1st Session

EPIDEMIOLOGY AND ACUTE CARE

Monday, May 7, 2001

COMMUNITY READINESS AND PREVENTION OF TRAUMATIC BRAIN INJURIES

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Objectives:
1. To use traumatic brain injury surveillance data and key informant interviews to identify major issues of interest in a rural community.
2. To develop prevention programs for reducing traumatic brain injuries that are appropriate for a community's stage of readiness.

Despite high rates of traumatic brain injury in rural communities, few published studies have reported intervention programs that have been conducted and evaluated in rural areas.

Design - Pilot intervention study using pre and post program interviews with key informants to determine the stage of readiness in the community to conduct traumatic brain injury prevention programs. Community Readiness interviews contain questions focusing on six dimensions: prevention programming; community knowledge about prevention; leadership; community climate; knowledge about the problem; and resources for prevention efforts. Scoring is done on each dimension and then an overall community ranking is computed. There are nine stages of readiness from community tolerance to highly effective, well trained staff addressing the problem.

Setting - A rural mountain community with a population of 14,603 residents in Colorado. The age adjusted traumatic brain injury rate in the county based on 1994 data was 129.0 per 100, 000 (95% confidence interval, 57.9-200.1). For Colorado, the comparable rate was 96.1(95% confidence interval, 92.8-99.4).
Study population - Included health professionals with an interest in injury prevention, human services personnel, and representatives from the ski industry.

Results - The leading external causes of brain injury were motor vehicle crashes (43.0%) and falls (31.2%). Key informants in the community indicated concern for brain injuries from recreational activities. Community Readiness scores on the six dimensions indicated low community knowledge about the problem with moderate prevention programming. Overall the community scored in the vague awareness category. Intervention programs were developed by community leaders and implemented over a one and a half year period. Changes in scores will be presented.

TRAUMATIC BRAIN INJURY AMONG MEN AND WOMEN AGED 65 YEARS AND OLDER: INCIDENCE AND EXTERNAL CAUSES

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Objectives:
1. Calculate the crude incidence rates of TBI.
2. Describe the distributions of TBI by gender and external cause of injury.

Despite high TBI death and hospitalization rates, few studies have focused on this population. A total of 1,038 cases of TBI death and hospitalization combined, occurring in 1997 to people aged 65 years and older, were identified from 3 U.S. states according to the *CDC Guidelines for Surveillance of CNS Injury*. Preliminary findings indicate that the case fatality rate for men (33.4%) was more than twice as high as for older women (13.1%). The crude incidence rate of TBI for older men (266.3 per 100,000 population) was also substantially higher than for women (208.9 per 100,000). Falls were the leading cause of TBI in both age groups accounting for 55.1 percent of TBIs among older men and 78.9 percent among women. The types of falls differed between the two groups, with more falls due to slips and trips occurring to older women than men (17.3% vs. 8.1% respectively). Not surprisingly, falls from scaffolding were more common among older men than women (3% vs. <1% respectively). Self-inflicted TBIs using firearms were occurred much more frequently among older men than women (13.1 vs. <1% respectively). TBI surveillance findings for older people should be used to target efforts aimed at prevention of traumatic brain injury in this vulnerable population.

TRAUMATIC BRAIN INJURIES IN ESTONIA

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3. ***Ilona Drikkit***, MD
4. ***Toomas Asser***, PhD

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Objectives:

1. To identify all traumatic brain injury (TBI) cases that occurred during 1999 among residents of two socially and economically different regions: the university town of Tartu and the industrial town of Kohtla-Järve.
2. To analyze the epidemiological features of TBI in the study regions and compare differences.

Material and methods.

A population based prospective epidemiological study of two areas. We identified TBI cases on the basis of ICD-10 diagnostic codes from medical documentation of all healthcare institutions of the study areas. All hospitalized and outpatient cases also cases with autopsy evidence of brain injury were included. Glasgow Coma Scale (GCS) score on admission was used to classify the severity of the brain injury.

Results.

The incidence of TBI in Kohtla-Järve was five times higher than in Tartu and three times higher than in 1987 in Estonia in general.

The mean age was 37.4 in Tartu and 34.4 years in Kohtla-Järve.

The causes in Tartu were falls in 38%, transport accidents in 30% and assaults in 19% of cases, in Kohtla-Järve these causes comprised 36%, 13% and 40%, accordingly. Alcohol intoxication was present in 32% of cases in Tartu and in 26% of cases in Kohtla-Järve.

Majority of brain injuries were mild, 71.6% in Tartu and 88.0% in Kohtla-Järve.

Among all patients 59.5% and 36.4% were hospitalized.

Mortality rate was 26/100000 in Tartu and 53/100000 in Kohtla-Järve. Majority of deaths occurred at the scene of accident or en route.

Conclusions.

The mean age was higher and age distribution of incidence rate was different than in other studies. In Kohtla-Järve, where the social and economical situation was more complicated, the incidence and mortality of traumatic brain injuries were 2-5 times higher than in Tartu.

THE QUÉBEC TBI MODEL SYSTEM: AN INFORMATION SYSTEM ON TRAUMATIC BRAIN INJURY

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Objectives:
1. To present the content and the main characteristics of the Quebec TBI Model System.
2. To present the results of a pilot study using the System.

The Quebec TBI Model System is a comprehensive database allowing outcomes evaluation; it is supported by an Intranet network linking all the institutions (hospitals and rehabilitation centers) offering TBI programs in Quebec.
In the context of continuity of cares, the system gathers data from the accident up to the reinsertion of the clients in their milieu, allowing outcomes researches and facilitating other specific researches.
The Quebec TBI system is not only a research tool creating a huge database but also an interdisciplinary clinical tool used directly by the clinical teams to structure the information available and to guide their interventions and decisions throughout the process of rehabilitation. The system has been tested in 8 pilot sites. The results of this experimentation will be discussed in terms of impacts on the clinical team and also in terms of improvements in the follow-up of the patients.

TERMINOLOGY OF MILD TRAUMATIC BRAIN INJURY, RESULTS OF A SURVEY IN AUSTRIA 2000

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In the year 2000, an inquiry about mild traumatic brain injury was conducted in neurological, neurosurgical and traumatological departments in Austria. A questionnaire based on an European questionnaire, presented by J.D.Krujik at the 4th EFNS Congress in Seville 1998,was used. The aim was to get more information about terminology, the use of additional examinations and the treatment programmes in patients with mild traumatic brain injury.
105 departments were contacted. The return rate was 65%. The most used term was Commotio cerebri, “Gehirnerschütterung” (more than 90%). Only 5% of the hospitals used mild traumatic brain injury. The main symptom are retrograde amnesia (88%) loss of consciousness (86%) and posttraumatic amnesia 82%.
The definition of Commotio cerebri is mostly identical to mild traumatic brain injury, defined by the “American Committee for Mild Traumatic Brain Injury” 1993. 73% of the departments used their own guidelines for diagnosis and treatment. Only 10% answered the question <bout guidelines in treatment programmes.
The duration of hospitalisation ranges from out-patient examination to 48h of patient observation. The medical treatment is different in the different departments. As additional examination X-ray of the skull was used in 86%, followed by X-ray of the cervical spine in 83%. CCT was performed in 73%.

Conclusion: Commotio cerebri is the most widely used diagnoses in Austria, but there is no common therapeutic concept in the different units admitting patients with traumatic brain injury. The results of this questionnaire shows the necessity for international harmonisation of diagnosis and treatment of patients with mild traumatic brain injury.

IN-HOSPITAL DEATH DUE TO TRAUMATIC BRAIN INJURY: A POPULATION-BASED ANALYSIS IN SOUTH CAROLINA, USA 1990-1999

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Objectives:
1. To identify determinants of death after admission to acute care hospitalization with traumatic brain injury.
2. To quantify the risk of dying as function of type of TBI sustained and other comorbid conditions.
3. To determine the influence of the trauma care facility in survival.

Introduction: TBI has the highest case fatality rate in the injury category. (1) Although most of the deaths occur at the site of injury, nearly 7-8% of the deaths occur after admission to acute care facilities. (2) There are limited data allowing full evaluation of the epidemiologic and clinical characteristics of these deaths in a well-defined statewide population. **Methods:** We identified 25,647 hospital discharges from 1990-1999 who met the CDC case definition of TBI. We acquired relevant clinical data from medical records and hospital discharge data sets. Additional information on severity was acquired by using a computerized ICDMAP (1990). We used a multivariable logistic model to determine the influence of putative risk factors on death after admission to acute care facilities. **Results:** For the ten-year period, there were 1,669 (7%) deaths after admission to hospital. Age, comorbidity, the type of TBI, and the level of trauma care were significantly associated with the death after admission. In a model that adjusted for the effect of age, race, gender, severity, type of TBI, comorbidity, (3) and level of trauma care, the risk of death increased with age, with penetrating TBI (OR 5.4; 95% CI 4.7-6.3), with dural and arachnoid hemorrhages (OR 3.5; 95% CI 3.1-3.9), and with comorbid conditions such as malignancy (OR 3.6; 95% CI 1.9-6.5), hematopoietic disorders (OR 3.2; 95% CI 2.7-3.8), and cardiovascular diseases (OR 2.7; 95% CI 2.4-3.1). **Conclusion:** TBI death after admission to hospital is influenced by various mutable factors. These data suggest further evaluation to improve better outcome.

References:

- *Elixhauser A, Yu K, Steiner C, Bierman AS. Hospitalization in the United States 1997. Rockville (MD): Agency for Healthcare Research and Quality; 2000. HCUP Fact Book No. 1; AHRQ Publication No. 00-0031. ISBN 1-58763-005-2*
- *U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Division of Acute Care, Rehabilitation Research, and Disability Prevention. Traumatic Brain Injury in the United States: A Report to Congress. Atlanta: Centers for Disease Control and Prevention, May 5, 1999.*
- *Elixhauser A, Steiner C, Harris DR, Coffey RM. Comorbidity measures for use with administrative data. Medical Care 1998, 36(1):8-27.*

TRACHEAL DECANNULATION IN STATES OF IMPAIRED CONSCIOUNESS

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Objectives:
1. At completion of this presentation, the audience will demonstrate ability to critically assess the need for chronic tracheostomy in patients with impaired consciousness.
2. The audience will demonstrate an appreciation of the factors affecting success of tracheal decannulation.

Chronic tracheostomy has been a perceived standard of care for survivors with impaired consciousness (1, 2). Successful tracheal decannulation was reported in 69% (3) to 86% (2) of patients with brain injuries of all cognitive levels. We report our experience with tracheal decannulation in 74 rehabilitation patients.

Seventy-four (N = 74) Rancho II, III patients who had tracheostomy were treated following our decannulation protocol. Ninety-eight percent (98%) of trauma patients were successfully decannulated. Mean time to decannulation was 15 days (SD = 11.89).

Further retrospective data on complications of chronic tracheostomy and factors affecting success of decannulation will be presented, as well as, our clinical decannulation protocol and long-term, outcome data.

References:

1. *Nowak PA, Cohn AM, Guidice MA. Airway complications in patients with closed-head injuries. Am J Otolaryngol 1987;8:91-6.*
2. *Woo P, Kelly G, Kirshner P. Airway complications in the head injured. Laryngoscope 1989;99:725-31.*
3. *Klingbell GEG. Airway problems in patients with traumatic brain injury. Arch Phys Med Rehabil 1988;69:493-5.*

VASCULAR TUNNEL CREATION AND OPEN SKIN METHOD IN THE TREATMENT OF SEVERE TRAUMATIC BRAIN SWELLING (TECHNICAL NOTE)

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Objectives:

1. Decompressive craniectomy has a role as an option in neurosurgery in the treatment of severe brain swelling.
2. New surgical method (vascular tunnel and open skin) worked out by authors improve the effect of decompressive craniectomy.
3. This newly developed method could decide the question of decompressive craniectomy.

Background

The role of decompressive craniectomy with durotomy has been controversial in the treatment of traumatic brain swelling. Although some authors have observed benefits from craniectomies using a variety of techniques, others have not. However, the operation can be complicated by ischemic necrosis of the portion of the brain protruding through the dural opening. Therefore, we have developed a surgical technique, to avoid these ischemic complications.

Method

20 decompressive craniectomies were performed in patients suffering from cerebral edema caused by trauma and hypoxia. The most significant feature of the operation, which represents the novel approach in this type of intervention, is the so-called "vascular tunnel" which is prepared around the main cortical veins and arteries of the herniated brain to achieve local decompression of the vessels. To avoid further ICP raising, we made head skin enlargemant, by autolog skin implantation from the thigh..

Results

In this series of 20 patients the results were surprisingly good, in spite of extremly elevated ICP before operation and severe GCS status (3 or 4) and signs of the beginning of impaction.

Conclusion

This operative technique is not only effective in reducing the ICP but also helps to prevent the occlusion of cortical vessels wich caused by shear and compresive forces between the dural age and brain tissue.

References:

- *A. Csókay Vascular Tunel Creation in Traumatic Brain svelling Child's Nervous System 16, 2000. p371 suppl.*

POST-TRAUMATIC HYDROCEPHALUS: CLINICAL ISSUES AND OUTCOME

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4. ***Elisabetta Angelino***, Psychologist, Fondazione "S. Maugeri", Veruno (No), Italy

Objectives:
1. To detect the clinical and radiological characteristics of post-traumatic hydrocephalus (PTH).
2. To define its prognostic value for late clinical and functional outcome.
3. To assess the effects of shunt surgery.

Ventricular enlargement is a common finding in the post acute phase of severe traumatic brain injury however there is no definite way to distinguish true post-traumatic hydrocephalus from hydrocephalus ex vacuo. Therefore the criteria for selecting patients for shunt surgery are not defined and are a source of controversial debate. One hundred and forty patients with severe traumatic brain injury were recruited. Main Outcome Measure were: (1) Glasgow Outcome Scale (GOS), Disability Rating Scale (DRS), Functional Independence Measure (FIM), Neurobehavioural Rating Scale (NBHRS); (2) SPECT and NMR. PTH was found in 45% of patients but the decision for surgery involved only 11% of them. Risk factors for PTH were: age (P<.04), duration of coma (P<.0001), decompressive craniectomy (P<.0001). PTH was correlated with the degree of hypoperfusion in the temporal lobes (P<.001). In patients who received ventriculo-peritoneal shunting we observed a significant reduction of ventricular size in 38% and improvement of hypoperfusion in 46%. Patients who showed clinical deterioration improved after surgery. PTH was significantly correlated to the functional and behavioural outcome evaluated by GOS, DRS, FIM, NBHRS (P<.0001) and it influenced the appearance of post-traumatic epilepsy (P<.02). In conclusion PTH concerns about one half of severe traumatic brain-injury patients but the selection of patients for surgery can be defined principally on a clinical basis. SPECT can be helpful in doubtful cases. PTH influences functional and behavioural outcome and represents an important prognostic factor for post-traumatic epilepsy.

References:

1. *Guyot LL, Michael DB(2000) Post-traumatic hydrocephalus. Neurol Res22:25-28.*
2. *Newton MR, Greenwood RJ, Britton KE et al. (1992) A study comparing SPECT with CT and MRI after closed head injury. J Neurol Neurosurg Psychiatry 55:92-94.*
3. *Meyers CA, Levin HS, Eisenberg HM, Guinto FC (1983) Early versus late ventricular enlargement following closed head injury. J Neurol Neurosurg Psychiatry 46: 1092-1097.*
4. *Marmarou A, Abd-elfattah Foda MBK, Bandoh K, Yoshihara M, Yamamoto T, Tsuji O et al. (1996) Post-traumatic ventriculomegaly: hydrocephalus or atrophy? A new approach for diagnosis using CSF dynamics. J Neurosurg 85:1026-1035.*

POST-TRAUMATIC HYDROCEPHALUS, DIAGNOSTICS AND TREATMENT

1. ***Sándor Zsolczai***, MD, PhD
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3. ***Tamas Pentelényi***, MD, PhD

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Objectives:
1. Post-traumatic hydrocephalus.
2. Severe brain injury.
3. Neurosurgical treatment and rehabilitation.

The authors tell the prospective examination results and experiences of posttraumatic, adult hydrocephalus of severe brain injuries, based on the data of 38 patients who were treated in the National Institute of Traumatology between 1995 and 1999.

The aim of the examination was to analyse the changes in the CT signs: the Evans-index, the periventricular hypodensity, the shape of the frontal ventricular and that of the 3. ventricular, to analyse the prognostic value of the hemispherial sulcuses and the roominess of the Silvius-ditch both in the pre- and postoperative period. The patients were classified based on the type of the hydrocephalus.

Conclusion: The CT parametres alone are not sufficient to judge the dinamics of the liquor-circulation and to state the appropriate indications for surgical intervention.
The authors modified the diagnostic and therapic activity during the pre-, peri- and postoperative periods, based on treatment experiences with patients and on data from the literature, thus giving a greater chance for the rehabilitation of patients with severe brain injury.

INDIRECT INJURIES OF THE OPTIC NERVE AND OPTIC CHIASM

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Objectives:
1. To define the differences between injury of the ocular, orbital, canalicular and intracranial segments of optic nerve.
2. To describe the ultrasonographic characteristics of each injury.
3. To give the examiner better information about prognosis as a result of knowing the foregoing.

100 cases of post-traumatic optic nerve or chiasmal injuries were neuro-ophthalmologically analyzed and divided by clinical and orbital echographic criteria into four distinct categories:

1) Marginal Tear Syndrome (8 cases), characterized by immediate peripapillary retinal hemorrhage(s) with secondary visual field loss, normal diameter optic nerves (measured by echographic A-scanning), and relatively early development of optic atrophy (less than 3 weeks)
2) Anterior Orbital Optic Nerve injury (8 cases), with immediate visual loss and echographic swelling of the distal optic nerve attributable to occlusion of the central retinal artery
3) Posterior Intracanalicular Optic Nerve injury (49 cases), with an acute altitudinal field defect, visual acuity ranging from normal to no light perception, normal retinal vasculature and delayed-onset segmental optic atrophy affecting the top or bottom portion of the optic disk
4) Optic chiasm (35 cases) trauma, characterized by central, temporal hemianopic visual field defects and clinical or laboratory evidence of damage to the adjacent neural structures, resulting in anosmia, diabetes insipidus, 3rd, 4th, 5th, 6th, 7th or 8th nerve dysfunction, rhinorrhea, otorrhea, or panhypopituitarism.

The clinical, radiographic and echographic characteristics of these four syndromes of non-penetrating, post-traumatic visual loss will be described. Since visual recovery is often based on whether the intraocular, intraorbital, intracanalicular or intracranial portion of the optic nerve was injured, the ability to distinguish these syndromes allows the examiner to offer a more accurate prognosis of visual loss following closed head injury.

ELECTROPHYSIOLOGICAL AND PSYCHOPHYSICAL STUDIES OF POST-TBI VISUAL DISTURBANCES

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Objectives:
1. Objectify post-TBI deficits in visual function.
2. Use visual evoked potentials and reaction times as markers of specific alterations in visual processing.
3. Correlate symptoms with results and other clinical parameters (TBI severity, neuradiology, etc.).

Individuals having sustained a TBI often present subtle but impairing alterations in visual function such as transient blurring, instability of the spatial environment, visual fatigue, increased sensitivity to light. The symptoms can be difficult to objectify with standard ophthalmological testing and are often overlooked if there are more serious sequellae that need to be addressed. If not diagnosed correctly, such deficits can have serious impacts on a person's quality of life. Our study aimed at evaluating post-TBI visual disturbances with functional methods in order to determine if the symptoms presented are related to specific dysfunction in the visual pathways. We simultaneously obtained visual evoked potentials (VEP) and visuo-motor reaction times (RT) using pattern reversal and motion stimuli in adult individuals having sustained a mild, mild to moderate or moderate TBI 12-36 months before testing. Stimulus spatial frequency as well as contrast were varied. Data can be classified into three groups: abnormalities to pattern reversal stimuli, abnormal responses to motion, combined deficits. Variables such as age, TBI severity, radiological findings and symptom type do not directly explain our findings which suggests that, as with other types of post-TBI sequellae (i.e. cognitive), traditional TBI severity quantification methods do not always predict functional impacts. In conclusion, pattern reversal and motion VEPs and RTs can be used to objectify specific post-TBI visual processing deficits. We are currently studying the neuroanatomical correlates (e.g. functional magnetic resonance and cerebral blood flow imaging) of the functional information obtained in the present study.

References:

- *Freed, S. et al., Brain Injury, (1997), 11, 25-36.*
- *Kay, T. et al., J. Head Trauma Rehab., (1993), 8, 86-87.*
- *Padula, W.V. et al., Brain Injury, (1994), 8, 125-133.*
- *Poggi, G. et al., Brain Injury, (2000), 14, 833-845.*

ANTI-EPILEPTOGENIC AGENTS IN TRAUMATIC BRAIN INJURY

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4. ***Francine Gervais***, PhD, Vice President Research and Development, Neurochem Inc., St. Laurent, Québec, Canada

Objectives:
1. Develop dual action anticonvulsant/anti-epileptogenic compounds for the prevention of post-traumatic epilepsy.
2. Prove efficacy in vitro and in vivo in models of epilepsy and epileptogenesis.
3. Develop an in vivo animal model of traumatic brain injury.

Development of compounds having dual activity with anti-convulsant and anti-epileptogenic properties was undertaken based on rational drug design principles. Compounds with such activities would prevent the genesis and the progression of epilepsy. Over 270 compounds were synthesized and tested for anti-convulsant and anti-epileptogenic activity using a comprehensive series of *in vitro* and *in vivo* models of seizure and epileptogenesis. From this testing two lead candidates were identified: an anti-epileptogenic compound and an anti-convulsant pro-drug which following metabolism is converted to an anti-epileptogenic compound.

The activity profile of both compounds suggests strong anti-epileptogenic/convulsant activity. These compounds were found to:
- increase inhibition of neuronal excitation by upregulating GABAergic function;
- increase inhibition of neuronal excitation by downregulating glutamatergic function, by binding the glycine site on the NMDA receptor;
- act as anticonvulsants *in vivo* preventing seizures induced by Maximal ElectroShock, Pentylenetetrazol and Pilocarpine;
- act as anti-epileptogenics *in vivo* preventing seizures in the Spontaneous Recurrent Seizure and Kindling models of epileptogenesis;
- cross the Blood Brain Barrier *in vivo* with minimal neurotoxicity.

These dual action compounds would be beneficial not only to epilepsy patients but also to Traumatic Brain Injury (TBI) patients. These compounds could be administered to all TBI patients as a neuroprotective agent to prevent the development of post-traumatic epilepsy. A Brain Trauma Animal Model has been developed to mimic the human situation by provoking a subdural haematoma. This Brain Trauma model will

be used for validating and confirming neuroprotective and anti-epileptogenic activity of these lead molecules.
This work is done in collaboration with Neurochem and D. F. Weaver's laboratory at Queen's University (Canada).

References:
- *T. Sutula, G. Cascino, J. Cavazos, I. Parada, L. Ramires, Ann Neurol. 26:321, 1989.*
- *E. Lothman, J. Bertram, J. Kapur, J. Stringer. Epilepsy Res. 6: 110, 1990.*
- *R. Sankar, D. Weaver. Anti-epileptic Drug Development in Epilepsy: a Comprehensive Text. Vol.2:1393-1401, 1998.*
- *Anti-epileptogenic agents; US Patent application 09/041,371; March 11, 1998; International Patent application CA98/00244; March 12 1998.*

PERSISTENCE OF PLASMA AMINO ACID ABNORMALITIES IN REHABILITATION PATIENTS WITH SEVERE BRAIN INJURY

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Plasma amino acids (AA) can be converted into "messenger" compounds, such as hormones and neurotransmitters, that are important for motor, cognitive, neuroendocrine and behavioral functions in the central nervous system (1) (2). This investigation was, therefore, designed to delineate the peripheral plasma aminogram in brain injury patients (BIP) before and after 30 days of a multidisciplinary rehabilitation program.

Ten male BIP (32±8 yrs; 88% usual body weight; GCS 8), nutritionally independent, consecutively admitted to our rehabilitation department 58±14 days after injury were considered in the study. In the first week of their admission, venous blood samples were drawn from the patients' antecubital vein to determine plasma AA concentrations (HPLC system). AA determinations were repeated 30 days later. Plasma AA were also measured in a control group (CG) of six healthy men (30±7 yrs).

Total plasma AA concentration was similar in the BIP and CG but the former had lower plasma concentrations of serine ($p < 0.0001$), histidine ($p < 0.001$), tyrosine ($p < 0.003$), phenylalanine ($p < 0.0001$), leucine ($p < 0.005$) and branched chain AAs ($p < 0.005$), and significantly higher plasma concentrations of aspartate, glutamine, glycine, and alanine than the CG. All these AAs remained virtually unchanged after 30 days of rehabilitation.

CONCLUSIONS

Given the role of AA in neurophysiological functions, every effort should be made to monitor and restore plasma amino acid concentrations in BIP.

References:

1. *Yudkoff M. Disorders of Aminoacid Metabolism-in: Siegel GJ.et al; editors-Basic neurochemistry: molecular, cellular and medical aspects, 6th ed. New York: Raven Press, p.887-915*
2. *Aquilani R. et al. Peripheral plasma amino acid abnormalities in rehabilitation patients with severe brain injury. Arch.Phys.Med.81:176-81, 2000*

TINNITUS AND HYPERACUSIS AMONG TRAUMATIC BRAIN INJURED PATIENTS

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4. ***Zeev Groswasser***, MD, Loewenstein Rehabilitation Hospital, Ra'anana, Sackler Faculty of Medicine, Tel-Aviv University, Israel

Objectives:

1. To explores cochlear function using otoacoustic emissions in TBI patients complaining about tinnitus and hyperacusis.

DESIGN: A case control study was performed, including 24 TBI patients with auditory complains of tinnitus and/or hyperacusis and difficulty to listen in background noise, and two control groups. One control group (15 subjects) had no neurological deficits and the other was comprised of 10 TBI patients with no clinical complains regarding the cochleovestibular system. The audiometric thresholds were normal in of all subjects (patient and controls).

All subjects filled a questionnaire concerning auditory complains like tinnitus, hyperacusis and difficulty to listen in background noise. Hearing thresholds were determined across 0.25-8kHz for each ear separately in each subject. The auditory pathway has been further examined by transient evoked otoacoustic emissions (TEOAE) and by a test of medial olivocochlear suppression, consisting of recording of TEOAEs before, after and with contralateral white noise stimulation, at 20, 30, 40dB above the hearing threshold.

The effect of contralateral white noise stimulation on TEOAE was studied in TBI patients and in healthy controls.

RESULTS: Significant lower TEOAE response amplitude and an absent medial olivocochlear suppression have been found in patients complaining about auditory disorders. In controls and TBI patients this test was within normal limits.

MAIN OUTCOME: TBI patients with clinical complains responded with increased TEOAE amplitudes in the presence of contralateral noise intensities while in control subjects, increasing the contralateral white noise intensities induced decreased TEOAE amplitudes. These results show a relationship between clinical symptoms and the physiological sign point that these disorders are linked to activity of the global efferent auditory system.

BENIGN POSITIONAL VERTIGO FOLLOWING SEVERE TBI: DIAGNOSIS AND TREATMENT

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Objectives:
1. The study was designed to investigate treatable forms of dizziness following traumatic brain injury.
2. To present treatment of Benign Positional Vertigo (BPV).

Dizziness limitting the activity of patients, is a common sequelae of TBI. Benign Positional Vertigo (BPV) may be preceded by several disorders, the most common of which are viral neuronitis and head trauma are. BPV results from an inapropriate activation of the ipsilateral posterior semicircular canal of the labyrinth. The clinical features of BPV are consistent with the hypothesis that the posterior canal contains free floating particles that are heavier than the surrounding endolymph. The symptomatology is probably caused by otoconical debris trapped in the posterior semicircular canal which starts to move when head position is changed quickly with respect to gravity. The concurrent flow of endolymph stimulates the hair cells of the affected canal, causing vertigo.

The diagnosis of BPV is confirmed by positional testing, as described by Dix and Hallpike, showing a characteristic torsional nystagmus. The "classic" nystagmus of BPV occurs when the head is reclined and turned to the affected side. Usually nystagmus appears at about 5 seconds after positioning but sometimes longer periods up to 30 seconds may take place.

Ten severe TBI patients following MVA who were initially unconscious and later complained about dizziness were examined. Most of the patients reported attacks of dizziness provoked by turning in bed, lying down or looking up, down or bending forward. No patient complained about nausea. The diagnosis of BPV was established in 5 patients, and the others suffered from posttraumatic dizziness. BPV was successfully treated by a simple manoeuvre that cleared the canal from debris. In some patients repeated manoeuvres were needed.

SURGICAL TREATMENT OF 31 SPASTIC CONTRACTURED UPPER LIMBS AFTER SEVERE TRAUMATIC BRAIN INJURY: ANALYTICAL AND FUNCTIONAL RESULTS

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Objectives:

1. Study analytical and functional results after surgery of spastic contractured upper limbs due to severe traumatic brain injury.

MATERIALS AND METHOD: From January 1993 to June 2000, 27 traumatic brain injured patients with uni or bilateral hemiplegia have been operated from their spastic contractured hand totalising 31 surgical procedures. The aim was hygienic in 22 cases and functional +/- hygienic in 16 cases. The assessment was analytical: spasticity, strength, voluntary control, range of motion at rest and under general anesthesia or peripheral motor block to differentiate spasticity and contracture. The upper limb function was assessed with the test of Green and Samilson before and after surgery. The surgical techniques were various (Z-plasty lengthening, fractional lengthening, neurotomy, Green transfer) and often associated. The elbow was operated 18 times in one or two goes.

RESULTS: The mean extension gain for passive wrist extension with flexed fingers is 55° at 1 year and 70° at 3 years. For passive wrist extension with extended fingers, it is respectively 70° and 80°. 8 of 11 Green transfer are active at 3 years. The hygienic aim was obtained in 22 cases (22/23), the functional aim in 11 cases (11/16). 7 of the Zancolli 3 hands (7/15) had an unexpected functional improvement.

DISCUSSION and CONCLUSION: in 4 cases, deformities reappeared (hyper or hypo-correction) due to spasticity, dystonia, or unexpected motor activity of the antagonists masked by the contractures of the flexors. They may also mask the good underlying motor control, explaining the functional improvement of Zancolli 3 hands. Hemineglect, cerebellar syndrom and proximal deficit caused the 5 bad functional results.

References:

- *BOTTE M.J., KEANAN M.A.E.: Reconstructive surgery of the upper extremity in the patient with head trauma. J Head Trauma Rehabil 1987 ; 2 (2) : 34-45.*
- *ZANCOLLI E.A., GOLDNER L.J., SWANSON A.B.: Surgery of the spastic hand in cerebral palsy: Report of the Committee on Spastic Hand Evaluation. J Hand Surg, Sept 1983; 8 : 766-72.*