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SPINAL TRAUMA IN PATIENTS WITH ANKYLOSING SPONDYLITIS – REDOUBTABLE, BUT PREVENTABLE COMPLICATION

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INTRODUCTION: The ankylosing spondylitis (AS) is a systemic, multifactorial, polygenic rheumatic disease. AS predispose to vertebral fracture after minor trauma, due to altered biomechanical properties of spine. Most papers (98% of 240 Pubmed citations) describe small series of AS suffering spine fractures with/without medullar injury (AS SCI).

OBJECTIVE: The analysis of associated AS SCI offer information for prevention strategies to avoid this devastating complication.

SETTING: Teaching Emergency Hospital “Bagdasar-Arseni”, Bucharest

METHODS: Retrospective study of post-acute traumatic patients (AS SCI), transferred from the neurosurgical department, first time admitted in our Neurorehabilitation Clinic during 2010-2014. Collected data: demographics, duration of AS, mechanism of trauma, involved vertebral level, neurological status, evolution, pre-morbid factors, complications. Neuroimaging evaluation consisted in conventional radiography, CT scan, MRI. ASIA Impairment Scale and FIM were used to evaluate the neurologic status. All AS SCI patients submitted surgical interventions (due to posttraumatic spinal instability and/or compressive epidural hematoma).

RESULTS: From 1220 SCIs transferred from the surgical department, 8 associated AS SCI (incidence of 0.65 %). All were men, with a mean age of 56.5 years (range 42 ± 73). The gap between AS diagnosis and SCI occurrence was in average 21.2 years (range 8 ± 32) years.

The levels of SCI were: cervical (6 cases), thoracic (1), lumbar (1). The cervical spine was affected mainly at C5-C6 vertebrae. In all, half of AS SCI patients were assessed ASIA A, 12.5% ASIA C, whereas 37.5% classified ASIA D.

The overall complication rates were 87.5 %, mainly infections (in 7 cases at urinary tract level, at 3 minor pulmonary complications, postsurgical osteo-discitis at 1 patient); the 4 cervical subjects had postural transient hypotension.

CONCLUSIONS: Severity and duration of AS, associated previous co-morbidities predispose to vertebral fractures, even after low-energy trauma. Fractures of spine represents a serious complication of AS, because the high biomechanical instability and posttraumatic neurological deficits.

Key words: ankylosing spondylitis, spinal cord injury, prevention strategies
PODAL SUPPORT EVALUATION IN CHILDREN WITH SCOLIOSIS - STUDY PHASE RESULTS (1 YEAR)

AUTHORS.: Liliana Pădure*, Florin Drăgan*,

INSTITUTION*: National Children Neurorehabilitation Center “Dr. Nicolae Robănescu”, Bucharest

INTRODUCTION: The study is being conducted in CNCRC “DR. N. Robănescu Bucharest “where there are in treatment and evidence many children with scoliosis. We also track whether these posture defects are scoliosis symptoms that appear at the beginning of these conditions, are changing during the disease evolution and, to what extent we can beneficially intervene in a conservatively manner on them. Purpose of this paper is to show a new way to assess the patient with spinal static disorder.

MATERIAL & METHODS: We present how this method helps us to also analyze the possibilities of multidisciplinary therapeutic intervention for patients with scoliosis:

We used modern training and assessment equipment:

- 2nd generation 7gait Footscan plate 2 m, 16,000 sensors - to our knowledge - unique in specialized centers for children in the country, Footscan 7Balance for training stability and for center of gravity projection awareness.

- Terra Unit workout band - wall and on ground device.

- Statistical analysis shall be done after achieving the corresponding frequency histograms to identify the degree of normality of the population’s distribution; we shall perform parametric tests for differentiation (T) or (Chi²).

We shall see whether or not the observation is statistically objectified. The estimate number of evaluated subjects evaluated in shall be about 100, which we shall be able to unitarily assess and quantify, at least 3 hospitalizations in this period of the doctoral work (at first, 2nd, at the 3rd hospitalization).

RESULTS: To date could be examined in over 2 admissions 47 patients.

DISCUSSIONS & CONCLUSIONS: Support improving can be performed by a sustained treatment (corrective posture in Cheneau brace, physiotherapy – Klapp, Cotrel, Schroth techniques) in inpatient and continued at home (medium and long term).
CLINICAL RESULTS AFTER DIRECT COAPTATION OF THE C5-C6-C7 BRACHIAL PLEXUS ROOTS IN TRAUMATIC TANGENTIAL SPINE LESIONS. PERSONAL TECHNIQUE

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(2)* Laboratory of Neurophysiology, Neurosurgery Hospital, Iasi, Romania

Abstract:

Introduction. Cut deep wounds in the neck often interested the great vessels (carotid, axillary) and the roots of the brachial plexus (BP). Threatening vascular lesions must be solved in emergency. Lesions of BP are mandatory to repair in emergency or delayed 48-72 hours avoiding difficult dissection in secondary intention, iatrogenic risk of vessels lesion and prolonged time of denervation. Sectioned BP roots near the spine require special techniques to solve.

Material and Methods. Retraction determined by the elasticity of the C5-6-7 roots and trunks of BP is particularly large approximately 4-5 cm (which can not be undone by a single, simple act of tightening wire approximation). Distal ends of C6-C7 roots can be retracted in the costo-clavicular space. Tangential proximal root section cause retraction of the external roots covering which will make it impossible to place stitches strong enough to approximate the stumps. Two wires are placed cranial and caudal on distal trunk and proximal to the vertebral body periosteum above and below the foramen. Each approximation wire is tight progressive and approaching of the distal stump is done inch by inch. After 4-5 maneuvers of approximation step by step, the 2 approximation wire are tight and neurorrhaphy of nerve fascicles is done under magnification. Results. We applied this technique for a single case who sustained a knife stab injury to the left side of the neck with C5-C6-C7 brachial plexus lesions. After six months the patient recovered shoulder abduction and M3-M4 elbow flexion.

Conclusion. The surgical technique proposed by us in tangential foramen BP roots lesion by choosing the proximal fulcrum as vertebral body periosteum above and below the foramen offers a safety possibility for microsurgical primary repair. Without placing the proximal wire on the vertebral body periosteum the approaching of the distal stump will be very difficult or impossible.
INTRODUCTION: After TCC child has a disabling neuromotor and mental sequelae status that our center handles over 20 years. Disabling clinical forms are similar to those of the CP but the recovery potential is increased.

MATERIAL AND METHODS: Both clinical observations, evaluators, and treatment are made on a sample of 118 patients with TCC or sequelae status sent directly from the resuscitation wards of hospitals of emergency in Romania in 2012-2014.

RESULTS: We received in a state of minimal consciousness 61 patients. All had pyramidal syndrome on admission. The first active movements emerged have also outlined a cerebellum syndrome in 38 patients. 82 patients resumed riding after a few weeks to a year. 64 of patients remained with hemiparesis, 26 of patients remained with motor deficits in all limbs, (frust or obvious).

CONCLUSIONS:
1. Neurorehabilitation after TCC is more spectacular when is both early and connect initiated.
2. Treatment involves intensive rehabilitation care, careful tactile, kinetic, physical, occupational stimulation, appropriate to the motor potential of each case.
ABSTRACT BOOK
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OBERLIN TECHNIQUE VERSUS OTHER NERVES TRANSFER FOR THE
REANIMATION OF ELBOW FLEXION IN BRACHIAL PLEXUS PALSIES

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(1) Plastic and Reconstructive Surgery Department, University of Medicine and Pharmacy, IASI, Romania,

(2) Laboratory of Neurophysiology, Neurosurgery Hospital, Iasi, Romania

Abstract:

Purpose. The priority in the management of brachial plexus palsies (BPP) is the restoration of elbow flexion. The transfer of intercostals nerves (ICN) for recovery of elbow flexion is possible by using a sural nerve graft to the musculo-cutaneous branches for biceps (MCBB). The Oberlin technique is much simple with functional results obtained in a short time. The aim of this retrospective study is to evaluate comparative results between neurotisation using ICN and Oberlin technique in brachial plexus palsies with uninjured C5 and C6 +/- C7 roots.

Methods. From 73 BPP, in 18 were used ICN (14 biceps and 4 triceps) and in 7 was used Oberlin technique. Patients were reviewed at 6, 12 and 36 months after nerves transfer. The average age of the patients was 31 years. The average time to surgery after occurrence of the injury was 6-9 months.

Results. The averaged time required for biceps reinervation was 12 – 14 months and for triceps was 9 months after ICN transfer and in Oberlin technique was 4-6 months. There was no motor or sensory deficit related to the ulnar nerve. After ICN transfer, 9 patients achieved M3-M4 elbow flexion, 3 patients with M1-M2 and 2, M0. For triceps, two patients achieved M3-M4 elbow extension – to which we performed Carroll transposition for elbow flexion recovery - one M1-M2 and 1 M0. From 7 patients using Oberlin technique, 5 achieved M4 and 2 M3.

Conclusions. Transfer of ICN into the nerve of MCBB for elbow flexion recovery is a reliable procedure in brachial plexus palsy. Transfer of ICN for triceps long head for the restoration of elbow extension offers an alternative for the cases in which the recovery of elbow flexion is failed. Oberlin technique is simple and offers a better results in short time and is an effective and safe option.
DECOMPRESSIVE CRANIECTOMY IN THE TREATMENT OF COMPLEX SEVERE TRAUMATIC BRAIN INJURY

Božić B., Rotim K., Šumonja I.

Aim. Authors present 4 interesting cases of severe traumatic brain injuries (TBI) treated by decompressive craniectomy in our emergency service and give a short review of literature on decompressive craniectomy.

Introduction. In modern medical era, decompressive craniectomy (DC) has been used since Bergmann first described the technique in 1880. DC can be performed in combination with evacuation of extra-axial collection, removal of intraparenchymal haematoma, diffuse brain oedema, following the debridement of penetrating wounds and evacuation of foreign body, removal of necrotic brain parenchyma or open impressive fractures. It was proven that time in which ICP is over 20 mm Hg correlates directly with the outcome of the patients and that early decompression (within 4 hours from the injury) results in improved functional outcome within 6 months.

Patients and methods. We present 4 cases with complex severe TBI admitted through our emergency service.

Results. Three out of four patients significantly improved after the surgery and were discharged from hospital for further rehabilitation.

Conclusion. In the period of 2011-2014. in UHC Sisters of mercy Zagreb, 154 decompressive craniectomies have been performed in patients with severe TBI. We present some of our interesting cases and their postoperative outcomes.
MY EXPERIENCE IN NEUROPSYCHOLOGICAL REHABILITATION AFTER TBI AND DISORDERS OF CONSCIOUSNESS: FRONTAL LOBE AND BRAIN CORTEX SYNCHRONIZATION IS THE KEY

León-Carrión, Jose¹,²

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² Center for Brain Injury Rehabilitation (CRECER), Seville, Spain

I have dedicated my entire professional life to the study, understanding and rehabilitation of traumatic brain injury and stroke. Brain injury produces neurobehavioral, cognitive and social disorders which affect a person’s daily life and activities, as well as their relationships at home, school and work. Most of my focus has been on the role of frontal lobe and conscious/unconscious processes. What we have found is that two synchronized networks subserving consciousness exist, a retrolandic, or cognitive network, and a frontal executive control network. Patients with disorders of consciousness show severely altered synchronization between these networks compared to patients with severe neurocognitive disorders (SND), who have higher levels of consciousness and preserved alertness. It appears that the executive control network could help synchronize cortical neurons throughout the brain by means of temporally precise high frequency oscillations. A breakdown in synchrony and coherence leads to the disruption or disappearance of consciousness. Our findings suggest that synchronization between these brain regions is essential to awareness, and that the frontal lobe is a surrogate marker for preserved consciousness. They also illustrate that deoxyHb concentration in the PFC varies during the suppression and emergence of consciousness. During suppression, deoxyHb levels increase, signaling the deactivation of the PFC, while during emergence, deoxyHb concentration drops, initiating PFC activation and the recovery of consciousness. In other words, PFC intervenes in the suppression and emergence of consciousness. In most of our rehabilitation regimes, we apply neurorehabilitation therapy and pharmacological treatment simultaneously, using functional neuroimaging techniques to help adjust drug dosage. This combined approach to treatment promotes connectivity among posterior and anterior cortical regions, which can aid emergence from the vegetative and minimally conscious state. Pharmaceutical therapy should be personalized and complemented with neuropsychological therapy and other techniques, including non-invasive brain stimulation techniques, namely Transcranial Magnetic Stimulation (TMS) and Direct Current Stimulation (DCS). In addition, functional neuroimaging should support methodological engineering processes used to adjust drug dosage. In neuropsychological rehabilitation and in the treatment of severe disorders of consciousness, pharmaceuticals that improve anterior/posterior cortical activity may accompany improved outcomes in these patients.

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Preference for method of presentation: Oral presentation

Acknowledgement: My thanks to Rosario Dominguez Morales and Umberto Leon Dominguez for their contributions and continuous support.
DEEP BRAIN STIMULATION FOR THE EARLY TREATMENT OF THE MINIMAL COSCIOUS STATE AND VEGETATIVE STATE

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2 Laboratory for Human and Experimental Neurophysiology, School of Medicine, University of Split, Split, Croatia

Introduction
Deep brain stimulation (DBS) of thalamic reticular nuclei has been attempted mainly in TBI patients. An effective treatment of minimal conscious state (MCS) and vegetative state (VS), caused by hypoxic encephalopathy (HE) or traumatic brain injury (TBI), has not been achieved yet.

Methods
Thirteen patients were included (with TBI 4 and 9 with HE, 4 being in MCS and 9 in VS). Entry criteria evaluating status of cerebral cortex and thalamocortical reticular formation comprise of: neurological, including Rappaport Coma/Near coma scale, electrophysiological with multimodal evoked potential and 12/24 hours of EEG, and imaging; positron emission tomography and MRI.

The stimulation target: unilateral centromedian-parafascicular nucleus complex, in 2 patients were bilateral (Fig.1). Patients were stimulated daily for 30 min every three hours (intensity, inducing “arousal reaction”, frequency 25 Hz, pulse duration 220 µs). Follow up was from 9 to 26 months.

Results
Three MCS patients regained consciousness, waking, speaking fluently, with impressive speech comprehension. One became completely independent while other needed some assistance in everyday life due to memory deficit (Fig.2). One VS patients improved to MCS with further recovery after 24 months of DBS. Three died from respiratory infection and sepsis. Other 8 patients remained unchanged consciousness.

Conclusion
If patients fulfills clinical, neurophysiological, and neuroimaging criteria they should undergo DBS at rather early stage. The spontaneous recovery of MCS/VS is very rare, therefore if entry criteria are fulfilled DBS could be option.
Coma assessment scales have been developed to facilitate ease of communication between emergency team members and to facilitate ease of clinical assessment for patients with severe impairment of consciousness.

In 1974 Graham Teasdale and Bryan Jennett published in the Lancet a scale which theoretically helped physicians get a quick and accurate status of comatose patients. The scale they described assessed patient behaviour regarding three key aspects – motor reactivity, verbal communication and eye opening. As the two authors were working in Glasgow, the scale was dubbed the Glasgow Coma Scale (GCS) a name which all neurologists and neurosurgeons are well-acquainted with.

In their description of the GCS, the authors started from the lack of broadly-accepted criteria by which assessment of patients should be made. This fact was a generator for communication issues between physicians all over the World, who had their own criteria for clinical assessment of comatose patients.

In Romania, for example, physicians used a coma scale described by Constantin Arseni and I. Oprescu in 1972. The scale divided post-traumatic comas in 5 different categories. At the time some Romanian physicians also used Jouvet’s Coma Scale (published in 1969) which evoked perception and responsiveness in patients. Jouvet’s scale was used for its strong insight on anatomical and clinical correlations between the patients symptoms and the existing lesions, however its use was difficult and time consuming, which rendered it useless in critical situations demanding instant decisions such as brain injury. Furthermore, the use of the Jouvet scale was impossible in patients with language disorders or patients which didn’t speak the same language as the physician.
The use of the GCS is based on the patient’s capacity to react using language and motion to external stimuli. Eye movement, Speech and Motion are graded using 4, 5 and 6 points, for a maximum total of 15 points or a minimum total of 3 points. (See table 1). A patient with a Glasgow Coma Score of 3 is completely non-reactive, while a patient with a Glasgow Coma Score of 15 is perfectly aware.

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<tr>
<th>Eye Movement</th>
<th>Verbal Response</th>
<th>Motor Response</th>
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<tr>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>To Pain</td>
<td>Sounds</td>
<td>Abnormal Extension</td>
</tr>
<tr>
<td>To Voice</td>
<td>Words</td>
<td>Abnormal Flexion</td>
</tr>
<tr>
<td>Spontaneously</td>
<td>Confuse</td>
<td>Withdraws from pain</td>
</tr>
<tr>
<td></td>
<td>Orientated</td>
<td>Localizes pain</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Obey commands</td>
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Table 1. The Glasgow Coma Scale System

There still are limits in the use of the Glasgow Coma Scale. One of these refers to the period of time after brain injury occurs. Emergency medical crews use muscle relaxants and sedatives to make patient transport easier and more effective. The use of such substances will interfere with the assessment of the GCS. Another limit in establishing the Glasgow Coma Score is identifiable in intubated patients which have a non-testable verbal response. Patients which cannot open their eyes due to palpebral edema, again have a non-testable eye response.

Despite its wide use today, the GCS has been seriously criticized due to its incapacity to determine the functional status of brainstem structures. Therefore, various improvements and updates were performed for the Glasgow Coma Scale.

One of the best-known improvements of the GCS came in 1982 from Born & colab. Who added to the known three parameters the assessment of brainstem reflexes: the fronto-orbicular reflex (with 5 points), the vertical oculo-cephalic reflex (4 points), the photo-motor reflex (3 points), the horizontal oculo-cephalic reflex (2 points) and the oculo-cardiac reflex (1 point).

One of the most recent improvements in assessing consciousness is represented by the FOUR score (Full Outline UnResponsiveness), developed in 2005 by Wijdicks & colab. This score is almost as easy to use as the GCS, however its usefulness is noticed when patients are admitted in intensive care units and intubated. In such situations the FOUR score allows for a better examination of the patient’s neurologic status.

Over the years, the use of the GCS extended in the entire medical meme despite its criticism. The simplicity and ease of use which characterize the GCS made it a very useful instrument for neurological examination since the first moment a patient is seen by a medical professional.

The Glasgow Coma Scale which recently reached its 40th birthday became an universal language for physicians. Since it has been in use neurological status can be expressed with great ease and without loss of meaning. Through their efforts, the two Scottish physicians made it possible for doctors to communicate easier in life-or-death situations and therefore greatly improved the odds for patients with traumatic brain injuries.

Key words: Glasgow Coma Scale, Traumatic Brain Injury, Neurosurgery
Seizures are a common complication of traumatic brain injury (TBI). Contusions are the main underlying lesions. Factors predicting the appearance of seizures are unknown. : Prospective study that compares the characteristics of non-surgical treated patients with cerebral contusions who develop seizures to those who do not. : Comparison of 15 patients with seizures to 25 without during a 3-year follow-up, concerning Glasgow Coma Score (GCS), brain CT/MRI, vascular risk factors and alcohol abuse on admission and Modified Rankin score (MRs) and EEG on discharge. One post-mortem brain was examined with 7.0-Tesla MRI. : Age, gender distribution, GCS, MRs, average number of contusions were not statistically significant between both groups. A trend of more vascular risk factors and of frontal contusions in the seizure group was observed. Alcohol abuse was significantly more found in the latter (p <0.05). EEG was also significantly more disturbed in the seizure group (p < 0.05). Although the use of anti-epileptic drugs the recurrence rate of seizures was found in more than 90% with a low rate of early onset and status epilepticus. Simple partial seizures occurred in more than 60%. In one post-mortem brain examined with MRI two contusion areas were observed but also focal areas of isolated superficial siderosis.: Severity of TBI and initial outcome are not predictive for the occurrence of seizures. Frontal lobe contusions, vascular risk factors and alcohol abuse are most promoting seizures. EEG has a predictive value. Post-mortem MRI examination shows that not only visible contusions but also focal areas of superficial siderosis, indicating underlying microscopic lesions, are observed, indicating a more generalized traumatic brain disorder as cause of seizures.
SEVERE TRAUMATIC BRAIN INJURY PATIENTS MANAGEMENT IN CLINICAL CENTER OF VOJVODINA

Petar Vuleković, Đula Dilvesi, Tomislav Cigić, Vladimir Papić, Nenad Krajčinović, Igor Horvat, Mladen Karan, Bojan Jelača, Antun Azaševac

Clinical Center of Vojvodina, Clinic of neurosurgery, Novi Sad, Serbia

Clinical Center of Vojvodina is the reference institution for the treatment of severe traumatic brain injury (sTBI) patients coming from the most of territory of Vojvodina Province (about 1.5 million inhabitants). Within Clinical Center of Vojvodina the New Emergency Center was opened in 2010. The new building and most advanced equipment in Emergency Center allows best treatment of sTBI patients. Reanimation ambulance, modern CT device, contemporary intensive care unit, neurosurgical operating room, neurosurgeons, anesthesiologists and other surgical specialties dealing with polytraumatized patients 24-7-365.

Last year 2014 98841 patients were treated in the Emergency Center. There were 167 sTBI patients (GCS score ≤8). 73 patients had isolated brain injuries and 94 patients had associated injuries to. During the same year 111 patients were operated because of sTBI. We operated on 34 patients with acute subdural hematoma, 23 patients with epidural hematoma, 24 patients with traumatic intracerebral hematoma, and 7 patients with an impressive skull fracture. Because of uncontrollable intracranial hypertension on 4 patients decompressive craniotomies were done.

Thanks to results in the management of traumatic brain injuries, presented at several neurotraumatology meetings in Europe, Clinical Center of Vojvodina became a part of CENTER-TBI study which is the largest European research project in traumatic brain injury ever. We are very proud to be small part of this endeavor hoping at the end it will bring us better understanding and better treatment of our patients with traumatic brain injury.
THE CAUSE OF COMA. IS IT DIFFUSE AXONAL INJURY OR LOSS OF BRAIN STEM FUNCTION?

R. Firsching

Introduction

While older neuropathological studies considered brain stem lesions as the cause of coma, later studies considered diffuse axonal lesions as the most severe form of brain injury, which causes coma. To the best of our knowledge there is no systematic study on the imaging of the brainstem of patients in coma and acute signs of herniation, such as loss of pupil reactivity or extensor response. We report on a prospective study of patients in posttraumatic coma and early magnetic resonance imaging (MRI).

Patients and Methods

A prospective series of 157 patients in posttraumatic coma for a minimum of 24 h was analysed. Magnetic resonance imaging of brain lesions was obtained within 10 days – median 2 days – of the injury with a 1.5 tesla magnet. Statistical analysis including contingency tables, Fisher’s exact test, cross tables and odd rations to investigate the correlation of coma and eventually loss of pupil reactivity and extensor response with the location of brain lesion on MRI and with outcome in terms of the Glasgow outcome score (GOS).

Results

Patients with either unilateral loss of pupil reactivity or extensor response were statistically significantly more likely to harbor MRI lesions of the brain stem when compared with patients in coma without further deficiencies (p = 0.0004 Fisher’s test). The correlation of brainstem lesions as identified by MRI and outcome according to the GOS after one year was also highly significant (p < 0.0001 Fisher’s test).

Conclusion

The correlation of loss of consciousness, pupil reactivity and onset of extensor response as clinical signs of acute brainstem dysfunction with the incidence of brainstem lesions and unfavorable outcome is highly significant. The onset of these symptoms should therefore be considered adequate reason to initiate urgent diagnostic and eventually surgical measures as long as a reversible brainstem dysfunction did not turn into an irreversible one. The above results are not compatible with the concept of diffuse axonal injury.
The history of Traumatic Brain Injury is strictly correlated with the history of humanity. Since head trauma has been inflicted in any circumstances since the early days of humanity, we may presume that the need for a solution to reduce suffering is equally old. In this respect, we arrive to the conclusion that neurosurgery is, along with hunting, one of the oldest professions of the human race.

Proof of human interventions on the skull exist since more than 10 000 years ago. Despite the existing debate that these were made in curative or religious purposes, there are clear arguments that an active intervention with instruments has been made on the skull, meaning that a neurosurgical procedure has been performed.

The development of Neurosurgery as a specialty in a continuously evolving process, has its beginnings lost in the early ages. For most of time, this evolution has been strictly correlated with the treatment of head injuries. Paradoxically, the most evil part of human personality, violence, has had a major contribution to the emergence and development of the most delicate and precise surgical specialty, which is Neurosurgery.

Our purpose is an historical perspective on surgery in head trauma and how the techniques and the concepts have changed during many centuries up to nowadays, based on literature data and published documents.
NEVER SAY NO TO A COMPLEX LOWER LIMB INJURY.
STRATEGIES FOR RECONSTRUCTION.

Lucian Fodor MD, PhD; Marius Fodor MD, PhD; Stefan Florian MD, PhD
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**Background.** Complex lower limb injuries are a challenge for reconstruction. Among them, high energy injuries and mangled extremities are the most difficult to treat. Most of the time bone fractures are associated with vascular, nerve, musculotendinous and soft tissue injuries.

**Patients and Method.** Over a 7 year period, 18 complex lower limb injuries have been admitted to our hospital. 14 patients had working or car accidents, 11 of them having high energy injuries. Two patients had 4th degree frostbite and another two had 3rd degree burns. Fractures were present in 11 patients. Revascularization was necessary in 6 patients. Vascular reconstruction, osteosynthesis, nerve repair and musculotendinous reconstructions have been performed in all of them. Latissimus dorsi muscle flap was used in 7 patients, anterior serratus was used in 4 patients, Anterolateral Thigh Flap in 5 patients, omentum in 2 patients and Thoracodorsal artery perforator free flap in one patient. Simultaneous free flaps was used in two patients.

**Results.** Lower limb salvage was successful in 16 patients. Two patients had below knee amputations. Free flap necrosis was present in single case. Local wound infections was present in 6 patients. Most patients had also secondary procedures among them: tenolysis, skin graft, neurolysis, tendon lengthening.

**Conclusions.** Never say no to a complex lower limb injury. Successfull reconstruction can be achieved even in difficult injuries.
DYNAMICS OF RECOVERY OF CONSCIOUSNESS AND HIGHER MENTAL FUNCTIONS OF CHILDREN AFTER SEVERE TRAUMATIC BRAIN INJURY IN THE EARLY PERIOD OF REHABILITATION

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Abstract Text Field:

Introduction: According to modern concepts of neurorehabilitation the early intervention can improve cognitive outcomes. Bedside neurological diagnostics combined with the assessment of the consciousness level does not always give a complete picture of the patient’s abilities. The aim of this study was to follow up patterns of recovery in children (6 - 17 years) at the first four months after injury.

Materials and methods: 17 children (aged 6-17) with sTBI (GCS ≤ 8) were evaluated with Coma Recovery Scale-R (CRS). Some of children, who regained their consciousness completely, were assessed by Luria Neuropsychological Battery test. Some children remained in the minimally conscious state (MCS) and were tested by the adapted procedure of neuropsychological assessment during the first four months. We processed our data using nonparametric statistic techniques.

Results and conclusions: Children were divided into three groups according to their consciousness recovery. 1. Children with the anterior cortex damage had a slower recovery dynamics. Statistically significant difference in the outcome and communication skills manifested by the third month after the injury. 2. During the period of consciousness recovery in children after the injury the key role played follow parameters: the time when behavioral changes appeared, character of the dynamics in consciousness recovery and velocity of changes in behavior. 3. The most destroying functions at the early recovery period were the processing speed (neurodynamics of metal activity), executive functions and memory functions (modal-nonspecific memory). 4. Children who had demonstrated a slower dynamics of consciousness recovery had a severe primary damages of visual gnosis, speech and executive functions according to neuropsychological examination. The factor of voluntary regulation plays a key role at the early stage in consciousness recovery.
TETRAPARESIS ON THE ICU – PITFALLS

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Life-threatening disease on ICU frequently is caused by sepsis or septic complications asking for prolonged artificial ventilation and high dose catecholamine therapy. Temporary multi-organ failure must be compensated. Providing the complete arsenal of modern medicine patients survive despite most severe medical conditions they would not have done so a few decades before. But these conditions seem to amount often to a common final pathway presenting with a more or less pronounced flaccid tetraparesis due to axonal damage predominantly of peripheral motor nerve fibres. This critical illness polyneuropathy (CIP) is frequently associated with severe neurogenic dysphagia and thereby the necessity for tracheal cannulation to protect from potentially fatal aspiration. These patients require intensive neurologic rehabilitation to restore their abilities concerning swallowing and nutrition, mobility and independence in their daily activities. In Germany actually 10 to 20 % of patients treated in early neurologic rehabilitation units suffer from CIP. However, this diagnosis must carefully be evaluated. Other complications emanating from critical disease result in weakness and are not rarely overlooked. This is especially true for cervical spinal processes, mostly spondylitis, in single cases also cervical spinal stenosis or epidural abscess. Similarly, bilateral cerebral damage can be misinterpreted as CIP, e. g. ischemia, hypoxic damage and central pontine myelinolysis. To avoid such potentially harmful wrong diagnoses a thorough evaluation of the patient’s history, the clinical signs and symptoms and in ambiguous situations additional diagnostic procedures are required. Moreover, the diagnosis critical illness polyneuropathy should be assured electrophysiologically. Examples for pitfalls of the diagnosis CIP will be presented and discussed.
ANTIOSTEOPOROTIC EFFECTS OF ALENDRONATE ON YOUNGER PATIENTS WITH ACUTE SPINAL CORD INJURY

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Introduction: Acute spinal cord injury (SCI) is associated with rapid bone loss followed by an increasing risk of fractures. Bisphosphonates are used successfully in treating patients with post-menopausal and senile osteoporosis. The question arises whether bisphosphonates have also a positive effect on reduction of early onset osteoporosis in patients with acute SCI and whether there are differences between patients with complete and incomplete status.

Methods: In a prospective, randomised, double blind study 70 mg alendronate or placebo was given weekly to 12 patients with ASIA Score A and B and to 12 patients with ASIA Score C and D 6 weeks after the acute injury for the duration of 12 months. Additionally calcium and vitamin D was administered daily to all patients. Bone mineral density was measured at baseline, 3, 6, 9 and 12 months after injury.

Results: 6 patients were females, 18 males, 8 patients tetra- and 16 patients paraplegic > L 1. The average age was 37,3 years. In lumbar spine there was in all patients no significant difference in bone density between the alendronate and the placebo group within 12 months, but in femur T-score decreased significantly in the placebo group of ASIA A and B > ASIA C and D patients in comparison to the alendronate group.

Conclusion: Weekly alendronate seem to have a positive effect on early onset osteoporosis of the femur in younger complete and incomplete paralyzed male and female patients with acute spinal injury.
MILD TRAUMATIC BRAIN INJURY – CONTEMPORARY DIAGNOSTIC ALGORITHM

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Introduction: Disturbing epidemiology, differences in mild traumatic brain injury (mTBI) clinical appearance and possible delayed complications make mTBI one of the most important global health problems as much as significant social and medico legal problem.

Aim: To reassess current diagnostic criteria for mTBI, apply modern imaging modalities and introduce psychological assessment in treatment of patients with mTBI.

Material and methods: Prospective clinical study was started and still is ongoing at Clinic for Neurosurgery, Clinical Centre of Vojvodina in order to achieve more complete treatment of injured with mTBI. Injured who met inclusion criteria underwent clinical observation, early MRI examination in first 72 hours after injury and neuropsychological assessment (Beck’s Depression Inventory and MMSE) one month and seven months after injury.

Results: All patients had normal initial computed tomography findings. MRI head examinations were performed in 73% of patients. 25% of those patients had small bleedings or oedema seen at MRI. All patients had good results on MMSE. 90% of patients had minimal or no depression, 7% had mild and 3% moderate depression. We did not find significant correlation between some particular clinical findings and presence of psychological disorders.

Conclusion: Current protocols in diagnostic of mTBI are designed to discover those patients in severe risk for intracranial hemorrhage and those who could need neurosurgical treatment. Introduction of contemporary imaging modalities together with neuropsychological assessment in reasonable number of patients can help us to discover and treat properly patients with cognitive, emotional and behavioral difficulties.
ROBOTIC-BASED ASSESSMENTS IN NEUROREHABILITATION

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Assessments are an important part of neurorehabilitative therapy. They serve not only to recognize the state and progress of a patient during the neurorehabilitative process from diagnosis to discharge, but assessments also help to investigate the effectiveness of interventions and, eventually, endorse evidence-based medicine principles.

Robots are increasingly implemented in neurorehabilitative therapy. Beside of training, these devices allow to monitor and record the patients’ progress and deliver quantitative and reproducible results. But different devices with different measures and protocols exist. Consensus and consistency in the application of robotic devices would facilitate the comparison of results. In the frame of the European Network on Robotics for NeuroRehabilitation (funded by the European Co-operation in science and technology (COST)), a multidisciplinary team of experts in the fields of neurorehabilitation gathered to define standards that aim to facilitate the development, implementation, and administration of different robotic assessments for the upper extremity. We describe this project on standards for robot-supported assessments (STARS).

As example, we present a battery of robotic-based assessments that is implemented into the arm therapy robot ARMin. It includes kinematic (i.e., active and passive ranges of motion, workspace) and kinetic (i.e., strength) assessments as well pathophysiological measurements (i.e., abnormal synergies, stiffness) and the description of the quality of a movement (i.e., distance-path ratio, precision, smoothness). The assessment battery was successfully tested on healthy subjects and patients after spinal cord injury. It offers a sensitive and objective measurement for detailed arm motor functions and can serve as a basis for the future development of robotic-based assessments.
Craniocervical dislocation (CCD) is an unstable and usually fatal injury resulting from osseoligamentous disruption between the occiput and C2, and is not as rare as once thought. CCD occurs more frequently in children. Ligamentous structures of craniocervical junction are underdeveloped in the children, and these variables lead to increased incidence of CCD. Patients with CCD have an associated head injury and other organs injury. This makes the initial neurological examination difficult. Most patients present after intubation and often under cardiovascular inotropic support. Despite the significant deficits that may occur, patients may present without neurological deficits. In the last decade these cases were treated successfully. This is result of improved resuscitation, immobilization, transportation, better diagnostic techniques, and a higher index of suspicion. The diagnosis of craniocervical dislocation was associated with an increased of neurological deterioration. Diagnosis is usually made with plain cervical radiographs. In cases in the injury is not initially evident, many schemes have been developed. These schemes are applied to the three-view or five-view cervical radiograph series. Radiological examination is aided by high-resolution computerized tomography and magnetic resonance imaging. Patients with incomplete CCD may be managed successfully with orthotic immobilization whereas other usually undergo early occipital cervical fusion. The effort of cervical traction is unclear. The definitive management of this injury is unclear. Several factors should be considered when deciding if a surgical or nonsurgical strategy will be used. Considerations should be given to the patient’s age, type of CCD, and neurological status. In this strategy the first step is deciding if the patient is an appropriate candidate for screw fixation. Children may be treated nonsurgically by close observation. We believe that early halo vest immobilization should be instituted for reduction of the dislocation. The exact length of time a halo vest or other orthosis is required to allow adequate healing is uncertain from 8 to 10 weeks. Most surgeons agree that occipitocervical screw fixation is superior to sublaminar cable (or wire) fixation. however, particularly regarding the C1-2 region, is unclear. Those with incomplete ligamentous injury (incomplete CCD) may also be treated with orthosis alone. Other with complete CCD should usually undergo early occipitocervical fusion. Early diagnosis and spinal stabilization protected spinal cord injury.
HEMISPHERIC CEREBRAL ISCHEMIA IN TRAUMATIC BRAIN INJURY: A REPORT OF TWO CASES

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Aim. We wish to discuss the possible pathophysiological mechanisms of hemispheric cerebral ischemia as secondary injury following traumatic brain injury and treatment options to prevent it’s occurrence.

Introduction. Vascular injury to the brain as a secondary phenomenon is not uncommon in head injury. Abnormality in cerebral blood flow after moderate or severe head injury is well known. There are plenty of reports of focal vascular insults in head injury; however hemispheric ischemia ensuing a few days after the initial presentation and surgical treatment of acute epidural hematomas is rare.

Case reports. We present two cases of young male patients, thirty and thirty-two years old, respectively, who presented themselves with sudden neurologic deterioration after traumatic head injury. CT scan showed acute epidural hematoma in both cases. Both were operated in our clinic emergently, hematoma evacuation through osteoplastic craniotomy was performed, and the patients were meticulously followed up in the ICU. Early postoperative CT scan showed good postoperative results and no signs of ischemia. Because of slow neurological recovery, another postoperative CT scan was performed a few days later and acute hemispheric cerebral ischemia was verified. In both cases decompressive surgery was performed to minimize damage from excessive brain swelling and in one case external ventricular drain was placed to measure and regulate ICP. After a prolonged hospital stay, neurological improvement was achieved to some degree, but major neurological deficits still remain making the clinical outcome undesirable.

Discussion. The traumatic vascular damage may be primary or secondary. Primary TVD involves intimal damage, dissection, subintimal hemorrhage, or laceration, all of which may be complicated by thrombosis or embolism. Secondary TVD occurs as a result of compression from intracranial hematoma, increased intracranial pressure or brain herniation and shearing forces following brain swelling. Significant extracranial factors influencing cerebral blood flow include: systemic hypotension, systemic hypoxia, pyrexia, anemia, hyperglycemia and others.

Protocol-based delivery of care consists of therapeutic interventions to improve oxygen delivery to the brain and brain protection strategies to minimize the damage to the ischemic brain tissue.

Conclusion. Recognizing secondary brain insult and the associated risk factors may help identify the group of patients at risk and tailor management of patients with severe TBI. Management strategies useful in prevention of such insults and early management of such complications when they occur can improve prognosis.
THE IMPACT OF ALCOHOL INTOXICATION AND CRANIOCEREBRAL INJURY TYPE ON TREATMENT OUTCOME FOR PATIENTS OPERATED WITH CRANIOCEREBRAL INJURY

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INTRODUCTION: In patients with severe craniocerebral injuries that require surgical intervention due to their compressive effect, we can expect poor outcome of the treatment. According to available data from the medical literature, harmful influence of alcohol intoxication at the time of the occurrence of injury, has not been proven to effect the outcome of the treatment. The aim of this study is to analyze the impact of these factors on the outcome of treatment in patients operated with craniocerebral injuries.

MATERIAL AND METHODS: In a group of 38 patients who underwent surgery because of craniocerebral injury in the period between 9/2011. and 9/2014, the authors have focused on the impact of alcohol intoxication at the time of the occurrence of injury (alcohol level in plasma above 1 promille (‰) and clinical signs of intoxication) and the type of the craniocerebral injury that required surgical decompression, on the final clinical outcome.

RESULTS: At the time of occurrence of craniocerebral injuries, all patients were intoxicated with alcohol concentration in plasma higher than 1 promille (‰). According to gender, most men were operate, 34 men (89.4%) and 4 women (10.6%). By the type of the craniocerebral injury, subdural hematoma occurs in 68.4% of cases, epidural hematoma in 44.7% of cases and impression fracture in 18.4% of cases. Statistical analysis did not show a worse prognosis in patients intoxicated with alcohol. The presence of craniocerebral injuries with significant compression effect influenced the final prognosis.

CONCLUSION: Results of this studies have not shown any harmful effect of alcohol intoxication at the time of craniocerebral injury on the final outcome of treatment.
PROBLEMS OF DIAGNOSIS, INDICATIONS FOR SURGERY AND OUTCOMES IN PATIENTS WITH POSTTRAUMATIC HYDROCEPHALUS

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Introduction Posttraumatic hydrocephalus (PTH) is a consequence of traumatic brain injury (TBI), which influences the recovery and outcomes of TBI victims. However, until now no strict indications for surgical treatment have been proposed. The influence of these procedures on mental recovery is still under question.

Materials and methods 200 patients with PTH have been admitted to our hospital for diagnosis and treatment. Before the treatment the outcomes according to Glasgow Outcome Scale (GOS) was estimated as good recovery in 8 pts (4,0%), moderate disability in 66 pts (33,0%), severe disability – 89 pts (44,5%) and vegetative state in 37 pts (18,5%). All these patients underwent surgery: 195 shunting procedures and 5 endoscopic ventriculostomies.

Results In 158 (79,0%) patients shunting procedures resulted in improvement of mental status. In 41 cases (20,5%) various complications have occurred, among them, 13 infectious complications (6,5%). A re-operation was performed in 34 cases. Mortality was 3,5% (7 pts).

Conclusions In patients with PTH shunting procedures can help to achieve higher levels of mental recovery, yet the indications for surgery should be thoroughly considered.
THE USE OF MODERN ADDITIVE TECHNOLOGIES IN RECONSTRUCTIVE NEUROSURGERY

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Introduction: Laser stereolitography (STL) is an additive technology, which proves to be very useful in reconstructive neurosurgery.

Materials and methods: 358 patients with large and complex skull defects (the area varied from 16cm² to 320cm²) underwent cranioplasty with the use of STL. Generally defects were larger than 60cm², involved orbito-frontal area and had complex configuration. On average it takes 24 to 72 hours to produce models of the skull, implant and the press-form with the use of STL. These models and press-forms are used by a neurosurgeon intraoperatively to produce PMMA implants. The ready implant can be additionally modeled in situ with a high-speed drill to fit the defect well.

Results Good functional and cosmetic results have been achieved in 336 pts (93,8%), satisfactory results in 17 pts (4,7%) – due to the scars and significant atrophy of soft tissues. Infectious complications have been in 5 cases (1,4%).

Conclusion STL is a simple modern technology, which improves functional and cosmetic results in reconstructive neurosurgery, especially in patients with large complex defects.

Head gunshot wound in thirteen year old boy Thirteen year old boy was admitted to the emergency room because of small wound on his right eyebrow. Anamnesis revealed that the wound was accidentally self inflicted by a air rifle. On admittance the boy was fully alert, Glasgow Coma Score 15 and walking with no neurological deficit. Skull x-ray showed metal fragments projecting inside the scull. Multi slice computerized tomography (MSCT) was performed showing two pieces of projectile. First one inside frontal sinus on the right side, and the second one penetrating the posterior wall of the sinus and brain parenchyma near the pole of right frontal pole, continuing upwards and stopping subcorticaly in area of superior frontal gyrus. Emergency surgery has been performed together with otorhinolaryngologist and both fragments were extracted. Postoperative course was regular and the patient fully recovered.

Keywords: gunshot wound, head, air rifle, traumatic brain injury Hrvoje Krpina, M.D. Department of Neurosurgery, Zadar General Hospital, Zadar CroatiaRade Škarica, M.D. Department of Neurosurgery, Zadar General Hospital, Zadar CroatiaProfessor Neven Skitarelić, M.D., pHD., Department of Otorhinolaryngology, Zadar General Hospital, Zadar, Croatia
HEAD GUNSHOT WOUND IN THIRTEEN YEAR OLD BOY

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Thirteen year old boy was admitted to the emergency room because of small wound on his right eyebrow. Anamnesis revealed that the wound was accidentally self inflicted by a air rifle. On admission the boy was fully alert, Glasgow Coma Score 15 and walking with no neurological deficit. Skull x-ray showed metal fragments projecting inside the skull. Multi slice computerized tomography (MSCT) was performed showing two pieces of projectile. First one inside frontal sinus on the right side, and the second one penetrating the posterior wall of the sinus and brain parenchyma near the pole of right frontal pole, continuing upwards and stopping subcorticaly in area of superior frontal gyrus. Emergency surgery has been performed together with otorhinolaryngologist and both fragments were extracted. Postoperative course was regular and the patient fully recovered.

Keywords: gunshot wound, head, air rifle, traumatic brain injury
RETAINED NON-METALLIC FOREIGN BODIES AFTER PENETRATING CRANIO-ORBITAL INJURIES: A TIME BOMB?

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Introduction Penetrating brain injuries (PBI) are common in urgent neurosurgical practice, however, PBI by non-metallic foreign bodies are otherwise sporadic. According to the available literature (mostly single case reports or small series) these injuries are often overlooked.

Materials and methods In our Institute 7 patients with retained wooden foreign bodies have been examined, treated and followed-up. Additionally we have reviewed 43 articles on this problem.

Results All the patients admitted to our department have come with various symptoms related to infectious complications. The foreign body was either misdiagnosed during primary admission or was left in place entirely or partly. Diagnosis may be confusing in the acute period of trauma. CT may not reveal the non-metallic (especially organic) foreign body. In this cases MRI can be helpful. The period of time between the trauma and the first symptoms of infectious complication varied from 2 days to 7 years. 6 patients in our series underwent surgerical procedures and improved. No patients have died.

Conclusions In cases of PBI with a suspected non-metallic foreign body precautions should be taken. MRI may be helpful in cases when CT shows no particular signs of a foreign body. Surgical removal should be considered a method of choice, because these foreign bodies seem to be a risk-factor of infectious complications.
HUMAN FACE OF MODERN NEUROSURGERY AND ITS CONTROVERSIES

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Background
Modern neurosurgery has become more accurate and effective due to neuroimaging techniques and minimally invasive approaches. It is more humane and patient-friendly today. But new controversies have also emerged which need to be resolved.

The 21st century neurosurgery experiences both a technological boom and an ethical crisis. Ethics is often viewed as an unnecessary wrapping for high technologies but it is the ethics that determines the human face of neurosurgery and every neurosurgeon.

Controversies in modern neurosurgery:
1. making a fetish of visual data and ignoring anamnesis, clinical picture and personality of a patient;
2. abundance of sophisticated methods and techniques and lack of general theories and concepts;
3. fulfilment of recommendations of evidence-based medicine and individual efficacy of treatment;
4. risk of surgery and risk of natural history;
5. common sense and logic of scientific knowledge;
6. hope for saving a life and need for organ transplantation;
7. professional duty and commercial temptations;
8. great technical possibilities and limited financial resources;
9. sencity of life and quality of life.

Modern medicine is focused on disease symptoms and pathology, whereas patient’s personality is often ignored. A human being is being divided into a disease bearer and a personality which is of little interest to a surgeon.

Neuroimaging techniques are necessary but their use may result into negative psychological effects such as:
1. a syndrome of doctor–patient disconnection;
2. hyposkillia and atrophy of clinical judgment.

A neurosurgeon should remember that he or she operates upon a patient, and not upon patient’s CT or MRI scans.

There are three models of doctor–patient relationship: paternalistic, partner, commercial. Ethics must play an important role in any type of doctor-patient relationship.

The key condition of humanization of neurosurgery in the 21st century is:
a neurosurgeon should be not only a HOMO SAPIENS, but also a HOMO MORALIS.
Spinal pain is a common problem concerning 70-80% of the population. Among various biological methods, the cell therapy based on the transplantation of autologous chondrocyte cells seems to be promising.

The aim of the study was to find the procedure which stimulates matrix production, increases the amount of chondrocytes, and equates the disturbed balance between anabolism and catabolism within the disc.

The population of the study consisted of 50 operated patients, aged 18 to 40, for single-level lumbar discopathy L4-L5 or L5-S1, and the control group of 20 patients operated on the same level without autologous chondrocytes transplantation. The study revealed that the transplantation of cultured cells produced a good radiological and clinical effect. Owing to the MRI examination and the assessment of T2-weighted images, the level of disc hydration was estimated before and after the operation with administering of cultured cells to the operated space. In order to carry out the clinical assessment, examinations on scales VAS and ODI were used. The same procedures were performed in the control group of operated patients without cells transplantation.

The conducted examinations show that the transplantation of autologous chondrocyte cells derived from the culture to the previously operated intervertebral space suppresses degenerative processes of the disc and influences its recreation. Tests in the light and confocal microscopes indicate a good integration of transplanted cells with the matrix and their correct productive activity as the production of typical components of the matrix - collagen I, II, III, IX, proteoglycans and aggrecans and anomalous for the matrix-collagen type IV.

The role of the collagen type IV in both processes of degeneration and regeneration of the intervertebral disc can be the subject for future research.
TRAUMATIC BRAIN INJURY IN CHILDREN – RETROSPECTIVE ANALYSIS

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Although traumatic brain injuries (TBI) occur commonly in childhood, they are mostly mild and not associated with long-term complications. In this retrospective analysis we showed 350 children (128 girls and 222 boys) hospitalized for TBI in a 5 year-period in Slavonia - Brod County. Most of injured children had both contusion and commotion (46.8%), followed by just contusion of the head (12.5%) and fractures of the skull (10.5%). The haemorrhages and hemathomas were less common (epidural, subdural, SAH) (3.2%). The most commonly X-rays performed were those of the head (craniogram) and/or cervical spine, followed by CT, EEG, ultrasound and NMR. The occurrence of complications was recorded in only 2% of injured children (seizure, syncopa, febril convulsions). In most children (89.6%) therapy was conservative. The children were treated in the consultation with pediatricians, surgeons/traumatologists, specialists of ENT/maxilofacial surgery, neuropediatricians, pediatric surgeons, ophtalmologists and others. Our results could be helpful in planning the prevention of such injuries, in the hospital admission process and in the treatment of injured children.
Posttraumatic epilepsy (PTE) is an established consequence of head injury. It accounts for about 4% of cases of focal epilepsy in the general population and is the leading cause of epilepsy with onset in young adulthood. (PTE is classified into three groups: immediate seizures, which occur within 24 hours after the injury; delayed early seizures, which occur during the first week; and late posttraumatic seizures, which occur more than 1 week after the injury. The first two groups are usually termed early, and these seizures are considered to be direct reactions to brain damage. Seizures during the acute phase (within the first week after trauma) have a low likelihood of recurrence, whereas later seizures are likely to recur and so may represent epilepsy. Early seizures appear to result from the direct physical injury. These are acute symptomatic events and are not believed to represent epilepsy. Immediate seizures are a distinct category of early seizures, those occurring within 24 hours of trauma. These are thought to represent “convulsive concussions” because of brief traumatic functional decerebration that results from cortical inhibition and not epileptic events. The risk of PTE is highest within the first 2 years following a brain injury with most patients who have a late post-traumatic seizure experiencing a second seizure within 2 years. A high seizure frequency in the first year of onset predicts future seizure severity and medical intractability. However, a substantial minority (15%–20%) of patients may experience their first seizure beyond 2 years. Brain trauma is the cause of epilepsy in approximately 5% of the patients referred to specialized epilepsy centers, and these cases of epilepsy are often difficult to control with medical therapy. Factors involved in the origin of posttraumatic seizures are still unclear. The commonly accepted risk factors for delayed posttraumatic seizures are: early posttraumatic seizures, depressed skull fracture and intracranial hematoma, prolonged unconsciousness, low Glasgow Coma Scale score, and prolonged posttraumatic amnesia. According to another group of authors, documented cortical-subcortical brain lesions represent the main risk factor for delayed PTE.

Key words: epilepsy, head injury, seizures
CEREBRAL HAEMORRHAGE ASSOCIATED WITH GINKGO BILoba - A CASE REPORT

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Background: Ginkgo biloba extract is widely advertised in the media as a magical herbal drug for an extensive range of conditions, most commonly used to treat dementia. While its precise mechanism of action is not completely understood, Ginkgo biloba is believed to improve cerebral and peripheral blood flow by nitric oxide induced vasodilation, antioxidant activity and inhibition of platelet-activating factor. We present a patient case report of fatal cerebral haemorrhage after regular self-medication with Ginkgo biloba.

Case report: A 87-year-old female were admitted to the hospital during the night. At admission she had a Glasgow Coma Scale of 10 (E4, V1, M5), symmetric, reactive pupils and occipital lacerocutaneous wound. Emergency CT- scans show a subarachnoid haemorrhage, temporal and parietal subdural haemorrhage on the left side and frontal on the right side. Laboratory findings show prothrombin time 60% and fibrinolysis 65 min. We start emergency preoperative preparation with fresh frozen plasma and cryoprecipitate; we checked platelets aggregation. During the preparation patient became hemodynamically unstable, GCS 3. Her family arrived to the hospital and we found out that she was without known health problems and in good physical condition, taking only Ginkgo supplement to boost memory and prevent dementia. The platelets aggregation test was extremely low. There were no other risk factors for haemorrhage than Ginkgo consummation. After emergency operation and in spite of appropriate transfusion and correction of coagulation impairment, patient died 24 hours after admission.

Conclusion: Numerous review articles note that Ginkgo biloba can be a risk factor for bleeding, but strong clinical evidence for it is lacking. Our case report can be a strong suggestion that using herbal supplements can be fatal. Nowadays we need a higher level of concern for that by medical staff, with complete list in medical record of all drugs patient taking, including herbal supplements.
POSTTRAUMATIC LONG-TERM BASAL CSF LEAKAGE: SURGICAL TREATMENT

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Introduction: Basal CSF leakage is considered a meaningful unfavorable risk factor influencing the outcomes of traumatic brain injury because of possible infectious complications.

We present results of surgical treatment of long-term basal CSF leakage.

Materials and methods: We operated 255 patients aged 3-71 years from 1988 to 2014. Time between CSF leakage occurrence and surgery varied from one month to 25 years, average 2,7 years. CSF leakage before admission of these patients to the Institute was complicated by development of meningitis in 43,9% of all cases. In all cases we used autological tissues alone for the plastic reconstruction; 135 of them were operated using fibrin-thrombin glue.

Results: Initially intracranial intervention was combined with recurrent lumbar punctures following surgery (46 cases); CSF leakage has recurred in 10 cases (21,7%) and meningitis encountered in 3 cases (6,5%). Later on (17 cases) intracranial intervention with percutaneous external drainage of the lumbar CSF was performed with the following recurrence and meningitis in this series making up 11,8% and 23,5% correspondingly. At the following stage an intracranial intervention with “tunnel” external drainage of the lumbar CSF was performed in 119 cases (recurrence - 10,9%, meningitis – 5%). In 5 cases when CSF leakage was combined with intracranial hypertension, skull base plasty was carried out together with shunting (recurrence – 40%). CSF fistula closure was performed by the transnasal approach in 51 cases; recurrence and meningitis were 15,7% and 9,8%, accordingly. Shunting operation alone was performed in 15 patients. CSF leakage recurrence with decreased CSF leakage volume was marked in 3 cases (20%), meningitis was observed in one patient (6,7%).

Conclusions: The best results of surgical treatment of long-term basal CSF leakage with the verified CSF fistula were achieved when using combination of intracranial intervention and intra-and postoperative CSF drainage.
In the study the dependence of species of the P300’s topography of acoustic event-related potential (ERP) on the stage of conscious recovery and consequent mental activity restoration were analyzed at 22 unconscious patients with heavy brain trauma. During the first ERP-recording patients have being in vegetative state or akinetic mutism. The catamnesis from 2 to 10 years was traced at all patients. The outcome to vegetative state, minimal conscious state and clear conscious was considered.

ERP were recorded with the using an oddball paradigm consisting of the target (20%) and standard (80%) tones. Regardless of the current mental state and availability of verbal contact to the patients, ERP were recorded as without any instruction and after the instruction to count target tones. Amplitude, latency and topography of P300’s amplitude were analyzed.

The high sensitivity (83%) of amplitude and latency relative to favorable forecast was shown. It was revealed that the already existence of P300 recorded without some instruction at patients in the vegetative state is prognostic favorable attribute. It was shown the right-side localization of P300 is more favorable attribute to forecast a conscious restoration on the stage of vegetative state. In the case of favorable forecast it is impossible to predict the exactly time and the completeness of mental restoration. Thus the absence of P300 ERP recorded both without any instruction and with instruction to count tones is not an absolute unfavorable attribute at any stage of conscious restoration and it is marked at quarter of patients with the consequent restoration of all formal attitudes of clear conscious.
ASSESSMENT METHOD VALIDATION AND OUTCOMES WITH INTERFERENTIAL MEDIUM FREQUENCY ELECTRICAL CURRENTS (IMFES) THERAPY FOR MICTURITION CONTROL IN NEUROGENIC BLADDER (NB)

Motto: “Necessity, who is mother of invention” - Plato, The Republic Dialogue

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Introduction Presentation of our endeavours towards validation of an own, customized, non-urodynamic, quantified assessment scale, applied to assess the efficiency of IMFES standardized therapeutic method for micturition control (MC) rehabilitation in (mainly) post SCI.

Methods Comparison of Bors-Comarr (B-CC – in figures converted) with our customized (OCC) methods: intrinsic and extrinsic validation, based on a related prospective study, fulfilled between 2006 - 2011: 332 in-patients with NB; the cases were divided in two lots: IMFES (162, mean 39.63 years, st. dev. 17.06) and control (170, mean 39.96 years, st. dev. 17.58), stratified by AIS sensory (AS) and motor (AM) scores.

Main Results of the tests used for validation: B-CC/OCC intrinsic global sensitivity (0.82/ 0.68), specificity (0.48/ 0.73) test efficiency (0.65/ 0.71) and extrinsic - coefficients -: Somers (0.921, 95% confidence interval - c.i. - 0.909-0.933), Spearman (0.970, 95% c.i. 0.962-0.978 ), α Cronbach (0.969, 95% c.i. 0.962 - 0.975), Kendall (0.921, 95% c.i. 0.909-0.933), Pearson (0.949, 95% c.i. 0.939-0.959). They support the statistical outcomes within the mentioned prospective study: the number of inpatients that significantly improved their MC was overall higher in the IMFES lot (by squared radicals’ efficiency averages - mean 14.95, st.dev. 11.95) compared to controls (mean 21.79, st.dev. 12.70) - p<0.0001 - especially for those AIS B at admission, with AS between 161-224 (IMFES: mean 16.82, st.dev. 69.11; controls: mean 32.57, st.dev. 78.51; p< 0.0001) and AIS C, with AS between 161-224 and AM below 41 (IMFES: 15.15, st.dev. 74.98; controls: mean 26.34, st.dev. 124.76; p< 0.0001). For AIS A or B cases, with AS between 89-160 and for those AIS C or D, with AS between 160-224 and AM over 40, the method is ineffective, respectively useless.

Conclusion OCC, although needing further research appears valid for evaluation and IMFES proves useful in rehabilitation of NB for incomplete SCI.

Key words: spinal cord injury, neurogenic bladder, assessment method, validation, interferential medium frequency electrical currents
DEEP BRAIN STIMULATION IN THE TREATMENT PROTOCOLS OF DISTURBS OF CONSCIOUSNESS

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ABSTRACT TEXT FIELD:

Recent growth of the entire rehabilitation area may have a close interaction with Deep Brain Stimulation (DBS). In latter times more neuro-rehabilitation protocols for treatments of Disturbs of Consciousness (DOCs) regard the applications of new technological tools (i.e. Robots) or advanced neurosurgical therapies such and DBS or ITB pump implants. DBS, as a rehabilitation therapy in DOCs, creates new opportunities of treatments but arises ethical and methodological issues. Consequently, it is important to study how the invasive brain stimulation approaches could be combined with traditional rehabilitation methods to guarantee the correct approach. We recently conducted a review on recent data available in literature concerning both ethical and DBS results in the acute phase of rehabilitation of DOCs and we will present the results of a protocol we recently conducted together with neurosurgeons performing bilateral electrical central thalamic stimulation in patients in Vegetative State (VS) and in Minimally Conscious State (MCS). We measured level of responsiveness using the CRS-r and Coma-Near-Coma scales and considered 48 patients as eligible. Only two patients (in a VS from a TBI) could be implanted after the strict neuro-physiological (by continuous EEG, BAEPs and SSEPs), and neuro-radiological inclusion criteria have been assessed. We in fact determined the location and extent of brain damage before including cases in the protocol. This strict method of selection is firstly used to include patient in a such protocol and is meant to provide effective results on awareness and waking from a VS and MCS. We detected few variation of scores of various scales, with changes in singular sub-items of CRS-r and Coma-Near-Coma scales but with no variations of final total scores. The crucial aspect of a correct selection of patients is definitively the main issue that will lead the decision to consider DBS in the rehabilitation protocol of DOCs.
COGNITIVE IMPAIRMENT AFTER TRAUMATIC BRAIN INURY

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University Department of Neurology
“Sestre milosrdnice” University Hospital Center, Zagreb

Cognitive changes are among the most common consequences of traumatic brain injury (TBI). Depending on the location and the extent of the injury, different types of cognitive and behavioral problems may be present.

In both the early and late post-injury periods, cognitive deficits most often include impaired attention and reasoning, impairment of executive functions and memory, which makes difficulties in learning new skills. Long-term memory most often remains unaffected. Posttraumatic speech impairment may include aphasia or dysphasia and dysarthria which lead to communication problems. Besides cognitive changes, patients with TBI often present with behavioral changes, so depression, anxiety, irritability, impulsivity and reduced frustration tolerance may be present.

The neurochemical bases of cognitive impairment after TBI is not completely clear, however, posttraumatic dysfunction of glutamate, dopamine, serotonine, acetylcholine and other neurotransmitter systems is probably involved. In acute TBI, excessive production/delivery of these neurotransmitters occurs, which probably contributes to attention, memory and arousal deficits. As cerebral cholinergic neurons and their ascending projections are particularly vulnerable to acute and chronic traumatically mediated dysfunction, long-term dysfunctions of these systems are most likely present in patients suffering from persistent post-traumatic cognitive problems. Posttraumatic cognitive and behavioral issues are often referred to as posttraumatic encephalopathy. If they become persistent problems for patients with moderate-to-severe TBI, the construct of posttraumatic dysexecutive syndrome is frequently used.

Depending on the degree of TB and cognitive impairment, therapeutic possibilities include catecholaminergic and and cholinergic augmentation, as well as specific cognitive rehabilitation interventions.
EVALUATING THE PROGNOSTIC VALUE OF A NEW MRI-BASED TRAUMATIC BRAIN LESION CLASSIFICATION FOR OUTCOME PREDICTION


Burdenko Neurosurgical Institute, Moscow, Russia

Introduction:
Advanced MRI sequences enable a delicate identification of traumatic brain lesions. Our aim was to develop a prognostically valuable grading scale for traumatic brain lesion level and localization.

Materials and methods:
Advanced MRI sequences were used to examine 212 patients aged 8 - 74 (average 31±14) with an acute traumatic brain injury (TBI) in the period of 2001 - 2014. All patients were classified into eight grades reflecting the level of brain damage (cortical-subcortical structures, corpus callosum, subcortical nuclei, thalami as well as uni- or bilateral midbrain level, pons and medulla oblongata) and relationships between the lesion level and localization and Glasgow coma scale (GCS) and Glasgow outcome scale (GOS). We evaluated the predictive value of a new classification using a generalized linear model and dichotomized GOS.

Results:
A significant correlation was revealed between the proposed MRI grading scale and GCS (R=-0.66; p<0.0001) and GOS (R=-0.67; p<0.0001). MRI data on brain lesions, intracerebral, subdural and epidural hematomas, intraventricular and subarachnoid hemorrhage, midline shift, mesencephalic cistern compression and secondary brain ischemia allowed us to predict outcome with 83% accuracy (95% confidence interval (CI), 69% - 92%). The proposed grading scale allowed the correct prediction of outcome in 81% of cases (95% CI, 68% - 90%). Adding gender and age, MRI data on intracranial hematomas, hemorrhage, brain displacement and GCS to the model jointly with the proposed classification has slightly improved the accuracy of prediction up to 89% (95% CI, 77% - 97%) with 88% sensitivity, 91% specificity, positive prediction value of 92% and negative prediction value of 87%.

Conclusions:
The results of the study have proved the prognostic value of the proposed MRI-based traumatic brain lesion classification. Validity of the developed model will be estimated on larger series of observations..
ANOSOGNOSIA: A DIAGNOSTIC AND THERAPEUTIC CHALLENGE IN MULTIDISCIPLINARY NEUROTRAUMATOLOGY

Honorary Klaus von Wild Lecture
Speaker: George P. Prigatano, Ph.D.

Abstract:
Classical anosognosia has been described in the neurological literature for hemiplegia, cortical blindness, and certain forms of aphasia. It has progressively become clear that anosognosia and less severe forms of impaired self-awareness (ISA) can exist for cognitive and personality deficits following severe traumatic brain injury (TBI). If not properly diagnosed and managed/treated, TBI patients with significant ISA do not adequately engage neurorehabilitation and often have poor treatment compliance. Moreover, they tend to make poor choices in life post-discharge. This results in significant psychiatric comorbidity which appears to be reactionary in nature (i.e. severe depression, enhanced anxiety, ongoing irritability and overt aggression). This presentation will discuss the problem of ISA after TBI within the context of a broader discussion of the study of anosognosia. It will compare and contrast ISA to denial of disability (DD) in this patient group and provide clinical suggestions for its diagnosis and management/treatment.
CURRENT CONCEPT IN ENDOSCOPIC AND MINIMAL INVASIVE PERIPHERAL NERVE AND BRACHIAL PLEXUS SURGERY

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ABSTRACT

Peripheral nerve injury is relatively common and occurs primarily from trauma or sometimes as a complication of surgery. Despite advancements in the precision of microsurgical techniques, full functional recovery following peripheral nerve repair is hard to achieve.

Multidisciplinary evaluation (cooperation of neurosurgeon, orthopedic, vascular, and plastic surgeon, physiatrist, physiologist, neurologist and radiologist) is necessary for a successful treatment.

The age of the patient, the mechanism of the injury and the associated vascular and soft-tissue injuries are factor that foremost influence the extent of recovery of the injured nerve.

In selected cases surgical treatment is performed. There are four main types of surgical treatment of peripheral nerve injury: 1. Neurolysis; 2. End-to-end suture; 3. Nerve grafting; 4. Nerve transfer. Primary tensionless end-to-end repair should be carried out whenever possible. For longer nerve gaps, the use of autologous nerve grafts is the current “gold standard”.

Over the past few years, the use of the commercially available nerve conduits for bridging short nerve gaps has increased. The evolution of tissue engineering, the use of biodegradable conduits for reconstruction of nerve gaps has shown promising results.

During last few years technological development lead to creation of new, minimally invasive surgical techniques, growing in every part of surgery, and it found its place in peripheral nerve and brachial plexus surgery.

Multidisciplinary approach individually shaped for every patient is of the outmost importance for successful treatment of peripheral nerve and brachial plexus injuries. In the future, integration of biology and nanotechnology may fabricate a new generation of nerve conduits that will allow nerve regeneration over longer nerve gaps and start new chapter in peripheral nerve surgery.

INTRODUCTION

In the year 1608 the first reconstruction of transected nerve was performed by Ferara, however, modern peripheral nerve surgery starts with use of operative microscope by Curtze in 1964. Technological development made possible for this part of neurosurgery to grow, so that nowadays, possibilities of peripheral nerve and brachial plexus surgery are exponentially improved. More precise diagnostics, microsurgical technique and minimally invasive approaches made huge improvement in treatment outcome. Multidisciplinary approach – cooperation of neurosurgeon, orthopedic, vascular, and plastic surgeon, physiatrist, physiologist, neurologist and radiologist is the essential factor in treatment of peripheral nerve injuries. The aim of this paper is to present current accomplishment and limitations of peripheral nerve and brachial plexus surgery, analyzing available literature.
Peripheral nerve injury is relatively common and occurs primarily from trauma or sometimes as a complication of surgery. Traumatic injuries can occur due to stretch, crush, laceration and ischemia and are more frequent in wartime. Up to 3% of all trauma patients have peripheral nerve injury, increasing to 5% if brachial plexus and root avulsion cases are included. (1)

Following a nerve injury, the axons undergo degenerative processes, followed by an attempt at regeneration. Despite advancements in the precision of microsurgical techniques, full functional recovery following peripheral nerve repair is hard to achieve. (2)

Primary tensionless end-to-end repair should be carried out whenever possible. For longer nerve gaps, the use of autologous nerve grafts is the current “gold standard”. Over the past few years, the use of the commercially available nerve conduits for bridging short nerve gaps has increased. The evolution of tissue engineering, the use of biodegradable conduits for reconstruction of nerve gaps has shown promising results.

Pathophysiology of the peripheral nerve injury

The epineurium, perineurium and endoneurium are the connective tissue structures that protect and provide a framework for the nerve fibers. Blood supply to the peripheral nerves originates from the segmental extrinsic and longitudinal intrinsic blood vessels that originate from local and regional arteries. Although there are extensive connections between the extrinsic and intrinsic blood vessels (3) the peripheral nerves are primarily dependent on the intrinsic blood supply. Excessive tension along the nerve can significantly compromise the intrinsic blood supply. (4)

Almost immediately after injury, Wallerian degeneration begins, sealing the severed axon ends and initiating the regenerative phase. (5) After this, decreased production of neurotransmitters and increased production of materials necessary for regeneration begins. (6) Over the first few days following peripheral nerve injury, the axons in the distal nerve stump will degenerate. However, the myelin sheath and the basal lamina provided by the Schwann cells remain intact. (7) Presence of macrophages at the site of injury stimulates the proliferation of Schwann cells in the distal stump. (8, 9) The proliferation of Schwann cells within their basal lamina leads to the formation of tube-like structures - Bands of Büngner, which provide a guide so that axons regenerating from the proximal stump can reach their targets. (10) Proliferating Schwann cells from the distal nerve stump provide the growth cones and guide the regenerating axons. Spontaneous functional recovery is dependent on the number of correctly matched motor and sensory neurons.

Patient evaluation

In order to properly evaluate every patient initially, detailed patient history must be obtained. Next, a thorough neurological and clinical examination must be performed. After these two essential segments of patient assessment, electrophysiological evaluation and sometimes neuroradiological examination (MRI, CT scan and high resolution ultrasonography) is done. EMNG (electromyoneurography) performed two or three weeks after injury shows fibrillations and later denervation potential. MR, CT and ultrasonography are adjuvant methods that can show partial or complete transection of the nerve or compression between bone fragments.

The age of the patient, the mechanism of the injury and the associated vascular and soft-tissue injuries are factor that foremost influence the extent of recovery of the injured nerve.
Table 1. Classification of nerve injuries by Seddon and Sunderland

<table>
<thead>
<tr>
<th>Seddon</th>
<th>Sunderland</th>
<th>Injury</th>
<th>Degeneration</th>
<th>Regeneration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neurapraxia</td>
<td>First degree</td>
<td>Myelin sheath (M)</td>
<td>Conduction block</td>
<td>Complete recovery</td>
</tr>
<tr>
<td>Axonotmesis</td>
<td>Second degree</td>
<td>M+Axon (A)</td>
<td>Wallerian degeneration</td>
<td>Incomplete recovery</td>
</tr>
<tr>
<td>Neurotmesis</td>
<td>Third degree</td>
<td>M+A+Endoneurium (E)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fourth degree</td>
<td>M+A+E+Perineurium (P)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fifth degree</td>
<td>M+A+E+P+Epineurium</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sixth degree</td>
<td>Combination of two or more previous types of injury</td>
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</table>

In a first-degree injury according to Sunderland classification (Table 1), patient history usually includes a blunt injury (stretch or compression). In this situation, the nerve continuity is intact and all the layers of connective tissue as well. As a result, there is no presence of Tinel's sign at the site of injury. With this degree of injury, management is conservative and full recovery is expected.

Second- and third-degree injuries according to Sunderland classification are clinically differentiated from first-degree injuries because Tinel's sign will develop and then advance as the axons regenerate. These injuries are also managed conservatively. Full recovery is expected after a second-degree injury.

Surgical intervention is indicated with fourth-, fifth- and sixth-degree injuries. In practice, any open wounds in which nerve injury is suspected should be explored, while closed injuries are usually followed up expectantly with investigative techniques such as electromyography or nerve-conduction studies. If nerve function does not recover after the initial 3-month period after the injury surgical exploration is performed.

Electrophysiological assessment with nerve conduction studies and needle electromyography are useful in evaluation of closed injuries that have not recovered within the first 3 months following the injury. The electrophysiological parameters such as conduction slowing, block or failure evaluates the gross dysfunction of the peripheral nerve.

However, electrophysiological assessments can falsely localize focal lesions because the proximal parts of the peripheral nerve are typically not amenable to electrophysiological evaluation. In these situations, magnetic resonance imaging is increasingly used as it has high specificity and sensitivity when evaluating focal injuries such as cervical nerve root avulsions or other brachial plexus injuries. (11)

Considering all the above, clear indications for surgical treatment are:

- Open injuries with apparent transection of the nerve continuity
- Closed injuries that show no signs of recovery three months after injury
- Progressive neurological deficit because of the scarring or vascular compression
- Pharmacoresistant chronic neurogenic pain, even if neurological recovery after surgery is not to be expected

**Surgical treatment**

Over the past years, surgical techniques have improved tremendously. For any nerve repair, an understanding of the nerve topography will enable the surgeon to align the motor and/or sensory fascicles in the correctly. This will ensure good nerve regeneration and also, optimize functional re-
covery. During nerve repair, it is important to appreciate the longitudinal extent of the injury. The nerve ends should be resected sufficiently to reveal the normal fascicular pattern.

There are four main types of surgical treatment of peripheral nerve injury:

1. Neurolysis
2. End-to-end suture
3. Nerve grafting
4. Nerve transfer

Neurolysis can be the only surgical procedure as it is with lesions in continuity, or it can be done during preparation of the nerve stumps for suture.

Primary end-to-end neurorrhaphy continues to be the most desirable approach for peripheral nerve repair when there is no nerve defect or when the gap between the two ends of the nerve is relatively short. Following complete transection of a nerve, the nerve ends will retract, due to their elasticity, so if not recognized on time, the best surgical option – direct (end-to-end) suture will be impossible to perform. Although interfascicular repair appears logical, extensive dissection and permanent intraneural sutures can lead to fibrosis, thus affecting the functional recovery of the injured nerve.

In contaminated wounds, primary repair should not be undertaken; however, nerve ends should be approximated during initial debridement to prevent the retraction and to ease dissection of the nerve stumps in the course of second surgery.

In the case of greater defects or longer gaps between the cut ends, neurorrhaphy will cause excessive tension at the repair site that will impair microvascular flow in the nerve tissue and lead to excessive scarring at the repair site. In these situations, primary neurorrhaphy should not be performed, and a suitable alternative should be considered.

Nerve grafting is usually performed when nerve tissue defect is longer than 2cm, after all the additional procedures for approximation of the nerve stumps without tension. There are several types of grafting: 1. Cable grafting; 2. Interfascicular grafting; 3. Fascicular grafting; 4. Vascularized grafting. Advantages of interfascicular nerve grafting are better approximation of nerve and graft diameter, better orientation of the fascicles, thin graft gets nutrients by diffusion from its bed, better graft revascularization and less scarring. However, there are also imperfections of nerve grafting - two suture margins that are potential obstacle to axon growth, harder identification of the appropriate fascicular groups in longer defects, scaring of the distal suture margin or graft itself in longer defects.

There has been a significant amount of research dedicated to the development of synthetic nerve conduits for short nerve gaps that are not amenable to primary tensionless end-to-end neurorrhaphy. Using nerve conduits donor-site morbidity, such as pain, scarring, neuroma formation and permanent loss of sensation of the area supplied by the donor nerve, are prevented. At present, several commercially available synthetic nerve conduits have been approved by the U.S. FDA for peripheral nerve repair and include collagen, degradable biological material derived from bovine Achilles tendon or a combination of polyglycolic acid (PGA) and polylactidecaprolactone (PLCL), both of which are degradable synthetic aliphatic polyesters. The majority of published papers is showing that outcome of recovery is similar as when using autograft.

Nerve transfer (neurotization) involves repair of a distal denervated nerve element using different proximal nerve as the donor of neurons and their axons to reinnervate the distal targets. The concept is to sacrifice the function of a lesser-valued donor muscle to revive function in the recipient nerve and muscle that will undergo reinnervation. Nerve transfer procedures are increasingly per-
formed for repair of severe brachial plexus injury (BPI), in which the proximal spinal nerve roots have been avulsed from the spinal cord. Functional priorities in nerve transfer of brachial plexus injuries are (in following order):

1. Forearm flexion
2. Shoulder stabilization
3. Abduction and external rotation of the shoulder
4. Sensory function of the thumb and index finger
5. Hand function

Table 2. Classification of nerve transfers

<table>
<thead>
<tr>
<th>Extraplexal nerve transfer</th>
<th>Intraplexal nerve transfer</th>
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</thead>
<tbody>
<tr>
<td>A. Nerves from the cervical cord</td>
<td>B. Nerves from the thoracic cord</td>
</tr>
<tr>
<td>▪ Spinal accessory nerve</td>
<td>▪ Intercostal nerves (usually III to VI)</td>
</tr>
<tr>
<td>▪ Phrenic nerve</td>
<td></td>
</tr>
<tr>
<td>▪ Anterior nerves of the cervical plexus</td>
<td></td>
</tr>
<tr>
<td>▪ C3 and C4 spinal nerves</td>
<td>▪ Spinal nerve stumps</td>
</tr>
<tr>
<td>▪ Contralateral C7 spinal nerve</td>
<td>▪ Collateral branches of the brachial plexus</td>
</tr>
<tr>
<td></td>
<td>▪ Combined nerve transfer</td>
</tr>
</tbody>
</table>

**Minimally invasive peripheral nerve and brachial plexus surgery**

During last few years technological development lead to creation of new, minimally invasive surgical techniques, growing in every part of surgery, and it found its place in peripheral nerve and brachial plexus surgery.

Endoscopic carpal tunnel release (ECTR) has been performed since the late 1980s, using two operating techniques. Advantages of endoscopic carpal tunnel release are shorter recovery time, less postoperative pain, reduced postoperative wound sensitivity and less scaring. Disadvantages are steep learning curve, less visibility, which may result in incomplete sectioning of the TCL and increased neurovascular injury and increased cost associated with endoscopic instruments. Several published papers showed excellent results using this technique. Hankins et al. showed 82.6% of complete recovery using Brown’s biportal technique, while Chen et al. had 91% of complete recovery using Menon’s uniportal technique. (20,21)

There are also attempts of treating cubital tunnel syndrome using endoscopy. Tsai et al. report 64% success in their series of 85 cubital tunnel releases. (22) Ahcan and Zorman show even better results – in their series good or excellent result was achieved in 91% of patients. (23) While in these series only “in situ” decompression was performed, Krishnan et al. published data of 11 treated patients, where decompression was followed by subcutaneous transposition, with excellent results in 63.7%, good in 27.3% and satisfactory in 9.1% patients. (24)

Tarsal tunnel syndrome surgery can also be performed using minimally invasive endoscopic approach with promising results – 82% had excellent recovery in Mulick and Dellon’s series of 87 treated patients. (25)

Endoscopic surgery of brachial plexus is still in development. Even though the technology has made huge leap in the last years, sometimes exact localization and type of lesion cannot be established,
so open surgical exploration is necessary. A few cadaver trials using surgical robotic systems were conducted in attempt to find a minimally invasive technique for exploration of the brachial plexus, during which would also be possible to make surgical reparation of the injured nerve. (26)

Another interesting application of endoscope is in sural nerve harvesting. As we know, sural nerve is probably the most frequently used donor for nerve grafting. Usual open approach for sural nerve harvesting is done by making series of small incisions in the path of this nerve. In the last few years a new method was developed – endoscopic sural nerve harvesting. Duration of the procedure is about 25 minutes and requires only one skin incision in length of 12mm. (27)

**Future**

The evolution of synthetic nerve conduits has led to exciting possibilities for the future of peripheral nerve surgery. The morbidities associated with autologous nerve grafts can be avoided completely if the synthetic nerve conduits are successful in bridging longer nerve gaps and large diameter nerve defects. Clearly, there is a need for a second generation of nerve conduits that can mimic the microenvironment present naturally within the human body. These include synthesis of conduits with multiple channels, incorporation of growth factors, support cells and extracellular matrix molecules, control of permeability and use of conductive biomaterial to guide axonal regeneration. With the advancement of nanotechnology, bionanocomposites are having a huge impact on diverse areas of biomedical science. Enhanced physical properties of the biomaterials can be achieved by combining the bionanocomposites with the biomaterial at a nanoscale level. One such nanocomposite, polyhedral oligomeric silsesquioxane (POSS), is currently being investigated as a possible biomaterial for engineering the next generation of nerve conduits. With the integration of biology, material science and nanotechnology, extensive work is currently being undertaken to fabricate a biofunctionalised multichannel nerve conduit that will allow nerve regeneration over longer nerve gaps. (28)

**CONCLUSION**

Peripheral nerve surgery has made a remarkable progress simultaneously with technological development. Microsurgical technique, use of operative microscope and usage of modern materials is imperative in surgery of peripheral nerves nowadays. Endoscopic surgery is being used only for selected cases; Using this minimally invasive method trauma of the tissue is less, the incision is smaller, there is less scaring, however chances for iatrogenic lesion of nerve and vascular elements is higher. Open surgery still remains the method of choice in treatment of peripheral nerve injuries, and especially brachial plexus injuries. Improvements in presurgical evaluation leads to more precise determination of type and location of the injury, decreasing the need for complete exploration of the peripheral nerve and brachial plexus and enabling usage of smaller incisions – specific approaches for specific types of lesions. Multidisciplinary approach individually shaped for every patient is of the outmost importance for successful treatment of peripheral nerve and brachial plexus injuries. In the future, integration of biology and nanotechnology may fabricate a new generation of nerve conduits that will allow nerve regeneration over longer nerve gaps and start new chapter in peripheral nerve surgery.
References

THE PEDIATRIC ARM REHABILITATION ROBOT ChARMin

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² University Hospital Balgrist, University of Zurich, Switzerland
³ Rehabilitation Center, University Children’s Hospital Zurich, Affoltern a. A., Switzerland

One of the most prevalent neurological disorders in children is cerebral palsy (CP). CP describes a group of chronic conditions affecting body movement, muscle coordination and posture. Children with CP often suffer from impairments of their arms which affect their independence and participation in daily life, and which require lifelong neurorehabilitative therapy.

Robots are increasingly used in the field of adult rehabilitation as they can provide intensive, repetitive and frequent training while assisting and assessing the patient. However, there are few devices specifically designed for children, taking into account not only safety constraints but also the typical patient requirements and properties of the pediatric target group.

We present ChARMin, a newly designed exoskeleton-based arm robot with six degrees of freedom that allow to guide and assist shoulder, elbow and wrist movements. ChARMin is a highly adaptable and safe robot for children aged five to eighteen years, applicable for the left and right arm. The serial mechanical structure includes parallel kinematics for remote center of rotation actuation. A new audiovisual therapy interface allows for motivating games in virtual reality as well as robot-assisted assessments, and provides the therapist with information concerning patient-specific calibration and settings.

To our knowledge, ChARMin is the first active exoskeleton robot that was specifically designed for rehabilitation of the arm in children.
ORBITAL RECONSTRUCTION IN CRANIO-MAXILLOFACIAL TRAUMA

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Abstract

In the last years, the complex fractures of the viscerocranium have become more frequent due to high velocity impacts. Among these, fractures involving the orbits and anterior cranial base represent a significant component. Orbit can be affected by isolated fractures or by lesions extending from the surrounding areas of the facial skeleton.

The multidisciplinary diagnosis of orbital and craniofacial fractures is of utmost importance in establishing a proper treatment plan. Failure to adequately diagnose these fractures can lead to severe disabilities of the patients. Frequently, these situations need numerous secondary corrections, which often fail to reestablish the proper anatomy and function. Regardless the type of orbital fracture, long-term morbidity remains a key issue.

Accurate reconstruction of three-dimensional orbital anatomy in an acute setting is the most important act in preventing the morbidity determined by this kind of trauma. Any surgeon involved in treating craniofacial trauma should know the multidisciplinary approach to the orbit.
COMBINATION OF CEREBRAL ARTERY DISSECTIONS AND CERVICAL SPINE FRACTURES

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ABSTRACT:
Background: The parallel invasive treatment of coincident invasive cervical fractures and dissecti-
ons of extracranial cerebral arteries is mutually exclusive in most cases. But left untreated, can mean
serious consequences for every single diagnosis. Uniform diagnostic and therapeutic regimens for
this combination injury not yet exist.

Methods: Retrospective analysis of 20 cases of combined injuries from 01/2005-12/2014 and lite-
rature review.

Results: 10 cases were operated on (all suffering for neurological deficits due to an unstable fractu-
re) 10 cases were treated non-operatively (all without neurological deficits; 5 cases unstable and
5 cases with a stable fracture). No ischemic complications were detected in both groups (with or
without anticoagulation therapy). Early onset of administration of heparine did not result in spi-
nal bleeding complications in the surgery group. Progressive neurological deficits or spinal blee-
ding complications were not observed during conservative treatment and anticoagulation therapy
immediately started after diagnosis.

Discussion and Conclusion: The surgical treatment of the cervical spine without treating the dissec-
tion is usually possible without cerebrovascular complications. Early anticoagulation during con-
servative or interventional treatment as well as after cervical spinal fusion rarely requires revision
surgery for spinal bleeding complications. Parallel treatments are indeed possible with surprisingly
low rate of reported/observed complications. A delayed staged therapy with inclusion of conserva-
tive concepts should be preferred (especially in the absence of neurologic deficit) to minimize
cerebrovascular risks. A preinterventional/preoperative cranial MRI is able to show early ischemic
lesions and thereby influencing and supporting the decision algorithms.

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PRIMARY OR SECONDARY DECOMPRESSIVE CRANIECTOMY FOR CIVILIAN AND MILITARY HEAD INJURIES: DOES EVIDENCE FOR DIFFERENT INDICATIVE DECISIONS EXIST?

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Introduction: Decompressive craniectomy after head injury is controversially discussed, although some clinical effects for subgroups are recognized. Beside the indication itself and the extent of decompression the adequate timepoint is a matter of concern. Under optimum conditions a strategy of staged procedures is possible, but in the military theater a primary decompressive craniectomy was recommended. Whether staged or primary decompression is advisable for the military head injury remains to be determined.

Materials and methods: Comparison of a published series of primary craniectomies performed in the military theater and a group of secondary craniectomies after civilian head injury.

Results: Surprisingly the mortality rate after primary craniectomy is lower than after staged decompression. Results after military head injury are better than after civilian trauma. But the mortality does not depend on the chosen surgical strategy. The main prognostic factors are clinical condition and the morphological (radiological) extent of the injury.

Conclusion: Staged procedures for a finding-related decompression after severe head injury is useful if optimum infrastructural circumstances are available. Under military conditions these optimum circumstances sometimes are absent and a primary decompression in the military theater could therefore be necessary and advisable. However, a prospective randomized proof for a beneficial effect of the resource-consuming primary craniectomies for all types of head injury in the military setting still does not exist to date.

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Honeybul S, Ho KM, Lind CR. What can be learned from the DECRA study. World Neurosurg. 2013 Jan;79(1):159-61
OUR EXPERIENCE OF THE CRANIOPLASTY OF AUTOLOGOUS BONE IN THE PEDIATRIC POPULATION

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Abstract Text Field:
Decompressive craniotomy is one of the options in the staged therapy of refractory intracranial hypertension.

A significant drawback of this technique is the formation of a complicated complex of pathophysiological disorders which develops due to an extended defect in the calvarium (disorders of brain perfusion, venous outflow, CSF-circulation, etc.). That is why questions of timing of reconstructive surgery on the calvarium and the choice of optimal plastic material remain actual up to now.

Aim: assess the effectiveness of early calvarium reconstruction with cryopreserved bone in children after decompressive craniotomy.

Materials and methods: 36 patients had cranioplasty with cryopreserved bone after decompressive craniotomy during 2005-2014. The area of the defect was more than 60 cm². The autobone was stored in the freezer at the temperature – 40°C. Before and after the surgery patients had CT-perfusion and MRI examination so as to evaluate the effectiveness of the surgical treatment. In 70% of cases cranioplasty was made during the first two months. In 30% of followed cases the restoration of skull integrity took place up to 65 days. Late cranioplasty was caused by trophic disorders in soft tissues as well as by intracranial and extracranial infective–inflammatory complications. At the early postoperative period the auto transplant infectioning was seen in two cases (5.5%).

The follow-up period lasted from 6 months until 8 years.
Complete bone resorption was registered in one patient in 4 months. The repeated surgical intervention took place in 4 cases because of partial transplant resorption.

Conclusion: early closure of extended defects of the calvarium should be regarded as a surgical intervention which provides maximally possible conditions for the early restoration of cerebral functions. Despite the higher risk of infection and resorption of the autobone remains the effective material for early cranioplasty in children.
TRAUMATIC THORACIC SPINAL EPIDURAL HEMATOMA: REPORT OF TWO CASES AND LITERATURE REVIEW

Rotim K, Sesar N, Beroš V, Fila J, Sajko T

Aim. Authors present two cases of traumatic thoracic epidural hematomas that were surgically treated as emergency cases.

Introduction. Traumatic spinal epidural hematoma is rare but important cause leading to spinal cord and root compression. Only several hundred cases and no population-based epidemiological studies of spinal epidural hematomas are available in world literature. Magnetic resonance imaging is the diagnostic method of choice. Urgent surgical spinal cord decompression and hematoma evacuation is the treatment of choice.

Patients and methods. Both patients presented with local thoracic pain followed by paraplegia and sensory deficit. Neuroradiological findings revealed thoracic ventral epidural hematoma compressing the spinal cord combined with the vertebral body fractures at the according level. Urgent radiological examination followed by decompressive laminectomies and hematoma evacuation were performed immediately upon admittance in both patients.

Results. Neurological deficits improved postoperatively, and the postoperative MRI images showed complete hematoma removal with no residual spinal cord compression. These two cases confirmed that, when accomplished urgently, surgical decompression can result in complete functional recovery.

Conclusion. The clinical importance of recognizing a compressive epidural spinal hematoma is due to its acute and progressive course that can lead to serious clinical consequences if not treated properly. Prompt diagnosis and urgent treatment are of importance to all neurosurgeons taking into account the potentially reversible neurological deficit.
THE ROLE OF THE NEUROTRANSMITTER SEROTONIN IN THE MENTAL RECOVERY AFTER SEVERE TRAUMATIC BRAIN INJURY IN CHILDREN, TREATMENT WITH SELECTIVE SEROTONIN REUPTAKE INHIBITORS IN THE EARLY PERIOD OF REHABILITATION

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Abstract Text Field:

It is known that the neurotransmitters in the brain processes involved recovery of consciousness after TBI. In this regard, currently there is a question of selective serotonin reuptake inhibitors (SSRI) in the early period after injury to restore consciousness, increase mental activity. Data on the use of antidepressants in the treatment of traumatic brain injury are inconsistent; children’s age has not been studied. 

Aim: To investigate the clinical efficacy of SSRI in children after sTBI.

Materials and Methods: 12 children (age 6-18) with sTBI (GCS≤ 8) admitted to the Institute of Emergency Children’s Surgery and Trauma for an early multidisciplinary rehabilitation with a standard medication. Methods: psychiatric and neurological; neuropsychological data, radiological studies, the use scales.

Results: Clinical condition defined: a vegetative state - have 2 children, minimal consciousness - at 3, mutism - at 4, amnestic confusion - at 1, cognitive, emotional and personal failure - in 2. SSRI was added to the treatment of all children.

We used sertraline due to minimal adverse events described, the lack of absolute contraindications, permits use in children aged 6 years. Sertraline administered 12,5-25 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. All children detected a positive trend: 7 days - active in the motor area, lively and varied facial expressions, to a greater extent included in the interaction; 14-21 - even more activity and initiatives, improve the cognitive impairment that objectively taken into account in the neuropsychological examination. All patients tolerated sertraline without adverse events.

Conclusion: Analysis of the dynamics of mental recovery showed a positive clinical effect of SSRI (such as sertraline) in children in the early period of recovery after sTBI to increase activity in the motor, emotional, motivational and cognitive areas.
BIOCHEMICAL MARKERS IN NEUROTRAUMA: HOW FAR FROM FINGERSTICK APPROACH?

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Abstract:
Traumatic brain injury is the main cause of death and disability among young adults. Numerous strategies exist to predict the neurological course and outcome in brain trauma patients.

One of the most challenging areas is the search for biochemical markers of cerebral damage. Here some of these potential markers are discussed.

First, the constituents of neurons may be released as these are damaged due to necrosis or apoptosis (the examples here are microtubule associated protein-2 (MAP-2), neuron-specific enolase (NSE) or amyloid precursor protein (APP)).

Second, the posttraumatic cell death affects also glia cells, the next source of potential TBI markers (as seen in the case of S100B-protein, glial fibrillary acidic protein (GFAP) or myelin basic protein (MBP)).

Finally, the pathophysiological processes (inflammatory response and oxidative stress) leading to secondary brain damage may be monitored.

However, according to some concepts, the biochemical changes after TBI are too versatile to look for one or few reliable markers of brain tissue damage. Based on this, some efforts were made in order to describe the posttraumatic changes of the whole biochemical profile rather than of the single protein level expressed in the brain. This approach has been already used in evaluation of TBI impact on gene expression changes on the level of protein spectrum (proteasome analysis) and on the transcription level (mRNA- and micro-RNA-stage of gene expression).

The goal of this lecture is to present the state-of-the-art in the exploration of the vast area of biochemical markers in neurotrauma and to critically appraise their use in the current and future clinical practice.
VALIDATION OF NON INVASIVE INTRACRANIAL PRESSURE AND PERFUSION MEASUREMENTS IN ADULTS WITH ISOLATED TRAUMATIC BRAIN INJURY (TBI)-PRELIMINARY STUDY

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Aim: Comparison among invasive gold standard estimation of intracranial pressure (ICP) using intraventricular catheter placement and non invasive measurements using ultrasound (US) with optic nerve sheath diameter (ONSD), pulsatility index of cerebral medial artery (ACM PI), pulsatility index of ciliar artery (oftalmic artery) pulsatility index (AOPI) and Marshall CT (computed tomography) criteria. Efforts to substitute invasive monitoring with less invasive who have similar prediction ability remain challenge.

Methods: In 31 adults with isolated TBI with GCS < 8 at admission and reanimation intraventricular catheter was introduced for intracranial pressure monitoring as well as cerebral perfusion pressure estimation. Simultaneously we used US measurements of ONSD, ACMPI, AOPI and compared this non invasive US measurements with invasive measurement of intracranial pressure with intracranial hypertension cut of 15 mmHg (obtain with intraventricular Catheter). Pulsatility index of both arteries were calculated using US incorporated software. Collected results are processed using Med Calc statistic calculator and ROC curve analyses.

Results: All observed metodes for non invasive intracranial pressure estimation had good ability to predict high intracranial pressure levels except Marshall CT criteria. That aft metode had smaller area under ROC curve (AUC ROC) with about 70 percent AUC ROC, while others had AUC ROC above 80 percent. That give them good sensitivity and specificity as metodes for prediction of intracranial pressure and perfusion in this study.

Conclusion: Good sensitivity and specificity of ONSD, ACM PI, AO PI metodes gives fast noninvasive insight for prediction of intracranial pressure and perfusion in this preliminary study. Further multicentric evaluation required.
THE IMPLICATION OF TRAUMATIC BRAIN INJURY ON QUALITY OF LIFE WITH EMPHASIS TO THE ELDERLY

Šumonja I, Koprek I, Sajko T, Rotim K

**Aim.** To present the epidemiology of traumatic brain injury (TBI) and the implication on quality of life especially in elderly.

**Introduction.** TBI is responsible for about 33% of all deaths caused by injuries. It is one of the leading causes of permanent disability. Despite recent progress in the treatment of TBI, prognosis is still unfavorable, especially in the elderly.

**Materials and methods.** This is a retrospective study for the period 2011-2014. Data was retrieved from our medical archive. Only patients with acute traumatic brain injury were included in the study. Patients were divided by gender and age groups (Group A: 0-40, Group B: 40-70, Group C: 70+). Statistical analysis of data was done by using SPSS 17.0 for Windows.

**Results.** 617 patients with TBI were admitted to our hospital, out of which 427 males and 190 females. The mean age of males was 57.6 ± 0.95 and of females 66.23 ± 1.54. Comparing the mean GCS upon discharge to GCS at admission it was found that in Group A GCS improved statistically, as it was found in Group B. However, in Group C discharge GCS showed a decrease. Significant difference was presented in the GCS upon discharge of females in Group B compared to males. Also, in Group C, females demonstrated a higher GCS upon discharge compared to men. For the 463 non-surgically treated patients the mean admission GCS was 13.56±0.25 (GCS 14) and the outcome 13.7±0.18 (GCS 14). The mean outcome GCS of the 154 surgically treated patients was 9.74±0.48 (GCS 10), which is slightly above the admission GCS 9.53±0.37 (GCS 10).

**Conclusion.** The age of the patient implicates in the outcome and further quality of life. Significant difference was also found in the outcome between males and females in favor of the last.
REHABILITATION FOLLOWING CEREBRAL ANOXIA:
AN ASSESSMENT OF 27 PATIENTS

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Abstract
Objectives:
1) To evaluate cognitive and emotional impairments, disability and quality of life for adults with ce-
rebral anoxia who have been institutionalised in medical or community care facilities.
2) To evaluate the efficacy of medication, psychotherapy and occupational therapy.

Methods:
Twenty-seven patients were included who had experienced anoxia, on average, 8 years prior. Over
three consecutive two-month periods, they were assessed four times to evaluate: baseline obser-
vations (T1-T2), adjustment of their medications (T2-T3); psychotherapy and physical, intellectual
and artistic activities, as well as efforts to improve autonomy (T3-T4).
The measurements used related to intellectual status (BNIS), anxiety and depression (HADS), ano-
sognosia (PCRS), alexithymia (BVAQ-B), disability (GOSE, MPAI-4) and quality of life (QOLIBRI).

Results:
All subjects exhibited cognitive and emotional impairments comparable to those reported in the
literature. Statistical analysis revealed good baseline stability of their condition, and no significant
effects following changes in their medication (between T2 and T3). Conversely, following imple-
mentation of the psychotherapeutic and occupational therapy protocols (between T3 and T4), qu-
ality of life, social involvement and processing of emotions were significantly improved.

Conclusion:
Social involvement and quality of life for individuals with cerebral anoxia were improved, even
long-term, by psychotherapy and frequent physical activities in particular.
Key words: cerebral anoxia, neuropsychology, disability, quality of life, psychotherapy, exercise
DECOMPRESSIVE CRANIECTOMY AS AN EFFICIENT TREATMENT OPTION FOR TRAUMATIC BRAIN INJURY

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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 the treatment. Patients with intracranial pressure (ICP) higher than 20mmHg not responding to intensive care measurements show higher morbidity and mortality. In these cases the decompressive craniectomy (DC) may be employed for lowering the elevated ICP. The aim of this study was to analyse our experience with DC in treatment of STBI.

Methods
The retrospective study at our hospital was conducted and patients with STBI were included (GCS from 3 to 8) in whom DC was performed due to a rise in ICP that was not responsive to conservative measurements. Treatment outcome was rated by GOSE score (Glasgow Outcome Scale Extended) during follow-up and according to patients’ age, initial GCS (Glasgow Coma Scale) and the time from injury to DC.

Results
From 2005 to 2008, 118 patients with severe brain injury were treated. DC was employed in 34 patients. Of all the patients involved, 43% of them died, 14% remained in persistent vegetative state and 7% severely disabled. A favourable treatment outcome was achieved in 36%. Rated by GOSE score (GOSE 1 to 4), poor treatment outcome was observed in 64% (average GOSE 1.4) and favourable in 36% (average GOSE 6.5). Patients treated by DC later than 24 hours after injury, those with GCS rated from 6 to 8 (p=0.0038) and those younger than 50 years, had a better treatment outcome.

Conclusions
DC effectively reduces the rise in ICP following a severe brain injury. To date, no prospective, randomised and controlled studies relating to DC in severe brain injuries were performed. Using GOSE, a successful outcome was observed in 36% and a poor outcome in 64%. Patients with lower neurological dysfunction and patients younger than 50 years benefit the most from the procedure.
DEPRESSIVE AND ANXIETY DISORDERS AFTER SEVERE TRAUMATIC BRAIN INJURY

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THE GOAL was to study depressive and anxiety disorders in the process of mental recovery after severe traumatic brain injury (TBI).

MATERIAL AND METHODS: psychopathological investigation of mental recovery was performed in 153 survivors of severe TBI, with the initial coma score < 8 by GCS.

RESULTS: depression was found in 48% of cases, anxiety in 38%. They were revealed on different intervals after TBI. Depression manifested significantly earlier than anxiety. In 10% of patients first signs of sadness were found at the level of disintegrated consciousness (before restoration of orientation in place and time) as emotional reflection of fact of trauma and handicap (confirmed by negative correlation with anosognosia: r=-0,3; p<0,01). After orientation recovery depression was found in 38% of patients and anxiety was in 10% only. They were revealed together with marked cognitive, emotional and personality changes. On the way to premorbid level rate of depression decreased down to 10% and rate of anxiety increased up to 38%. Depressive manifestation itself correlated with good recovery, especially in the long-term (> 1 year after TBI) follow-up (r=-0,32; p<0,001). Anxiety didn’t correlate with outcome. In cases of marked and prolonged (> 1 week) depression it was necessary to use antidepressants, they were successfull only in 44% of them, in 52% cases unfavorable side-effects were revealed. Exclusion of tri-cyclic antidepressants, use of four-cyclic (maprotiline, pyrindole) and serotonergic ones (fluoxetine, fluvoxamine, paroxetine) allowed to increase efficacy of antidepressive therapy to 59% and reduce rate of side-effects to 29%.

Anxiolytic treatment was successful in 41% of courses, unfavorable side-effects was found in 35%. Exclusion of benzodiazepine drugs increased efficacy up to 63% and decreased side-effects down to 16%.

CONCLUSION: there is a further need to study depression and anxiety disorders and search of their effective treatment for rehabilitation of patients with severe TBI.
Pain is defined as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage” according to the International Association for the Study of Pain (IASP). Pain following an injury can be either acute or chronic and often accompanies individuals for months or years post injury. Acute pain occurs at the time of injury and although it often occurs as a one-time event, but as well it may reoccur as a series time limited event and become chronic pain. Acute pain is usually associated with defined tissue damage or a pathological process. Chronic pain is usually defined as pain that continues for more than 3-6 months, it should be evaluated as separate condition because it includes more complicated mechanisms than acute pain including negative neuroplasticity. Therefore in chronic pain, individuals experience the net effect of many interacting and very complex physiologic, biochemical, and psychological mechanisms involving both the peripheral and central nervous system. Numerous intracranial and extracranial tissues must be considered in the evaluation of pain after TBI, with the specific mechanism of trauma influencing the anatomic distribution of injuries. The differential diagnosis usually falls into one of the following pathoetiologic classifications: primary or secondary musculoskeletal, vascular, visceral, and neural pain syndromes. Pain after traumatic head injury mostly clinically presents as chronic headache, facial pain, neck pain, shoulder pain, pain in the extremities (painful hemisindrome and rare pain syndromes. The main goal of this work is to present diagnostic and treatment approach in such conditions.
THE PHENOMENON OF TRAFFIC ACCIDENTS IN ROMANIA

Florentin Bracea

This lecture brings data and statistics on the widespread phenomenon of traffic accidents in Romania, which is seeing a significant decrease and which is the main factor of head trauma.

It also tackles the causes of severe road accidents in the last years, showing the numbers in which pedestrians, speed and other factors lead to these incidents. Moreover, it shows the casualty numbers and analysis on the factors that affect the casualty rate (seat belts, moto helmets) and on the need of a multidisciplinary team on-site of the accident.

Finally, there will be a presentation of the goals of the Traffic Road Police and the challenges and objectives of implementing the European Strategy to decrease 50% of serious injuries after traffic accidents by 2020.
THE IMPORTANCE OF CEEG MONITORING IN ICU AFTER HYPOXIC BRAIN INJURY

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Prolonged continuous digital video and electroencephalographic monitoring (continuous EEG or cEEG) for critically ill and comatose patients has become standard practice in many Intensive Care Units. It was established 30 years ago intraoperatively during carotid endarterectomy. This procedure monitors morphology, frequency and amplitude of EEG and provides dynamic information regarding brain functions. cEEG monitoring consists of the longitudinal bipolar montage with minimal 8 electrodes or international 10-20 system, frequent analysis of 2 minutes inserts - relative alpha (RA), elimination of artifacts - a continuous RA histogram and measuring of RA variability.

Indications for cEEG monitoring are: 1) detection of nonconvulsive seizures (NCS) or nonconvulsive status epilepticus (NCES) in patients with fluctuations of levels of consciousness, with prior history of epilepsy or acute traumatic brain injury and subtle stereotypical activities; 2) monitoring of the therapeutical efficacy of AED (antiepileptic drug) or other administered drugs in patients in induced coma due to increased intracranial pressure or refractory epileptic status or monitoring of the level of sedation; 3) detection of vasospasm in acute subarachnoid haemorrhage (SAH) and early detection of cerebral ischemia in acute stroke or delayed cerebral ishaemia in patients with high-risk of stroke; 4) detection of systemic disorders: hypoxia, hypotension and acidosis and 5) prognosis in patients with ischemic stroke following cardiac arrest or acute traumatic brain injury.

EEG can detect seizures or epileptic status in 35-40% of patients, and in critically ill patients in first 24 hours by cEEG monitoring seizures can be detected in 88% of patients. In patients with aneurysmatic SAH there is increased incidence of epileptic seizures (4-9 %) and NCS or NCES in 10-19%, especially in first 18 days with poor outcome. Reduced RA variability is biomarker of vasospasm as it allows early detection of vasospasm by cEEG monitoring in patients with SAH even 2.9 days before it can be detected by digital subtraction angiography – DSA or transcranial Doppler sonography.

24-hour monitoring is recommended for non-comatose patients, but in comatose patients longer monitoring is required, as almost 20% of patients experience first epileptic seizures after first 24 hours. For patients with SAH monitoring up to 48 hours gives clear information of vasospasm.
Objective: To report the rate of hormon deficiencies after moderate traumatic brain injury (TBI).

Introduction: Post-traumatic hypopituitarism (PTHP) after TBI was recognized more than 90 years ago, but it was considered rare. Today, clinical evidence demonstrates that TBI may frequently cause hypothalamic-pituitary dysfunction contributing to a hampered recovery. PTHP entails physical, psychological, and social changes, and it has significant implications for recovery after TBI. PTHP may be observed during the acute phase of recovery or in later stages, anytime after the TBI. In early stages of recovery, clinically most important are hypocorticism and antidiuretic hormone (ADH) abnormalities. In the late stage, the most common chronic hormone deficiencies are somatotropin and gonadotropin deficits.

Methods: Endocrinological testing was performed on 20 patients, 2 days after admittance for moderate TBI. The serum levels of T3, T4, TSH, ACTH, GH, IGF-1, PRL, LH, FSH, testosterone and cortisol in 24-hour urine was measured. The presence of ADH abnormalities were evaluated according to urine specific weight and volume, and electrolyte values.

Results: Hypocorticism was detected in 6 patients (30%), diabetes insipidus in 4 (20%) and syndrome of inappropriate ADH secretion in 1 patient (5%). Hypotireoidism was present in 1 patient (5%), gonadotropin deficiency in 10 (50%), GH deficit in 1 (5%) and hiperprolactinemia in 4 patients (20%).

Conclusion: In the early stages after TBI it is of utmost importance to detect and treat hypocorticism and ADH abnormalities since they can pose a life threat. In order to improve outcome and quality of life after TBI, an adequate replacement therapy is crucial. Our data is similar to what is reported in the literature.

Key words: traumatic brain injury, posttraumatic hypopituitarism, neuroendocrine dysfunction, hormone deficiency
INHALED NITRIC OXIDE (INO) REDUCES BRAIN DAMAGE AFTER EXPERIMENTAL TRAUMATIC BRAIN INJURY

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Abstract text:

Ischemia is one of the leading causes of secondary brain damage after traumatic brain injury (TBI), but so far efforts to treat it were not successful. We previously demonstrated that nitric oxide (NO) applied by inhalation after stroke improves cerebral perfusion in hypoxic brain regions. As regional ischemia in the traumatic penumbra is a key mechanism determining secondary posttraumatic brain damage the aim of the current study was to evaluate the effect of NO inhalation (iNO) after experimental TBI.

We studied the effect of NO-inhalation (50 ppm) in a mouse model of TBI. Major side effects of iNO were ruled out in preliminary experiments. The effect of iNO was then studied in the acute and in the chronic stage. Firstly, ICP and cerebral perfusion was assessed 0-90 minutes after trauma; in a next step we evaluated the effect iNO on brain edema formation, blood brain barrier disruption, lesion volume, and neurological outcome for up to 7 days after trauma.

No adverse effects on cerebral auto-regulation, systemic blood pressure, primary homeostasis, endogenous NOS – expression, or oxidative damage were observed under application of 50 ppm iNO. NO-inhalation significantly improved cerebral blood flow and reduced intracranial pressure after experimental TBI; the effect set in very quickly upon start of the treatment. iNO-application over a 24h period resulted in in significantly reduced lesion volume, edema formation and blood brain barrier disruption as well as improved neurological recovery and outcome for up to 7 days.

This study demonstrates that NO-inhalation effectively reduces brain damage and improves neurological function following experimental TBI, most probably due to a selective dilation of resistance vessels with subsequent increase of cerebral blood flow in the traumatic penumbra, as already demonstrated for cerebral ischemia. As NO-inhalation is clinically approved for human use swift translation to the clinic seems feasible.
ANTERIOR SINGLE SCREW FIXATION OF THE ODONTOID FRACTURE – SINGLE INSTITUTION EXPERIENCE IN 26 PATIENTS

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AIM:
Majority of the odontoid fractures is unstable (type II Anderson and D’Alonzo). At our department, the option of the anterior screw fixation of the odontoid Type II fracture is preferred. Anterior odontoid screw fixation offers the advantage of a stable fixation without loss of atlantoaxial motion.

METHODS:
A retrospective analysis of twenty six patients with fresh odontoid Type II fractures treated surgically between January 2002 - January 2014. X-ray, CT and MRI verification showed Type II odontoid fracture with preservation of transvers ligament of C1. The patients underwent anterior odontoid single screw fixation using fluoroscope.

RESULTS:
Twenty six patients, including 6 women and 18 men ranging from 29 to 78 years (mean age of 54,3) have been submitted to surgical treatment. With a follow-up (CT scan after 1 year radiographic fusion was achieved in all cases. All patients remaind neurologically intact.

CONCLUSION:
Anterior odontoid screw fixation secures immediate stabilisation, while preserving atlantoaxial rotation. It restores the contact of the fragments at the fracture line thus promoting normal fusion. The advatage of this methode is a generous mobility of the craniocervical junction early following the injury, and a start of rehabilitation without the external mobilisation.
SOMATOSENSORY, BRAINSTEM AUDITORY AND MOTOR EVOKED POTENTIALS AS THE PREDICTORS OF BRAIN DEATH IN PATIENTS WITH SEVERE BRAIN INJURY

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Abstract Text Field:
Comatose patients with severe brain trauma were evaluated with short latency somatosensory evoked potentials (SSEP). The SSEP detected the loss of N20 wave responses as the predictors of brain death. If the initial recordings were indefinite, the SSEP assessments were repeated and further assessments included; brainstem auditory evoked potentials (AEPs), motor evoked potentials (MEPs) and facial corticobulbar motor evoked potentials (FCoMEP). In 8 of 15 patients with the absence of N20, peak III responses of AEPs were still recordable within 24 hours. The III peak is the earliest brainstem audio response component that primarily originates from the coclear nucleii ipsilateral. However, contributions of contralateral nuclei, through nuclei connections, might be possible. This type of response should not be recorded in brainstem of a deceased patient. However, peak III brainstem audio responses were recorded at higher amplitudes during the audio stimuli ipsilateral to the site of the injury. Furthermore, 5 of 15 patients had initially recordable FCoMEP as the sign of preserved corticobulbar tract function, although simultaneous MEPs recordings in the targeted muscles of corticospinal tract were not detected. This suggests that both MEPs techniques should be used to detect possibly preserved motor functions in traumatized brain patients. Although the absence of N20 still persists as the robust sign of brain death in comatose patients, we concluded there is also a need to use the multimodal evoked potential approach. This approach should be selectively focused on neural tract functions in order to obtain a more precise functional brain evaluation.
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