minimally Conscious State in an Inpatient Rehabilitation Brain Injury Unit

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Background: There are ample literature on the burden of care and needs of caregivers of patients who are in vegetative state or minimally conscious state\textsuperscript{1,2,3}. However, there has not been any report on the burden of care of these patients from nursing perspective.

Objectives: To survey and report on the rewards and challenges from the nursing staff on the care of patients who are in the disorder of consciousness (DOC) spectrum in an inpatient rehabilitation hospital brain injury unit. In this study, patients in DOC are those who are either in vegetative state or minimally conscious state.

Methods: We sent out a one page survey to current nursing staff (RN, LPN, CNA) on the brain injury (BI) unit of a busy inpatient rehabilitation hospital to solicit feedback with two questions: 1) What are the challenges of working with DOC patients? 2) What is rewarding about working with patients in DOC? The surveys were left at the nursing station, with answers kept anonymously in an enclosed envelope. The BI unit has 31 beds, with a total of 30 RN/LPN and 21 CNA.

Results: The survey was available for 1 week and we received a total of 20 responses; 13 from nurses (RN/LPN) and 7 from CNAs. The average RN/LPN length of employment on the BI unit ranges from 4 months to 20 years, with an average of 9.4 years. The average CNA employment on the BI unit ranges from 2 months to 4 years, with an average of 1.6 years.

The most common challenge in caring for patients in DOC as reported by RN/LPN is the time constraint needed to provide care for these patients, including time to counsel and perform family training. The second most common challenge is the physical requirement to care for these patients, who often require 2-3 persons to transfer. Responses from our CNA, on the other hand, point to challenges and frustrations in communication as the patients are unable to voice their needs or wants.

When reviewing the comments regarding the rewards of caring for patients in DOC, the unanimous answer from both RN/LPN and CNA is seeing patients emerge to consciousness and start to interact with their environment again.

Conclusions: This simple and concise, yet informative, study revealed the challenges and rewards of caring for patients who are in the DOC from nursing viewpoints. It is also interesting to point out the differences in challenges perceived from RN/LPN versus CNA. This is an opportunity to work with our CNA so that they can better understand the needs of patients in DOC and decrease the perceived burden of care. Further studies are underway to evaluate the effectiveness of addressing these challenges.
Potential Adverse Effects of Apnea as a Result of Trialing Zolpidem in Patients in Vegetative State

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Zolpidem has been shown to induce paradoxical effects of increasing arousal in patients in vegetative state due to severe traumatic brain injury\(^1\). It is thought that zolpidem induces paradoxical and vascular changes via activation of GABA receptors of neurodormant brain cells, thus causing brain activation\(^2\). Despite increasing trialing of zolpidem among brain injury physicians who care for patients in vegetative state, apnea has not been reported as a potential side effect of zolpidem.

Methods: This is a report of two cases of patients who were in the vegetative state who developed apnea after trialing zolpidem.

Results: MG is a 20-year-old man with severe traumatic brain injury, who was in a vegetative state according to the Coma Recovery Scale-Revised. He was trialed on zolpidem 10mg every morning (QAM), and 5 days later had a witnessed episode of apnea where he stopped breathing for 3-5 seconds and desaturated to below 80% P02. Zolpidem was stopped and no further apnea episodes were witnessed for the next 5 days. Zolpidem was restarted again at 10mg QAM, and 2 days later, he was witnessed to have 2 more apnea episodes. Zolpidem was again discontinued and no further episodes of apnea occurred. It should be noted that the patient was more alert and was tracking when taking zolpidem.

RE is a 19-year-old woman with severe TBI, who was in a vegetative state. She was trialed on zolpidem 5mg QAM. On the second day, she developed periods of apnea for several seconds each, with oxygen desaturation. The apnea episodes resolved after stopping zolpidem on day 3. Level of alertness did not improve with zolpidem, so it was not restarted again.

Conclusions: These two cases raise concern for apnea in patients undergoing zolpidem trial while they're in vegetative state. The cases demonstrated convincing evidence that apnea was directly related to the use of zolpidem and not due to chance alone. The case of MG, in particular, showed reproducible and witnessed apnea episodes with oxygen desaturation. We suggest that close monitoring, perhaps with continuous pulse oxygenation, for apnea in patients in vegetative state who are undergoing trials of zolpidem.


Impact of attention on health related quality of life following severe traumatic brain injury in young children

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Background: Children experiencing severe Traumatic Brain Injury (TBI) demonstrate long-term impairments. An evaluation of Health Related Quality of Life (HRQoL) should be incorporated into standards of care and as an outcome measure in TBI research.

Objectives: 1. Assess HRQoL outcomes after severe Traumatic Brain Injury (TBI) using the Multiattribute Health Status Classification System (MHSCS) at 3 and 5 or more years post injury.

2. Compare the 3 and 5 or more Year MHSCS HRQoL outcomes.

3. Consider the role of pre-existing conditions.

Methods: This was a retrospective chart review of 19 children sustaining severe TBI before 12 years. Ethics approval was granted. Variables were analyzed using SPSS version 16.0.1. T-tests and chi square tests assessed equivalency between groups. Group MHSCS scores were compared using Multivariate Analyses of Variance (Manovas) and Multivariate Analyses of Covariance (Mancovas).

Results: An independent t-test on Total MHSCS scores revealed non-significant differences between groups (t(17)=−1.3,p=.20) at 3 and 5 or more years. A MANOVA on MHSCS scale scores showed no significant overall difference in HRQoL between the groups but univariate tests revealed significant differences for Sensation (F(1,17)=6.26, p=.02), Emotion (F(1.17)=5.16, p=.04) and Cognition (F(1,17)=5.84, p=.03). The 3-year group had more problems with sensation and the 5-year group with Emotion and Cognition. Three Mancova analyses revealed significant multivariate effects on MHSCS scores for pre-existing Emotional Regulation (F(8,5)=5.63, p=.037) and Social Skills problems (F(8,4)=8.71, p=.026), but not for ADHD (F(8,4)=0.88, p=.59).

Conclusions: Our results provide several important pieces of information regarding children's progress after severe TBI. Children sustaining severe TBI early in life experience more difficulties with Cognition and Emotion at 5 or more years than at 3 years in follow up. There are increasing problems with Emotion and Pain over time relating to emotion regulation and social skills problems presenting shortly after injury. Problems with Sensation are greater at 3 than at 5 or more year follow-up and the presence of ADHD shortly after the initial injury may be a factor in later problems with Emotion, Cognition and Pain. Intervention for ADHD shortly after the initial injury may be a factor in attenuating these later problems.
Effects of Social Economic Status (SES) and Outcomes from Traumatic Brain Injury (TBI)

Status: Accepted Presentation type: Poster
Category: Neurotrauma – health services and outcomes
Author's preference: Oral

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Objectives:
1. To investigate relationships among outcome variables and social class.
2. To establish or refute any relationships that may exist between SES and specific outcome variables.

Methods: A systematic sample was made of 636 patients TBI were followed up for at initial, 3, 6 and 12 months. Analyses excluded students (n=114) and unemployed/retired/not looking for work (n=399). SES categories were 1= Professional or managers; 2 = Skilled (trades and administration); and 3 = Semi-skilled and unskilled. Data such as demographic data, education, Post Traumatic Amnesia (PTA), Galveston Orientation Assessment Tool (GOAT), Rivermead Post-Concussional Scale (RPCS), Hospital Anxiety & Depression Scale (HADS) and Quality of Life (QoLi). ANOVA were performed to associations among outcome variables and SES at various data collection points. Statistical analysis was performed using SPPS software version 21.

Results: There were 84 SES 1, 191 SES 2 and 199 SES 3. At 3 months post-TBI ANOVA showed a trend towards significance for RPCS mainly for SES 2. ANOVA at 3 months for HADS Anxiety was highly significant $F (2,339) = 5.814, p= 0.003$. This remained highly significant for Anxiety at 6 and 12 months, $F (2.322) = 6.27, p = 0.002$ and $F (2.232) = 6.388, p=0.002$. HADS Depression subscale showed significance at 6 months with an ANOVA of $F (2,322) = 3.058, p = 0.048$. While at 12 months The ANOVA was highly significant for the HADS Depression subscale with $F (2,322) = 5.597, p = 0.004$. There were no significant differences among the three SES groups for the outcome variables of QoLi, PTA or relationship status or for all variables at initial assessment.

Conclusions: It was shown that there is a statistically and biologically significant finding for RPCS at 6 and 12 months. RPCS functions as a proxy for post-Concussional disorder (PCD) with lower SES associated more commonly with PCD. HADS positive findings with the Anxiety subscale at all data points with low SES having more anxiety than higher groups. The HADS Depression subscale was not significant at 3 months though became more significant out to 12 months. This supports our previous work regarding an increase in depression the further out from the injury. There was a difference in Depression between the SES 2 verses SES 3 groups gives depression and anxiety both being more common in the lowest SES group. Social class can have a profound effect on access to and outcome from health care as well as other aspects of life.
Diverse Changes in Responsiveness to Preferred Music in Brain-injured Patients with Disorders of Consciousness

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Recent studies suggest that complex emotions and neural activities induced by pleasant or preferred music may improve cognition function. However, the potential benefits of listening to preferred music for improving awareness in patients with disorders of consciousness (DOC) have not yet been fully explored. This study aimed to investigate whether brain injury survivors with DOC benefit from listening to their preferred music.

Methods: An ABA single-subject design was used. Two patients with a chronic DOC following a severe brain injury listened to their preferred music every day for 4 weeks, followed by 4 weeks of follow-up assessment. Information about preferred music of each participant was collected through interviews with their influential family members. Motor behaviours, heart rate and Glasgow coma scale (GCS) were measured throughout baseline, intervention and post-intervention phases of each session. Motor behaviours were coded from videotapes. A combination of visual analysis and two standard-deviation band method was used for data analysis.

Results: Both patients demonstrated significantly responsiveness changes while listening to preferred music, but such changes reflected in different measures: one produced significantly more motor behaviours, the other one showed significantly increased heart rate. In addition, there were no significant intervention-related improvements on the GCS scores of both patients.

Conclusions: The findings suggest that although diverse changes in responsiveness exist, listening to preferred music may lead to arousal changes in brain-injured survivors with chronic DOC. A possible explanation for the varied responses in two patients could be different modes of their preferred music. Further research with larger study population is necessary to validate these findings.
New Form Of Physical Therapy, Progressive Rehabilitation Of Neuromotor Dysfunction

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: No preference

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This contribution will present a new approach in neuromuscular and motoric rehabilitation. It has been successfully implemented in rehabilitation programs in Centre NAPREJ, where Long term psychosocial rehabilitation for persons with ABI is conducted. In a few steps we will show you some new possibilities of progressive rehabilitation with the use of training device called PRO SKI SIMULATOR.

We will explain how is it possible with PRO SKI medical training progressively & positively affect on the motor as well as cognitive abilities of people with neuro-motoric dysfunction with consequences of stroke or trauma. We will emphasize in which segments of rehabilitation as well as a part of healthy lifestyle PRO SKI training is successfully used.

We will present the results of the program based on assessment of specific, short time period of training persons with ABI, with data about their physical condition before and after the implementation of the program.

Keywords: Medical fitness, neuro-rehabilitation, progressive approach, motoric & cognitive abilities, acquired brain injury, Centre Naprej
Observed Versus Predicted Outcome In Patients With Severe Traumatic Brain Injury Using The Crash Prognosis Model

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Background: Traumatic brain injury (TBI) is a leading cause of death and disability worldwide. The ability to accurately predict patient outcome after TBI has an important role in clinical practice and research. The collaborators of the Corticosteroid Randomisation After Significant Head Injury (CRASH) study provided a user-friendly web-based outcome prediction model. External validation is necessary to determine the ability of a model to reliably predict outcome in populations, different from the development setting.

Objectives: to validate the CRASH prognostic model to a cohort of patients with severe TBI when applied to a local context.

Methods: Retrospective study of patients admitted at the Hospital of León (Spain) with severe TBI during the five-year period 2010-2014. This is a tertiary referral centre for a population of half a million people. The source used for case ascertainment was Intensive Care Unit (ICU) admissions. The standard medical management of severe neurotrauma was based on the Brain Trauma Foundation guidelines. Outcome assessment was made by reviewing patient files and telephone calls. The clinical and radiological data required for the CRASH prediction model were all collected and entered into the web-based calculator during October 2015. Patients were classified according to the percentage of predicted mortality and unfavourable outcome. We plotted mean observed versus predicted outcome and assessed the performance of the model by logistic regression. The area under the receiver operating characteristic curve was calculated to assess the discrimination of the model. Discrimination describes how well a model distinguishes between patients with and without the outcome of interest.

Results: One hundred and fifteen adult patients with severe TBI were admitted to the ICU between 2010 and 2014. The incidence of hospitalised severe TBI during the period analysed was 6 per 10^5 of the population and year. The mean age of the patients was 55 years (median 56 years, age range 15 to 89). There was a male predominance (77%). The mortality at 14 days was 62 patients (54%). At 6 months, the clinical outcome was unfavourable (GOS 1-3) in 85 patients (74%). The mean risk of mortality at 14 days among the 115 patients according to the CRASH calculator was 53% (±32). The mean risk of unfavourable outcome at 6 months was 76% (±23).

Conclusions: CRASH prognostic model is a valid instrument to quantify prognosis in severe TBI. Furthermore, the model is available in a web-based user-friendly way, making it clinically practical. The model appeared to be more accurately calibrated (i.e., the observed risk was very close to the predicted risk) when the predicted risk of unfavourable outcome was greater than 60%. The mean age observed in this study is one of the highest reported and it reflects a change in the epidemiological pattern of TBI.
The neuroprotective effects of treadmill exercise on parkinsonian rats probably involve BDNF and oxidative stress alterations in the brain

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Oral

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Evidences indicate that treadmill exercise (TME) ameliorates physical and cognitive impairments in neurological pathologies and seems to enhance neuroplasticity. BDNF is thought to play a role in regulating neuronal survival, differentiation and synaptic plasticity. In Parkinson’s disease (PD), BDNF reduction within the substantia nigra is related to degeneration of dopaminergic neurons. Furthermore, the oxidative stress is considered to be important in the development and progression of neurodegenerative diseases, as PD. The objectives were to use TME and evaluate its benefits on parkinsonian animals. Male Wistar rats were divided into 4 groups: SO (no exercise), SO (with exercise), 6-OHDA-lesioned (no exercise), 6-OHDA-lesioned (with exercise). TME was performed for 14 days, starting 24 h after the saline (SO group) or 6-OHDA injection into the right striatum (lesioned side). Afterwards, the animals were euthanized and subjected to brain (prefrontal cortex, hippocampus and striatum) dissection and neurochemical measurements (DA and DOPAC, BDNF, TBARS and nitrite). The data were analyzed by One-way ANOVA and Tukey (post hoc test) and considered significant for p<0.05. The results showed a drastic decrease in striatal DA contents of the right striata from the 6-OHDA group with no exercise, as related to its left side and mainly to the right sides of the two SO groups. A recovery in DA contents was demonstrated in the right side of the 6-OHDA group after exercise, relatively to that with no exercise. Furthermore, TME increased the left striatal DA toward values even higher than those of the two SO groups. A similar profile was observed in DOPAC contents. TME increased BDNF levels in the pre-frontal cortex and hippocampus, as related to the same area of the groups with no exercise. An important finding was the BDNF increase in the right side of the striatum from the 6-OHDA group after the exercise, in relation to the same side of the 6-OHDA group with no exercise. An increase in nitrite contents was observed in the pre-frontal cortex and hippocampus, as well as in the right side of the striatum from the 6-OHDA group with no exercise, relatively to all other groups. A similar result was observed in the TBARS assay whose values increased significantly in the pre-frontal cortex and hippocampus of the 6-OHDA group with no exercise and decreased after the exercise. TBARS values were also higher in the right striatum of the 6-OHDA group with no exercise, as related to its left side. However, in this area from the 6-OHDA group after exercise, TBARS values returned towards those shown by the SO groups. In conclusion we demonstrated that TME reduced striatal DA depletion and significantly increased brain BDNF levels. Furthermore, the increases in oxidative stress observed in parkinsonian rats were significantly reversed after TME.
Responsiveness and discriminant validity of the Child and Adolescent Scale of Participation (CASP) in a US sample of children and youth with Traumatic Brain Injury (TBI) across a 3-year period.

Status: Accepted
Presentation type: Poster
Category: Neurorehabilitation – activities and participation
Author's preference: Poster

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Objectives:

1. To examine the responsiveness of CASP scores among children and youth with TBI and a comparison group of children and youth with arm injuries across a 3-year period.

2. To examine the differences in CASP scores among children and youth with mild TBI, moderate TBI, severe TBI and arm injuries across a 3-year period (discriminant validity).

Methods: Data were examined from a longitudinal prospective cohort study with 515 children ages 0-18 years with TBI (n=401) and arm injury (n=114) from diverse racial and ethnic backgrounds. The CASP (Bedell, 2004) was administered at 3, 12, 24, and 36 months post-injury.

Repeated measures analysis of variance (using "within-between" model) was used to examine differences among group scores over time along with Scheffé post-hoc tests.

Results: Comparison between four groups: Arm, mild, moderate and severe TBI groups indicated a decrease in CASP scores from pre-injury to 3 month in all groups. A gradual increase in scores was found from 3 month to 36 month for the Arm, and mild and moderate TBI groups. However, in the severe TBI group a gradual increase was found from 3 month to 24 month, but a decrease in scores was found from 24 month to 36 month.

Scores at 36 month were found to be higher than pre-injury for the Arm and mild TBI groups, but lower for the moderate and severe TBI groups. A significant time effect was found between groups (F = 13.066, p < 0.001), as well as interaction effect between time and type of group (F = 2.306, p = 0.014). The severe TBI scores were found to be significantly lower than scores from the other groups. The Arm injury scores were found to be consistently higher than all the TBI scores across time.

Conclusions: Results provide evidence of the CASP’s responsiveness to change over time particularly for the severe TBI group. The results indicated a pattern of gradual increase in the CASP scores over time for most groups. Groups with low level of severity (Arm and mild TBI), on average, displayed improved CASP scores and returned to their pre-injury level or higher at 36 months post-injury. Groups with high level of severity (moderate and severe TBI) however did not return to their pre-injury level at 36 months post-injury.

Consistent with prior discriminant validity evidence (Bedell, 2009; McDougall, Bedell & Wright, 2013), the CASP was able to differentiate children with more severe injuries from those with milder injuries. These results support the use of the CASP for assessing participation of children with TBI across levels of severity and time.
Profiles of care in severe neurotrauma in Europe: patients, choices and carers

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Oral

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Objectives: To provide an overview of variations in admission criteria, guidelines adherence and implementation for severe neurotrauma patients in intensive care wards across Europe.

Introduction: Large variation is commonly reported in the treatment and the logistics surrounding severe neurotrauma. It is unclear what the effect of this variation is on patient outcomes and mortality. We aim to describe the variation in policy and guideline adherence for academic, high-volume centers in Europe treating severe neurotrauma patients.

Methods: Within a prospective, observational, multi-center cohort study, 68 centers, mostly level I high-volume academic trauma centers (94%) in 21 countries, were asked to fill in questionnaires regarding the daily "standard of care" in severe neurotrauma in their hospitals. The 72 questions were developed by a panel of experts in the field and included questions about guideline adherence, hospital admission and treatment policy of severe neurotrauma.

Results: The questionnaires were completed by 59 centers (86.7%). Fifty-four percent of hospitals had high-volume intensive care wards, admitting more than 1000 patients a year. In 65.6% of hospitals patients with a Glasgow Coma score between 13-15 and other risk factors would also be admitted to the intensive care ward. One center stated that a Glasgow Coma Score of less than eight does not factor in the decision to admit the patient to the intensive care ward. With regard to treatment, 76.1% of centers use the Brain Trauma Foundation Guidelines or institutional protocols based on these guidelines in order to support clinical decision making, while 11.1% use no guidelines whatsoever. However, only 59.1% of the centers had written guidelines. Overall, 82.4% had formally implemented them. With respect to training in the use of guidelines, 31.8% organize formal training and less than half, 34.8%, structurally adhere to the guidelines during rounds. The main reasons for nonadherence were stated to be the fact that every patient is unique (64.5%) and the presence of extracranial injuries (41.9%).

Conclusions: Variation in policy and guideline use is large, even among academic centers treating high volumes of neurotrauma patients each year. Moreover only 34.8% of centers report paying structural attention to guidelines during rounds as a form of implementation, despite the fact that paying structural attention to available evidence is an important part of high-quality patient care, especially in complex and not fully understood diseases such as severe traumatic brain injury.
Posttraumatic Epilepsy among Patients on Stationary Rehabilitation after Traumatic Brain Injury

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – case reports/clinical research
Author's preference: No preference

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Objectives: Trauma is one of the most common causes of symptomatic epilepsy, especially after severe traumatic brain injury (TBI). We analyzed the incidence, causes and treatment of posttraumatic epilepsy / seizures (PTE) among patients at rehabilitation after TBI.

Methods: We collected data for 102 consecutive patients with an average age 42 ± 17 years, of which 84% were men. The average duration of follow-up after TBI was 229 ± 136 days. In the majority (62 patients or 61%) it was a severe TBI and in 21 or 21% a moderate, the mean GCS after the injury was 7 ± 4.

Results: Epileptic seizures occurred in 27 (26%) patients, of which 12 during the acute treatment; 12 patients had recurrent attacks during follow-up. Antiepileptic therapy (AET) at the admission was prescribed at 45 patients and at 10 was introduced during rehabilitation. The most common AET at admission and at discharge was methylphenobarbital (69% at admission and 36% at discharge), followed by carbamazepine (11% vs. 13%) and valproate (9%, both at admission and discharge). At discharge there was a higher prevalence of newer AETs (primarily lamotrigine; only 2% at admission, but 25% at discharge, topiramate 4% and levetiracetam 4%; oxcarbazepine was prescribed in 9% patients at admission and discharge), only four patients required a combination of several drugs. At seven patients AET was discontinued during rehabilitation, and for ten more withdrawal was recommended; three patients continued AET drugs for psychiatric diagnoses. Although patients with PTE had higher incidence of cranial fracture with fragments depression, multiple or bilateral brain contusions and Glasgow coma score after trauma 8 or lower, the differences were not statistically significant. The frequency of subdural, epidural or subarachnoid hemorrhage, brain structures midline shift in the acute phase greater than 5 mm, diffuse axonal injury or penetrating injuries was equally common. The only statistically significant difference (p <0.001) was in a higher incidence of severe disorders of consciousness (minimally conscious and persistent vegetative state) in patients with PTE on admission to rehabilitation.

Conclusions: PTE has been reported in about a quarter of patients admitted to rehabilitation after TBI, more often in those with prolonged severe disorders of consciousness. Methylphenobarbital is most commonly used in the prevention and treatment of PTE, at the release there is a tendency of introducing newer AET.
Survey of Cognitive Rehabilitation Practices in the State of Kuwait

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Background: Rehabilitation professionals must be astute at recognizing, assessing and treating individuals with cognitive deficits. No data is available in Kuwait to examine cognitive rehabilitation practices applied to individuals with neurological conditions.

Objectives: To identify the use of cognitive assessments, the availability of resources, and the barriers to cognitive rehabilitation practices in Kuwait.

Methods: Face-to-face interviews were conducted with health care professionals working with adult individuals with neurological conditions. These professionals included occupational therapists, speech-language pathologists, psychiatrists and neurologists.

Results: The most commonly used cognitive based assessments are MMSE (41%), and MoCA and LOTCA (15.2%). The only clinical assessment used is the Line-Bisection Test (2.2%). The most used occupation-based assessments are FIM (6.5%), COPM (4.3%), the Interest Checklist (2.2%), and the Barthel Index (2.2%). Resources related to cognitive rehabilitation in Kuwait that are not available to practitioners include journal clubs (91%), special interest groups (89%), and continuing education programs (82.6%). Barriers to cognitive rehabilitation practice included lack of sufficient funds for continuing education, lack of time, lack of standardized assessments, and lack of inter-professional teamwork.

Conclusions: Many adults in Kuwait live with cognitive impairment. There is a need to develop appropriate evidence-based cognitive rehabilitation clinical guidelines in Kuwait.
Impaired Sense of Smell following Traumatic Brain Injury and its relationship with Outcome Variables

Status: Accepted
Presentation type: Poster
Category: Neurotrauma – case reports/clinical research
Author's preference: Oral

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Objectives: 1. To investigate the epidemiology of olfactory impairment in a large group of TBI patients.
2. To analyze any relationships among a group of outcome variables and olfactory function.

Methods: A systematic sample was made of 636 patients TBI were followed up for at initial, 3, 6 and 12 months. Data such as demographic data including age, Post Traumatic Amnesia (PTA), Galveston Orientation Assessment Tool (GOAT), Rivermead Post-Concussional Scale (RPCS), Hospital Anxiety & Depression Scale (HADS) anxiety and depression sub-scales, Mini-Mental Status Examination (MMSE), Quality of Life (QoLi), Digit Span, Visual Span, Brixton Spatial Anticipation Test (Brixton), FAS word fluency test and the Visual Patterns Test (VPT). Analyses were performed t-test to check whether there were any significant relationships of olfaction and the outcome variables. Statistical analysis was performed using SPSS software version 21.

Results: 436 (69%) subjects were found to have normal sense of smell and 200 (31%) had either reduced or absent olfaction. There were no significant differences between olfaction groups for age or PTA. Next t-analyses on initial GOAT, MMSE, RPCS, GOAT was not significant. While MMSE was 2.017 (p=0.044), RPCS was 5.620 (p= < 0.001), HADS Anxiety 5.028 (p= < 0.001), HADS Depression 4.706 (p= < 0.001). Subsequent analyses showed intact sense of smell had highly significantly lower RPCS, HADS Anxiety and HADS Depression at 3, 6 and 12 months post-TBI. It was shown that with intact olfaction that RPCS symptoms were less at 3 months (p= < 0.001), 6 months (p=0.005) and 12 months (p= 0.003). The intact group had lower levels of anxiety at 3 months (p= < 0.001), 6 months (p= 0.005) and 12 months (p= 0.002). Those with intact olfaction had less depression and those with olfaction deficits at 3 months (p= < 0.001), 6 months (p= 0.002) and 12 months (p= 0.003). Initial t-test analyses of olfaction and its relationship to Digit Span was 2.698 (p= 0.007), VPT 3.438 (p= 0.001)Subsequent t-test analyses for VPT, Brixton and FAS for all data points were not significant with the exception of Digit Span at 6 months (p= 0.045) where the intact group scores were higher than those with deficits.

Conclusions: This study provides new information about olfactory dysfunction and its relationship to outcome from TBI in a large group. It clearly shows that with a olfaction deficit patients will have more problems with cognition, physical symptoms affect. Further research and analysis of this data set to shed more light on these phenomena.
Comparison of macro- and microcirculatory cerebral blood flow in healthy controls using contrast-enhanced ultrasound.

Status: Accepted Presentation type: Poster

Category: Technology – basic research

Author's preference: Oral

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Objectives: Acute brain injury has a high morbidity and mortality. TBI management mainly aims for early detection and treatment of secondary brain injury. Ischemia is an important mediator of secondary brain insults, and the main goal of intensive care management is optimizing cerebral perfusion and oxygenation, by ensuring adequate cerebral blood flow (CBF) to the brain. Contrast-enhanced ultrasound (CEUS) with microbubble contrast agents is a relatively new imaging technique for quantification of tissue perfusion. The aim of the study was to determine CBF simultaneously in macrocirculation and microcirculation during baseline and decreased CBF.

Methods: We performed an observational study in 10 healthy volunteers. Duplex and CEUS measurements were performed on the subjects during rest and hyperventilation. A Philips iU22 ultrasound system was used, equipped with a 2.5-MHz phased-array S5-1 probe for all duplex and CEUS measurements. Ultrasound examinations were performed in tissue harmonic imaging, phase inversion mode after IV bolus injection of 2.4 ml of a sulphurhexafluoride-dispersion. For the data analysis the DICOM files were visualized in matlab, and specific regions selected from which time intensity curves were calculated.

Results: We included 10 healthy volunteers in this study. The CEUS was well tolerated with no adverse effects. The peak intensity (PI) in the middle cerebral artery (MCA) was 24.3±5.2dB compared to 2.5±1.3dB in the parenchymal region (P<0.01). No significant differences between ipsilateral and contralateral parenchymal regions was measured (2.5±1.3, 3.1±1.7 and 2.7±1.5dB, P>0.05). Time to Peak (TTP) in the MCA was significantly higher compared to the contralateral parenchyma regions (5.9±3.6, 8.1±2.0, 7.5±2.1s, P<0.05). Hyperventilation decreased CBF velocity measured by duplex in the MCA from 60.6±7.1 to 49.9±3.4cm/sec. Hyperventilation resulted in PI of 21.1±4.8dB in the MCA (P>0.05) and decreased to 1.0±0.9dB in the parenchyma (P<0.05). TTP decreased in the anterior contralateral parenchyma region (P<0.05). No difference in TTP during hyperventilation in the MCA was measured (P>0.05).

Conclusions: Ultrasound is an attractive technique because it is non-invasive, has a high temporal resolution and can be applied at the bedside in the intensive care unit. CEUS can detect CBF in the macro- and microcirculation and may be an attractive technique for the detection of CBF changes in patients with acute brain injury.
The Relationship Between High Level Balance and Post-Concussion Symptoms following Traumatic Brain Injury (TBI)

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives:

1. To investigate the relationship if any of Post-Concussional Symptoms and high level balance as measured by the Sharpened Romberg's Test (SR).

2. Establish a relationship between chronological age and high level balance (SR)

3. Determine whether there is any relationship between high level balance and cognitive deficit following TBI

After traumatic brain injury (TBI) post-concussion symptoms (PCS) are well documented, although it is not clear whether they have an underlying physical or psychological cause. In addition to PCS, TBI patients often experience balance deficits. However, previous research has not established whether balance deficits, which are physical in nature, are linked to PCS, nor whether an age-related decline in balance may play a role.

Methods: This study examined the association between acute balance deficits (sharpened Romberg) and the experience of PCS over the first 12 months after brain injury, and whether age plays a part. Cross-sectional samples of up to 509 participants aged 16-97 were administered the Sharpened Romberg test initially, to test for balance, and the Rivermead Post-concussion Symptoms Questionnaire (RPCS), to measure PCS symptoms at all assessment points (within 1 month of TBI, then at 3-months, 6-months- and 12 months post-injury. Using ANOVA The Rivermead scores were analysed both in terms of total score, and using its three principal factors (Emotional, Physiological, Cognitive).

Results: Results suggested that acute balance deficits are significantly associated with persistent PCS for up to six months post-injury, the first time such a relationship has been established. The findings were not due to TBI severity, as PTA scores for the two groups (balance deficit versus no deficit) were not significantly different. The Rivermead Emotional factor scores reflected significantly higher symptomatology at initial assessment (p= 0.016), and at 3 months (p= 0.009) and 6 months,(p= 0.01) post-TBI for those with initial balance difficulties. Similarly, the Cognitive factor scores were significantly higher for the balance-impaired group at initial (p= 0.001), 3-month (p= 0.007), and 6-month (p= 0.016) assessments. This group also reported higher symptomatology on the Physiological factor at initial (p= 0.005) and 3-month (p= 0.042) assessments, but only non-significant differences at 6 months after injury. There were no significant differences in terms of total Rivermead or factor scores at 12 months after TBI.

Age was significantly linked to RPCS at the initial assessment only (p= 0.01) The strong association of acute balance deficits with emotional and cognitive symptoms in the first six months post-TBI suggests an interplay between physical and psychological factors in the persistence of PCS.
Conclusions: The results provide a baseline from which future research can investigate the effect of variables such as depression, life satisfaction, medication and sex differences, on the link between balance and PCS.
**Healthcare Utilization for Concussion Within a Large Pediatric Care Network**

Status: Accepted  Presentation type: Oral

Category: Neurotrauma – prevention and public health

Author's preference: Oral

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**Objectives:** Previous epidemiologic research on concussions has been limited by population (e.g., athletes) or site of healthcare delivery (e.g., emergency department (ED)). However, only half of concussions occur from sports, and children with concussions enter the healthcare system in multiple ways. We utilized electronic health records (EHR) to more comprehensively describe point of entry into a large, regional pediatric healthcare network for children with concussion.

**Methods:** All patients, age 0-17 years, who had at least one clinical encounter with an ICD-9-CM diagnosis of concussion in The Children's Hospital of Philadelphia’s (CHOP) EHR system (7/1/2010–6/30/2014) were selected and their initial concussion-related encounter identified. Initial encounter location was described by relevant variables.

**Results:** 14,054 patients were included (average age: 12.1 years). Overall, 45% had their first encounter within primary care, 27%: specialty care, 6%: after-hours triage, and 19%: ED. For those with a CHOP primary care provider, 72% had their initial encounter within primary care and 11% within the ED. Healthcare entry varied by age with 0-4 year olds more often entering via the ED (37%) or after hours (26%) versus older children who entered via primary care (5-11: 69%; 12-14: 77%, 15-17: 78%).

**Conclusions:** This approach leveraged a unified EHR system across a large care network to describe the point of healthcare entry for children with a concussion across age and healthcare setting. Findings suggest that estimates of concussion incidence based solely on ED records likely underestimate the burden of injury and that point of entry varies by age.
Objectives: Sexuality is a fundamental aspect of life. According to Maslow (1943) it is as important as breathing, food, water and sleep. An acquired brain injury (ABI) can have a great impact on sexuality. Common changes include reduced libido, reduced sexual desire, erectile and lubrication problems, reduced frequency of sexual contact and reduced ability to reach an orgasm. The brain injury can directly influence aspects of sexuality through organic damage or hormonal changes. However, other consequences of the brain injury can affect sexuality as well. Research shows that people with ABI are among other things tired more quickly, they can experience depressive symptoms or have a negative self image. Moreover, a brain injury can alter the dynamics of an intimate relationship. Furthermore, a person with ABI can find it more difficult to find a romantic partner due to a lack of social and communication skills (Bender, 2003; Ponsford, 2003). Although sexuality has an impact on quality of life in general, it is often not a priority in the treatment program. The objective of this intervention is to improve the experience of sexuality by giving information about sexual problems associated with ABI, possible solutions and resources, practicing skills and to increase openness to talk about sex.

Methods: We searched the literature for programs about sexuality following ABI. We could only find one education program in Australia, which only focusses on education. However, we did find recommendations for a holistic approach to improve sexuality with this population. We tried to implement these recommendations in our program by using existing workbooks, therapy programs and information booklets and articles. We adjusted them so that we could use them in a group setting with patients who suffer from ABI.

Results: We put together a group intervention consisting of three sections. In the first section we try to increase openness with the members of the staff. We do this by giving information about sexual functioning after ABI and practicing talking with patients about sex. In the second section information is given to patients about the sexual response cycle, possible sexual problems related to ABI and safe sex. Patients are also being informed about possible solutions for sexual problems. The third section of the program focusses on training skills and foster coping. Among other things assertiveness, worrying, depressive symptoms, social skills and self image are being covered. First information is given whereupon skills are practiced via role play, exercises and discussions. Afterwards they get a homework assignment.

Conclusions: A program about sexuality after ABI is being developed for Flanders and The Netherlands.
Free Hand External Ventricular Drain Placement: Its Accuracy via the Kocher's point

Status: Accepted  Presentation type: Poster

Category: Neurotrauma – basic research  

Author's preference: No preference

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Authors: You Xinli, Liew Boon Seng, Rosman Azmin Kass

Objectives: The study was undertaken to evaluate accuracy of freehand external ventricular drain (EVD) placement via the Kocher's point.

Methods: This is a descriptive study in which we retrospectively reviewed patients’ records from 1st January 2015 to 30th June 2015. Patients younger than 12 years old were not included within this review. All patients underwent post-procedure computed tomographic scan of the brain (CTB). Data were collected for accuracy of the EVD tip position, calculation of the Evan’s index, and measurement of the distance of frontal horn of the lateral ventricle to the midline.

Results: A total of 150 procedures were reviewed. The mean age of patients was 41.1±16.7 years old (age range, 12 to 78 years old). Thirty-two procedures (21.3%) were done for pure cerebrospinal fluid (CSF) diversion and 118 (78.7%) were done for intracranial pressure (ICP) monitoring with CSF diversion. Eighty-seven procedures (58%) were done by surgeons with at least 2 years operating experience. Pre-operative CTB revealed a total of 96 patients with Evan’s index of < 0.3 and the mean distance between the frontal horn of lateral ventricle to the midline was 38±7mm. Among the post-EVD CT scans, 71 (47.3%) EVD tips were optimally placed within the ipsilateral frontal horn, whilst 46 (30.7%) were sub-optimally placed in other CSF spaces and the remaining 33 (22%) were misplaced within the brain parenchyma. There was statistically significant relationship between the Evan’s index > 0.3 and the accuracy of the position of the EVD tip (p < 0.001). No statistically significant correlation was made between accuracy of EVD tip position and surgeon’s experience (p =0.574).

Conclusions: Evan’s index of more than 0.3 is associated with accurate EVD placement via the Kocher’s point. Further studies are needed to assess the feasibility of intra-operative neuro-navigation usage to increase the accuracy of EVD placement in patients with Evan’s index of less than 0.3.
Methods to Prevent and Correct Post-surgical Temporal Hollowing Deformity in Neurosurgical Patients

Status: Accepted Presentation type: Poster
Category: Neurotrauma – case reports/clinical research
Author's preference: Oral

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Objectives: Contour deformities of the temporal fossa, a source of patient dissatisfaction, are unfortunately common following emergent decompressive hemicraniectomy for neurotrauma or neurovascular etiologies. More specifically, the origin of the temporalis muscle/temporal fat pad is often disrupted during the approach - allowing downward retraction/caudal displacement. The resulting concavity and the inferior bulge produces noticeable and permanent facial asymmetry. In fact, recent reports show an incidence of temporal hollowing deformity approaching 52%. With this in mind, we sought to evaluate all contributing factors leading to post-surgical temporal deformity, and at the same time, investigate possible methods of prevention and correction. As such, within this study, we report our results in a cohort of consecutive neurosurgical patients.

Methods: A single surgeon/institution, retrospective cohort study of 108 consecutive cranioplasty patients between 2012-2014 at The Johns Hopkins Hospital were identified. Temporal contouring techniques utilized during this time period included 1) liquid poly-methyl-methacrylate (PMMA) and screw fixation [FIGURE 1], 2) high-density porous polyethylene (Medpor) onlay sheets, and 3) dual-purpose customized craniofacial implants (CCIs). Primary and secondary outcomes, including all reoperations for persistent temporal hollowing and all related minor and major complications, were statistically reviewed.

Results: Of the 108 patients, nineteen (19/108; 18%) patients required a primary or secondary intervention to address persistent temporal hollowing deformity following their initial neurosurgical procedure. In fact, three (3/19; 16%) patients required secondary surgery with additional hospitalization for 1-2 days following their initial neurosurgery procedure. Of note, one major complication (1/19; 5%) occurred due to mass effect induced mental status change requiring urgent re-contouring of PMMA.

Conclusions: The management of post-surgical temporal hollowing deformity is a significant challenge facing all neurosurgeons and craniofacial plastic surgeons alike. It is now well accepted that these patients no longer accept significant temporal asymmetries following their surgeries - for several reasons including a negative social stigmata and reduced levels of self-confidence. However, since 2012, the senior investigator [CRG] has identified several safe and reliable methods and procedures to correct persistent temporal hollowing. This entails a wide spectrum of materials based on each patient-specific scenario. Furthermore, careful attention to adequate soft tissue reconstruction at time of secondary cranioplasty is paramount for achieving stable restoration of craniofacial symmetry and ideal patient satisfaction.
Effects Of Laser Exposure On Cognitive Impairment In Patients With Chronic Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Technology – clinical research/applications

Author's preference: Poster

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Objectives: Many individuals with traumatic brain injury (TBI) will suffered from cognitive impairments, which may hinder individuals’ ability to perform daily tasks. The orbitofrontal cortex is critical for behavioral adaptation in response to changes in reward value, as well as decision-making, and the frontal operculum may play a key role in awareness of limb functioning. Cognitive deficit has been demonstrated as a result of disturbance of cerebral blood flow in those brain areas. The intravenous laser irradiation of blood (ILIB) has been widely applied clinically to treat various pathological diseases, such as type 2 diabetes mellitus, rheumatoid arthritis, juvenile idiopathic arthritis, and chronic spinal cord injury. To our knowledge, there is no report to discuss the effect of ILIB in the cognitive impairment after TBI. The purpose of the study aimed at investigating the regional cerebral loci, such as frontal operculum and orbitofrontal gyrus activities after ILIB.

Methods: A total of 15 patients with TBI were enrolled with another 15 patients as control. Treatment protocol was designed as intervention with ILIB. The equipment is a He-Ne Laser YJ-ILIB-5 device (Taiex) with a continuous output beam of power 1.2-3.8mW. A course of ILIB with ten sessions was performed in two weeks, five times a week. During every session, the total amount of irradiation time was 60 minutes. Outcome measure was brightness of single photon emission computer tomography (SPECT) in order to assess the activities of precentral gyrus, orbital gyrus, and frontal operculum. GOAT score was for evaluation of amnesia. The generalized estimating equation was applied to assess the association of interest, and was adjusted for the correlations due to measurement of the brightness at brain locations and for potential confounders.

Results: In all 15 patients, SPECT showed a slight improvement of cerebral tissue activities after a 10 day-ILIB therapy. After adjustment for potential confounders, the association between duration and brightness of brain regions was highly significant (P = 0.0025). However, significant differences were not demonstrated for gender, body weight, or interaction between brightness of brain regions and GOAT score. With elimination of the influence by duration in statistics, the results indicate significant associations between the two brain locations and brightness of the two regions. The brightness for the precentral gyrus on both sides were significantly higher compared to the analogous values for the orbital gyrus and frontal operculum by 37.04 and 6.18 units, respectively (P<0.0001).

Conclusions: Our data suggest ILIB may be an effective, low-morbidity therapeutic modality in the treatment of cognitive deficit resulted from impairment of cerebral tissue activities, e.g. orbital gyrus and frontal operculum, in those patients. The results stand for new evidence of ILIB therapy for the cognitive impairment in TBI patients.
Training and educational background in sexuality after traumatic brain injury (TBI): A survey of health care professionals

Status: Accepted  Presentation type: Poster
Category: Neurorehabilitation – case reports/clinical research
Author's preference: No preference

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Objectives: To examine the training and educational background in sexuality after TBI among health care professionals who work with individuals with TBI and their partners.

Methods: An online survey was disseminated via email to approximately 500 professionals working in the area of brain injury. 134 health care professionals began the survey and 97 completed it between March and October of 2015. They represented 15 countries. Respondents had an average age of 43.7 years, were mostly (69%) female, and had on average 12.9 years of work experience with TBI patients. Thirty one percent and 33% of the sample had a master’s and a post-doctorate degree respectively. Over half of the sample was comprised of respondents from the USA (33%), Portugal (14%) and Norway (13%). Most respondents were neuropsychologists (36%) or physiatrists (30%) who performed mostly clinical work (92%), followed by research (45%), and teaching (38%).

Results: Eighty three percent of participants reported not receiving formal training in identifying or addressing sexuality issues with individuals with TBI. Furthermore, participants reported not having received any course related to human sexuality or sexuality after neurological injuries during their training (56% and 66% respectively). Fifty six percent did not have any clinical practice on sexuality issues after TBI during their professional training, and 66% during their clinical training after having completed their education. The majority of the sample (67%) indicated having little knowledge in the area of sexuality after TBI, but most of them reported being important (40%) or very important (50%) to receive good training on the topic. Eighty percent believed that their competence in the area affects the way in which they address the issue with their patients, and 86% think that they would have an easier time addressing the topic if they had more training. In their opinion, professionals should receive training in the area at the undergraduate level (34%) or during specialization (38%). Finally, 89% of participants indicated being interested in courses on the topic of sexuality after TBI because their patients usually present issues in this area (65%) or due to personal interest (54%).

Conclusions: More than half of health care professionals reported not having received courses related to human sexuality or sexuality after TBI during their education and clinical training. It is possible that introducing post-educational programs and courses related to the topic could improve not only their knowledge in the area, but it also could influence the way they address the issue with their patients.
A survey of health care professionals’ attitudes towards sexuality in individuals with traumatic brain injury (TBI) and their partners

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: To examine health care professionals’ attitudes towards sexuality after TBI who work with individuals with TBI and their partners.

Methods: An online survey was disseminated via email to approximately 500 professionals working in the area of brain injury. 134 health care professionals began the survey and 97 completed it between March and October of 2015. Respondents had an average age of 43.7 years, were mostly (69%) female, and had on average 12.9 years of work experience with TBI patients. Thirty one percent and 33% of the sample had a master’s and a post-doctorate degree respectively. Over half of the sample was comprised of respondents from the USA (33%), Portugal (14%) and Norway (13%). Most respondents were neuropsychologists (36%) or physiatrists (30%) who performed mostly clinical work (92%), followed by research (45%), and teaching (38%).

Results: The majority of participants disagreed with the following statements: sexual activity is harmful to the health of individuals with TBI (89%), individuals with TBI should focus only on physical and cognitive recovery (96%), after TBI interest in sex is gone (96%), and institutions should not encourage or support sexual activity of individuals with TBI (90%). Most respondents agreed with the following sentences: Sexual activity can be psychologically beneficial to individuals with TBI (100%); Talking about sexuality is important for the health of individuals with TBI (99%); Sexual expression among cognitively intact patients is healthy and can contribute to their quality of life (100%); Sexual expression among cognitively impaired patients is healthy and can contribute to their quality of life (91%); and Sexuality is an essential part of the person, regardless of their condition (96%). The statements for which there were more varying levels of agreement included: Patients with severe TBI can no longer consent to sexual activity (31% responded “Yes”, and 69% “No”); Many individuals with TBI are too affected to be interested in sex (30% responded “Yes”, and 70 “No”); and it is the practitioner’s responsibility to decide if a patient is able to consent to sexual activity (40% responded “Yes” and 60% “No”).

Conclusions: Most participants have positive attitudes towards sexuality after TBI that are empowering to patients; however there are still some issues for which health care professionals’ attitudes vary widely. Given that attitudes can influence professionals establish rapport and address sexuality concerns with their patients, it is important to explore and identify attitudes towards sexuality after TBI, as well as provide education and training in order to decrease negative attitudes.
Assessment and rehabilitation in individuals with traumatic brain injury (TBI) and their partners in issues related to sexuality: A survey of health care professionals

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: To explore how health care professionals who work with individuals with TBI and their partners address issues related to the assessment of sexuality functioning in patients with TBI.

Methods: An online survey was disseminated via email to approximately 500 professionals working in the area of brain injury. 134 health care professionals began the survey and 97 completed it between March and October of 2015. Respondents had an average age of 43.7 years, were mostly (69%) female, and had on average 12.9 years of work experience with TBI patients. Thirty one percent and 33% of the sample had a master's and a post-doctorate degree respectively. Over half was comprised of respondents from the USA (33%), Portugal (14%) and Norway (13%). Most respondents were neuropsychologists (36%) or physiatrists (30%) who performed mostly clinical work (92%), followed by research (45%), and teaching (38%).

Results: Ninety eight percent of the respondents indicated that sexuality is a topic to be discussed during rehabilitation; however, 39% indicated they talk about sexuality with some patients or couples but not as a part of their usual practice and 27% only discuss sexuality if patients or couples bring it up. Eighty one percent had been asked questions related to sexuality, 67% reported feeling comfortable addressing the topic and 71% reported feeling calm and competent when a patient or their partner raised sexuality concerns. The majority of respondents reported being more likely to start a conversation about sexuality issues with adults (57%) and young adults (54%) than with adolescents (47%), older adults (42%) and elderly (27%). The most common reasons for professionals to not discuss sexuality issues with their patients included following: patients do not ask for information (53%), patients do not report having problems related to sexuality (37%) and the lack of training in this area (34%). Participants believed that assessment and treatment of sexuality issues is part of their work (90% and 88% respectively). Sixty three percent reported that an integral approach that includes pharmacological therapy, counseling, psychotherapy, sex therapy and psychoeducation is the most effective way of addressing sexuality issues. Finally, the majority of institutions where participants worked do not have guidelines for dealing with issues related to sexuality after TBI (77%) or for assessing decision-making capacity of individuals with TBI regarding their sexual life (82%).

Conclusions: Most participants reported feeling comfortable and calm addressing the topic of sexuality with their patients, and they considered the assessment and treatment of the issue as part of their work. However, most of the respondents' institutions did not develop guidelines for dealing with sexuality or assessing decision-making after TBI. Guidelines for competent and effective treatment of sexual issues after TBI should be developed and implemented in the clinical practice.
The effect of intracerebroventricular administration of sodium nitroprusside on brain perfusion in the early phase after subarachnoid hemorrhage

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: To assess the effect of intracerebroventricular (ICV) administration of sodium nitroprusside (SNP) on early perfusion changes after subarachnoid hemorrhage (SAH).

Methods: Male Wistar rats were used. Animals were assigned into 3 groups: (1) animals with non-traumatic SAH (n=8), (2) SNP-treated animals after SAH induction (n=16), and (3) control animals that received 5% glucose solution (SNP vehicle) after SAH induction (n=8).

SAH induction: The skull of anesthetized rats was exposed from soft tissues and the bone above the right hemisphere was abraded. SAH was modeled by injection of 300 microL of fresh autologous non-heparinized arterial blood into the prechiasmatic cistern.

Therapeutic interventions: SNP-treated animals received 10 microg of SNP in 5 microL in 5% glucose solution 3 minutes after SAH induction through the cannulated lateral ventricle; control animals received ICV 5 microL of 5% glucose solution 3 minutes after SAH induction.

Monitoring: Laser Speckle Contrast Analysis method (Perimed, Sweden) was used to measure cortical perfusion. Changes of perfusion were recorded for 30 min during and immediately after induction of SAH. The data were analyzed by original software. Invasive blood pressure was monitored continuously via femoral artery.

Statistical analysis: Two-way ANOVA, Bonferroni`s post-test.

Results: In control animals receiving ICV injection of SNP, the brain perfusion increased significantly above the baseline level; this increase persisted till the end of the monitored period. ICV injection of 5% glucose solution did not lead to any change of the perfusion. ICV injection of SNP was followed by mild decrease of mean arterial pressure (MAP), nevertheless the brain perfusion increased in the same time. The SNP-treated animals split into two subgroups: in 7 animals, neither the blood pressure nor brain perfusion did change. The other 7 animals developed severe hypotension (drop in MAP up to 50%) accompanied by decrease of brain perfusion. The perfusion was significantly lower 1 and 2 minutes after SNP administration in this subgroup. We observed no statistically significant increase of brain perfusion in either normotensive or hypotensive SNP-treated animals, compared to control group during the monitored period.

Conclusions: Intracerebroventricular administration of SNP did not improve the brain perfusion during the early vasospasm in non-traumatic SAH model. Moreover, half of the SNP-treated animals developed serious systemic hypotension which led to brain hypoperfusion.

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The 3-Dimension Model: A therapeutic intervention in people with brain injury, better than classic Cognitive Behavior Therapy?

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: The 3-Dimension Model (TDM) has been presented in 2014 on a congress in Belgium as a psycho-educational model in psychiatry, using an integrated position of the brain in psychiatric disorders. In 2015 we presented in our research that TDM could be an useful instrument in the rehabilitation of people with Brain Injury and their relatives (12th Annual NABIS Conference on Brain Injury). In this new pilot-study we would like to compare the results in the first study when using TDM, with the results when using classic Cognitive Behavior Therapy (CBT) in this new pilot-study.

Methods: In a prospective open label study we described the improvement of quality of life using the Lability Affect Scale-Short Form (LASSF). We included 14 out-patients, 6 men and 8 women, with ABI. All subject were adults. We started the first measurement before starting the first CBT session. We repeated the sessions one and two months later and repeated the measurements one month after each session. All three sessions were mediated by the same investigator in presence of the patient. Sessions were limited in time to 60 minutes. Satisfaction of the sessions were qualified from 1 (very poor) to 5 (very good) by the patients at the end of the pilot-study.

Results: All subjects showed a marked improvement in the LASSF one month after the first CBT-session compared with the LASSF before starting the CBT-sessions. Two and three months later no more improvement in the LASSF has been showed for any patient. Eight patient showed even a decline in LASSF the third month. Patients qualified their satisfaction about the quality of the sessions fair to good. No drop out has been recorded.

Conclusions: Compared with the subjects treated with TDM, the subjects treated with classic CBT did not show any degree of improvement even after two or three months. This can suggest that the TDM can be more useful to improve quality of life of patients with Acquired Brain Injury. When using classic CBT, relatives are less or not at all involved in the therapy of patients with ABI. More observations and investigations are needed to evaluate and confirm what this pilot-study suggests.
Serotonin Syndrome Presenting as Lower Extremity Hyperreflexia: A Case Report

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: A 15 year old girl with new-onset lower extremity hyperreflexia found on routine physical exam was referred by her pediatrician to the pediatric rehabilitation medicine clinic for further evaluation.

Methods: The patient denied any overt neurological or functional impairment. History was significant for attention and mood disorders. Within the past several months, she had been started on fluoxetine and methylphenidate by her psychiatrist with gradual increase in dosing. On exam, she had a resting heart rate of 92, dilated pupils, excessive sweating, mildly increased tone and hyperreflexia in the bilateral lower extremities, and clonus at both ankles. There was mild proximal muscle weakness out of proportion to her history of being an athlete.

Results: Based on history of dual serotonergic medication use and exam with abnormal neurological and autonomic findings, we were primarily concerned for serotonin syndrome. Concerns were discussed with her psychiatrist, who tapered the fluoxetine off. On re-evaluation, the patient was found to have a normal neurological exam, although her depression was worse.

Conclusions: Serotonin syndrome is the clinical manifestation of excess serotonin in the central nervous system, characterized by a triad of neuromuscular excitation (clonus, hyperreflexia, myoclonus, rigidity), autonomic excitation (hyperthermia, tachycardia, diaphoresis, flushing) and altered mental status (insomnia, anxiety, agitation, confusion). At mild toxicity, symptoms may not be concerning to the patient. Severe cases can be fatal. Several drugs have been implicated, with severe cases generally due to a combination of agents from different drug classes. The Hunter Criteria has been validated to detect even mild cases of serotonin syndrome with high sensitivity and specificity. Management is to stop the serotonergic agent. For more severe cases, additional supportive measures, typically in an intensive care setting, may be needed. Serotonin syndrome should be considered in patients with new-onset clonus after exposure to serotonergic medications.
Improving treatments and outcomes in TBI: an emerging role for dietary zinc.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Oral

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Objectives: Traumatic brain injury (TBI) is associated with a wide variety of behavioral deficits, including memory loss, depression, and anxiety. New interventions are needed to improve resilience to TBI. Recent work has shown that Zn supplementation in a non-blast, mild TBI model reduced depression-like behaviors, reduced markers of stress-related anxiety, and improved learning and memory.

Methods: To examine the role of dietary Zn on biomarkers of TBI following exposure to blast, rats were fed a low Zn (5 ppm, LoZn) or Zn adequate (30 ppm, ZnAD) diet for 5 weeks, followed by exposure to a single explosive blast (Semtex, 130 kPa incident pressure). Blast-exposed rats exhibited transient bradycardia and bradypnea post-injury. At 48 h and 14 d post-injury, frontal cortex, hippocampus, cerebellum and soleus muscle tissues were collected. We used reverse phase protein microarray to measure protein biomarkers HNE and HIF1α (for oxidative stress), VEGF and AQP4 (for vascular function), MMP8 and CRP (neuroinflammation), NSE, Tau and phospho-Tau (neuronal and axonal integrity), and GFAP, S100β and MBP (glial integrity). RT-PCR was used to quantify the matrix metalloproteinase (MMP) response to cell stress.

Results: At 48 h post-injury, there was a significant blast-induced increase in GFAP in the cerebellum, and HIF1α in the hippocampus. HIF1α expression was significantly higher in rats fed LoZn diets, and this difference persisted through 14 days. At 48 h post-injury, there was significant blast-induced, and Zn-responsive, upregulation of MT-MMP, MMP2, TIMP1 and TIMP2 mRNA in soleus muscle, and a down-regulation of MT-MMP, MMP2, TIMP1 and TIMP2 mRNA in frontal cortex tissue. At 14 d post-injury, the expression of GFAP and phospho-Tau in the hippocampus was significantly lower than at 48 h in rats fed ZnAD diets, and not different from non-blast, control animals. ZnAD diets reduce MT-MMP, MMP3, MMP9 and TIMP2 mRNA expression in the both hippocampus and muscle by 14 d post-blast; however, in rats fed LoZn diets, MMP2, MMP3 and TIMP1 mRNA remained significantly down-regulated in frontal cortex tissue.

Conclusions: Our findings implicate neuronal and glial cell damage, and metabolic/oxidative stress following blast-induced mTBI. The data implies that low Zn diets interfere with the MMP/TIMP response in neuronal tissue, suggesting that Zn-supplementation may activate MMP-dependent tissue remodeling post-injury, reducing cell stress. In contrast, skeletal muscle appears to have a functional repair and remodeling mechanism that is Zn-responsive. In summary, the data demonstrates that Zn can be a novel and effective strategy for preventing adverse cellular and molecular outcomes associated with mTBI. 

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Do Patients in the Vegetative State Sleep?

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: No preference

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Objectives: The presence of open eyes / closed eyes cycles is an important diagnostic feature distinguishing Vegetative State (VS) from coma. More detailed information of sleep patterns in VS patients would be useful for their rehabilitation and treatment. However, we still do not have enough information about the architecture of sleep and the features of sleep patterns in the VS. In the present study we firstly aimed to test the null hypothesis that in contrast to physiological signs (e.g., closed eyes) there are no neurophysiological signs of sleep in these patients. If the hypothesis is rejected, we intended to investigate differences in sleep between patients in VS and healthy people.

Methods: Nocturnal sleep data of 15 patients (4 females, 45.5±15.3 years old) in VS were included in this study. Clinical assessment was made by Coma Recovery Scale - Revised. The assessment was performed 1-2 weeks before and 2-12 weeks after the sleep EEG recording. The time since the accident ranged between 2 and 182 months (mean 27.5±2.9). Standard Rechtschaffen & Kales criteria were used for sleep scoring. The data were explored to find signs of REM sleep, as well as stages 2, 3 and 4 of non-REM sleep.

Results: As showed in previous studies sleep stages in disorders of consciousness do not always correspond to the standard scoring criteria. Taking into account the localization and the type of brain lesions as well as the retardation of the baseline ("wakefulness") EEG rhythmic activity, we were able to detect at least stage 2 of non-REM sleep in each patient. Slow wave sleep (stages 3 or 4) was identified in eight patients. REM sleep was found in 6 patients. Four of the 15 patients improved rapidly after examination; three of them demonstrated all electrophysiological signs of sleep.

Conclusions: As expected, the architecture of sleep and the sleep patterns in VS are frequently atypical as compared with healthy people. Nevertheless, the hypothesis about the absence of neurophysiological sleep in VS cannot be rejected: most VS patients have polysomnographic features of sleep-wake cycle. Moreover, we suggest that scoring criteria for VS patients need to be upgraded. More data are necessary to check whether the characteristics of sleep could serve as a prognostic tool for the assessment of patients in disorders of consciousness.
The Effect of Shoulder Pad Design on Head Impact Severity during Shoulder Checks in Ice Hockey

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: Oral

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Objectives: Ice hockey accounts for 44% of sports-related brain injuries in Canadian youth. Over 40% of ice hockey concussions are caused by contact to the head by the opposing player’s shoulder. Reducing the stiffness of shoulder pads, through the in-series addition of foam padding, should decrease impact force for a given impact energy. However, lower-stiffness pads may affect impact energy by causing players to adjust their “risk compensation” and deliver hits with higher impact velocity. The goal of this project was to determine how shoulder pad stiffness affects peak head accelerations during shoulder-to-head impacts, through laboratory experiments where players delivered checks to an instrumented dummy.

Methods: In the experiment, participants (n = 15 men, aged 16-25 years) delivered “the hardest shoulder checks they were comfortable in delivering” to the anterior aspect of the head of a custom-made dummy. Trials were conducted with participants wearing shoulder pads (Bauer Supreme or Sherwood Traditional), with and without a 2 cm thick moulded layer of polyurethane foam over the pad shoulder cap. Participants performed five repetitions in each of the four randomly-presented conditions, with a 3 m run-up. The dummy was supported on a ball joint and stabilized by an overhead spring. The dummy head was covered with a caged helmet, containing tri-axial linear accelerometers (acquired at 20 kHz; Endevco 7264C) and angular velocity gyros (1 kHz; GForceTracker). A high speed camera (Nikon S2) was used to record player shoulder position at 1200 fps, which we differentiated to estimate impact velocity. The experiment was approved by the SFU Office of Research Ethics, and all participants provided written informed consent.

Results: When players delivered checks with foam-modified versus unmodified pads, there was a decrease of 27.7% in the average value of peak linear head acceleration of the dummy (31.1 versus 43.0 g; mean difference = 11.91 g; p < 0.001), a decrease of 13.8% in average peak rotational head velocity (951.6 versus 1103.9 deg/s; mean difference = 152.3 deg/s; p = 0.025), and no significant difference in shoulder impact velocity (3.57 m/s versus 3.46 m/s; mean difference = 0.10 m/s; p = 0.16).

Conclusions: During simulated shoulder-to-head collisions in ice hockey, a 2 cm thick foam layer overlying the cap of shoulder pads reduced head accelerations by 27.7% and rotational velocities by 13.8%, while causing no significant increase in impact velocity. Padding the shoulder area of jerseys should cause similar protection, and warrants further examination as a method for preventing brain injuries in ice hockey.
A case report on the use of benztropine for a dystonic movement disorder associated with anti-NMDA receptor encephalitis in a 4 year old.

Status: Accepted  Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: Despite limited evidence supporting the use of benztropine in pediatric populations, this case report shows some success in controlling a dystonic movement disorder in a 4 year old boy with anti-NMDA receptor encephalitis.

Methods: A 4 year old with antibody-proven NMDA receptor encephalitis was admitted to our acute inpatient rehabilitation facility in summer 2015. Impairments were noted in arousal, attention, language, and swallowing, though his most disabling impairment was a hyperkinetic movement disorder characterized by frequent dystonic movements in all limbs as well as the face, neck, and trunk. His movement disorder made positioning and care tasks very difficult and also raised concern for the risk of self-harm due to high-velocity limb movements. Multiple agents were used by the rehabilitation physicians to control his adventitious movements, including benzodiazepines, carbidopa-levodopa, and trihexyphenidyl, all with some success. In discussion with the neuroimmunologist following him, we decided to start benztropine with the goal of further reducing adventitious movements.

Results: The addition of benztropine seemed to help control the patient's adventitious movements as noted by decreased scores on the Barry Albright Dystonia Scale. Multiple rehabilitation staff members, including nurses as well as physical, occupational, and speech therapists, all reported subjective improvements in the patient's ability to maintain neutral positioning, demonstrate voluntary movements, and participate in therapy sessions. As the patient is on many pharmacologic agents, including medications to improve sleep and arousal as well as immunomodulating therapies, it is not possible to attribute his overall functional and neurological improvement to any one agent or intervention. However, this case demonstrates that benztropine was well-tolerated by this young child, and is suggestive of its beneficial effect in controlling extrapyramidal symptoms.

Conclusions: Despite limited evidence supporting the use of benztropine in young pediatric patients with secondary dystonic movement disorders, this case demonstrates that it was well-tolerated, and suggests beneficial effect. Pediatric rehabilitation physicians may want to consider using it as an additional medication when other, more typical agents are not fully effective in patients with uncontrolled dystonic movement disorders.
Concussions Patients with Symptoms Persisting More Than 30 Days are More Likely to be Females and Significantly More Likely to Report Elevated Symptoms Scores of Migraine Headaches and Cognitive And Emotional Symptoms

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: Classify posttraumatic headaches according to HIS classification and determine relationship between gender, type of headache and severity and duration of post concussion presentation

Background: Posttraumatic headaches are not classified according to their features but rather according to type and timing of trauma. Classifying posttraumatic headaches is possible to do by ising IHS criteria and may prove to be helpful in understanding pathogenesis and determining best treatment approach.

Methods: As part of our concussion neurology clinics flow, we used Standardized Clinical Assessment and Management Plan (SCAMP). We followed concussion patients, ages 6-21, prospectively and classified their headaches based on HIS definitions.

Results: 569 patients were enrolled. We focused on 242/569 patients who continued to endorse headaches 30 days after onset on concussion. 88.4% were >10 years of age. Average PCSS was 43.1. 30.8% had one or more previous concussions. 24.4% endorsed LOC. 56.5% endorsed migraine symptoms and out of those who endorsed migraine symptoms the majority (76%) were females. 32.7% endorsed premorbid headaches and or migraines. 29% endorsed premorbid learning or cognitive disability. Patients with persistent headaches endorsed significantly more emotional and cognitive symptoms. 68.6% of patients endorsing headache symptoms after 30 days of concussion onset were females. Females were significantly more likely to endorse more severe overall headache symptoms. Mechanism of concussion did not predict severity or nature of symptoms.

Conclusions: Patients who present to the outpatient neurology concussion clinic and continue to endorse symptoms beyond 30 days are very likely to endorse severe and frequent headaches that can be classified into migraines. Those who endorse migraine headaches are highly likely to be females. These patients are likely to be self-selected. A neurology concussion clinic is likely to receive patients with more severe concussive symptoms and should be equipped to handle patients with more medical needs who have significant emotional and academic difficulties.
Delusional nihilism after “mild” traumatic brain injury: A case report and review of the literature on cotard syndrome and the neuropsychiatry of time perception

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Background: First described as "délire des negations" by Parisian neurologist Jules Cotard in the late 19th century, the eponymous Cotard syndrome refers to any of a variety of delusions centering around the belief that one's body, in whole or in part, is rotting, dead, or has otherwise ceased to exist. Delusional nihilism has been reported in depression and schizophrenia and, infrequently, in traumatic brain injury (TBI), stroke, dementia, and movement disorders.

Methods: We present a case of Cotard syndrome arising after ostensibly mild TBI and accompanied by the linked delusional belief that time has stopped. Magnetic resonance imaging (MRI) of the brain demonstrates subtle abnormalities of the right hippocampus and bilateral white matter. Right hemisphere dysfunction is thought to play a major role in producing delusions, with particular importance given to right prefrontal, temporal, parietal, and limbic cortices and to the subcortical networks linking them. The two-factor model of delusions suggests that delusional disorders arise when a primary neuropsychiatric deficit is compounded by a secondary failure of self-monitoring. Alteration of subjective time perception, known to occur in neuropsychiatric illness, may serve as the primary deficit in this case and provides a potential model for understanding delusional nihilism. We review the literature on delusional nihilism and the potential role of altered time perception in giving rise to this syndrome.

Conclusions: Cotard syndrome is a relatively rare variant of the delusional misidentification syndrome and delusions related to the passage of time are rarer still. A clearer understanding of the neurobiology and clinical manifestations of delusional disorders may help to shed new light on a range of complex neuropsychiatric syndromes.
Contributing Factors in Mobility-Related Participation Restriction in Traumatic Brain Injury (TBI): An Australian Community Patient Perspective

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: A majority of persons with moderate to severe traumatic brain injury (TBI) return to independent ambulation following rehabilitation, yet experience long term participation restrictions in the community due to difficulties in mobility. To improve participation outcomes, we sought to specify the contributing factors for this discrepancy from patient-perspectives. We sought to identify contributing factors for mobility-related participation restriction in persons with TBI in an Australian community cohort, through a qualitative analysis of focus groups and patient-interview transcriptions.

Methods: For the validation of the International Classification of Functioning, Disability and Health (ICF) Core Sets for TBI, persons diagnosed with TBI (as evidenced by post-traumatic amnesia) and treated at the Royal Melbourne Hospital between 1 September 2009 and 30 August 2013, were invited to participate in focus groups. If attendance in person was difficult, phone interviews were allowed, and pooled for grouped analysis for confidentiality. Groups were formed using maximum variation strategy. Ethics approval was granted by the Melbourne Health HREC (2013.224). Participant discussions were transcribed verbatim and linked to the ICF in the primary study. For this qualitative analysis, transcriptions were re-examined using the linked ICF concepts to identify contributing factors in mobility-related participation restriction from patient-perspectives.

Results: A total of 21 (76.2% male) community-dwelling persons with TBI participated in five groups, with a mean age at injury of 55.2 years (range 18-83); and a mean time since injury of 2.86 years (range 0.78-5.33). Mobility-related participation restriction resulted from: increased cognitive effort or concentration required for walking; altered sensation for walking; difficulty with multi-tasking, crowds, objects, or noise in the physical environment when walking or driving. Compared with empathy for concomitant orthopaedic injuries, societal attitudes towards the subtle mobility problems of TBI added to participation restriction. Community access was complicated by administrative delays for returning to driving, or a new need to depend on supports and public transportation systems. Difficulties with time management, fatigue, health care systems, and family or staff attitudes after TBI contributed to decreased return to recreational or professional sporting activities. Of note, severity of impairments or financial constraints were not patient-perceived contributing factors for participation restriction in this Australia cohort. However, this study did not involve validated measures of disability, or clinician or carer perspectives.

Conclusions: In this community dwelling cohort, participation restriction after TBI was only partially explained by the physical impairments, with many modifiable physical, social, and attitudinal environmental factors identified. Further studies to specify and address the contributing factors may be beneficial in improving participation outcomes for persons with TBI.
A change in Glasgow Coma Score from the scene to hospital admission in traumatic brain injury is associated with post-traumatic amnesia duration.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: In traumatic brain injury (TBI), shearing injuries at the initial impact is understood to be responsible for neurocognitive outcomes of TBI. This is, however, influenced by secondary systemic and local insults, as may be reflected in early changes to the total Glasgow Coma Score (GCS). Together with early scores, a changes in GCS (δGCS) may be associated with neurocognitive outcomes of TBI, such as the duration of post traumatic amnesia (PTA). We sought to examine whether δGCS from the scene to the hospital, as well as scene GCS (sGCS) or admission GCS (aGCS), is associated with PTA duration.

Methods: As a part of a larger study (Melbourne Health HREC 2013.224), the Royal Melbourne Hospital (RMH) Trauma Database – a prospective ‘opt-out’ dataset of all major trauma cases admitted to the RMH, a state-wide tertiary trauma hospital – was accessed to identify cases of TBI with documented PTA (based on Westmead PTA Scale (WPTAS)), admitted between 1/9/2009 and 30/8/2013. Cases with missing data (GCS, PTA duration); RMH length of stay (LOS) <7 days and in PTA when changing care settings; or scene-to-RMH time >12 hours (usually in inter-hospital transfers) were excluded. If patients were discharged to other care settings while in PTA, PTA durations were recorded as ‘> [LOS] days’. Categories for δGCS were: ‘stable’ for -1 to +1 (for measurement error); ‘improving’ for +2 to +12; ‘deteriorating’ for -8 to -2 without sedation; ‘sedation’ for aGCS 3 due to sedation (if sGCS >3); and ‘GCS 3-3’ if sGCS and aGCS were 3. Given ordinal nature of GCS, we used non-parametric statistics (Kruskal-Wallis Test and Mann-Whitney U Test in SPSS) with statistical significance for p <0.05.

Results: From the initial dataset meeting the inclusion criteria (n=485), 140 cases were removed according to the exclusion criteria. Included cases (n=345) were characterised by: mean age of 42.4 years (sd 19.9); 81.4% (n=281) male; and blunt trauma in 99.1% (n=341), given the Australian context. Based on available data for PTA duration of >14 days (n=260), both sGCS and aGCS (median 13, range 15-3) were associated with PTA duration (for sGCS, p=.042; for aGCS, p=.000). The δGCS categories showed a statistically significant between-group differences for PTA duration (p=.000). Based on available data for PTA duration of >21 days (n=199), 24.7% of ‘stable’ cases and 53.9% of ‘deteriorating’ had PTA >21 days (p=.019). Interestingly, no statistically significant difference was observed between the ‘deteriorating’ and the most severe groups of ‘sedation’ and ‘GCS 3-3’.

Conclusions: Neurocognitive outcomes following TBI (as measured by PTA duration according to WPTAS) were associated with sGCS, aGCS and δGCS. A δGCS could be incorporated into routine clinical practice as an independent predictive variable, to improve planning and management of TBI.
Validation of the International Classification of Functioning, Disability and Health Core Sets for traumatic brain injury from Australian community patient perspective.

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: Traumatic brain injury (TBI) is a complex health condition affecting one’s ability to function within their personal and social contexts. The World Health Organization’s International Classification of Functioning, Disability and Health (ICF) Core Sets for Traumatic Brain Injury is an application of the ICF, which seek to capture pertinent biopsychosocial issues in TBI. The objective of this study was to present data for validation of the ICF Core Sets for TBI from Australian community patient perspectives.

Methods: Adult persons with a definite diagnosis of TBI, with a prospectively documented post-traumatic amnesia (PTA), were invited to participate in focus groups (Melbourne Health HREC 2013.224). Groups were determined by maximum variation strategy from consenting participants. Sampling size was determined by saturation. All focus groups and individual interviews (where physical attendance was not possible due to access issues) were digitally recorded. All discussions by participants were transcribed verbatim. Standard meaning condensation procedures were followed, with qualitative analyses and linking to the nearest ICF categories thereafter. Finally, ICF categories from patient perspectives were compared with the ICF Core Sets for TBI for agreement; missed items; and additional items of potential relevance to persons with TBI. Given the wide spectrum of TBI in severity and chronicity, we hypothesised that the groups would cover 100% of the Brief, and 70% of the Comprehensive ICF Core Sets for TBI if the Core Sets were valid.

Results: Twenty-one persons with TBI participated in five groups: in three focus groups (n=14), and in two grouped analyses of individual interviews (n=7). Included persons were characterised by: mean age at injury of 55.2 years (range 18-83); 76.2% (n=16) male; median worst pre-sedation total Glasgow Coma Score (excluding loss of consciousness) of 12 (range 8-15); median Injury Severity Score (ISS) of 24 (range 14-38); mean time since injury of 2.86 years (range 0.78-5.33); and at least 52% of the participants had a PTA duration >14 days. Saturation was reached at five groups. Of the 139 categories of the Comprehensive ICF Core Sets for TBI, 108 (78%) categories were covered at least once. All categories of the Brief ICF Core Sets for TBI were covered. For the 31 missed ICF categories, 27 (87%) ICF categories related to very severe TBI, and, or acute care of TBI. Additional ICF categories identified by 2 or more groups were: taste function, b250; touch function, b265; weight maintenance function, b530; sensation of muscle spasm, b7801; and caring for household objects, d650.

Conclusions: Most categories of the ICF Core Sets for TBI were confirmed from the Australian community patient perspectives. Missed items mostly related to different severity or time since injury, as anticipated. Additional concepts, including sensory abnormalities, should be further explored from wider patient perspectives.
Comparative effectiveness of surgical versus conservative treatment in acute traumatic subdural and intracerebral hematoma/contusion: study protocol for an observational study

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: Currently, controversy still exists about the optimal treatment for traumatic acute subdural and intracerebral hematoma/contusion. As a consequence, treatment varies among different regions, hospitals and neurosurgeons. The effect of this variation on patient outcome is largely unknown.

In this article we present the protocol for a prospective multicenter observational study aimed at comparing the effectiveness of different treatment strategies in patients with acute subdural hematomas and/or intracerebral hematoma/contusion. Specifically, the aims are to compare a surgical approach to a conservative approach and craniotomy to decompressive craniectomy.

Methods: All patients presenting to the emergency room with a clinical and radiological diagnosis of a traumatic acute subdural hematoma and/or an intracerebral hematoma/contusion will be eligible for inclusion. Standardized prospective data on patient and injury characteristics, treatment, and outcome will be collected on all participants in 60 centers through two multicenter prospective observational cohort studies, Collaborative European NeuroTrauma Effectiveness Research in Traumatic Brain Injury (CENTER-TBI) and Neurotraumatology Quality Registry (Net-QuRe). The primary outcome measure is the Glasgow Outcome Score – Extended at six months. Secondary outcome measures are mortality at discharge and amongst others quality of live (the TBI specific Qolibri scale) and neuropsychological tests. In the analysis the between-hospital variation in treatment will be described and will be related to case-mix adjusted outcomes, to reduce confounding by indication. Thus, management strategies are compared by exploiting the existing between-hospital variability in surgical management.

Conclusions: This study protocol is designed to elucidate the best surgical management strategy for traumatic acute subdural hematoma and intracerebral hematoma/contusion using the variation that exist in treatment between different centers.

Reference: The European Union seventh Framework Program (grant 602150) for Collaborative European NeuroTrauma Effectiveness Research in Traumatic Brain Injury (CENTER-TBI).

Hersenstichting Nederland (Dutch Brain Foundation) for Neurotraumatology Quality Registry (Net-QuRe).

No industry affiliation.
Preventing Traumatic Brain Injuries in Developing Countries: Lessons for Taiwan

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: Poster

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Objectives: Traumatic brain injury (TBI) as a result of motor-vehicles have become a major public health issue across the world.

Methods: A nationwide motorcycle helmet law was implemented on June 1, 1997 in Taiwan. We undertook a population-based study using registration data on motorcycle number, road length, population, and motor-vehicle injury deaths in Taiwan between 1991 and 2013.

Results: Between 1991-2013 the number of motorcycles continued to grow by 92% in 2013, despite this, the motor vehicle-related death rate has declined sharply (43%). In 2013 there were 3,129 motor vehicle-related deaths in contrast to 7,322 deaths in 1991. To our knowledge, this is the largest reduction of TBI in the shortest period of time for any country.

Conclusions: Implementation and enforcement of motorcycle helmet law played important roles in reducing motor vehicle-related deaths. Our experience and process of helmet use enforcement in Taiwan can be used as a model for other countries.
Ordinal analysis of the Glasgow Outcome Scale improves the detection of hospitals with significantly aberrant outcomes for comparative effectiveness research in Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – health services and outcomes

Author's preference: Poster

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Objectives: Treatment as well as patient outcomes after Traumatic Brain Injury (TBI) have been found to vary substantially between centers. In comparative effectiveness research outcome differences are attributed to treatment differences to identify optimal treatment. The goal of this paper is to explore the use of the full ordinal GOS, instead of a dichotomized outcome, to determine variances in hospital outcomes.

Methods: The study was based on simulations built around the International Mission on Prognosis And Clinical Trial Design in Traumatic Brain Injury (IMPACT) study, which includes 9205 patients with moderate and severe brain injury from 256 different European and North American hospitals. Outcomes were measured with the Glasgow Outcome Scale, reduced to a four-point ordinal scale (mortality and vegetative stage combined). The simulation scenarios included differences in the variance between outcomes of hospitals, variation in the average number of patients per hospital, and binary as well as ordinal outcomes. The data with ordinal and binary outcomes was analyzed with random effects regression models, with hospital as a random effect, to test which of the outcomes would yield better results. Better results were defined as the ability of the model to correctly determine which health care providers were outliers. Outliers were detected by scoring those outside the 95% limits, which resulted in a number of true and false outliers found by each model. The ‘true’ outlier status of a center is known because it is defined in the simulations. The overall ability of the model to correctly determine outliers was expressed as the positive predictive value (PPV), which is the number of true outliers detected, divided by the total number of outliers detected.

Results: The random effects regression models using the ordinal outcomes overall have better precision compared to the dichotomized outcomes. This is illustrated by the positive predictive value being higher when using the ordinal scale (dichotomized GOS: PPV = 9.62; ordinal GOS: PPV = 12.18). With a higher number of patients per hospital (mean > 36) the PPVs of the ordinal and dichotomized scale were more similar.

Conclusions: The ordinal outcomes have better precision in detecting outliers compared to the dichotomized outcome. As advised before, outcomes of the GOS should therefore be handled on an ordinal scale, instead of being dichotomized. This applies in particular to cases with lower numbers of patients or few outcome events per hospital. True outliers potentially represent hospitals with a significantly different outcome and should be further analyzed to find the best possible treatments.
**Neurocognitive Intervention for Post-Stroke Aphasia: A Neuropsychological Perspective**

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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**Objectives:** Aphasia is the most striking cognitive sequel of stroke and other neurological conditions. Neuropsychological rehabilitation (NR) ameliorates cognitive, emotional, psychosocial & behavioral deficits caused by an insult to the brain. India not only possesses racial diversity but also linguistic diversity. Therefore, its rehabilitation also becomes challenging. As work done in other countries cannot be adopted as such in the Indian context, the requirement to deal with this area is urgent. It's also important to develop neuropsychological rehabilitation program for illiterates along with the literate population. A comprehensive neuropsychological rehabilitation with aphasia therapy is the need of the hour for our country for overcoming the neuropsychological deficits following stroke which will in turn help in improving the overall quality of life & psychosocial wellbeing of the stroke survivors of the country.

**Methods:** 22 consenting patients suffering from post stroke aphasia were recruited in a single blind randomized controlled clinical trial with 11 in the Treatment As Usual (TAU) and 11 in the Treatment Group (TG) using block randomization. Patients suffering first-time ischemic stroke diagnosed with non-fluent or fluent aphasia within a year of index event, any education level, aged 20-69 years (TG-Mean age: 52.54 ± 17.12; TAG-Mean age: 45.90 ± 12.56). Pre-Post Neuropsychological assessment included Indian Aphasia Battery (IAB), Color Trail Test 1 (CTT1) & 2 (CTT2), Visual N Back, Stroke Specific Quality of Life (SSQOL) and Stroke Aphasia Depression Questionnaire (SADQ). An 8 week home based neuropsychological program was developed with tasks for language and cognitive remediation. As NR techniques from other countries can’t be blindly adapted for use in a diverse country like India. The designed tasks had no influence of age and education. Post assessment was done after 2 months from the baseline assessment.

**Results:** Wilcoxon sign rank test revealed that the neuropsychological assessment of TG post NR shows a marked improvement in the scores of the IAB as compared to the TAU (TG- p=0.10; TAU- p=0.000). The scores of CTT1, SSQOL and SADQ also showed improvement in the TG as compared to the TAU.

**Conclusions:** A home based NR program can help in ameliorating the language as well as cognitive deficits in patients suffering aphasia & can come as aid in developing countries where it becomes difficult for patients for routine travel to the hospital due to financial constraints.
Sleep in Disorders of Consciousness due to Traumatic Brain Injury before and after Transcranial Direct Current Stimulation

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: Sleep in patients suffering from Disorders of Consciousness (DOC) has not been adequately investigated; more interestingly, the impact of Transcranial Direct Current Stimulation (tDCS), which is a non-invasive technique that applies small electrical currents through the brain, in sleep and its features in patients suffering from DOC has not been previously addressed. As a part of a larger study, we aimed to investigate the variation of sleep and its features in patients suffering from DOC due to Traumatic Brain Injury(TBI), who underwent therapeutic sessions of tDCS.

Methods: Seven patients (6 M, mean age: 25 ± 6 years) suffering from DOC due to TBI (JFK Coma Recovery Scale – Revised (CRS-R): 9.3 ± 5.2), after 66 ± 48 months since the TBI event, underwent (15 ± 3 ) sessions of tDCS; the latter consisted of the application of anodal tDCS (25 cm² sponge electrode, 2 mA) over the left primary motor area of the hand while the patients received verbal movement commands. tDCS was applied for 30'/daily. Patients were assessed with the CRS-R before and after the completion of all sessions. Sleep has been assessed with the use of limited PSG (6 EEG electrodes: F3,F4,C3,C4,O1,O2, 2 EOG leads, and 1 chin EMG); presence of common primary sleep disorders (i.e., sleep apnea, periodic leg movements) has been previously evaluated and thus excluded. The American Academy Sleep Medicine sleep scoring criteria (AASM 2007) have been implemented. Sleep parameters under investigation were: Total Sleep Time –TST-, Sleep Efficiency –SE-, Sleep Onset –SO-, REM latency –LREM-, percentages of sleep stages (%N1, N2, N3, REM), number of NREM/REM cycles, number and duration of Awakenings and Arousal Index. Paired t-tests and Analysis of Covariance (ANCOVA) were used for the measurement of sleep parameters before and after tDCS and evaluation of the influence of clinical features on sleep parameters and (i.e., CRS-R, time since TBI, number of tDCS sessions). Statistical significance (p) was set at <.05.

Results: Among the sleep parameters, N2% is significantly different before and after tDCS (17.3 ± 13.3 vs 31 ± 11.1 % respectively, p=.0079). ANCOVA showed that increase of REM% and NREM/REM cycles were associated with the improvement of DOC (as shown by the CRS-R score; p=.002 and p=.001 respectively).

Conclusions: The most interesting finding in this pilot study is the significant increase of N2% after tDCS. Though N2 in sleep medicine is routinely considered a “lighter and less important sleep” compared to N3 (otherwise called “Slow Wave Sleep”), when it is about DOC, N3 is rather an index of encephalopathy than an index of “good and deep” sleep; thus, the increase of N2 after tDCS maybe an index of encephalopathy amelioration.
Which biomarker is most effective to determine severity of acute head trauma in experimental animal head trauma model?

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Because of the need for effective method to determine the severity of head trauma, the importance of biomarkers is recognized recently. This study aims to analyze the values of sera levels of some biomarkers and the relation with their tissue levels in acute head injury.

Methods: In this study, rats were divided into three groups (mild head trauma, severe head trauma and control group). All rats were anaesthetized. Weightdrop method was used as trauma method. Blood samples were obtained five minutes after trauma when the acute effects of trauma occurred. Then whole brains of rats were excised. Levels of biomarkers were investigated in the sera samples and homogenized brain tissues biochemically.

Results: Significant differences in the sera GFAP (p=0.015) and insulin (p=0.011) levels were observed. Very significant difference in the sera nNOS level was observed. Extremely significant difference in the tissue IL-6 (p<0.001) level was observed between all groups.

Conclusions: Sera nNOS and tissue IL-6 were the best biomarkers to predict trauma severity. Sera GFAP and insulin also were capable to show trauma severity in the very acute period of post injury. Tissue levels of the biomarkers except insulin were found to be higher than their sera levels.
Do Pre-Injury Health Problems Influence Injury Severity Following Mild Traumatic Brain Injury?

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: The purpose of this study was to determine if there is an association between pre-injury health problems and injury severity in mild traumatic brain injury (MTBI) patients evaluated in the Emergency Department (ED). Specifically, we evaluated whether certain pre-existing health factors (e.g., older age, psychiatric or neurologic diseases, substance abuse), singly or in combination, are associated with greater injury severity (e.g., more likely to have LOC, PTA, Glasgow Coma Scale score [GCS] under 15 or an intracranial abnormality on CT).

Methods: The study population included all consecutive patients who underwent head CT due to acute head injury (N=3,023) at the ED of Tampere University Hospital between August 2010 and July 2012. MTBI was diagnosed per WHO criteria, and the pre-injury diseases (based on ICD-10 classification) were collected from the hospital records. MTBI severity indicators (loss of consciousness [LOC], post-traumatic amnesia [PTA], GCS, and traumatic CT findings) were recorded. Crosstables (Pearson chi² and risk ratios) were calculated. The level of statistical significance was set at 0.01, as a correction for multiple comparisons.

Results: In the total sample, the age distribution was skewed (N=3,023, median=55 years, interquartile range=34-76), and the majority (56.4%) were men. Two thirds (1,990, 65.8%) fulfilled the MTBI criteria, 257 (8.5%) had a moderate or severe TBI, and 776 (25.7%) had head trauma without obvious signs of brain injury. The most common pre-injury diseases among MTBI patients were circulatory (n=808, 40.6%), psychiatric (n=548, 27.5%), neurological (n=502, 25.2%) disorders, and endocrine, nutritional, and metabolic diseases (n=381, 19.1%). Chronic alcohol abuse was present in 20.4% (n=405). Of the MTBI patients, 34.6% (n=689) were aged 70 years or older. The incidence of MTBI severity indicators was as follows: LOC, 23.2%; PTA, 32.0%; GCS <15, 10.2%; acute traumatic lesion on CT, 17.4%. Chronic alcohol abuse was associated with a GCS of under 15 (RR=1.67, 95% CI 1.17-2.40; p=0.005) and having an acute traumatic lesion on head CT (RR=1.37, 95% CI 1.12-1.67; p=0.002). Older age (≥70 yrs) also increased the risk of sustaining a CT-positive brain injury (RR=1.52, 95% CI 1.27-1.82; p<0.001). Psychiatric, neurological disorders, and endocrine, nutritional, and metabolic diseases were unrelated to MTBI severity indicators when considered independently. The following pre-injury disease combinations were associated with increased risk of having an acute traumatic lesion on head CT: (i) circulatory system or endocrine, nutritional, or metabolic disease (RR=1.50, 95% CI 1.25-1.80; p<0.001); (ii) psychiatric or neurological disorder, circulatory system disease or endocrine, nutritional, or metabolic disease (RR=1.43, 95% CI 1.15-1.77; p=0.001).

Conclusions: Premorbid diseases are common among patients sustaining MTBIs and some are associated with injury severity. Chronic alcohol abusers, in particular, are at risk of suffering a CT-positive MTBI and an injury with an altered level of consciousness.
Understanding Fatigue and Fatigability of Traumatic Brain Injury: An Australian Community Patient Perspective

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Objectives: Fatigue is a well-recognised problem following traumatic brain injury (TBI), and is described in terms of, or in relation to, sleep and arousal; alcohol and medication; mood and anxiety; and deconditioning and exercise tolerance. The objective of this study was to explore TBI fatigue, and to consider contributing factors and sequelae of TBI fatigue, from an Australian community patient perspective.

Methods: For the validation of the International Classification of Functioning, Disability and Health (ICF) Core Sets for TBI, persons diagnosed with TBI (as evidenced by post-traumatic amnesia (PTA)) were invited to participate in focus groups. If attendance in person was difficult, individual interviews were permitted. Ethics approval was granted by the Melbourne Health HREC (2013.224). Participant discussions were transcribed verbatim and linked to the ICF in the primary study. For this qualitative analysis, transcriptions were re-examined using the linked ICF concepts to explore patient perspectives on fatigue.

Results: A total of 21 (76.2% male) community-dwelling persons with TBI participated in five groups, with a mean age at injury of 55.2 years (range 18-83); and a mean time since injury of 2.86 years (range 0.78-5.33). Firstly, on waking, fatigue was described as a lack of energy and tiredness, from altered sleep quality. It was likened to a sense of heaviness (‘cloud on the shoulders’); and feeling lightheaded, or intoxicated (as with alcohol) – which lasted throughout the day. Secondly, during the day, fatigue was exacerbated by effortful tasks (reading, handling stress, conversations, walking, people interactions, studying, or working), or by external stimuli in the background (sound of clocks, radios, or open-concept offices; visual stimuli from objects near a path; or crowds of people). Even in chronic phases, increased cognitive and physical efforts were necessary to accomplish previously ‘effortless’ tasks, while decreased ability to eliminate background sensory stimulus (auditory, visual, or people interactions) resulted in cognitive exhaustion. Such susceptibilities to fatigue, or fatigability, may reflect similar processes to (or a continuation of) early agitation of PTA. Thirdly, TBI fatigue resulted in: irritability or difficulty with decision making; decreased memory and attention; and in severe cases, visual, auditory, vocal, sensory, and motor symptoms. This potentially reflects a decreased ability to compensate for chronic impairments of TBI with increasing fatigue. Fourthly, disability as a result of these problems included: decreased completion of planned tasks; intimate relationship difficulties; and decreased participation in community life, recreation, and leisure. Finally, TBI fatigue improved with rest, sleep, or solitude in a quiet environment.

Conclusions: Patient perspectives in TBI fatigue identified additional concepts of potential relevance for research and clinical practice. The concept of susceptibility to TBI fatigue, or fatigability, could improve the management of TBI fatigue by optimising the environment and daily routines to reflect individual priorities.
Effects of preference and sensory modality on behavioral reactions in patients with disorders of consciousness

Status: Accepted Presentation type: Poster
Category: Neurorehabilitation – case reports/clinical research

Author's preference: No preference

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Objectives: The CRS-R is the most reliable and sensitive tool for the differentiation between UWS and MCS. However, recent studies still find a 40% rate of misdiagnosis. Therefore, a large body of research is aimed at improving the sensitivity of diagnosis, and proper stimulus selection might be crucial. For example it has been shown that preferred music listening has a beneficial effect on the cerebral activity of UWS and MCS patients. The aim of the present study was to test if preferred stimuli could have an effect on behavioral tests. We tested the effect of sensory modality (music vs. odor) and preferred characteristics (preferred vs. neutral) on the performances of the CRS-R.

Methods: The 4 stimulations were compared in 13 patients (7 MCS; 6 UWS). Favorite stimulations were made through the use of questionnaires about patients' preferred music and smells (alimentary odors) given to patients' loved one. Neutral smells consisted of artificially created smells for which there is no identification in nature. Neutral sounds were noises (with similar spectral composition than music but without timbre or rhythm). A trial was a period of stimulation (one of the 4 conditions) followed by one of the 4 items selected in the CRS-R (two self-referential: visual pursuit and reaction to name, and two movements to command). Each of the 16 combinations was assessed over the course of several weeks. Items were scored blinded by video on quantitative and qualitative reaction.

Results: Results of behavioral scores showed that patients respond more often to preferred sound, i.e. music (20%), followed by neutral sound (17%), preferred odor (12%), and neutral odors (8%). The percentage of responses was significantly different between music and odor (wilcoxon p=0.03; effect size=-.41). When only looking at self-referential items the differences between the stimuli were bigger, and preferred music was significantly different from neutral sound. The same effect was seen when looking at qualitative scores (measure of emotional reactions during the stimulations and items). Two patients, diagnosed as UWS showed emotional and improved behavioral reactions that show that these patients were in fact not unresponsive.

Conclusions: There was a significant effect of sound, and of preference on behavior. Furthermore, the biggest effect was observed for preferred music on self-referential items. Interesting is that emotional stimuli can trigger behavioral responses not otherwise observed, and indicate importance in behavioral assessment of patients. However, music is not magic; no significant difference could be observed with standard CRS-R protocol assessment before and after our study protocol. It is likely that the effect of music (which in our study did not include any tactile or vocal arousing) together with the protocol of the CRS-R (which do include stimulations to awaken the patient) will give larger effects.
Post Traumatic Glioma – Its Association and Review of Literature : A Case Report

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives -To further contribute to the medical literature supporting the association of development of glioma after head trauma.

Methods: Post traumatic glioma has been a matter of debate. Few reports favor its occurrence in previous head injury scar, subsequently developing into glioma. We report a case of young patient presented with headache, seizures and gradual loss of vision. On investigation found to have brain tumor. Patient had head injury occurred 3 yrs back.

Results: It fulfills all the criteria required to establish traumatic origin, further supporting the association.

Conclusions: An association between head trauma and brain tumor risk can not be ruled out and should therefore be kept in mind, though a larger studies need to be carried out to find out further relationship.

Keywords: Post traumatic glioma, Brain tumor, Head injury.
Exploration of functional connectivity during preferred music stimulation in patients with disorders of consciousness

Objectives: Patients with disorders of consciousness (DOC) are very difficult to assess. Various interferences like physical and/or cognitive impairments, or medical complications can affect the diagnosis based on clinical assessments of consciousness. Previous research has proposed to increase the sensitivity of clinical tests by using personally relevant stimuli to decrease the high rate of misdiagnosis. Music is highly emotional and salient, and seems to have effects in these patients. For example, it has been shown to increase the probability of auditory cognitive event-related responses in patients with disorders of consciousness (DOC). We here aim to explore whether the effect of music in severely brain-damaged patients with DOC is related to functional connectivity changes. We expect to observe changes, and more specifically increases, in functional connectivity in the auditory and attentional systems in patients with DOC during the music.

Methods: Functional MRI scans were acquired while patients (three MCS, two UWS; mean age=50 years, SD=10) were exposed to their preferred music as well as a control condition when they were exposed to the repetitive noise from the scanner (also present in the music condition). We assessed functional connectivity using seed regions in both primary auditory cortices. We also analyzed and mean network connectivity of three networks linked to conscious sound perception; the auditory network, the external network, and default mode network. Data was analyzed using SPM8, and the "conn" toolbox.

Results: Functional connectivity in patients was mainly restricted to the areas surrounding each of the two primary auditory seeds for both the music and the control conditions. The left primary auditory seed showed more functional connectivity in the right precentral gyrus during music as compared to the control condition.

All three networks (i.e. auditory network, external network, and DMN) show severely limited functional connectivity. However, the auditory network showed stronger functional connectivity with the left precentral gyrus and the left dorsolateral prefrontal cortex during music as compared to the control condition. Furthermore, functional connectivity of the external network was enhanced during the music condition in the temporo-parietal junction.

Conclusions: Although caution should be taken due to small sample size, these results suggest that preferred music exposure might have effects on patients auditory network (implied in rhythm and music perception) and on cerebral regions linked to autobiographical memory.
Neurotrauma, Vision Restoration, And Brain Functional Connectivity Network Reorganization

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Because more than half of our brain’s cortex is involved in vision, low vision and blindness are a frequent consequence of neurotrauma to the retina, optic nerve and the central visual pathway. This impairs sensation, perception, and/or higher cognitive functions in the “person behind the eye”. To achieve rehabilitation and recovery of vision, we need to consider retinal (“bottom-up”) processes and their interaction with higher-level (“top-down”) brain network function which construct the conscious vision. Because most cases of vision loss are only partial blindness, we can not only activate residual vision by brain network amplification and plasticity using vision restoration training but, most recently, also by non-invasive alternating current stimulation (ACS). In two prospective, randomized, sham-controlled clinical trials we studied patients that suffered optic nerve damage which were assigned to a group receiving ACS or a sham treatment. ACS was carried out for 10 consecutive days (20-40 min daily) using AC-current bursts with amplitudes <1000µA at 10-50Hz (see video: www.youtube.com/watch?v=g8p3mWsvAl.) The primary outcome measures were detection performance in visual fields and visual acuity. In addition, we measured vision related quality of life with the NEI-VFQ questionnaire and collected EEG recordings. ACS, but not sham, led to significant increases in the primary outcome measures (perimetric stimulus detection rates) and several secondary measures including visual fields, reaction time, and visual acuity. These changes remained constant at 2-months follow-up in most but not all patients and they were associated with improved vision-related quality of life. Physiological EEG changes were increased alpha-power in both occipital and frontal brain areas, and brain networks reorganization of functional connectivities. In conclusion, vision loss after neural injury must not be viewed as irreversible, but there is light at the end of the tunnel: by activating residual vision through mechanisms of brain plasticity some vision restoration is possible.
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The Predictive Value of Quantitative EEG in Severe Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: Severe traumatic brain injury (TBI) is one of the leading causes of death and invalidity in young people. Early identification of potential recovery or secondary deterioration of TBI patients in the ICU is a major challenge, especially since clinical scores are often limited due to sedation and ventilation. We studied the prognostic predictive value of electroencephalography (EEG).

Methods: Twenty consecutive comatose patients with severe TBI were included in an explorative, prospective cohort study. Continuous EEG, containing at least 10 channels, was recorded during the first days of admission. Sixteen quantitative EEG (qEEG) features were calculated from a "long distance" bipolar montage: power, Shannon entropy, alpha to delta ratio (ADR), regularity, heterogeneity (measured as variances in power and ADR between EEG channels), and center of gravity on the x- (left-right direction) and y-axes (anterior-posterior direction). The center of gravity measures were calculated for the total power spectrum and for each frequency band separately. The qEEG values at 24 and 48 hours after ICU admission were correlated with outcome. In 11 patients intracranial pressure (ICP) was measured simultaneously and correlated with mean EEG power.

Results: Median Glasgow Coma Scale at ICU admission was 6.0 (range: 3-9) and EEG was started at a median of 8 hours after ICU admission (range: 2-42 hours). Eleven patients (55%) survived until hospital discharge.

At 24 hours after ICU admission, EEG data was available in 15 patients. At this time point the EEG of survivors showed on average a higher Shannon entropy (5.0 vs 4.0, p=0.02), less heterogeneity (variance in ADR of 0.07 vs 0.17, p=0.004), a more central center of gravity in the anterior-posterior direction of the total spectrum (center of gravity of the y-axis: 0.09 vs 0.17, p=0.05) and of the beta band (0.11 vs 0.23, p=0.01), and less left-right asymmetry in the alpha band (cog on the x-axis: 0.10 vs 0.27, p=0.02) in comparison to non-survivors. The other features showed no significant differences between survivors and non-survivors.

At 48 hours after ICU admission, EEG data was available in 17 patients, and the EEG of survivors still showed a higher Shannon entropy (5.1 vs 4.5, p=0.01) in comparison to non-survivors. The other features were not significantly different between survivors and non-survivors, although a trend was seen towards a more central center of gravity in both the anterior-posterior and the left-right direction for survivors. ICP was significantly negatively correlated with EEG power in 7 out of 11 patients.

Conclusions: Continuous EEG provides relevant information for the prediction of outcome, and is correlated with ICP, in patients with severe traumatic brain injury. The detection of secondary brain injury using EEG and the relation between continuous EEG registrations and other modalities is presently studied in our ICU.
Illness Cognition and Adult Mild Traumatic Brain Injury: A Scoping Review

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – basic research

Author's preference: Poster

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Objectives: Concussion, or mild traumatic brain injury may impact individuals in a multitude of ways and does not always resolve within the typical seven to ten day range. In fact, it is estimated that approximately 15% of those diagnosed with mild traumatic brain injury go on to develop persistent post-concussion symptoms. While debate exists regarding the cause of persistent symptoms, a need for research exploring non-injury factors has been identified. A number of models of persistent symptoms have been described, drawing attention to the potential contributing role of cognitive processes to health outcomes. One such cognitive process, illness cognition, has received increasing attention in recent years. To date, no attempts have been made to synthesize this promising literature base, potentially due to inconsistent terminology use related to illness cognition within and across disciplines.

Methods: A scoping review was undertaken to answer the question: What is known about illness cognition and mild traumatic brain injury in an adult population? In keeping with scoping review methodology, a focused purpose and outcome were identified. The purpose was to identify how illness cognition has been conceptualized and applied in the adult mild traumatic brain injury literature. The intended outcome was a literature map, expected to facilitate dialogue between researchers and clinicians. A literature search was conducted of eight peer-reviewed electronic databases (n=3571). After removing duplicates (n=453) and eliminating studies at the title (n=2578) and abstract (n=436) levels, 104 full text studies remained and were assessed for inclusion based on a priori criteria. Remaining studies (n=20) were analysed via quantitative numerical and qualitative content analysis. Two authors independently screened studies for inclusion and extracted data for analysis.

Results: Twenty studies from four countries, published between 1992 and 2015, originating primarily from psychology and neuropsychology were included in the review. A literature map will be presented to illustrate areas of overlap and gap between four interrelated conceptual bases of literature. To further illustrate the interrelationship between these literature bases, themes highlighting health outcomes, and research and clinical implications of included studies will be outlined. Findings will then be discussed in the context of mild traumatic brain injury rehabilitation research and clinical practice.

Conclusions: This study is the first to synthesize and conceptualize the illness cognition and mild traumatic brain injury literature in an adult population. The literature map, which demonstrates areas of overlap and gap between literature bases, provides a point from which to initiate dialogue between and within disciplines. In this way, this study has the potential to inform future research and clinical practice in mild traumatic brain injury rehabilitation (e.g., development and evaluation of an interdisciplinary model of persistent symptoms, etc.).
Quality of Survival after Brain Tumor in Childhood

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Objectives: The cognitive sequelae of brain tumor in childhood are well known (Mulhern & Butler, 2004). For the children themselves, and also the parents and families, a poorer quality of daily life after the completion of treatment is often more perceptible than the cognitive challenges the children face.

Methods: Data on 305 children have to date been collected in our hospital in a comprehensive follow-up program for children with brain tumor at one, two and five years after end of treatment. The program consists of a neuropsychological examination, in addition to collecting data on quality of life (Peds QL) and behavior (BRIEF).

Results: Results show that a great proportion of the children have challenges also in the areas physical, emotional and social well-being, as well as on the school arena. There appeared some interesting differences between the parents’ and the childrens’ answers to the questionnaire.

Conclusions: We propose to include routine evaluation of psychological functioning and well-being in all follow-ups of children with brain tumor. When this important quality of life is taken into account, one would early detect possible problems, and therefore have the opportunity to start treatment at a stage where the problems have not yet become cronic.
A Systematic Review of Peer Mentoring Interventions for People with Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Objectives: This systematic review sought to discover what theoretical evidence supports the use of peer mentoring interventions for people with traumatic brain injury (TBI). The aim was to inform the design and intervention content of a randomised controlled trial (RCT) of peer mentoring for TBI survivors in the UK.

Methods: Literature searches were developed using medical subject headings (MeSH and EMTREE) and words relating to traumatic brain injury and any form of peer mentoring intervention. We searched 14 relevant databases, including MEDLINE, EMBASE, CINAHL, PsychINFO and the Cochrane Library. The search strategy was adjusted as appropriate for each database. We also searched two trials registers and the PROSPERO International Prospective Register of Systematic Reviews. Grey literature searches were conducted using Open Grey, Google Scholar and eight other grey literature databases. Any paper reporting an intervention in which TBI survivors acted as peer mentors to other TBI survivors was selected for inclusion, including published studies, conference abstracts with sufficient information and grey literature. Two reviewers independently screened all titles and abstracts and selected articles for inclusion. A third reviewer resolved discrepancies and authors were contacted when necessary for further information. Hand searches were conducted of the included studies’ reference lists and citation searches were conducted using SCOPUS and Google Scholar. Data were extracted relating to aspects of study design, participant population, components of the intervention, outcome measures and results. Two reviewers extracted data independently to ensure reliability and studies were assessed for quality and risk of bias using the Mixed Methods Appraisal Tool (MMAT).

Results: The database search returned 684 records with one record identified through hand searching. 447 records remained after removal of duplicates and 412 were excluded after screening. Full texts were obtained where available for the remaining 35 records and six studies were found to meet the inclusion criteria for the review. All six studies were conducted in the United States between 1996 and 2012 and included one single centre pilot RCT, one single centre RCT, one quasi-experimental study, one before and after design, one concurrent mixed methods design and one description of service. Articles varied in their models of peer mentoring and there were considerable differences in the duration, frequency and intensity of the interventions, even within single studies. All research studies reported positive outcomes on a range of measures and the description of service article reported positive feedback from participants.

Conclusions: There is a paucity of published evidence for the effectiveness of peer mentoring after TBI. Available evidence is based on relatively small-scale studies of variable quality conducted in the United States. Further research is required to determine the efficacy of peer mentoring interventions for TBI survivors in the UK.
Response Evaluation Program: An Interdisciplinary Team Approach for Evaluation and Treatment of Severe Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: Poster

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Background: The Response Evaluation Program (REP) is an example of an inpatient rehabilitation hospital's program for the standardized evaluation and continued reassessment of individuals with a Disorder of Consciousness following a severe acquired brain injury. The Response Evaluation Program is an interdisciplinary program comprised of a diverse team of medical professionals and therapists responsible for the continued reassessment of the patient in the program as well as educating caregivers for transitioning the individual home. The program provides a means of systematically collecting data to determine an individual's rehabilitation readiness, provide a more accurate diagnosis of Disorders of Consciousness, and prepare caregivers with education and training to shorten hospital lengths of stay.

Objectives: There is currently limited documentation on the specific roles of the medical professionals comprising the interdisciplinary team caring for these individuals. This presentation will illustrate one inpatient rehabilitation hospital's program to model the specific roles and purpose of each member of the medical team to provide best practice for individuals with a Disorder of Consciousness. Each medical professional must have a thorough understanding of the presence or absence of behaviors associated with conscious awareness of self or environment including object manipulation, purposeful communication, and following simple commands and completes training in the Response Evaluation Program before he or she can be a member of the interdisciplinary team. A well-trained and diverse medical team is required for the understanding and interpreting of the complex behaviors displayed by individuals with a Disorder of Consciousness due to the complexity and severity of their injuries as well as the motor, sensory, and cognitive skills that are affected.

Methods: An understanding of the basic structure of the Response Evaluation Program as well as the protocol schedule provides a framework for each team member to follow through an individual's length of stay in the program. Case studies with examples of implementing the Response Evaluation Program protocols and goals will be provided to illustrate the role of each of the interdisciplinary team members.

Conclusions: Interdisciplinary team evaluations and co-assessments promote team discussion to improve reliability and validity of diverse data collected from an individual with a Disorder of Consciousness. Systematic data collection from the interdisciplinary team can be used to support justification for rehabilitation readiness or return to rehab in the future to reduce healthcare costs and improve functional outcomes for individuals with severe acquired brain injuries.
The Clinical Evaluation of the Multiply Brain Injured Professional (NFL) Athlete

Status: Accepted Presentation type: Oral

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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The National Football League (NFL) has accepted the relationship between repetitive traumatic head impacts and the subsequent development of neurological impairment. The NFL concussion settlement accepts that participation in football on a professional level provides sufficient proof of causation if a player subsequently develops symptoms of Chronic Traumatic Encephalopathy (CTE). In addition, a recent pathologic analysis of the brains of 79 former NFL players, 76 tested positive for CTE.

The role of the brain injury specialist has changed in this subset of patients. Often, one of the principle elements in the assessment of the post TBI patient is establishing the causal relationship between the traumatic injury/injuries, and the subsequent clinical picture. This is primarily important in cases where medical and legal implications of the injury/injuries may result in financial compensation to the patient and/or the family for medical expenses and other forms of compensation.

This presentation will concentrate on the clinical evaluation of 25 former NFL patients with suspected CTE. We will outline our referral patterns, examination techniques, reporting vehicles and possible implications of our evaluations. All players had detailed general medical, concussion and sub concussive event, and sports medicine histories. All patients had detailed neurological examinations including mini-mental status exams and clinical dementia rating scores. In addition, each patient underwent an extensive (approximately 4 hour) session of neuropsychological testing.

The authors’ methods, results, and recommendations for future considerations in this patient population will be discussed. Graphic analysis of pertinent historical events, deficits found on neurological examination, clinical mental status testing and detailed neuropsychological scores will be presented.
Don't Sit Too Close To The TV

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Background: Here we present the case of an Anterior Cranial Fossa Remodeling in a 15 year old female. In March of 2007 the patient originally presented to Accident & Emergency after a television fell onto her head. Radiology showed a left frontal bone fracture. She was treated conservatively. 6 months after the incident she developed epilepsy and was managed pharmacologically with Epillin for one year before weaning off medication.

Objectives: In August 2015 she noticed puffiness around left eye and neck stiffness. She subsequently experienced a seizure in the shower. This was the first since 2008, and she went on to have 2 more Generalized Tonic-Clonic seizures. Upon presenting to Accident & Emergency her Glasgow Coma Scale score was 14/15 and she was treated for meningitis and the seizures with Flucloxacillin, Cefuroxime and Kepra. Radiology showed a tear in the dura with brain tissue herniating into the nasal space.

Results: 6 weeks later she was admitted for elective reconstruction of the Anterior Cranial Fossa. Frontal bone craniotomy was performed, and reflecting the left prefrontal cortex back revealed a 2cm fracture in the floor of the Anterior Cranial Fossa. Mucus and dura matter that had herniated into the space were recovered. Bone chips taken from the frontal bone craniotomy were utilized in the bone graft to seal the fenestrated floor of the Anterior Cranial Fossa.
Ultrasound Guidance to Improve Accuracy of Injections of Botulinum Toxin – 15 Years of Experience

Status: Accepted Presentation type: Poster

Category: Technology – clinical research/applications

Author's preference: Oral

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Objectives: Patients with upper motor neurone syndrome after severe traumatic brain injury commonly display severe muscular overactivity. Botulinum toxin (BoNT) has been firmly established as pharmacological treatment to reduce such overactivity within an integrated treatment plan. Ultrasound has emerged as leading technique to guide injections with BoNT during the last 15 years. Our initial publication as technical note paved the way to ever increasing use in the neuropediatric, and consequently in the neurologic/neurorehabilitation arena. Meanwhile ultrasound guidance has become the preferred method to guide injections with BoNT all over the world. Most international consensus statements on treatment with BoNT cite ultrasound guidance as the method of choice to inject BoNT.

Methods: We will give a detailed review of the existing guiding techniques to inject BoNT. We will highlight the advantages and disadvantages of various approaches with a special emphasis on the treatment of patients with spasticity. The current supporting evidence will be presented. We will highlight the opportunities and the obstacles to use ultrasound and multimedia learning tools to overcome initial difficulties. The value of using injection guidance will be delineated by short case reports and hands-on demonstration sessions.
A set of clinical and instrument-based diagnostics to evaluate ataxia after paediatric traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Poster

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Objectives: Traumatic brain injury (TBI) is the most common cause of morbidity and mortality in paediatrics¹ and leads to different motor dysfunctions depending on the site of injury. Until now, ataxia as being one of these post-traumatic movement disorders is unfortunately a little investigated area in the field of paediatric neurorehabilitation. It has been known that even without direct damage to it, the cerebellum is often affected after traumatic injury to the head². In order to be able to assess the severity and to further monitor the progress of the ataxia, a battery of tests was assembled.

Methods: The investigation of the child with suspected cerebellar involvement includes the following:

I. a bed-side clinical examination, which contains the standard neurological examination with special emphasis on testing the oculomotor system, coordination and fine motor control for children beyond the age of two years. II. A thorough examination by an experienced orthoptist. Key features here, are the eye position and motility, whether the smooth pursuit is disturbed by saccades and whether a gaze deviation nystagmus can be observed. The vestibulo-ocular reflex (VOR) and its suppression by fixation is tested as well. III. Additional clinical rating scales as the "Spinocerebellar ataxia Functional Index" (SCAFI) and the the semi-quantitative assessment "Scale for the assessment and rating of ataxia" (SARA) are used for a better evaluation³ and are performed by physiotherapists. IV. Instrument-based diagnostics include a video-oculography to assess oculomotor function as well as posturography and gait-analysis to evaluate disturbances of stance and gait.

Results: With the help of the above mentioned assessments, the level of ataxia was evaluated within the dimensions of body functions as well as activities in eight patients during their inpatient rehabilitation stay. The cooperation of the neuropediatric rehabilitation clinic with a highly specialized centre for balance and vertigo disorders offers the opportunity to establish a toolbox for monitoring the course of the ataxia in paediatric patients that suffered a traumatic brain injury (n=3). Even though the combination of these examination assessments still has to be analysed in more detail concerning its reliability and reproducibility in children with TBI, these assessment tools could in the future be used to further evaluate different treatment plans containing neuro-pharmacological medications established for e.g. congenital ataxias or rehabilitations programmes.


To quantify and describe medical resource requirements in a Prolonged Disorders of Consciousness (PDOC) sub-group in a tertiary hyper-acute rehabilitation service in the UK.

Status: Accepted  Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: There is now strong evidence for the effectiveness of early rehabilitation following acquired brain injury. Hyper-acute rehabilitation services are increasingly developed in the UK to take patients directly into rehabilitation from intensive care settings, so relieving pressure on acute care services.

This prospective cohort service evaluation from a single tertiary hyper-acute rehabilitation service in London, UK was carried out to quantify and describe the resource requirements to specifically manage the sub-group of patients admitted to rehabilitation while still in a prolonged disorder of consciousness (PDOC).

Methods: The Rehabilitation Complexity Scale (RCS-E v13) is the standard casemix measure for specialist rehabilitation services in the UK. It is a simple ordinal scale providing standardised measurement of resource use in rehabilitation settings (ie care, nursing, medical and therapy input). The Medical subscale (RCSE-M) identifies the requirement for medical support. RCSE-M scores range from 0-4, and scores of 3-4 identify patients with potentially unstable medical conditions requiring management in a rehabilitation setting with on-site 24-hour medical care.

Medical Activity Assessment (MAA) is a supplementary tool for use alongside the RCSE-M score to describe and quantify the types of medical resources actually used, and thus to characterise the co-dependencies of hyper-acute rehabilitation services, ie the interventions from other specialties that patients may need to access during their rehabilitation.

In this study, MAA data were recorded alongside RCS-E scores at weekly intervals over 1 year. Resource use in terms of medical input (doctor hours/week) was recorded through the Northwick Park Therapy Dependency Assessment Medical Score.

Results: 421 parallel data points were recorded from 36 patients (mean age 41 (SD=13) and mean length of stay 108 (SD=35) days). The majority of diagnoses were: 45% Trauma, 32% Anoxic brain injury. On discharge 38% had emerged while 19% remained in vegetative state and 33% Minimally conscious state.

Overall, specialist input was required from 20 different medical specialties. The commonest were ENT/tracheostomy team 79 (19%), Neurology 28 (7%), Neurosurgery 28 (7%), Radiology 15 (4%).

The RCS-M scores in 223 (53%) of data-points identified medical instability. 161 (72%) of medically unstable data-points required between 2.5 and 6 hours/week of medical input. The commonest reasons for requiring medical intervention were bowel management 45 (20%), respiratory distress/desaturation 43 (19%), autonomic dys-regulation ('sympathetic storming') 30 (13%), sepsis 16 (7%). This group of patients frequently required medical interaction with family and 155 (70%) of data-points included informal family meetings.
Conclusions: Prolonged Disorder of Consciousness patients in a hyper-acute rehabilitation service require an extensive range of on-site specialist medical and emergency services. These patients need both medical time for intervention as well as family discussions during the time of assessment and establishment of the level of consciousness.
Appropriate management of patients with traumatic brain injury and dysphagia in our hospitals or not?

Status: Accepted  Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: Traumatic brain injury (TBI) is the cause of various neurological deficits including swallowing disorders. Until now, the studies in patients with TBI show the incidence of dysphagia from 17.2% to 61%. Enteral nutrition is preferential route of nutrition, fluid and drug administration vs parenteral nutrition. Percutaneous endoscopic gastrostomy (PEG) feeding should be considered if the patient cannot have an adequate intake of nutrients (qualitatively or quantitatively) orally for a period 2-3 weeks. The aim of this study was to establish if the patients with TBI have proper treatment when having dysphagia before arrival on rehabilitation.

Methods: This retrospective study included 114 patients with TBI and dysphagia (96 men and 18 women) that needed feeding tube and were on craniocerebral rehabilitation. Inclusion criteria were: age over 18 years, traumatic brain injury and first rehabilitation after injury. Exclusion criteria were: other etiology of dysphagia and second time on rehabilitation or death during rehabilitation. We have analyzed patients date from 1.1.2012. to 1.9.2015.

Results: 26% patients with TBI needed feeding tube because of dysphagia on their first rehabilitation after trauma. 24% had NG tube and 2% had PEG when they arrived on craniocerebral rehabilitation. Time from injury to arrival at rehabilitation was from 4 weeks to 20 weeks. At discharge from rehabilitation 15% of patients needed feeding tube.

Conclusions: All 24% patients with TBI and NG tube needed to be referred with PEG on rehabilitation. Appropriate management of these patients can reduce complications that manifest during medical rehabilitation (e.g., the risk of malnutrition, risk of aspiration, risk of pneumonia, affect the length of the stationary type of medical rehabilitation). In addition, there is evidence of intermediate level that postpyloric feeding associated with lower risk for pneumonia (30% compared to gastric feeding). According to literature, placement of a percutaneous endoscopic gastrostomy or percutaneous endoscopic jejunostomy tube is simple, safe and well-tolerated by patients. Doctors who manage patients with traumatic brain injury and dysphagia should be informed about aforementioned.

Key words: traumatic brain injury, dysphagia, percutaneous endoscopic gastrostomy
Using Evidential Stories to Assess Epistemic Inferencing in Bilingual People with Brain Injury (BI)

Objectives: People with BI have difficulty inferring the intended meaning of a message. Consistent problems in inferencing can result in difficulty achieving social communication and vocational goals. However, possible sources of inferencing difficulty in people with BI have not yet been investigated.

This is the first study that examined the ability to infer from epistemic state of events (understanding the possibility/probability or certainty of an event occurrence) using evidential stories. Epistemic language is central to understand the functions and intentions of utterances as well as the scenes around us. Evidential cues help assigning epistemic inferences in linguistic and non-linguistic settings.

Methods: An integrated approach was used: linguistic (Test I) and non-linguistic (Test II) epistemic inferencing were tested. For Test I, 3 story types (24 sentences) were presented to a group of 3 people with cerebrovascular BI and 3 age- and education-matched healthy adults. Each story type provided a different evidential cue: direct evidence (positive perceptual), indirect evidence (negative perceptual), and no evidence (no perceptual cue). Epistemically modalized utterances (can: possibility vs. must: certainty) were used as a linguistic tool. For Test II, the same participants were presented only with the three evidential picture-set-stimuli used in Test I, with no linguistic mean. The participants determined epistemic certainty levels within three-picture sets. Both tests were performed in both languages spoken by the participants since the presence of an epistemic deficiency after BI was expected to influence both languages similarly.

Results: In Test I, healthy participants scored significantly higher than participants with BI on indirect evidence and no evidence conditions in both languages, (chi-square, p<.05). However, no significant between group differences was found for direct evidence for neither languages (chi-square, p>.05). These findings indicate that correct linguistic epistemic inferences people with BI make may depend on the type of evidence in a context. In Test II, significant between group differences was present for both languages (chi-square, p<.05), suggesting that failure in epistemic inferencing is not specific to language.

Conclusions: This study presented the first preliminary results in developing a task for people with BI that would identify difficulties in epistemic inferencing using evidential stories. Although the current sample is yet small (data collection is on-going), it appears that there exist people with BI experiencing problems in epistemic inferencing: they are epistemically uncertain as to the occurrence of an event when there is no direct perceptual evidential cue. This information can help the rehabilitation teams in identifying language and cognitive ability of people with BI when contextual information is and is not a cue for understanding the message of a sentence. Improving epistemic inferencing may help people with BI understanding language and the world around them better.
Blast-Induced Traumatic Brain Injury and Neonatal Hydrocephalus: Assessing Similarities of Pressure-Induced Cellular Injury Patterns

Objectives: Elevated intracranial pressure (ICP) is evident in a number of neurological disorders. Increased ICP and microstructural changes in white matter tracts are present following both blast-induced traumatic brain injury (bTBI) and neonatal hydrocephalus. While much effort has focused on identifying and/or protecting the brain from the initial injury processes, secondary cellular injury is often responsible for poor outcomes by both patient populations. Understanding signaling cascades of these secondary injury mechanisms should provide a means to both assess the degree of injury and develop therapeutic interventions to mitigate long-term deficits induced by both disease processes.

Methods: Using a novel pressure controlled cell culture incubator (PC3I) to model pressure-induced brain injury, 3-D alginate hydrogel cultures of primary and progenitor central nervous system (CNS) cells were grown at normal and pathophysiological pressures (sustained and pulsed pressures). During sustained pressure exposures, a model of hydrocephalus and ventriculoperitoneal (VP) shunt malfunction, cells were subjected to different pressures (10, 20 and 30 mmHg) for periods of 5 min, 30min, 1 hr, 2 hrs, and 24hrs. Pulsed pressure, which mimics pressure injury in bTBI and concussion, exposes cells to single/multiple pathological pressure pulses (80-100 mmHg 1, 5, or 10 times). Vulnerability for repeat injury was assessed by repeating a single pathologic pulse pressure 7 days later. ATP-release assays, live/dead assays, and immunohistochemistry for markers of injury (Caspace-3, apoptosis-inducing factor) or repair (microtubule-associated protein 2) were used to evaluate and quantify pressure-induced cellular injury.

Results: When compared to controls, both sustained pressure (30 mmHg for 2hr) and repeated pressure pulses (80-100 mmHg repeated 1-10 times) increased the release of intracellular ATP when compared to controls. Sustained pressure elevation produced a 3-fold higher ATP release compared to pulsed pressures of 3-fold higher magnitude.

Conclusions: Using our recently developed PC3I, we are able to maintain neuronal cell cultures at physiological and pathological pressure to determine how altering pressure alone affects the release of various cell-injury biomarkers. CNS cells grown in 3-D alginate hydrogel cell culture matrixes at physiologic pressures deemed to be normal for a developing neonatal brain, as well as incremental pressure differences, which are pathologic conditions of untreated hydrocephalus. Pulsed pressure, mimicking bTBI and intermittent VP-shunt malfunction produces measurable cell-mediated stress response. Preliminary results suggest pathologic pressure alone demonstrates characteristics of cell injury through ATP release, which is the primary mediator in purinergic signaling. Although lower magnitude pathologic pressure, when sustained without relief, may be more injurious. Continued work is exploring if after pulsed pathologic pressure, CNS cells are left more vulnerable to a second injury of same or lesser magnitude.
Using Cognitive Training based on Adaptive Motion-Interaction Video Games for Rehabilitation of Executive Functions in Acquired Brain Injury - Experience and Potential Benefits

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Deficits in executive functions are common following an acquired brain injury (ABI). Computerized software for cognitive training is becoming more popular, however this software is often hard to use by individuals with impairments, and there is limited evidence that transfer of the improvements to real-life performance occurs. Cognitive training using motion-interaction software offers a training environment that is more realistic and natural, therefore may facilitate transfer to everyday-life performance. Cognitive software that adapts in real-time to the patient's behavior may potentially enhance the usability by these individuals. The goal of the experiments presented here was to assess the experience of training with dynamically-adaptive motion-interaction cognitive training software for improving executive functions and assess the potential benefits for individuals with ABI.

Methods: Seven participants from the Loewenstain rehabilitation hospital (inpatient) with moderate-to-severe TBI with executive dysfunction performed the intervention, as well as two individuals with ABI living in the community. The intervention included 4-9 computerized training sessions (30-45 min each) over a 3-week period with an occupational therapist using dynamically-adaptive video games which are based on body motion and are designed to train behavioral control, self-initiation, working memory and attention (the Intendu Functional Brain Trainer software). Three of the inpatient participants as well as the two community participants performed executive assessments pre and post the intervention that included the Dysexecutive Questionnaire (DEX), computerized neuropsychological assessments of executive functions (WebNeuro) and functional assessments. A control group of 4 individuals with TBI was also recruited from the Lowenstein hospital included playing non-cognitive games on a touchscreen tablet for the same duration as well as pre and post assessments. All participants filled in a satisfaction questionnaire once they completed the intervention. The performance within the games was analyzed throughout the training sessions.

Results: The participants who performed the experimental intervention (7 inpatient + 2 community) were gradually able to perform games involving higher executive function challenge. Specifically the difficulty of the task they were able to successfully complete in the last session of training was significantly higher than in the first session and their response time significantly decreased. They reported that they enjoyed the training and felt successful in the training sessions. Preliminary analysis of the executive assessments shows a trend of improvement in executive functions following training.

Conclusions: The findings demonstrates the potential of using motion-based adaptive cognitive training with individuals with ABI. We are currently recruiting more participants from the inpatient facility and the community to assess the effectiveness of this training for improving executive functions in individuals ABI and the transfer of training into daily-life functioning.
A Dark Room - A documentary presentation on the psychiatric effects of head injuries in hockey players

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: Oral

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Psychiatrist Dr. Shree Bhlerao and resident Dr. Ryan Todd have helped to create a documentary that shares their experiences and scientific knowledge about hockey head injuries from the clinic. They have combined their passion for hockey with their medical background to highlight the relevant mental health issues facing their patients with hockey head injuries. Using scientific rigour, they have helped to ensure the film accurately depicts the true essence of psychiatric issues facing their patients.

Film Summary

A Dark Room offers a sobering look into the world of contemporary Canadian hockey culture. It underlines the passion and commitment shared by professionals and amateurs alike while choosing to focus specifically on the stigma and devastating effects of head injuries in players' lives. Award winning director Joe Recupero and esteemed producer Dorlene Lin have put a very real and compassionate face on a concern which until recent times has been ignored or shrugged off by the macho attitude of players and coaching staff alike.

Central to the film is former American Hockey League player, Max Taylor whose story is one of coping with and recuperation from a head injury sustained during his professional career. Family members speak about Max's early years in the junior leagues, his subsequent injuries and the challenges of his slow and ongoing recovery from the psychiatric repercussions of head trauma.

Toronto hockey enthused psychiatrists Dr. Shree Bhlerao and Dr. Ryan Todd describe their own experience with blows to the head and how, as health professionals, they were subsequently drawn into the field of head injuries. As front-line clinicians, they work to reconcile their love of the game and its gritty mythology with the medical reality they see every day.

The film outlines both the short and long-term psychiatric effects of head injuries and concussions as well, as recent breakthroughs in diagnosis and treatment. There is also discussion about the violence in sport and the near impossible task of reconciling the visceral appeal of contact sport and it’s prominent place in our current culture with the more common sense concerns of injury. Hockey greats Eric Lindros and Hayley Wickenheiser along with sports writers Michael Landsberg and Stephen Brunt are just a few of the many sports and health professionals who offer their personal insights and advocate that mental health needs to be discussed more openly in the hockey community.

While the room remains dark for countless people suffering from head injury, this film succeeds in casting initial shafts of light and understanding into a place overlooked and misunderstood for far too long.
Prevalence and predictors factors of heterotopic ossifications in people with severe acquired brain injury in intensive rehabilitative unit: a national multicentric observational cross survey

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Background: Heterotopic Ossifications (HO) in patients with severe Acquired Brain Injury (sABI) seem to have a different distribution in intensive rehabilitation units. Evidence in the literature are no uniqueness in the determinants: the severity of the traumatic injury, the autonomic dysregulation, coma or mechanical ventilation prolonged duration, the coexistence of fractures treated surgically, while some aspects of the clinical care pathway (such as the interval time between acute event and admission in rehabilitation), are almost absent.

Objectives: A prevalence study, in sABI people admitted in intensive rehabilitation units, trying also to detect what are the clinical and pathway factors that may influence significantly the presence of the HO.

Methods: We studied all adult (≥ 18 yy) sABI patients admitted (first admission) on the date of May 28, 2015 in 48 rehabilitation units of 19 italian regions. For each patient, we verified the HO presence and number and we collected several clinical and pathway data, among which: date and severity of sABI, date of admission in rehabilitation unit, etiology, coma and mechanical ventilation length, specific mobilization in acute phase, LCF, DRS, alkaline phosphatase and serum calcium at the survey date, autonomic dysregulation and spasticity presence and so on.

Results: We investigated a total amount of 697 sABI persons, 95 of which (14%) had one or more HO. In 53% they had a single HO, 39% two and 10% three or more. Anoxic and traumatic etiology distribution seems to have a different statistical weight between group with (W) and without HO (O). We also found significant differences between W and O group for:

- interval length (dd) between the sABI and admission to rehabilitation;

- mean and median coma and mechanical ventilation length;

- specific mobilization performed in acute phase;

- autonomic dysregulation and spasticity (ash≥ 3) presence.

Conclusions: The prevalence of HO can be considered a complication still significant (14%) in the sABI population. The HO predisposing factors appear to be related to the coma and mechanical ventilation length, the spasticity and autonomic dysregulation presence, while a short time interval between the acute event and rehabilitation admission and early and regular mobilization in the ICU phase seem to be
protective factors. The statistical analysis is still in progress in order to identify other, even regional or local, significant differences.
What factors influence whether a fall in an older adult will result in head impact? Evidence from a cohort study in long-term care analyzing video-captured falls.

Author's preference: Oral

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Objectives: Falls cause 80% of traumatic brain injuries (TBIs) in older adults, and any fall from standing that results in head impact can cause TBI. The biomechanical and physiological factors that associate with risk for head impact during falls in older adults have not been determined. To provide insight on this issue, we collected and analyzed video footage of real-life falls in the high-risk long-term care (LTC) setting, to test whether the odds for head impact in the event of a fall associate with physical and cognitive function, disease diagnoses, and use of medications.

Methods: We conducted this prospective cohort study in two long-term care facilities in British Columbia, Canada. Between April 2007 and June 2014, we captured videos of 520 falls experienced by 160 residents (100 women and 60 men) of mean age 81.7 (SD = 9.5). Each fall video was analyzed with a structured, validated questionnaire to determine the characteristics of the initiation, descent, and impact stages of the fall. Using generalized estimating equation models, we examined whether head impact, and other fall characteristics, associated with pre-existing health status, acquired through the computerized minimal data set (on average 2.1 months before the fall (SD = 1.6; range: 0 – 5.8)).

Results: Head impact occurred in 33% of falls (n = 170). Injuries were documented for 29% of cases. In multivariate models, residents with intact to mild cognitive impairment had higher risk for head impact (odds ratio 2.8, 95% confidence interval 1.5-5.0) than those with more severe cognitive impairment. Impaired vision was associated with 2.0-fold (1.3-3.0) higher odds of head impact. Women were 2.2-times (1.4-3.3) more likely than men to impact their head during a fall. Age, disease diagnoses, and use of medications did not associate with the odds for head impact. The site of impact was the back of the head in 44.1% of cases, side in 31.2%, front in 21.2%, and top in 3.5%. Landing in a forward direction - while less common than backward or sideways – created 3.5-fold greater odds for head impact than backward or sideways landings. While hand impact occurred in 64% of falls, it did not reduce the odds for head impact.

Conclusions: Head impact occurs in one-third of falls in LTC, and strikes a wide range of the resident population, suggesting the need for a universal (versus risk screening) approach to prevention. Factors that increased the odds for head impact were female sex, relatively intact cognitive performance, impaired vision, and landing in a forward direction. Our results should help to guide interventions (exercise programs, protective gear and improvements to the built environment) to reduce the frequency and consequences of falls that involve head impact in high-risk settings such as LTC.
Time Interval Reduction for Delayed Implant-based Cranioplasty Reconstruction in the Setting of Previous Bone Flap Osteomyelitis

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: Re-infections following implant-based cranioplasty, in the setting of previous bone flap osteomyelitis, are unfortunately common and associated with significant morbidity. Currently, the timing of reconstruction following initial osteomyelitic bone-flap removal remains controversial; most advocate for prolonged time intervals around 6-12 months. With this in mind, we chose to investigate our delayed cranioplasty outcomes following both "early" (between 90-179 days) and "late" (≥180 days) time intervals with custom cranial implants to determine if timing affected outcomes and rates of re-infection.

Methods: A retrospective cohort review of 25 consecutive cranioplasties performed at a multidisciplinary center from 2012-2014 was conducted under IRB approval. A non-parametric bivariate analysis compared variables and complications between the two different time interval groups defined as: "early" cranioplasty (between 90-179 days) and "late" (≥180 days) cranioplasty.

Results: No significant differences were found in primary and secondary outcomes in patients who underwent "early" vs "late" delayed cranioplasty (p>0.29). The overall re-infection rate was only 4% (1/25) - with the single re-infection occurring in the "late" group. Overall, the major complication rate was 8% (2/25). Complete and subgroup analyses of specific complications yielded no significant differences between the early and late time intervals (p>0.44).

Conclusions: Our results suggest that "early" delayed cranioplasty is a viable treatment option for patients with previous bone flap osteomyelitis and subsequent removal. As such, a reduced time interval of three months - with equivalent outcomes and re-infection rates - represents a promising area for future study and aims to reduce the morbidity surrounding prolonged time intervals.
Development and Validation of a Tool for Analysis of Hockey Related Head Impacts Captured on Video

Status: Accepted Presentation type: Oral

Category: Neurotrauma – prevention and public health

Author's preference: No preference

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Objectives: Ice hockey accounts, by far, for the greatest number (44%) of sports-related head injuries in Canada, and rates of concussion in hockey are twice as high as in football. Improvements in prevention require a better understanding of the circumstances of head impacts in ice hockey. In this study, we developed and tested the inter-rater reliability of a 32-item questionnaire that examines, based on video footage, the biomechanical, situational, and environmental aspects of body checks in ice hockey that resulted in head impact. Eight of the 32 questions were adopted from Hutchison et al., Br J Sports Med, 2013, and eight were adopted from Mihalik et al., Pediatrics, 2010.

Methods: The questionnaire focused on head position, site of impact, and nature of struck object (12 items), anticipation of collision (8 items), player speed and trajectory (4 items), upper limb impact dynamics (6 items), and game situation. Inter-rater reliability was tested using 30 randomly selected NHL hits that involved head impact, 18 of which were from the NHL Department of Player Safety’s website and 12 of which were from YouTube. All events were from the 2011-2012 through 2014-2015 hockey seasons. The videos were randomly assigned to two of seven trained, university-aged analyzers. For each question, we examined the percent agreement between analyzers, and the corresponding Kappa value, interpreted based on Landis & Koch’s recommendations (0.00-0.20 = slight agreement; 0.21-0.40 = fair; 0.41-0.60 = moderate; 0.61-0.80 = substantial; 0.81-1.00 = almost perfect).

Results: All 32 questions answered had a percent agreement between analyzers of 70 or higher (mean 85, SD = 10) and 30 questions answered had a Kappa value of 0.40 or higher (mean = 0.71, SD = 0.15). Eight of these 30 questions were classified as having "almost perfect" agreement, 13 had "substantial," 8 had "moderate," and 1 had "fair." Among the 30 videos, the head was the first contact site in 76% of cases. The striking object was an opposing player's shoulder in 33% of cases, hand in 17% and elbow in 13%. Secondary head impact occurred in 27% of cases. 62% of impacts occurred to the side of the head, delivered with the head facing down in 48% of cases, and rotated sideways in 82%. Players appeared to be aware (looked toward) the impending impact in 48% of cases, but in only 17% of cases did they initiate protective responses (e.g., arm raise).

Conclusions: Our 32-item questionnaire appears to be a reliable tool for analyzing the biomechanical circumstances of head impacts in ice hockey. Future analyses with this tool should generate an improved understanding of the initial and boundary conditions surrounding these events, for the design and evaluation of strategies to decrease the risks for TBI in hockey.
0831

Minor Brain Injury in anticoagulated patients: facing the cost effectiveness of a 48h in-hospital observation protocol.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: anticoagulation therapy is being increasingly employed to treat or prevent thromboembolic disease. As a result, brain injury in anticoagulated patients is becoming a major clinical challenge with a significant impact on public health system. Due to the higher risk of traumatic intracranial hemorrhage (tICH), the management of these patients is controversial. In particular, the value of sequential Head Computed Tomography (HCT) scan identifying delayed hemorrhage is still a matter of debate.

Precautionarily, at our institution patients are admitted for a 48-hours observation period and submitted firstly to a noncontrast head computed tomography (CT1) followed by a subsequent CT before being discharged (CT2) in order to exclude delayed intracranial hemorrhage. This study was conducted to evaluate yield and advisability of this approach as well as the amount of its costs on health system.

Methods: we performed a retrospective, observational study of all patients on chronic anticoagulation treatment consecutively admitted to our emergency department for minor head injury between March 2010 and September 2015. We reviewed demographic data, medications, injury mechanism, international normalized ratio (INR) and neurological examinations. We assessed the frequency of ICH on both the initial noncontrast HCT and on the routine 48-hour follow-up HCT.

Results: three hundred forty-four patients were included in this study. 7 patients (2.03%) had positive CT1 while 337 (97.9%) were initially negative. Among these latter, mean age was 78 years and 216 (62.2%) were female. The most common mechanism of injury was fall from standing, reported in 221 patients (65.5%). The great majority of patients were treated with warfarin (290, 86%) or acenocoumarol (30, 8.9%) alone; 6 patients (1.7%) were on concomitant antiplatelet therapy. INR was within the therapeutic range in 140 subjects (41.5%) and above in 69 (20.4%). CT2 was performed on 284 patients and was positive in 4 patients (1.4%). However, neither they developed concomitant neurologic worsening nor needed neurosurgery. None of the four patients with delayed bleeding had a supratherapeutic INR (greater than 3) at admission.

Conclusions: the incidence of delayed ICH we investigated in our study was 1.4% but none of the delayed findings were clinically significant and patients were discharged without any intervention required or functional impairment. Ultimately, these data are consistent with those of previous studies suggesting that, despite substantial resource use, the yield of routine delayed imaging is extremely low and unnecessarily burdens the health system.
Objectives: To examine the effectiveness of Amantadine HCL, a Glutamate antagonist at the NMDA receptor, in treating medication resistant dysregulated behavior, resulting from traumatic brain injury in children and adolescents.

Methods: 57 children and adolescents, ages 6 to 18 years, (37 boys, 20 girls), were referred for evaluation and management of frequent episodes of behavioral dysregulation manifested by the sudden onset of verbally and physically violent temper outbursts, out of proportion to the circumstances at the time. All had been unsuccessfully treated with at least 4 medications including stimulants, atypical antipsychotics, antidepressants/antianxiety and mood stabilizing medications. All were taking at least 2 medications when Amantadine was begun. Previously prescribed medications were continued while treatment with Amantadine was initiated.

Results: Fifty three (53/57) children tolerated Amantadine and had complete control of dysregulated behavior. Side effects resulted in amantadine being discontinued in 4 cases (Levido Reticularis in 2, abdominal discomfort in 1 and intense irritability in 1).

Forty three (43/53) children had control of an associated disorder of attention. Eight (8) children benefited from treatment with amphetamines in addition to Amantadine.

Fifty (50/53) children had a significant reduction in anxiety. Three (3/53) children benefitted from treatment with Selective Seratonin Reuptake Inhibitors in addition to Amantadine.

Conclusions: Amantadine antagonizes the stimulating effect of Glutamate at the NMDA receptor. Excessive stimulation contributes to the dysregulated behavior in previously treatment resistant children and adolescents following traumatic brain injury. Amantadine, by antagonizing the effect of Glutamate at the NMDA receptor, controlled the dysregulated behavior. The resolution of symptoms resulting from treatment with Amantadine HCL emphasizes the organic nature of this disorder and refutes the concept of the dysregulation being related to parent/child interaction disorder and conduct disorder. Of the medications previously used to treat the children and adolescents in this report, none are known to have
The last decade there is a growing interest in children with acquired brain injury (ABI), traumatic (TBI) and non-traumatic (n-TBI). Medical treatments improve, a growing number of children survive, more methods for assessing neuropsychological functioning are available, even cognitive rehabilitation methods are popping up and last but not least there is a growing interest in daily living and school performances.

After initially successful medical treatment in the acute phase, followed by successful rehabilitation in the rehabilitation phase, the child with ABI appears to be as normal as it was before the brain injury. However, a previously normal functioning child starts to demonstrate deterioration in cognitive functioning over time: it seems like it ‘grows into a deficit’ in the chronical phase. These deficits become evident in intellectual functioning and in learning difficulties, in unexplained tiredness and headaches and in behavioral changes. Consequently, these children do have problems in keeping up with regular school performances.

Our focus is on the need for understanding a child with ABI. On the need to inform the child, their siblings and parents, their peers and teachers.

Literature suggest that improvements can be made in early diagnosis, in transitions, in increasing expertise, transfer of knowledge and expertise and in long term monitoring.

It becomes more evident that children with acquired brain injury are vulnerable for long term sequelae in neuropsychological functioning. A lot of work has to be done for these children in the chronical phase at home as well as at school.

One of the most important factors in brain injured children who experience long term sequelae is the break in a regular school career. In the Netherlands an example of an intensive treatment / school reintegration program is developed, the ABI observation class. This program is carried out in a school class setting for a period of 2-10 months. In four phases the child’s cognitive level, academic skills and social skills are assessed, rehabilitated, and trained in practice before the transition to school is made. Cognitive and physical rehabilitation is integrated in the program. Every six weeks individual goals are set and evaluated by the team and the parents. A realistic school perspective with the special needs for that child with ABI, is needed. A well-trained team, specialized teachers together with therapists, a neuropsychologist social worker, family therapist and a pediatric rehabilitation physician, working interdisciplinary together can provide this. After ABI children can have a successful school career.
Structure (DWI) and Function (PET Metabolism) Connectivity of the Default Mode Network in Severely Brain Injured Patients

Status: Accepted Presentation type: Oral

Category: Technology – basic research

Author's preference: Oral

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Objectives: Literature exists showing cerebral metabolic and structural dysfunction of patients with chronic disorders of consciousness. No study has directly investigated how the structure (MRI DWI)-function (PET metabolism) relationship is affected in this population. In this study we aimed to assess this relationship in the default mode network (DMN) patients with varying levels of consciousness (UWS, MCS, and EMCS).

Methods: We studied 25 chronic (>1month) severely brain-injured patients and 14 healthy subjects using two neuroimaging modalities: diffusion-weighted MRI and 18F-FDG-PET imaging. The analysis focused on four regions per hemisphere (thalamus, frontal cortex, precuneus, inferior parietal cortex) comprising the DMN.

Each subject's T1-weighted image was labelled using the Desikan-Killiany atlas using Freesurfer (v 5.3.0). Labels were combined to produce eight regions of interest. White matter and brain masks were produced by combining Freesurfer and FAST (part of FSL) segmentation methods. DWI were corrected for vibration artifacts, subject motion and eddy current-induced distortions. Diffusion tensors were fit at each voxel using non-linear least squares fitting and fractional anisotropy (FA) was computed. Next, non-negativity constrained spherical deconvolution was performed, fiber orientation distribution functions within each voxel were estimated and probabilistic tractography was performed. Tracks were affine transformed to the T1-weighted image and mean FA of each bundle was extracted.

FDG-PET underwent partial volume correction using the Muller-Gartner-Rousset method in PVElab v. 2.2. The mean partial volume-corrected FDG-PET signal in each of the eight regions of interest was calculated. Standardized uptake value within each region was calculated. The entire processing pipeline is visualized in Figure 1.

Structural and functional markers were averaged over each hemisphere. Average SUV and FA were compared between groups using ANOVA with Tukey's HDD. Linear regression models were used to see if metabolism could be predicted by FA and demographic factors such as diagnosis and etiology.

Results: A profound decline in function and structure was found in patients compared to healthy subjects. Interestingly, structure of brain injured patients was found to have no relationship with metabolism, while in healthy subjects structure of the cingulum and superior longitudinal fasciculus was significantly related to metabolism in frontal, precuneal, and inferior parietal regions (Figure 2). No structure-function relationship with the thalamus was found. However, a relation seems present between thalamus and frontal cortex in EMCS patients, having a stronger structure-function relationship compared to both UWS and MCS patients.
Conclusions: Loss of structure function relationship is brain injured patients could be due to methodological problems associated with DWI, or perhaps because regions function more as isolated islands rather than in a network. The stronger structure function relation of the thalamus and frontal cortex in EMCS patients compared to DOC patients is in line with the hypothesis that recovery of thalamo-cortical connectivity is essential to sustain some level of consciousness.
Monitoring neuroplasticity in TBI: Motor function recovery years after injury

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Background: We recently published functional magnetic resonance imaging (fMRI) evidence of neuroplastic change during the remarkable recovery of Canadian soldier Captain Trevor Greene (D’Arcy et al. J Head Trauma Rehab, 2015). Captain Greene survived a penetrating axe blow to the top of the head while on tour in Afghanistan, 2006. Whole brain fMRI activity in motor regions corresponded closely with recovery of motor function during rehabilitation of walking ability. The fMRI evidence was the first demonstration of neuroplasticity in motor function recovery more than 6 years post-injury.

Objectives: The current study focused on identifying the specific neuroanatomical regions with the greatest neuroplastic improvements across the 3 year, 12 fMRI session longitudinal study.

Methods: The longitudinal acquisition of 12 functional MRI sessions were acquired every three months. Task-based fMRI scans of a lower limb extension task (4-5 extensions in 20 second block, 20 s rest between blocks, alternating left and right leg per block; 7 rest, 6 active blocks) were collected on a 1.5 T GE Signa HDx. First level fMRI analysis was done using FSL FEAT, yielding activation Z-scores for each session. Voxels showing Z-scores > 2.3 (p < 0.05) were concatenated into 12 whole brain activation maps and underwent data-driven analyses using independent component analysis (ICA) using FSL Melodic function. The components were examined for time courses and localized neuroanatomical regions in which consistent increase of brain activity occurred over three years.

Results: Data revealed neuroplastic changes of greatest intensity in right hemisphere brain activity, consistent with a left greater than right motor performance asymmetry. In addition, two prominent bilateral clusters were observed laterally in primary and secondary motor cortices (i.e., motor regions not typically involved in lower limb movement). The pronounced plasticity changes outside of the injured primary lower limb motor regions demonstrated reorganization of nearby motor cortices. Importantly, all changes of brain activity correlated with clinical behavioural assessment scores r = 0.76 (p<0.005).

Conclusions: Neuroplasticity several years after injury showed patterns consistent with both behavioural recovery and neuroimaging evidence of plasticity. There was clear evidence of correspondence between fMRI results and clinical behavioural recovery of function. Specific neuroanatomical analyses highlighted reorganization of nearby intact motor regions. The current results support the emerging role of fMRI in monitoring recovery progress after severe TBI. Future work will examine functional connectivity to better characterize neuroplastic changes in rehabilitation of motor networks.
Combined skull and spine injuries during sea sports activity

Objectives: Aim of this study was to review cases of combined skull and spine injuries during sea sports activity

Methods: During a 10 year period (2000-2010), 40 individuals with combined skull and spine injuries during sea sports activity were admitted to our hospital. The injuries resulted mainly from falls during sea related sports,

Results: Emergency CT-scan was performed in all 40 cases (100 %).

Surgery was required in 4 cases of severe brain injuries and in 4 cases of severe spine injuries. Other injuries (leg and arm) were presented in 20 cases (50%)

Conclusions: Accurate initial support and primary health aid care for patients with appears to be necessary for patients with combined skull and spine injuries.

Key words: skull injuries, athletes, trauma, spine injuries, sports sea activity
A Systematic Method For The Emergency Room Assessment Of Head CT In Patients With Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: Traumatic brain injury (TBI) is a public health problem that causes high mortality and disability in young economically active population. Computerized tomography (CT) of the head is the gold standard method for initial evaluation of TBI patients in the emergency room (ER). There are generic recommendations in order to identify the most common injuries, however there is no correlation between this recommendations and specific identification of TBI patients that requires emergency surgery. The objective of this study was to evaluate and establish the diagnostic value of a standardized method for the initial assessment of the CT in patients with severe TBI that requires emergency surgery.

Methods: A cross-sectional study was performed. Eight CT of patients with severe TBI were used. We compared two methods of reading the CT including the proposed method compared with the generic recommendations of the ATLS 9th edition textbook. The new method consists of 5 steps (ABCDE) based on the acronyms: Abnormal findings, Blood Volume, Cisterns Compression, Deviation from Midline and External Elements. CT was read by matched samples of medical students, residents and emergency physicians. Participants were randomized and blinded. The results were compared with the original reading of neurosurgeons looking for surgical indications. We measured the sensitivity, specificity, PPV, NPV and the accuracy rate for the two methods using standard statistics.

Results: We analyze 504 readings made by 63 participants; the first group performs 264 readings and the second group 240 readings. The time used to read each tomography on both groups was 4.9 ±3.9 vs 4.2 ± 2.6 min, p=0.005. Abnormal findings in the head CT were identified using the ABCDE method with a sensitivity of 88.3% vs 84.1%. The specificity was 88.9% vs 90%. The PPV was 72.6% vs 72.6% and the NPV 95.8% vs 94.8%. The Kappa value was 0.72 vs 0.7 (p= <0.01); Blood Volume detection sensitivity was 67.5% vs 56.8% and specificity 41.6% vs 45.3%. PPV was 66.2% vs 64.9% and NPV 43% vs 37.1%. The Kappa value was 0.09 vs 0.02 (p= >0.05); Cisterns Compression: sensitivity 48% vs 42.3%, specificity 51.7% vs 47.6%, PPV 74.6% vs 72%, NPV 25.2% vs 20.5 % and Kappa -0.002 (p= >0.05); Deviation from Midline: sensitivity 55.6% vs 41.8%, specificity 60% vs 47.6%, PPV 80.6% vs 71.8%, NPV 31% vs 20.4%, Kappa 0.11 vs -0.73 (p= 0.03); External Elements: sensitivity 43.3% vs 40.9%, specificity 0% vs 0%, PPV 100% vs 100% NPV 0% vs 0%, Kappa 0 (p= >0.05).

Conclusions: The systematic ABCDE method for the initial analysis of the head CT scan in patients with TBI compared with the generic recommendations of the ATLS textbook, evidence better diagnostic value to identify serious injuries and the requirement of emergency surgery.
Preliminary Investigation of Brain Network Activation (BNA) Following Sport-Related Concussion

Status: Accepted Presentation type: Oral

Category: Technology – clinical research/applications

Author's preference: No preference

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Background: Clinical diagnosis, management and treatment of patients with sports-related concussion (SRC) are based on clinical exam/interview, symptom reports, and functional assessments of impairment (e.g., cognitive, vestibular, oculomotor). These measures represent indirect assessments of injury to the brain. Direct measures of injury such as neuroimaging, blood biomarkers, and electrophysiological markers for SRC are currently lacking for clinical application. There is a significant need for more objective tools that can corroborate and extend current functional assessments and help inform clinical decision-making for SRC. Brain Network Analysis (BNA), which is a high-density, multi-channel EEG/Event Related Potentials (ERP)-based mapping and analysis tool that generates functional brain activity networks characteristic of a specific disease or condition, offers a potential physiological marker for SRC.

Objectives: To evaluate using a repeated measures prospective design the utility of BNA as an assessment of brain function to differentiate concussed from healthy young athletes.

Methods: The study comprised pooled data of athletes with a diagnosed, symptomatic SRC and matched controls from two university concussion clinics located in Pennsylvania and Michigan. Both samples included a two-arm, prospective study conducted to evaluate BNA's utility to assess brain network impairment and recovery following SRC. A total of 152 subjects (80 concussed, 72 controls) aged 14-24 years were enrolled in the study and completed 4 visits of BNA assessments. The first assessment was conducted at 2-10 days post injury. The BNA analysis involved comparing athletes' recorded ERPs during the performance of an auditory oddball task to normative, age-matched reference networks. BNA similarity scores ranged from 0-100, where 100 represented a complete match between a participant's score and the matched groups' normative networks.

Results: An age-based analysis revealed that concussed subjects aged 16-24 years showed decreased BNA scores immediately following SRC compared to age-matched controls at the initial post-injury clinic visit (F[1,198.95] = 4.28, p<0.05). The difference between concussed subjects and healthy controls was further enhanced in concussed subjects with total symptoms score above 35. (F[1,372.99] = 291.07, p<0.0001). In contrast, BNA scores remained stable across time in healthy controls. The difference in BNA scores between the two groups was not significant when all age groups were grouped together.

Conclusions: The use of BNA may help differentiate patients with concussion from healthy controls immediately following SRC onset. Current findings provide initial support for using BNA to track brain network changes following SRC. BNA may help to augment current clinical approaches to assessing and monitoring recovery from SRC.
Undertriage In Severe TBI: Review Of A Population-Based Emergency Department Data Base.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: No preference

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Objectives: An injured patient should be transported to the appropriate level of care in the shortest practical time. Undertriage occurs when severely injured patients receive care in facilities that may not have the resources or expertise to appropriately treat the injury. Approximately 1/3 of severely injured patients are treated in hospitals without a Level I or II trauma center (TC) designation. In an analysis of the 2010 National Emergency Department Sample (NEDS) dataset, 40.2% of undertriaged individuals had a TBI diagnosis but the undertriage rate in severe TBI remains unknown.

Methods: National estimates were derived from the 2012 NEDS. Emergency department visits with a severe TBI were identified using the Barell Matrix. Type I TBI, with codes indicating intracranial injury, moderate/prolonged loss of consciousness, or injuries to optic nerve pathways, was considered severe. Undertriage occurred when an individual sustaining a severe TBI received definitive care in a hospital other than a level I/II TC. Transfers to other hospitals were excluded as they were likely transferred to a higher level trauma center for definitive care. Individuals who died in the ED were excluded. Weighted descriptive analysis examined characteristics of those undertriaged. Multivariable logistic regression was used to predict undertriage, adjusting for patient and hospital characteristics.

Results: Nationally, an estimated 21,248,153 trauma ED visits included ~134,000 (0.6%) severe TBIs. Of the 58,444 (43.6%) severe TBIs seen not seen in a level I/II TC, almost half were admitted with only 4.4% subsequently transferred to another hospital. After excluding ED deaths (1.4%) and transfers (32.7%), 37,225 (34.3%) of individuals with severe TBI did not receive definitive care at a level I/II TC. 27,843 (74.8%) of severe TBI were admitted and 2,632 (9.5%) died in hospital. Routine discharges from the ED accounted for 16.7% of the severe TBI while 8.4% were discharged to other healthcare. After adjustment for demographic and clinical characteristics, the odds of undertriage were higher in women (Odds ratio [OR]=1.22; 95% Confidence Interval [CI]=1.23-1.31), the uninsured (OR=1.47; 95% CI=1.12-1.93) and those covered by Medicare (OR=1.51; 95% CI=1.24-1.85). The odds of undertriage increased with increasing age; those aged over 85 had an OR of 3.40 (95% CI=2.65-4.36) compared with those aged 16 to 25. Mechanism of injury and region of country were not significantly associated with undertriage while having multiple injuries was associated with a decreased odds of undertriage (OR=0.6; 95% CI=0.53-0.68).

Conclusions: After excluding transfers to another hospital and deaths in the ED, 34.3% of severe TBI were undertriaged. The odds of undertriage were higher in women, older individuals, those covered by Medicare and the uninsured. Once admitted, few were transferred to another hospital. Further research is needed to find out why certain groups are more likely to be undertriaged.
Assessing self-perceived cognitive functioning in everyday life after ABI prior goal-setting in rehabilitation

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: The aim was to explore how a combination of self-report questionnaires could be used to identify clients' self-perceived problems in everyday life prior to goal setting in rehabilitation after ABI.

Design: A cross-sectional design was used in this study with comparisons between and within two matching groups (ABI and healthy controls).

Methods: The participants were requested to fill out the Community Integration Questionnaire (CIQ), the Comprehensive Assessment of Prospective Memory (CAPM) and the Cognitive Failure Questionnaire (CFQ). Descriptive statistical analysis were carried out to provide an understanding of participants' self-perceived difficulties.

Results: Differences in total scores between the ABI group and control were not significant. The patterns in CIQ subscales showed restrictions in community integration related to both life situation and injury-related problems. The procedure when using CAPM is that total scores are calculated only on the items that was rated (1-5) by the participants and there was no significant difference between the ABI group and the healthy control group. Items deemed as not applicable by the participants were not included in the analysis. Still, analysing items marked Not Applicable in CAPM and responses in subscale home competence in CIQ confirmed that tasks was performed by somebody else more often in the ABI group. According to CFQ distractibility was the most frequent cause to cognitive failures in both groups followed by memory and blunders. The case studies illustrated self-perceived problems whereas the life situation as well as the injury-related limitations should be taken into account.

Conclusions: A combination of self-report questionnaires can contribute to illustrate the clients' perspective prior to goal setting. Thus, a comparison with normative data will not be enough. Subscales and patterns in responses contribute to the picture of the clients' self-perceived problems.
Background: Brain Injury can be elusive regarding rate of return and plateaus, stamina and drive to recover lost functionality. Different people respond to different approaches, yet if not encouraged some can be satisfied with the status quo rather than striving for continued recovery of lost function.

Objectives: Discussing the progression of out-patient care to complementary and alternative medicine to integral healthcare, for a male with ABI from infancy.

Methods: 60-year old adult male presented in a wheelchair, with crutches, for Feldenkrais, Awareness Through Movement® (ATM®) classes in April 2015. Standing with bent knees he presented at a height of less than 4’ 9”. He was able lie down with support under his knees as they would not straighten without pain. Attending weekly Feldenkrais ATM/Cortical Field Re-education® (CFR®) classes, the subject would return the following week reporting less pain. By early June 2015, he could stand at a support bar at a height of 6’ 1” to integrate lessons and work following an hour-long ATM.

Results: Following 4 months of weekly or biweekly hour long ATM lessons, the subject reports less pain and easier sleep patterns. He is more flexible. The subject presents with a straighter posture in his automated chair. He is visibly straighter when lying supine on the floor and his feet are less plantar flexed than when he first presented in this position 6 months ago. He now reports the pain has diminished but that he occasionally finds new pain in terms of soreness of muscles which have not been used before. The subject also reports having increased stamina with less likelihood of wanting to rely on his crutches to walk in the home and to use to transfer.

Conclusions: The small slow movements intrigue the cortex into learning new or lost function similar to a new born baby learning to explore his world. The subject explored the sequenced movements within the range he could easily achieve. Thus his function increases and his deficits reduce as his brain relearns its new reality. The Feldenkrais Method and CFR® has proven instrumental to the subject's recovery. The incorporation of the Feldenkrais method and of CFR® into physical rehabilitation techniques could a) easily be implemented with appropriate training of physical rehabilitation therapists and b) prove influential if administered appropriately to ABI patients.

With continued work, the subject should be able to start walking if he wants to in 12 to 18 months, but time frame is ambiguous as each person's recovery from ABI is different. The Feldenkrais Method's ATM has been instrumental in his increased mobility and self-reported decreased pain level, including noticed and mentioned changes to his physical appearance by his friends and acquaintances.

Reference: Feldenkrais, 1980 Taub, 2005
Potential novel biomarkers for the traumatic brain injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: No preference

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We have recently identified plasma levels of PrP⁰ as a potential biomarker for mild traumatic brain injury (mTBI). Using quantitative ELISA and immunoblotting methods, we are now reporting an additional novel mTBI biomarker in an animal model of blast-induced TBI and human mTBI cases. The mRNA and protein levels of this potential biomarker are elevated in the hippocampi of rats subjected to mTBI and are involved in cellular prion protein (PrP⁰) shedding. The biomarker in addition to preventing formation of toxic amyloid precursor protein (APP) fragments also boosts production of neurotrophic and neuroprotective APP related fragments.
Dual-Hemisphere Repetitive Transcranial Magnetic Stimulation for Rehabilitation Of Poststroke Aphasia: A Randomized, Double-Blind Clinical Trial

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – case reports/clinical research

Author's preference: Oral

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Objectives: Recent neuroimaging studies on poststroke aphasia revealed maladaptive cortical changes in both hemispheres, yet their functional contribution in language recovery remains elusive. The aim of this study was to evaluate the long-term efficacy of dual-hemisphere repetitive transcranial magnetic stimulation (rTMS) on poststroke aphasia.

Methods: Thirty patients with subacute poststroke nonfluent aphasia were randomly allocated to receive real or sham rTMS. Each patient received 1000 rTMS pulses (1 Hz at 110% of resting motor threshold [rMT] over the right unaffected Broca’s area and 1000 pulses (20 Hz at 80% rMT) over the left affected Broca’s area for 10 consecutive days followed by speech/language training. The language section of the Hemispheric Stroke Scale (HSS), the Stroke Aphasic Depression Questionnaire-Hospital Version (SADQ-H), and the National Institutes of Health Stroke Scale (NIHSS) were measured before, immediately after the 10 sessions, and 1 and 2 months after the last session.

Results: At baseline, there were no significant differences between groups in demographic and clinical rating scales. However, there was a significantly greater improvement in the HSS language score as well as in the SADQ-H after real rTMS compared with sham rTMS, which remained significant 2 months after the end of the treatment sessions.

Conclusions: This is the first clinical study of dual-hemisphere rTMS in poststroke aphasia. Combining dual-hemisphere rTMS with language training might be a feasible treatment for nonfluent aphasia; further multicenter studies are needed to confirm this result.
Objectives: Mild Traumatic Brain Injury (mTBI), commonly referred to as concussion, is a major public health concern. The World Health Organisation estimates that it affects 600 per 100 000 people worldwide. Post-concussion symptoms are common acute sequelae of mTBI, and include headaches, dizziness, irritability, and cognitive impairments. Despite the majority of patients recovering from these symptoms within three months, there are a considerable amount that go on to develop persistent post-concussion syndrome (PCS), whereby patients suffer from the somatic, psychological, and/or emotional effects of concussion for an extended period of time. It is, however, unclear as to the exact prevalence of these long-term negative outcomes. This study investigates the prevalence of PCS, and the quality of life of patients who were treated in the Clinical Decision Unit of Cork University Hospital in 2013.

Methods: The CDU database was searched to identify adults (>18) treated for mTBI in 2013. A telephone interview then took place whereby the subjects completed three questionnaires on post-concussion syndrome (RPQ), quality of life (SF-12), and functional outcome (EQ5D5L). Patient records were examined to ensure full mTBI criteria were met and CT reports, where available, were reviewed.

Results: 112 subjects were identified from the CDU database. Of these, 57 completed the telephone interview. PCS of at least mild severity was present in 21% percent of patients. They also had a decreased quality of life when compared to age-matched populations from Europe and elsewhere (including U.S., N.Z., and Japan).

Conclusions: Telephone follow up of patients with mTBI may be feasible but there is a significant loss to follow up. A proportion of patients presenting to the ED continue to suffer from PCS at approximately one year post-injury. Appropriate routine follow up is warranted including clinical pathways to appropriate specialist services when issues are identified.
In Vivo Reprogramming to Produce Functional Neurons Following Traumatic Brain Injury

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Traumatic brain injury (TBI) results in a significant amount of cell death in the brain. Unfortunately, the adult mammalian brain possesses little regenerative potential following injury and little can be done to reverse the initial brain damage caused by trauma. The objective of this project is to generate new neurons in the adult brain to replace the damaged neurons following TBI.

Methods: There is a large number of reactive glia surrounding the injury area following TBI. Reprogramming adult cells to generate induced pluripotent stem cell (iPSCs) has opened new therapeutic opportunities to reprogram these reactive glia to neural fate with the four transcription factors, Oct4, Sox2, Klf4 and c-Myc for possible cell-replacement therapy in vivo.

Results: In this study we show that four retroviral mediated transcription factors, Oct4, Sox2, Klf4 and c-Myc, expressed in the reactive glial cells and cooperatively reprogrammed infected glia into iPSCs in the adult neocortex following TBI. These iPSCs further differentiated into a large number of neural stem cells, which further differentiated into neurons and glia in situ, and filled up the tissue cavity induced by TBI. The induced neurons showed a typical neuronal morphology with axon and dendrites, and exhibited action potential. The glia were preferentially astrocytes and oligodendrocytes, but not microglia.

Conclusions: Our results report an innovative technology to transform reactive glia into a large number of functional neurons in their natural environment of neocortex without embryo involvement and without the need to grow cells outside the body and then graft them back to the brain. Thus this technology offers hope for personalized regenerative cell therapies for repairing damaged brain.
Are Falls Presenting to the Emergency Room a Sentinel Event?

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: Falls have become the most common cause of injury in many locations in the United States. Presentation of same level falls is an increasing population of patients seeking medical attention through the emergency room. The performance improvement review at a regional level-two urban trauma center revealed a significant number of patients was being seen and discharged from the emergency room for same level falls. We hypothesized the initial fall may represent a sentinel event which may require further work up and interventions if follow-up was mandatory. A retrospective review of all patients who presented to our trauma center and discharged for falls with minimal injury where reviewed to comprehend both the nature of the injury and the potential opportunities for preventative intervention.

Methods: Retrospective reviews of all patients who presented with a diagnosis of fall and were subsequently discharged home from the emergency room at an urban level two trauma center were reviewed. Data collected included patients age, sex, type of injury, ISS score, RTS, GCS, discharge diagnosis, home medications, associated medical conditions, and directed follow up instructions. Data was collected and evaluated for statistical significance.

Results: Review of the discharges from our level two trauma center provided a patient sample of 1,451 patients. 1041 patients with a diagnosis of fall with injury were discharged to home from the emergency room over the nine month study period. 50% of these patients were over 65 years of age. In the older age group the average age was 80.6. None of the patients in the older age group were referred for further evaluation despite a high percentage of co-morbid conditions. There also appeared to be an under-appreciation of symptoms associated with balance.

Conclusions: This retrospective review of discharges from an active urban level 2 trauma center would indicate there is a significant opportunity to intervene in patients who seek attention for symptoms of injury associated with falls. Interventions such as balance training, medication adjustments, and treatment of co-morbid conditions may decrease ER visits in a meaningful way.
Time-based mortality in Patients with Traumatic Brain Injuries

Status: Accepted Presentation type: Poster
Category: Neurotrauma – case reports/clinical research
Author's preference: No preference

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Objectives: Traumatic brain injury (TBI) is a major cause of morbidity and mortality worldwide. We studied the time-based mortality pattern in TBI patients.

Methods: A retrospective observational analysis was conducted for all TBI patients admitted in a level 1 trauma center between 2010 and 2014. Patients were divided into 3 groups according to the time of death post admission to the emergency department (Group 1: with the first day, Group 2: first 2-7 days and Group 3: after the first week). Patients demographics, vital signs at the scene and on admission, injury severity score (ISS), head injury severity (AIS), type of TBI and hospital complications were analyzed and compared in the 3 groups.

Results: Over the study period, 946 patients (93% males) were admitted with TBI with a median age of 28 (1-86) years. MVCs were the main MOI (58%) followed by fall (28%). The mortality was higher in group 2 followed by group 1 and 3 (53%, 25% and 22%, respectively). Age, males, EMS time, scene systolic blood pressure, mean ISS, chest AIS, and abdominal AIS were comparable in the 3 groups. Head AIS was greater in group 1 whereas scene GCS was greater in group 3 and lower in group 1. Hospital pneumonia, sepsis, and ARDS were significantly greater in group 3 followed by group 2. Brain edema, and SDH were higher in group 2, whereas DAI, and EDH were significantly greater in group 3. Overall mortality rate was 24%. On multivariate analysis, age and ISS-adjusted predictors of mortality were scene systolic blood pressure (OR=0.98), scene GCS (OR= 0.84), head AIS (OR= 2.14), and brain edema (OR= 2.00).

Conclusions: TBI in Qatar is associated with high morbidity and mortality. MVC is a major cause of TBI in the young population. The peak of deaths occurs within the first week post injury. Further studies are needed to assess the long-term outcome of survivors and to reduce in-hospital morbidity and mortality.
Subconcussive Impact Exposure and Computational Modeling of the Brain Using an Atlas-Based Biomechanical Finite Element Model

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: There is increasing evidence that lifelong repetitive subconcussive impact exposure experienced in sports may result in brain alterations and cognitive impairments. To better understand the biomechanical basis of repetitive head impacts, fundamental injury mechanisms need to be well-characterized and understood. The objective of this work is to present biomechanical resources available for studying biomechanics of subconcussive head impacts. This includes concussion risk-based subconcussive impact exposure metrics combined with an atlas-based finite element (FE) model (ABM) of the brain and on-field head impact data from youth football athletes. This work is performed as part of an on-going study to relate head impact exposure to neurocognitive and imaging data to determine effects of subconcussive impacts.

Methods: The ABM FE model was developed from the International Consortium for Brain Mapping (ICBM) atlas. The mesh for the model was created from this image set using custom code developed in MATLAB. The ABM has major anatomic features of the brain including cerebrum, cerebellum, cerebrospinal fluid, ventricles, falx cerebri, tentorium cerebelli, and skull. Brain density, bulk modulus, and shear response parameters a viscoelastic formulation were varied using an Optimal Latin Hypercube Design (LHD) of experiments for optimal material parameters. Brain displacements at model neutral density target (NDT) locations were compared to experimental results. Multi-axis error was quantified using CORA (CORelation and Analysis), a quantitative method to evaluate curve correlation. The model was validated using three impact configurations with good agreement in a multi-objective optimization.

Head impact exposure was measured by instrumenting helmets of 95 youth football players on three teams (Jr Pee Wee (JPW) ages=9-10; Pee Wee (PW) ages 10-11; and Jr Midget (JM), ages 11-12) with helmet mounted accelerometer arrays during three seasons of data collection. A total of 29,637 impacts were collected. Median (and 95th percentile) impacts per player for each team (JPW, PW, and JM) were 240 (543), 268 (597), and 309 (669), respectively. Median peak linear accelerations for each team were 19.5g, 20.7g, and 22.4g and 95th percentile linear accelerations were 45.7g, 49.5g, and 52.8g, respectively.

Conclusions: We have identified accurate material properties through optimization and quantitatively matching real world dynamic biomechanical testing. We have successfully collected thousands of on-field head impacts in youth football players. Future work includes applying the on-field head impact data to the ABM to study the response of the brain to subconcussive head impacts. This new approach will allow for better characterization of strain-based measures of subconcussive impacts to complement existing exposure metrics such as the Athlete-Exposure (AE), summed acceleration, and others and will allow us to compare cumulative strain response of the brain due to subconcussive head impacts to subject-specific imaging findings.
Neural Internet: Web surfing with brain potentials for the completely paralyzed

Status: Accepted Presentation type: Poster

Category: Technology – clinical research/applications

Author's preference: Poster

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Neurological diseases such as amyotrophic lateral sclerosis (ALS), Guillain-Barré syndrome or brainstem stroke can lead to severe or total motor paralysis often referred to as locked-in syndrome, where the intact intellect is locked into a paralyzed body. For such patients invasive and non invasive EEG controlled brain-computer interface (BCI) systems (Karim et al., 2006; J. Neurorehab. & Neural Repair) have been developed enabling them to write messages independently of voluntary muscle control. The goal of this study was to probe the feasibility of a web browser based on self-regulation of brain potentials and to investigate the effects of this technology on the quality of life of locked-in patients. This innovative technology, which we call Neural Internet, enables severely paralyzed patients to regain a certain level of autonomy in the interaction with the outside world, such as writing, sending and receiving private emails from relatives and friends without an intermediary (a caregiver or a nurse) and thereby enhance their quality of life.
Imaging of Myelination in Brain Injury

Status: Accepted  Presentation type: Poster

Category: Technology – basic research

Author's preference: Oral

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Objectives: Destruction or changes associated with myelin in the CNS play a key role in brain injury and related neurodegenerative disorders. Novel therapies are currently under development to prevent demyelination and promote remyelination. For efficacious evaluation of these myelin-targeted therapies, a major challenge is assessing and quantifying changes in myelin content in vivo. To meet this unmet need, we have developed a PET probe ([11C]-MeDAS) that readily enters the CNS and selectively binds to myelin membranes. Here we reported its application in image-guided myelin repair therapies in an animal model of MS.

Methods: 1) Lysolecithin (LPC) was administered to the brain and spinal cord via stereotactic injection; 2) The LPC rats were treated with a mesenchymal stem cell-based hepatocyte growth factor (HGF) to promote remyelination. 3) The time course of myelin changes were quantitatively monitored by longitudinal microPET imaging in the brain and spinal cord and correlated with histological analysis.

Results: 1) Focal demyelination in the brain and spinal cord was induced by LPC; 2) HGF treatment showed significant remyelination; 3) Quantitative imaging analysis showed that the uptake and retention of [11C] MeDAS correlated well with the level of demyelination/remyelination in the brain and spinal cord.

Conclusions: [11C]MeDAS-PET is a promising imaging marker to monitor the changes in myelination in vivo, which is capable of monitoring myelin-targeted drug effects.
Factors that Predict Two Year Post-trauma Communication Outcomes for Adults with Severe Traumatic Brain Injury

Status: Accepted Presentation type: Oral

Category: Neurorehabilitation – activities and participation

Author's preference: Oral

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Background: Understanding factors that predict communication outcomes and influence communication recovery may facilitate effective intervention that improves a person with TBI's capacity to engage in rehabilitation, maintain social relationships and achieve vocational goals.

Objectives: This study examines communication recovery following severe traumatic brain injury (TBI) by addressing the research questions: (1) What factors predict communication recovery at two years post-injury?; and (2) What associations exist between pre-injury demographic factors, injury severity, post-injury communication impairments and two year communication outcomes?

Methods: 57 participants, aged 16-67 years, with severe TBI attended comprehensive communication assessments at three months, six months post-injury and two years post injury. Predictor measures included pre-injury (gender, age, pre-morbid education), injury (PTA, GCS) and post-injury (diagnosis of aphasia, dysarthria, conversation discourse, cognitive communication and neuropsychological) data. For two year outcomes, perceived communication skills were measured using the LaTrobe Communication Questionnaire (LCQ-Other; Douglas et al., 2000). The Sydney Psychosocial Reintegration Scale (SPRS-2; Tate, 2011) provided self and other reports of psychosocial participation. Conversational participation and support outcomes were evaluated with observational ratings (Adapted Kagan Rating Scales; Togher et al., 2010).

Results: Multiple regression analyses indicated that pre-injury and injury measures predicted communication partners’ perceptions of psychosocial outcomes (p< .05) with pre-morbid education the only independent predictor of recovery (accounting for 17% variance).

Non parametric statistical comparisons showed perceived communication skills outcomes were significantly correlated with information speed/memory and executive functioning skills at six months post injury (rho= -.507; rho= -.384 p<.01). Self-reported psychosocial outcomes were significantly, positively correlated with pre-injury education (rho=.319, p<.05) and with six month aphasia and information processing speed/memory (rho=.387, rho=.339, p<.05) scores. Diverse factors were associated with other-reported psychosocial outcomes including: pre-injury education (rho=.378, p<.05); duration of PTA (rho=.432); three month executive functions (rho=.396, p<.05); three and six month information processing speed/ memory (rho=.570, rho=.546, p<.01); three and six month aphasia (rho=.435; rho=.497 p<.05, p<.01 respectively); six month dysarthria scores (rho=.334, p<.05) and cognitive communication
activity skills (ρ=.706, p<.01). Conversation participation outcomes were strongly correlated with three month information processing speed/memory (ρ=.538, p<.05) and six month aphasia (ρ=.663, p<.01), dysarthria (ρ=.556, p<.01) and cognitive communication activity (ρ=.707, p<.01).

**Conclusions:** Findings indicate premorbid education and subacute communication and neuropsychological status are key factors in determining communication recovery.
Is And Which Serum Troponin Correlate With Traumatic Head Injury Severity

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: Traumatic brain injury (TBI) is a frequent challenge and complex injury with worse outcomes. We assessed the correlation between serum Troponin and severity of head injury severity (head AIS) and which type of troponin assay (troponin T (TT), high sensitive TT and Troponin I (TI) is well correlated with the degree of head injury.

Methods: A retrospective observational analysis was conducted for all TBI patients admitted in a level 1 trauma center between 2010 and 2014. Patients demographics, vital signs at the scene and on admission, injury severity score (ISS), head AIS , type of troponin assay , type of TBI and hospital outcomes were analyzed.

Results: Over the study period, 805 patients were admitted with TBI with a median age of 28 (1-86) years. MVCs were the main MOI (58%) followed by fall (28%). In comparison to TBI with negative troponin, ejection from the car was frequent in patients with positive troponin (20% vs 13%,p=0.005). Admission blood pressure (BP) and GCS were lesser in patients with positive troponin (p=0.001). Mean ISS (28±10 vs 21±9), head AIS (4.04±1.1 vs 3.7±1.0) were greater in positive troponin TBI patients. Skull fracture (P=0.009), brain edema (p=0.001) and diffuse axonal injury (p=0.001) were more prevalent in patients with positive troponin. The rate of in-hospital pneumonia and sepsis were higher in positive troponin patients. Median ventilatory (10 vs 3 days), hospital (17 vs 13 days) and ICU (10 vs 6 days) length of stay were prolonged in positive troponin TBI patients. Overall mortality rate was 24%. Patients with positive troponin had 3-fold increase in mortality. On multivariate analysis, positive troponin was independent predictor for mortality (OR 2.71,p=0.001) after adjusting for ISS, GCS, and head AIS. Among the 3 types of troponin assay, only high sensitive troponin T correlated with head AIS (p=0.001)

Conclusions: In Qatar, TBI is associated with high mortality( one quarter of cases). Positive troponin has a 3-fold increase in mortality and prolonged hospitalization in TBI patients in the absence of traumatic cardiac injury. Further studies are needed to support our finding that high sensitive TT is recommended for risk stratification in TBI patients.
Correlation Between ImPACT Test Performance and Neuropsychological Test Performance in a 15-year-old Patient

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: The patient is a 15 year old right handed male. He was referred for an evaluation of neuropsychological functioning s/p concussion with a history of multiple concussions. Overall, brief neuropsychological testing revealed that his pattern of performance was indicative of significantly impaired and varied performance. The patient’s neuropsychological test scores represent significant impairments in the areas of processing speed and working memory, although severe deficits in sustained attention and below-expected performance in executive functioning were also noted. From a psychological perspective, the patient displayed major depression and moderate to severe generalized anxiety. These appear to be primary confounds for the patient for his thinking skills.

Methods: ImPACT Clinical Report was utilized: Memory Composite (verbal) < 1%, Memory Composite (visual) < 1%, Vis. Motor Speed Composite < 1%, Reaction Time Composite < 1%, Impulse Control Composite 2, Total score 8.

Personality Assessment Inventory- Adolescent (PAI-A) was utilized as well, there was noted significance on somatic and anxiety scales. WCST = CC = 2 TE: T= 48 PE: T = 39.

Results: The TOVA (a test of sustained attention/concentration which incorporates reaction time) score (-11.5) was moderate to severe impairment, which correlates highly with the patients moderate to severe impaired performance on the ImPACT Reaction Time Composite (< 1%).

Conclusions: In conclusion, it appears that the ImPACT does correlate with select neuropsychological measures.
Correlation Between ImPACT Score Performance and Neuropsychological Test Performance in a 58-Year-Old Woman

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: The patient is a 58-year-old female who was referred for evaluation of neuropsychological functioning after a concussive event. She presents with a history of probable concussion, with this incident occurring secondary to a work-related incident in which she apparently hit her head on a beam. She endorses a mental health history indicative of generalized anxiety disorder (GAD) and potentially major depressive disorder (MDD).

Methods: As part of her neuropsychological evaluation, the following tests were administered: Beck Depression Inventory – Second Edition (BDI-II), Beck Anxiety Inventory (BAI), Hopkins Verbal Learning Test – Revised (HVLT-R), Test of Variable Attention (TOVA), Trail Making Test (parts A and B), Word Memory Test (WMT), Wechsler Adult Intelligence Scale – Fourth Edition (WAIS-IV), Wechsler Memory Scale – Fourth Edition (WMS-IV), and Wisconsin Card Sorting Test – Computerized Version (WCST-CV). Behavioral observations revealed that the client provided an inadequate amount of effort during the testing process.

Results: Brief neuropsychological testing revealed that his pattern of test performance was indicative of significant and varied neurocognitive deficits, although this may not be reflective of her true neurocognitive capacity. From a psychological perspective, the patient displayed significant depression.

ImPACT Clinical Report was utilized: Memory Composite (verbal) 11%, Memory composite (visual) <1%, Vis. Motor speed composite <1%, Reaction Time Composite 4%, Impulse control composite 8, Total symptom score 40.

Personality Assessment Inventory was utilized as well; there was noted significance on somatic and anxiety scales. TOVA = -4.15, WCST = CC = 3 TE: T = 39 PE: T = 45.

The TOVA (a test of sustained attention/concentration which incorporates reaction time) score (-4.15) was in the severely impaired range. Severe deficits in sustained attention/concentration were identified. This correlated highly with reaction time deficits in the ImPACT.

Conclusions: In conclusion, it appears that the ImPACT does correlate with select neuropsychological measures.
Antisaccades as a Neurological Marker for Concussion and Mild Traumatic Brain Injury

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Objectives: Identification of non-invasive neurological markers for assessment of Mild Traumatic Brain Injury (mTBI) severity and prognosis of recovery has been a key component of neuroscience research, and increasingly a clinical priority over the past several decades. We present a study further investigating the validity of the antisaccade task in said assessment, from neuropsychological, neuroimaging, and symptom reporting perspectives. Antisaccades are thought to involve higher level inputs from neural centers involved in rapid eye movement inhibition and control. Previous work has demonstrated that performance on the antisaccade task can help in assessment of injury in acute and/or chronic mTBI.

Methods: We recruited eleven acute and fifteen chronic mTBI patients from the emergency department and head injury clinic at St. Michael's Hospital, respectively, correlating antisaccade performance against gold standard assessments of symptom burden, diffusion tensor imaging, and a neuropsychological test of response inhibition. Ten healthy controls were also administered the same tests.

Results: Significant deficits in antisaccade median latency and prosaccade mean duration were found between patient groups and controls; the former was correlated with loss of white matter integrity in the splenium of the corpus callosum in acute mTBI. Furthermore, higher antisaccade median latency was associated with poorer performance on executive functioning, and greater symptom burden in the acute patients.

Conclusions: Our research suggests that the antisaccade task may be useful as a neurological marker for mTBI.
Recognizing the symptoms of mental illness following concussions in the sports community: A need for improvement

Status: Accepted Presentation type: Poster

Category: Neurotrauma – prevention and public health

Author's preference: Oral

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Objectives: To evaluate the awareness of concussion-related symptoms amongst members of the sports community in Canada.

Methods: A cross-sectional national electronic survey was conducted. Youth athletes, parents, coaches and medical professionals across Canada were recruited through mailing lists from sports-related opt-in marketing databases. Participants were asked to identify, from a list of options, the symptoms of a concussion. The proportion of identified symptoms (categorized as physical, cognitive, mental health-related and overall) as well as participant factors associated with symptom recognition were analyzed.

Results: The survey elicited 6,937 responses. Most of the respondents (92.1%) completed the English language survey, were male (57.7%), 35-54 years of age (61.7%), with post-secondary education (58.2%), or high reported yearly household income (>$80,000; 53.0%). There were respondents from all provinces and territories with the majority of respondents from Ontario (35.2%) or British Columbia (19.1%). While participants identified most of the physical (mean=84.2% of symptoms) and cognitive (mean=91.2% of symptoms), they on average only identified 53.5% of the mental health-related symptoms of concussions. Respondents who were older, with higher education and household income, or resided in the Northwest Territories or Alberta identified significantly more of the mental health-related symptoms listed.

Conclusions: While Canadian youth athletes, parents, coaches and medical professionals are able to identify most of the physical and cognitive symptoms associated with concussion, identification of mental health-related symptoms of concussion is still lagging.
Effects of Cumulative Subconcussive Head Impact Exposure Associated with Youth Football on White Matter Microstructural Integrity

Status: Accepted Presentation type: Oral

Category: Neurotrauma – basic research

Author's preference: Oral

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Objectives: Evidence is converging that cumulative head impact exposure can affect the normal trajectory of brain development, even in the absence of clinically diagnosed concussion. The purpose of this study was to examine the effects of subconcussive impacts resulting from a single season of youth (age<13 years) football on the changes in specific white matter (WM) tracts, as detected by diffusion tensor imaging.

Methods: Subconcussive impacts were recorded using the Head Impact Telemetry (HIT) system at all practices and games and quantified as a cumulative risk weighted estimate (RWE) of head impact exposure. Subjects were excluded if they experienced a clinically diagnosed concussion. Twenty five non-concussed male subjects were evaluated for FA changes in inferior fronto-occipital fasciculus (IFOF), inferior longitudinal fasciculus (ILF) and the superior longitudinal fasciculus (SLF), which are undergoing rapid myelination in this age group and have been shown to be affected by concussion. All fibers were segmented into the core and two terminals of the fiber, and the relationship between seasonal FA change in whole fiber, core, and terminals with RWE was computed. Cognitive function was evaluated with the Multimodal Assessment of Cognition and Symptoms (MACS), a measure of recognition learning, memory and response speed.

Results: There was a statistically significant linear relationship between RWE and post-pre season change in FA in the whole IFOF (p=0.0096), as well as the IFOF’s core (p=0.0114). There was also a statistically significant linear relationship between RWE and FA changes in the terminal portions of the IFOF (p=0.0276) and ILF (p=0.0003), but not the SLF. With regard to functional outcomes of this cohort, there was a significant linear relationship between RWE and post-pre season change on the MACS, specifically for the sub-composite score of Decision Speed, a measure of visual scanning and response time (p=0.0406).

Conclusions: Subconcussive head impact exposure, experienced over a single season of youth football, is associated with changes in the microstructural integrity of the IFOF and ILF. These key long association tracts connect frontal, temporal and occipital lobes, and are known to be undergoing rapid developmental change in this age group. These data further suggest that subconcussive head impact exposure may affect different parts of the track, particularly the terminal regions that are at risk of shear type injury at the gray-white junction. Finally, subconcussive head impact exposure was also associated with functional outcomes, with slower visual scanning and response speed in the absence of concussion in this sample of youth football players.
Oculomotor Behavior Profile: Biometric Indicator of Post-Concussion Recovery.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: Although oculomotor behaviors such as fixation and saccades are well accepted as important indicators of protracted recovery, there continues a need for reliable diagnostic biometrics to help categorize patients with post-concussion syndrome (PCS). We aimed to develop a standardized composite profile of oculomotor behavior and explore its relationship to PCS.

Methods: Twelve participants with/without (10/2) a history of mild traumatic brain injury (mTBI) provided informed consent to participate from a university campus. Average age = 24.95 +/- 4.01 yrs, BMI = 26.18 +/- 4.24 and a concussion history within the past 12 months or longer. Inclusion criteria was age over 18 years, status post head injury last 12 months, and binocular vision. Exclusion criteria included ocular pathology, visual acuity ≥ 20/200 or cervical spine pathology. Medical history included concussion history, symptoms, sleep patterns and a simple physical screening of overall health. Eye function was assessed using the InVision® Computerized System (NeuroCom) for static visual acuity (average -0.2717 +/- 0.045 LogMAR) and perception time (average 36.90 +/- 8.12ms), at 3 meters and finally the Near Point Convergence Test NPCT (average 6.72 +/- 5.22cm). A standardized, computerized neurocognitive assessment called the ImPACT® was used to measure verbal (MEM_Verb) and visual memory (MEM_Vis), reaction time (RT) and processing speed (VM_Speed). Lastly, the EyeLink® Tracker at 1000Hz was used to quantify oculomotor behaviors such as Fixation Qualitative Score (FQlS), Saccade Quantitative Score (SQnS), and both simple and complex over and under shooting errors using an automatic processing protocol developed by Komogortsev et al 2013. Participants were tested twice to establish reliable characterizations of oculomotor function.

Data analysis: Descriptive statistics were performed using IBM SPSS vs. 22.0. In addition, nonparametric statistics were used including the Spearman Rho Coefficient and a Linear Multiple Regression to characterize both bivariate and multivariate relationships and predictive associations. Alpha level was set at 0.05.

Results: Neurocognitive function results indicated deficits with MEM_Verb (average 58.78 +/- 32.09%), MEM_Vis (average 55.63 +/- 25.39%), VM_Speed (average 36.90 +/- 8.12ms), and RT (average 0.432 +/- 0.276) ms. Most exhibited mild to moderate convergence insufficiency, NPCT (avg. 6.72 +/- 5.22cm) which was significantly related to deficits in MEM_Verb (r = -0.380), MEM_Vis (r = -0.610), and VM_Speed (r = 0.400), TSYMP (p < 0.001) and CON_Score (p = 0.014). A regression analysis indicated that seven outcomes, Con_Score, NPCT, MEM_Vis, RT, FQIS, SQnS and Dynamic Overshoot to explain a significant percent of TSYMP variance.

Conclusions: Preliminary results indicate a multiple component profile of oculomotor behavior appears to be a valid indicator of recovery status of PCS as related to concussion history and the total symptom score suggesting possible a protracted recovery. Further work continues to provide rehabilitation specialists with a simple, yet effective diagnostic profile to help measure patient progression and response to treatment.
Dextromethorphan/Quinidine leading to remission of 39 years of compulsive behavior following Traumatic Brain Injury (TBI)

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Oral

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Objectives: To describe Compulsive/Disinhibited behavior resulting from TBI and its remission in response to Dextromethorphan/Quinidine (DM/Q) started 39 years post-injury during which he displayed this behavior

Methods: A 51 year old man who sustained a severe TBI due to an auto accident when 10 years of age. This caused bilateral parietal fractures and underlying contusions (mainly left hemisphere), respiratory arrest and hypothalamic damage which led to Growth Hormone Deficiency, growth retardation and hypothalamic/impulsive eating leading to morbid obesity. At 5’3” his weight peaked at 487lb It is currently 200lb after gastric stapling. MRI 30 years after injury revealed encephalomalacic changes in left frontal, temporal and parietal lobes and mild left ventricular dilatation. Shortly after accident he started stealing, originally mainly food but soon including unneeded and unwanted items or duplicates of those already purchased. He was never short of money during his kleptomanic episodes. By 10 years after his accident he was frequently arrested for shop-lifting/kleptomania of food or other (sometimes duplicates of items purchased) despite having ample money. Cases were dismissed on medical grounds. He also began over-buying and hoarding items such as facial tissue and paper towels and food. He also on a nearly daily basis began compulsively withdrawing cash advances from ATM machines only to redeposit the money moments later. He described doing this for the enjoyment of watching money “fall into the tray and watch my account balance grow”. He ran up in excess of $55,000 in fees and from near-daily taxi fares to and from the bank. On our initial examination he was well related, moderately obese, demonstrated a mild degree of Pseudobulbar Affect, (PBA) and cognitive slowing (IQ 89) but worked part-time in a family business and attended a day program. He reported the behavior described above for nearly 4 decades despite 12 different medication trials

Results: Based on DM/Q (NUDEXTA 20mg/10mg) efficacy treating (PBA) and impulsive shopping following TBI he was begun on NUDEXTA, reaching maintenance dosing of 1 capsule bid at week 2. Within 2 weeks compulsive behavior diminished considerably and remitted after 4 weeks.

Conclusions: This case report extends our knowledge of the efficacy of NUDEXTA for treatment of severely disabling, compulsive even after 39 years of such behavior. It also has theoretical implications for understanding the relationship between such behavior following TBI (our patient had no family history of Obsessive-Compulsive Disorder(OCD) or Impulsivity and that arising without known cause e.g idiopathic OCD. NUDEXTA of course is a glutamate blocker and Glutamate hyperactivity is considered to play a central role in idiopathic OCD. Thus the phenomenology shared by Idiopathic and TBI-induced OCD may both involve Glutamate abnormalities. This will be discussed
Incidence and Prevalence of Complications of Children with Head Trauma

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Oral

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Traumatic brain injury is a leading cause of death and life-long disability in children. TBI in children differs significantly from adults population. Most pediatric head trauma occurs secondary to motor vehicle accidents, falls, assaults, recreational activities, and child abuse. Falls and motor vehicle collisions are common unintentional causes. Traumatic brain injury from a car accident can be hard to understand, because the more common symptoms involve the car accident victim's cognition and emotional functioning. A brain injury can affect every area of a child's life, including thinking, behavior, emotions, communication, physical abilities and personal relationships. In the present study, we discuss the incidence and prevalence of complications of children with head trauma refer to medical exam center of Forensic Medicine Department of Kashmar from 2013 -2014.
Concussion Injuries Brain Injury And Suicide

Status: Accepted Presentation type: Poster
Category: Neurotrauma – health services and outcomes
Author's preference: Oral

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CONCUSSION INJURIES

BRAIN INJURY

AND SUICIDE

"War on Terrorism" veterans from all branches of service and all countries have a high rate of suicide and other neurological issues.

I would like to propose a managed, participation based discussion on this topic during the upcoming IBIA's World Congress to be held in The Hague, The Netherlands.

I will start the session with a brief overview of what we know and do not know about veterans and suicide. Military and public policy are at the center of the trend toward suicide. The room will then be open to discussion of the topic.

The goal of the discussion will be to find ways to identify veterans who are at risk of suicide, find ways to redirect their thoughts, and prevent the act.

I am a veteran with a brain injury and have been in the system and know how it works and does not work.

Your meeting is the perfect forum for this discussion in basic research and I hope that you will be able to find a place for it in the conference program.

V/R

Dianna Eiland
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Normative Data for the Post-Concussion Scale in High School Boys

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: Poster

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Objectives: The Post-Concussion Scale (PCS) is commonly used for medical monitoring of recovery from sport-related concussion. The purpose of this study is to provide comprehensive normative data for the PCS for male high school athletes with and without pre-existing conditions, including learning disabilities, attention deficit hyperactivity disorder (ADHD), academic problems (i.e., special education classes and/or failing a grade), headaches, migraines, prior concussions, and history of psychiatric treatment or substance abuse treatment.

Methods: Participants in this multi-year, cross-sectional, descriptive, cohort study were 21,313 male student athletes between the ages of 13 and 18. They completed a health survey and the PCS. The PCS is a self-report inventory that includes 22 symptoms rated from zero to six, with 1-2 being mild, 3-4 being moderate, and 5-6 being severe.

Results: The internal consistency reliability of the scale for the total sample and across subgroups ranged from 0.84 to 0.93. Normative tables including means, medians, SDs, interquartile ranges, and 95th percentile and 98th percentile cutoffs were constructed for those with no pre-existing conditions and stratified by subgroups. Boys with no pre-existing conditions had low baseline total scores on the PCS (Md=1, IQR=0-4) compared to boys with ADHD (Md=4, IQR=0-10), a history of migraines (Md=4, IQR=0-12), or a history of treatment for a psychiatric problem (Md=7, IQR=2-17). There was an increase in total scores associated with 1 (Md=2), 2 (Md=3), 3 (Md=3), and 4 or more prior concussions (Md=5). The greatest PCS total scores were obtained for boys with more than one pre-existing condition, such as prior psychiatric treatment and headaches/migraines (Md=12, IQR=4-23).

Conclusions: Boys with pre-existing conditions are expected to have higher baseline scores on the PCS. Use of gender and health condition stratified norms will facilitate a more sophisticated interpretation of this test.
Evaluation of an attention and memory intervention post-childhood acquired brain injury: Preliminary efficacy, immediate and 6 months post-intervention

Status: Accepted Presentation type: Poster

Category: Neurorehabilitation – activities and participation

Author's preference: No preference

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Objectives: Impairments in attention and memory are common sequelae following paediatric acquired brain injury (ABI). While it has been established that such impairments are long-term and, therefore, affect quality-of-life, there is a scarcity of evidence-based interventions to treat these difficulties. The current study aimed to pilot the efficacy of the Amsterdam Memory and Attention Training for Children (Amat-c: English version) using both neuropsychological and ecologically sensitive measures. It was expected that children with attention and memory difficulties post-ABI would show improved performance post-intervention on cognitive and ecological measures, with maintenance at 6 months post-intervention.

Methods: Ten children with an ABI, between the ages of 8-13 years at the time of recruitment were identified through audits of presentations to a metropolitan paediatric hospital. Each child underwent screening, the 18 week intervention programme, pre-intervention, immediate and 6 month post-intervention assessments.

Results: Findings supported the hypothesis that children would show post-intervention (immediate and 6 month) improvement in areas of attention and memory, with generalization to everyday life.

Conclusions: Preliminary results provide support for the efficacy of the Amat-c post-childhood ABI. A larger study is needed to confirm these findings, as a reduction in attention and memory difficulties will enhance everyday functioning.
Enhancement of brain D-serine activity mediates recovery of cognitive function after TBI.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: No preference

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Objectives: Several studies from recent years suggested activation of the NMDAR as alternative modes of treatment for the sequela following traumatic brain injury (TBI) and stroke, especially for cognitive outcome. This concept opposes the theory of blocking glutamate excitotoxicity, which failed in clinical trials, and allows a therapeutic window of 24 hrs or more. The mammalian brain contains unusually high levels of D-serine, which was demonstrated to be a physiological co-agonist of the NMDA receptor. Along with glutamate it mediates important physiological and pathological processes. D-Serine is metabolized by the enzyme DAAO (D-amino acid oxidase) thus a DAAO inhibitor could block its metabolism and enhance the availability of endogenous D-serine. 6-Chloro[2H] benzoxazol (CBIO) is a competitive inhibitor of DAAO. The present study was designed to examine the effect of CBIO on functional recovery of mice after TBI.

Methods: We found significant improvement of functional recovery including delicate motor and especially cognitive performance following a single dose of CBIO (30 mg/kg i.p.) given 24 hours post closed head injury (CHI). The improved cognitive performance was found in the novel object recognition, Y maze and Barnes maze. Moreover, CBIO treatment of CHI mice led to a significant reduction of lesion volume and gliosis, increase of dorsal hippocampus volume and increase in CA1 and CA3 hippocampal neurons.

Conclusions: These results suggest a role of D-serine in the cellular regulation of NMDAR neurotransmission and may suggest targeting D-serine binding site for repair synaptic plasticity, induce regeneration, and reduce cognitive deficits after TBI, and other brain disorders.
Diagnostic management of traumatic brain injury in pediatric patients of first year of life.

Status: Accepted Presentation type: Poster

Category: Neurotrauma – case reports/clinical research

Author's preference: No preference

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Objectives: Describe and present the possibility and efficacy of transcranial ultrasonography (TUS) in pediatric patient with traumatic brain injury (TBI).

Methods: From 2013 to 2015 in the department of pediatric neurosurgery in The Republican Research and Practical Centre of Neurology and Neurosurgery of Belarus, were admitted 341 patients with moderate traumatic brain injury (TBI II) and severe traumatic brain injury (TBI III). Which correspond as follow percentages, TBI II - 94.73% (323) and TBI III - 5.27% (18).

Results: During the analysis, we determined that the largest number of pediatric patient having trauma were in the age of first year of life, the number of pediatric patient was 224 accounting for 65.7% corresponding to percentages. The reasons of a significant prevalence of the amount of these patients with head injuries in this age group is due to anatomical and behavioral characteristics bearing this first year of life patients as also the relatively higher weight of the head in correlation to body, the lack of skills for insurance by their self and the unawareness for different suddenly actions.

According to the mechanism of injury was prevailed, a fall down of the patients from high places corresponding a 90% of cases, a child abuse occurred in 3.1% (7).

In this age group revealed the predominance of linear skull fractures 83% (186), depressed fractures 6 (2.67%), by x-ray imaging was identified the fracture only 114 (61.3%) and the rest was not diagnosed, because of the fact of inability to adequately capture the head while the child is exited.

In addition to all patients we performed TUS in order to exclude intracranial pathology, and the result in 20 patients was found out epidural hematoma who were treated conservatively and controlling that hematoma by repeating TUS examination, in 6 patient was found a significant epidural hematoma which was needed emergency surgery, 5 patients where found out subacute subdural hematoma which also underwent surgery. All children with or suspected abnormalities on TUS and worsening neurological symptoms we perform head CT scan to determine further treatment strategy.

Conclusions: 1. first year of life patients account a significant amount of cases with traumatic brain injury in children.

2. The TUS is a reliable screening method that allows evaluate the dynamics and changes in younger patient with intracranial brain injury.

3.-For this group age of patient is great diagnostic value TUS because helps significantly reduce the use of CT scan in the diagnosis of traumatic brain injury, and thereby reduce the radiation exposure on children.
Traumatic brain injury in mice and possible treatment with Hyperbaric oxygen

Status: Accepted Presentation type: Poster

Category: Neurotrauma – basic research

Author's preference: Poster

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Objectives: Traumatic brain injury is a common health problem with significant effect on quality of life. Hence, TBI is a major social problem and economic burden. The major causes are motor vehicle crashes, falls, and violence. Mild traumatic brain injury (TBI) accounts for 80-90% of total brain injuries. mTBI may lead to short- and long-term cognitive, emotional, and behavioral deficits. As yet, there is no effective treatment or cure for patients with mTBI. Hyperbaric oxygen therapy (HBOT) is a treatment by which 100% oxygen is administered at a pressure greater than atmospheric pressure at sea level (one atmosphere absolute, ATA). This involves placing the patient in an airtight vessel, increasing the pressure within that vessel, and administering 100% oxygen for respiration. In this way, it is possible to deliver a greatly increased partial pressure of oxygen to the tissues. HBOT has been shown to decrease cerebral edema, normalize water content in the brain, decrease the severity of brain infarction, and maintain blood-brain barrier integrity.

Methods: Mice were subjected to closed head weight-drop injury with 70 g weight. Mice were treated with hyperbaric oxygen for 1 hour at 2 ATA for 4 consecutive days starting from 3 hours post injury. 7 days post injury mice were assessed in 2 behavioral paradigms: Y-Maze and Novel Object Recognition test. Mice exhibited a lower learning ability following mTBI in both the Y-Maze and Novel Object Recognition test. All cognitive impairments were ameliorated in mice treated with HBOT. Brains (from another group) were remove 72 hours post last HBO treatment. mTBI group had decrease in myelin basic protein. Moreover, we found increase in neuronal loss and in astrocyte reactivity post brain injury. These changes were abolished in mice that were treated with HBOT.

Conclusions: These findings may suggest a new therapeutic strategy to treat damages induced by mTBI. The mechanisms underlie this improvement may be related to reducing inflammation and preventing de-meyelinization.