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ABSTRACTS FROM

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001 Decompressive craniectomy and contemporary cranioplasty options in patients with gunshot wounds to the head

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Penetrating brain injuries (PBI), and among them gunshot injuries, are the most life-threatening form of traumatic brain injuries. It is estimated that only 10% of the patients survive to reach the hospital, half of which ultimately die in the Emergency Department, and the other half often suffer devastating consequences. Throughout history the largest number of gunshot head injuries occurred during war conflicts. Therefore, the biggest improvement in their treatment was achieved during wars. On the other hand, since the second half of the 20th century there has been a significant increase in civilian gunshot head injuries, mostly due to availability of firearms and increase in gun violence. Because of that, understanding the pathophysiology, diagnostic methods, treatment, as well as solving possible complications is very important both in peacetime and wartime conditions. In this article, we will review the methods of treatment in patients with PBI, with the special emphasis on the role of decompressive craniectomy (DC). We will also refer to cranioplasty, in terms of the way it is performed, optimal timing for it, as well as possible complications related to it.

Decompressive craniectomy has defined this era of damage-control wartime neurosurgery. Recent experiences from Iraq and Afghanistan has shown that DC has an impact not only on survival, but also on neurological recovery of the seriously injured patients. DC is recommended in patients with PBI who are prone to significant brain swelling because of the diffuse trauma caused by high- velocity military weapons. It should be also performed in patients with persistent cranial hypertension resistant to conservative treatment and in patients who are likely to develop intracranial hypertension. Two types of DC are mostly used, frontotemporoparietal DC and bifrontal DC, depending on the type of injury. Some authors recommend the L.G. Kempe incision instead of standard reverse question mark incision, for blood supply preservation. Most common complications of PBI are infection and cerebrospinal fluid leak. Due to this, reestablishing dura continuity is highly recommended. Although the general recommendation is watertight dural closure with pericranial vascular graft, there are some findings recommending only dural substitutes.

Cranioplasty (CP) following DC have a role not only in cerebral protection and cosmetics, but also in improving neurological function and preventing post-craniectomy complications such as sinking skin flap syndrome. CP is associated with potentially severe complications like infection, hematoma, hydrocephalus, seizures. Previous studies have shown different results related to the timing of CP after DE. And while some authors report that late CP is associated with fewer complications, other did not find difference. There are also studies showing that risk of complication is related to initial injury pattern.

Decompressive craniectomy has an important role in the treatment of patients with PBI and should be considered in almost every case. Defects caused by DE can be effectively solved by different CP methods, although further research is needed to minimize potential complications.

Keywords: decompressive craniectomy, cranioplasty, gunshot wounds

002 Posttraumatic refractory intracranial hypertension- new approaches to old mystery

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Injuries and damage of the highly sophisticated tissue of the brain has engaged thousands of researchers. Traumatic brain injury (TBI) is the cause of around half of all fatal consequences arising as a result of trauma in the first four decades of life. Increased intracranial pressure (ICP) is one of the leading causes of death and disability after a severe TBI.

Refractory intracranial hypertension (RIH) is typically defined as an ICP > 25 mmHg and is a life-threatening situation. This state requires remarkably aggressive methods of treatment as a final option such as barbiturate induced coma or decompressive craniectomy (DC). Limited referrals upon at most several smaller retrospective trials, which included a small number of patients with TBI and stroke, showed that, in some patients, *hinge craniotomy* (HC) may be a useful procedure in the treatment of acute edema of the brain, intracranial hypertension or RIH. The results of the aforementioned studies showed that the aggressive DC does not necessarily result in better outcomes than more conservative medical treatment – HC.

Carrying the information above in mind, HC is a procedure which is imposing itself as a potential separate operative technique, useful in solving problems associated with DC.

Keywords: traumatic brain injury, refractory intracranial hypertension, decompressive craniectomy, hinge craniotomy

003 Most important outcome predictors of war missile penetrating brain injury: an experience from the military conflict

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Introduction: Penetrating missile brain injuries are generally encountered during military conflicts. Herein, we review and discuss the surgical management and outcome of such an injury.

Material and Methods: The initial clinical condition (GCS), the evacuation time, the injury extent, the presence of retained foreign bodies, and the complications were analyzed in an institutional series of 126 surgical patients during the two- year period (1991-1993) of armed combat in Eastern Croatia to get an outcome, which was assessed at six months.

Results: The wounds were either of low or high velocity and mainly caused by shells and/or bullets, which were visualized by urgent head computed tomography as retained foreign objects. Decompressive craniectomy and less vigorous wound debridement and removal of in-driven metal/bone fragments were the standard management methods. Sixty-seven patients survived, while 40 patients succumbed to injury with an adjusted mortality rate of 31.7%. They mostly had a low admission GCS and sustained bilateral hemispheric, and/ or trans ventricular lesions. The mean evacuation time of over two hours and postoperative complications (CSF leak, infection, seizures) were predominantly observed for this group of patients.

Conclusion: The poor admission clinical condition, the extensive brain damage, and the prolonged evacuation time are the most important features implying worse outcomes. No relationship between the in-driven/retained fragments and the development of complications implies that it is not necessary to remove/ reoperate for retained fragments. Early evacuation and aggressive surgery comprising of decompressive craniectomy and less radical wound debridement diminish complications and provide a better chance of survival and good recovery.

Keywords: war, missile brain injury, outcome predictors

004 Severity of brain injury- influence on treatment outcome in trauma patients

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Head injury is often present in polytraumatized patients. During the period January 2017 until December 2021, at the Neurosurgical Clinic Niš, 1260 polytraumatized patients have been treated.

Applying Glasgow Coma Score (GCS), all injured patients had been divided in two groups: patients with severe head injury with GCS ≤8 and patients with mild head injury and GCS>8.

We have also observed all associated injures of other organs and systems, and mechanism of injury.

The highest rate of mortality was observed in patients with associated severe head and chest injuries. In these patients, in addition to the primary brain lesions were present and secondary lesions caused by hypoxia.

The best recovery is recorded in patients with mild head injury associated with lesions of the extremities.

Keywords: brain injury, trauma, Glasgow Coma Score

005 ICP monitoring in severe traumatic brain injury

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Traumatic brain injury (TBI) is a major cause of death and disability worldwide. The rising burden of TBI from increases in road traffic incidents predominantly affects young individuals, with significant increase in fall related head injury in elderly people. For optimum care, patients should be moved along a chain of trauma care, from prehospital to post-acute care, following guidelines and protocols made on global level or the level of one institution.

For pathophysiological reasons the recording of ICP appears useful, since the clinical monitoring of many cerebral functions is limited in the comatose and sedated patient and may give early warning of an impending herniation from swelling or intracranial hematomas and thus may allow for preventive measures in time.

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. Despite latest improvements, the recommendations are limited in many areas, reflecting persisting gaps in the evidence base for severe traumatic brain injury (TBI) management. We tried to made comprehensive protocol for sTBI patients in Clinical Center of Vojvodina relying on evidence- based medicine based on our clinical experience.

Keywords: trauma, brain injury, intracranial pressure

006 Causes, treatment and outcome in delayed deterioration after severe traumatic brain injury

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Introduction: Severe traumatic brain injury (TBI) is one of the most debilitating conditions worldwide and is defined as traumatic brain injury followed with deterioration of the GCS score <8. The delayed complications after severe TBI can be divided as early and late complications.

Objectives: To assess and evaluate the causes and treatment options from delayed complications after severe TBI.

Methods: This is a retrospective longitudinal study in which 125 patients were included. We evaluated the mechanism of TBI, GCS score on admission, initial CT scan findings, CT angiography and MRI findings, type of surgical treatment and Glasgow outcome score. The follow up time was one year.

Results: Between 2020/2021, a total of 125 patients were treated with severe TBI. The age of the patients ranged from 7-81 years of age. As polytrauma patients were identified 70 patients (56%). Out of all 83 (66.4%) were male and 42 (33.6%) were female. The most common mechanism of injury was motor vehicle accident 44 (35%), followed by fall from height 25 (20%), bicycle accident 18 (15%), gun-shot injury 4 (3%), physical assault 31 (25%) and other types of injuries 3 (2%). The most common accompanying injuries were identified as lung contusions, spinal cord and spinal column injuries, muscle-skeletal injuries, abdominal injuries, blast injuries and crash injuries. Most common causes for delayed deterioration after severe TBI were as follow – contusion progression, re-bleeding after hematoma removal, ischemic demarcation after hematoma evacuation, ICA traumatic dissection, brain vessel dissection, posttraumatic pseudoaneurysm (peri callosal artery), hydrocephalus, posttraumatic epilepsy. Overall mortality was 35%, vegetative state 20%, minimally conscious state 15%.

Conclusion: We observed that the most important predictor for delayed deterioration after severe TBI was the mechanism of injury, concomitant injuries on other parenchymal vessels, GSC on admission and patient age.

Keywords: trauma, brain injury, delayed complications

007 Traumatic dissections and ultrasonographic evaluation

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Traumatic carotid artery dissection is uncommon and serious condition that may cause ischemic stroke in young patients. It has been under-diagnosed in the past. We present possibilities of Dopplersonographic evaluation of traumatic internal carotid artery dissection.

The clinical manifestations include hemicrania, hemiparesis, partial Horner's syndrome and cranial nerve palsy.

Severe trauma is responsible for 4% of dissections and up to 20% of the strokes in younger age group are caused by traumatic carotid artery dissection. Diagnosis is possible with carotid color Doppler ultrasound, CT angiography of the neck and conventional angiography.

We discuss the clinical presentation and Dopplersonographic findings that will facilitate the early recognition and treatment of carotid artery dissections.

Keywords: trauma, carotid artery dissection, ultrasonography

008 Analysis of the factors affecting outcome after combat related cranial defect reconstruction

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Introduction. Reports on the outcome of cranioplasty after combat related injuries are relatively rare in the current literature. We present our results on the reconstruction of cranial defects resulting from injuries sustained in combat comparing outcomes using autologous (iliac bone) grafts or allografts (acrylate) and analysis of other factors that may influence the final outcome.

Material and methods. The study comprised 207 patients with cranial defects resulting from combat related injuries, repaired with autografts or allografts. The final outcome was defined at least 5 years postoperatively on the basis of cosmetic restoration and the existence of complications as successful or unsuccessful.

Results. Successful outcome was achieved in 83,6% of patients: there was no operative mortality. There were 25 instances of complications: postoperative infection (n=15, allograft 7/53 autograft 8/54) autograft resorption (n=8) and in two cases graft luxation. Poor cosmetic restoration was noted in 9 patients who had received an autograft.

Conclusion. Thin and poorly vascularized skin, a surface area of the defect larger than 88 cm^2, previous local infection and communication with paranasal cavities significantly influenced outcomes after combat related cranioplasty, the final three being independent predictors of an unsuccessful outcome.

Keywords: combat injuries, cranial defect, reconstruction, outcome

009 Wartime prehospital care of the patients with GSW

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One of the primary determinants of outcome in craniocerebral missile injuries (CMIs) is the initiation of timely care, both for maintenance of hemodynamic status, and keeping the airway patent. Immediate care rendered to a patient with CMI depends upon the place of injury (battlefield, terrain, rural or urban setup, etc) and consequently the resources available at the nearest medical setup. A sniper or an assassin deliberately aims at the head so as to ensure death or at least permanent disablement. On the other hand, soldiers in the battlefield are likely to sustain CMI due to high velocity missiles (HVMs) as well as low velocity missiles (LVMs); here the CMI is generally part of polytrauma involving neck, chest, abdomen, pelvis and limbs. Since HVMIs are largely incompatible with life, survivors are few and those who do so, would have sustained grazing injury. Most of the survivors would have sustained injury due to LVM. Injury due to exploding devices are being seen more often in violence in urban areas or in areas with armed militancy and anti-terror operations. These devices generally inflict multiple missile injuries to the head and neck.

The determinants of decision making for final destination for patients from the scene of injury are governed by protocols followed by first responders and triage decisions. This initial link of first responders and their decision is crucial to the outcome of CMIs. In active ops scenario, treatment of CMI begins at the site of injury, with basic first aid, application of shell dressing by the paramedics or other soldiers. The patient is then transported to the regimental aid post (RAP) located close to the forward defended location, where he is evaluated first time by a physician. Airway should be cleared and respiration supported by mouth to mouth breathing if necessary. Since immediate apnea may be reversible, it is important that his fact is understood by paramedics, police and fire personnel and other people capable of rendering first aid. Open wounds are covered and the patient should be transported in three quarters prone position, so that the oropharynx remains clear of secretions and tongue falling back. “Scoop and run” as a policy have much to recommend in such a situation. Casualties are multiple and there may be a delay of hours before medical aid can reach the injured depending upon the intensity of the battle.

The casualties are collected, often under fire, and prioritized. The practice of triage creates a situation whereby the greatest good for the greatest number can be accomplished and has led to significant improvement in survival among the war-wounded soldiers. Triage may be based on physiological parameters or on those based on anatomical factors and mechanism of injury. Physiology-based triage systems manage patients with current clinical instability, while anatomy-based systems are used to identify those patients who have potential for deterioration and may require early surgery. Motor component of GCS and systolic blood pressure are strongest physiological predictors associated with critical brain injury.

Transportation of patients with CMI is usually carried out to predetermined appropriate centers (Tactical Aeromedical Evacuation or TACEVAC). However, it may be appropriate and lifesaving, to have the patient stabilized hemodynamically at a smaller hospital or facility if direct transport to a major center is not readily available. Direct evacuation to neurosurgical center is undertaken by ambulances and helicopters.

A hemodynamically stable patient can be given osmotic diuretics *en-route*, and an antiepileptic medication can be started. The intervention undertaken at each of these echelons depends upon the resources of the military units they care for. CT scan and facilities for neurosurgical procedures are generally available at rear echelon facilities (Base/Command Hospitals). There is progressive shortening of the period of evacuation to a neurosurgical center due to better transportation facilities including availability of helicopters when required.

Keywords: craniocerebral missile injuries, prehospital care, wartime

010 Cranial and spinal injuries due to handmade explosives–experience from the battlefield

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Handmade explosives are bombs constructed and deployed in ways other than in conventional military action. These explosives cause complex and unpredictable damages. They are widely used by terrorist organizations as roadside bombs against armored targets. They contain fragmentation-generating objects to cause wounds at greater distances than blast pressure alone could.

Therefore, medical approach to patients injured with handmade explosives is always challenging. Multiple dirty wounds and active bleeding sites are main life- threatening characteristics of these injuries. Intracranial multiple bone or metallic fragments as well as shrapnels in the spinal column cause significant neurological complications. Less invasive surgical approach including debridement of necrotic tissues, control of bleedings and removal of superficial foreign bodies is recommended for these patients in order to achieve better clinical outcome.

State-of-art combat helmets and protective body armors may be helpful for the prevention of injuries secondary to handmade explosives.

Keywords: homemade explosives, cranial injuries, spinal injuries, wartime

011 Modern technology in neurosurgery: 3D patient specific implants (P.S.I) for cranioplasty. (A romanian multicenter study)

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These authors present a multi-center study cohort study on 50 patients with cranial defects of multiple etiologies (trauma, decompression, tumor surgery, etc.) operated in 10 hospitals in Romania (public&private). In all patients the neurosurgeon repaired the cranial defect using 3D printed and CNC milling and drilling grafts or Patient Specific Implants (P.S.I.), from two world known manufacturers (custom made in accordance with the data obtained from the patient's 3D CT reconstruction).

Introduction: Cranioplasty is defined as the surgical intervention performed to repair cranial defects following trauma, surgical decompression, tumor surgery, congenital anomalies or growing skull fractures. The implications of cranioplasty are psychological, aesthetic and functional. The history of cranioplasty dates back to 7000 BC. with archeologic evidence supporting the use of both inorganic and organic materials. In time, many elements changed the vision and the approach referring to Cranioplasty. Although many modern methods have been described there is little consensus regarding the optimal solution: 3D, P.S.I. cranioplasty for personal specific cases, using the total computer technology.

Materials & Methods: We started a multicenter cohort study on patients with cranial defects of multiple etiologies (trauma, decompression, tumor surgery, etc.) operated in 10 Romanian hospitals having enrolled in study a total of 50 patient from which 16 were female 34 were male, 22 from urban, 28 from rural area of Romania. Period of study was 2010-2022. Age of patients was between 15-68 years old. Etiologies: 31 were trauma, 16 were decompression and 3 were tumor. In all patients during the surgery were repaired the cranial defects using Patient Specific Implants made by 3D printing and Computered Aid Design (CAD) and Computer Assisted Manufacturing (CAM) (Computering Numerical Control milling and drilling) methods using specific data obtained from the patient's 3D CT

reconstruction using a very clear scanning protocol. There were used materials for implantation such as PEEK, Titanium, Bioverit; PMMA is an outdated method. In our data there are very few complications, only with scalp problems, not about the material tolerance and biological assimilation.

Neurosurgical procedures: In almost all cases were used large tegument openings respecting anatomy and pedicles positioning. Dura was very well protected and only in few cases was closed and attached to implant. Timing after craniectomy was in general "early stage", 2-3 months and we sustain surgical procedures that reconstruct intracranial volumes and respects cerebral homeostasis. In all cases main objective was quality of patient life. We had minor complications, 2 cases of suture infections. In none of the cases, material was removed.

Outcome: Cases were followed up between 6 months- 10 years. Global outcome at 6 months post-operative (GOS) is significant good in more than 92% from cases; Patients present a moderated to a good recovery with no important neurological deficit.

Cranioplasty represents a modern procedure in most cases where we have traumatic or non-traumatic defects of calvaria. Present methods and materials using CT 3D and Patient Specific Implant procedures represents a new trend in Neurosurgery, it is a combination of modern reconstructive technology with the use of 3D elements and realizing the cranioplasty through methods of computerized reconstruction (CNC milling and drilling). Finally, the authors sustain "early approach" theory in Cranioplasty.

Conclusions: Present research it is ongoing because of still new developing procedures that aim a perfect structure for calvaria defects and realized a perfect cranian volumetry what is very fruitful for the CSF & blood circulation.

Keywords: Patient Specific Implant, trauma, tumor, decompression, neurosurgery, reconstruction, cranioplasty, Peek, Titanium, Bioverit, CNC milling and drilling, 3D printing

012 Risk factors for postoperative infection after combat related head injuries

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Introduction. Current concept of surgical treatment is controversial regarding infective potential of retained intracranial foreign objects and different surgical strategy is used. We are presenting our experience of postoperative infection in patients with combat related injuries and analysis of other factors that may influence the occurrence of infection as the long-term functional outcome of the casualties.

Material and methods. The study comprised 202 patients with combat related penetrating head injuries treated in MMA between 1991/1999.

Results. Infection occurred in 36 (17,82%) patients, in vast majority of the cases in the form of brain abscess 31, in 4 cases as meningitis and in 1 case as osteomyelitis and epidural infection. Postoperative infection was twice as frequent in patients with retained fragment and in 40% in patients with CSF leak.

Conclusion. Retained metal and bone fragments and postoperative CSF leak have significant influence on occurrence of postoperative infection. Postoperative infection considerably increases long term functional outcome.

Keywords: combat, penetrating head injury, infection

013 Chronic subdural hematoma- The best strategy for treatment in the field

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Introduction. Chronic subdural hematomas (CSDH) are collections of blood between the dura and arachnoid that show clinical symptoms three or more weeks after presumed causing event. Beside the head trauma as the main etiological factor in the development of CSDH significant risk factors are older age, male gender and the use of anticoagulant/antiplatelet therapy. Despite the fact that CSDH is one of the most common neurosurgical conditions, there is no consensus regarding optimal treatment.

Goal. To review the literature on CSDH management to identify the best modalities and methods. Compare different medical treatments of patients with CSDH. Determine the differences between clinical characteristics in patients with CSDH in relation to duration of hospitalization and treatment.

Material and Methods. This research was conducted as a retrospective study at the Clinic of Neurosurgery, University Clinical Center of Vojvodina. The study included 83 patients with CSDH who were treated over a period of three years.

Results. There were 61 (73%) men and 22 (27%) women. Median patient age was 70,36 years with a range from 42–91 years. SD was 14,45 and 60 (72%) patients were older than 65. Most common clinical sign was focal neurological deficits. There was no mortality. Patients were discharged from our clinic usually on the fourth or fifth postoperative day.

Conclusion. As the world population becomes progressively older, the increasing incidence of CSDH will be a burden and a future challenge for neurosurgeons.

Surgical management with single burr/twist hole craniotomy and drainage remains the primary treatment choice and embolization of the MMA can be used as an effective treatment

for recurrent CSDH after surgical evacuation or in patients with comorbidities that are not conditions for surgery.

Keywords: chronic subdural hematoma; treatment; craniotomy; postoperative complications.

014 Minimally invasive skull base surgery: what is possible and what are the limitations?

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Historically seen microsurgery has evolved in the field of neurosurgery only since the 1960s after the introduction of microscopes for the operating room. This made it also possible that through interdisciplinary close collaborations between neurosurgery ENT and oral and maxillofacial surgery, skull base surgery could be further advanced. The lack of diagnostic imaging, magnification and illumination as well as the appropriate microsurgical instruments in the past determined the size of the craniotomies.

In comparison with standard skull base surgery versus minimally invasive skull base surgery (MISS) advantages and risks of both types of approaches have to be considered. MISS is not the definition of the size of a skin incision or craniotomy but rather the description of a concept with individually tailored approaches that are not bigger than necessary rather done as small as possible. One of the main advantages of minimally invasive skull the surgery is the faster recovery of the patients due to the reduced perioperative trauma enabling the patient to get back to a normal life sooner.

While MISS represents the state of the art it is not a proper method for some large malignant lesions with extensive infiltration of the surrounding neurovascular structures the require an en bloc resection or extensive drilling of the skull bone. Representative cases are demonstrated showing the possibilities and limits of MISS.

Keywords: minimally invasive, skull base surgery, MISS

015 Personal experience from the war time 1992-1995

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The old truism is that war is bad in every possible sense, but it allows one to gain enormous surgical experience. I stayed alone as a resident right at the beginning of the war, without any experience in the treatment of severe CNS, spinal, and PNS injuries. Unavailability of education, educators, or professional literature. Any type of communication with fellow neurosurgeons was difficult or impossible.

Due to the large influx of injured patients with neurotrauma, surgical treatment was performed by other surgical specialists. The numbers presented in this paper are from available resources and far from reality. We had a very limited capacity for the intensive care unit - 6 beds. We succeeded in the gradual strengthening of the Neurosurgical Department, with a separate operating room, medical staff, and equipment. Many patients were admitted and died within a few hours like John Doe. The only available radiological diagnostic was a classical X-ray. We were fighting a constant lack of medicines and medical materials. The administration was difficult and improper.

Despite all, equal medical treatment is ensured for all injured persons. Available data showed 401 treated patients. 273 soldiers and the rest were civilians. There were 196 shrapnel, 129 bullet, and 8 blast injuries. 119 patients were treated surgically. 250 patients had head trauma, 37 spinal injuries, and 6 peripheral nerve injuries. 308 patients died.

Keywords: war injuries, neurotrauma, surgery

016 Peripheral nerve injuries

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During the 4-years war period, more than 3.000 of nerve injuries were treated in the Neurosurgical Department of the Belgrade Military Medical Academy, while more than one thousand and seven hundred were treated surgically. In 90% of patients, injury mechanism was missile-related trauma.

The series included injuries of the median, ulnar, radial, tibial, and peroneal nerves, and, to the lesser extent, injuries of the musculocutaneous, femoral, and axillary nerves. Level of nerve lesion was considered as high, intermediate or low.

We assessed the outcome of treatment at least 4 years after surgery, on the basis of sensorimotor recovery, EMNG recovery,

and patient's judgement about the outcome. On the basis of the total score, we defined the final outcome as poor, insufficient, good or excellent. The last two outcomes were considered to be successful.

A successful outcome was achieved in more than 90% of musculocutaneous nerve repairs, disregarding the repair level, as well as after low-level femoral nerve repairs. Even after proximal femoral nerve repairs, a successful outcome could be expected in more than 60% of cases. In additional 20%, improvement was sufficient to achieve stability of the knee joint.

Results were excellent after radial nerve repairs as well: even after high-level repairs, recovery of wrist extension may be expected in 40% of patients. Results after peroneal nerve repair were poor. Clinically significant dorsiflexion of the foot regained in only 10%, 31%, and 57% of cases after high-, intermediate-, and low-level repairs, respectively.

Regarding the median, ulnar and tibial nerves, a successful outcome was achieved in up to 85% after low-level repairs and in one-third to one-half of patients after intermediate-level repairs. A successful outcome is rare (in the range of 0 to 10%) after high-level repairs.

Differences in outcome between high, intermediate and low-level repairs are significant statistically only for the nerves with moderate recovery potential – the median, ulnar and tibial nerves.

The outcome correlated significantly with the length of nerve defect, except for the radial nerve.

High-level repairs of the ulnar and peroneal nerves are probably useless while other nerve repairs are useful if preoperative interval is not too long.

The nerves differ significantly regarding recovery potential: it is the best for the radial, femoral and musculocutaneus nerves, and the worst for the peroneal nerve.

Keywords: peripheral nerve, injury, outcome

017 Management of brachial plexus missile injuries

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Missile wounding of the brachial plexus is the second most common cause of the brachial plexus injuries (BPI) in peacetime. They are difficult to explore and treat because of the complex anatomy of the region and proximity to the great vessels.

In the 24-year period between 1991 and 2015, 68 patients were operated at our department for 202 missile caused BPI. After a follow-up of two years, results of 173 nerve lesion operations on 60 patients were analyzed. Evaluation of motor and sensory recovery was performed according to Medical Research Council Grading System for Nerve Recovery, taking into consideration nerve functions that are of primary importance for everyday activities and quality of life.

All patients were surgically treated within 3 weeks to 12 months after the injury, 3 months on average. 22 patients had associated vascular injuries that required emergency surgery and led to an earlier treatment of the nerve elements. Continuity of the nerves was at least partially preserved in 75.8% of the lesions. Based on intraoperative findings, patients were treated with neurolysis, nerve grafting or combination of the two. Two years after the surgery, functional recovery was achieved in 90.4% of lesions treated by neurolysis and 85.7% treated by nerve grafting. Useful functional recovery was better in proximal brachial plexus lesion (100%) than in terminal branches lesion (91.1% after neurolysis and 86% after nerve grafting). All six lesions treated with combination of these two techniques resulted in useful functional recovery.

In conclusion, gunshot caused BPI are usually in continuity, with incomplete functional loss and are best treated two to four months after injury; however, associated vascular injuries prompt for emergency surgical exploration. Neurolysis and nerve grafting yielded similar functional recovery results.

Keywords: brachial plexus surgery, missile injury, outcome

018 Clinical aspects of ballistic peripheral nerve injury: shrapnel versus gunshot

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Aim: The aim of the present work was to analyze our experience in the surgical treatment of peripheral nerve ballistic injuries with respect to the mechanism of injury (gunshot versus shrapnel), and identify common and dissimilar prognostic factors in both types of injury.

Results: Overall postoperative outcome appears to be more favorable for gunshot wounded (GSW) patients than shrapnel injured patients, especially in terms of neuropathic pain relief (75% vs. 58% respectively, $p<0.05$). Presence of foreign particles in shrapnel injured patients has a negative impact on the surgical outcome in terms of rate of pain improvement (28% compared to 67% in patients with and without foreign particles, respectively). Nerve graft reconstruction, rather than neurolysis, seems to be the more beneficial treatment for shrapnel induced neuropathic pain (100% vs. 47% in improvement rate, respectively). Early surgical intervention (median 2 months after injury) significantly relieved neuropathic pain in 83% of shrapnel injured patients compared to 58% in patients operated later.

Conclusions: This study suggests that shrapnel injury is more destructive for nerve tissue than gunshot injury. Microsurgical intervention can relieve neuropathic pain and restore motor function in ballistic peripheral nerve injuries. Shrapnel injuries, especially those containing foreign bodies in the nerves, have a substantial role as pain producing and exacerbating agents. Grafting in shrapnel victims has beneficial effects on neuropathic pain compared to neurolysis alone. Early surgical intervention in shrapnel injuries (especially when small fragments are recognized in the nerve) significantly decreases neuropathic pain and improves motor function. Shrapnel injury resulting in severe neuropathic pain might be considered for surgery, even in patients without severe motor deficit. Ultrasound evaluation helps the clinical decision-making process.

Keywords: peripheral nerve injury, gunshot wound, shrapnel injury

019 Nerve surgery for paralysis & pain

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Reconstructive nerve surgery aims at regaining lost function. The field develops at fast pace and is influenced by different specialties. To achieve the obtainable it is frequently necessary to embed the patients in a comprehensive interdisciplinary treatment concept.

The field underwent an amazing development within the last 20 years. Besides the reconstruction of lesioned nerves the principle of nerve transfer is used in ever more variants: functional nerves or fascicles thereof are being used as axon donors, and rerouted to nerves that have been severely damaged. The donor nerve and its correlated cortical area serve as „emitting device“ for per se other than the original functions – this is possible because of brain plasticity. In this sense a growing number of nerve transfers are now being used to make up for lost function. It became evident that the nerve transfer principle is not limited to a use for peripheral nerve injury. There is robust data that nerve transfers have its place in restoring function for people with spinal cord injury. On the horizon appear applications for stroke and brain lesions. The knowledge about „new“ and reliable transfer combinations increases fast.

Apart from these „rewiring“ techniques there are multiple other options, surgeries, and devices to improve function in such cases if pain and spasticity is treated. Many of those are not new in the neurosurgical armamentarium, however are not frequently enough considered.

The presentation gives a focused overview over this fascinating field and its current and future capabilities.

Keywords:

020 Dynamic reconstruction of facial nerve paralysis

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Facial nerve deficits which are due to denervation and paralysis cause significant psychological and functional impairment on the patient which can be devastating. Facial paralysis can affect facial expression, verbal communication, smile symmetry, eye protection, and oral competence. It is a problem which requires a multidisciplinary approach where multiple modalities and strategies exist for each patient; it is within the role of the physician who is required to accurately evaluate and examine the patient and determine the etiology, duration, and the scale of the paralysis.

The desired goal for all protocols relating to restoration of the facial nerve function is to restore dynamic motor function that is well controlled, symmetric, and spontaneous. This is best achieved by direct facial nerve repair. However, when this is not feasible the next best solution is Dynamic muscle transfer which in its entity involves the transfer and use of a functional, innervated, and vascularized temporalis muscle to reproduce desired facial movements. The muscle transfer is most commonly and successfully used to recreate the ability of the oral commissure to produce a smile. It is also successful in reestablishing eye closure. The success of the aforementioned technique relies on various factors, but the most significant one is the duration of the facial nerve paralysis, as one of a longstanding duration presents greater challenges than one managed early after its onset.

Dynamic muscle transfer may be considered as a treatment modality within various etiologies such as in congenital facial paralysis where the nerve or muscle is underdeveloped such as in Mobius syndrome, as well as in cases following the resection of the facial nerve, or in long-standing cases of facial nerve paralysis. The principles of dynamic muscle transfer for facial reanimation combine a multidisciplinary approach which involves both the surgical aspect of the primary treatment plan followed by extensive qualified physiotherapy. This in turn leads to the highest success rate, including facial symmetry at rest, controlled and symmetric facial movements, as well as oral commissure and eye closure.

Keywords: facial nerve paralysis, dynamic muscle transfer, reconstruction

021 Treatment of patients with facial palsy

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Facial reanimation therefore must be directed at: restoration of normal function (control of ocular, oral and nasal sphincter), normal appearance at rest, symmetry in voluntary movement and symmetry in involuntary and emotional movement.

No surgical technique can achieve all these objectives functional problems are the most important and should be given priority in treatment.

In treating facial paralysis surgeons have to use different concepts depending on: etiology, time interval and characteristics of the paralysis.

Etiology: facial nerve palsy can be congenital or acquired congenital.

Etiological factors of the acquired facial palsy can be classified into 3 groups: a. pathological changes in central or intracranial region, b. pathological changes in the region of the temporal bone, b. pathological changes in the region of the parotid gland.

On the frontal region. Of the paralyzed side: frontal wrinkles are absent, eyebrows fall. Of the non-paralyzed side: frontal wrinkles are emphasized, eyebrows are raised.

On the area of orbital region. On the paralyzed side: palpebral fissure is extended**,** lagophtalmos**,** epiphora**,** ectropion**,** bell's phenomenon occurs, corneal ulceration can occur**,** blindness (can result from damage to the cornea)**.** On the non-paralyzed side: palpebral fissure is narrowed.

In the area of oral region. On the paralyzed side**:** problem of saliva retention and saliva and food falling out of the mouth**,** distorted articulation occurs**,** dropped corner of the mouth, nasolabial fold is flattened**.** On the non-paralyzed side: the cheek shows hyperactivity due to an imbalance with the paralyzed side**,** nasolabial fold is emphasized.

In the area of nasal region. Nose and philtrum are deviated towards the non- paralyzed side.

Diagnosis is based on: anamnesis, clinical appearance**,** careful medical examination**,** diagnostic tests (conduction, electromyography and a variety of other tests for assessing facial paralysis)

Selection of the reconstructive procedure requires: a detailed analysis of etiology, duration and analysis of clinical appearance**,** and whether the paralysis is partial, sectional or complete**,** rehabilitation targets

Facial reanimation targets should be the following:1. functional, reanimation of ocular, oral and nasal sphincter (the first priority is to enable protection function of the eyes).2 reanimation of normal appearance at rest, 3. symmetry in voluntary movements, 4. controlled balance in the expression of emotions

Facial reanimation surgical techniques can be divided into: A. reparation of the nerve itself, B. static methods, C. dynamic methods.

We have come up with the idea to excise the paralyzed orbicularis oris muscle on the paralyzed side and after that we use Karapandzic's lobe-technique for the reconstruction of the defect, i.e. we perform the transposition of orbicularis oris muscle from the opposite healthy side

Conclusion. We concluded that the technique we use establishes the following goals: 1. satisfactory functional facial reanimation of ocular, oral and nasal sphincter control 2. facial reanimation of a normal appearance at rest, 3. satisfactory symmetry during voluntary movements and 4. solid facial resuscitation in the expression of emotions

Keywords: facial nerve; injury, surgical treatment

022 The role and importance of the neurosurgeon in multiple limb injuries in the multidisciplinary team- a review of the vascular surgeon

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Significant multiple extremity injury was associated with worse outcomes including a higher number of operative procedures, a higher rate of blood transfusion and a longer hospital length of stay.

Multidisciplinary teamwork as well as the participation of several doctors of different specialties are necessary in order to complete the treatment with maximum recovery of the injured limb.

From the surgical aspect of a vascular surgeon, the importance of adequate revascularization of the injured limb is as great as the importance of adequate neurosurgical reconstruction.

Our experiences show us that a revascularized extremity without motor and sensory function is functionally equivalent to a limb prosthesis of either an arm or a leg.

Keywords: multiple limb injuries, multidisciplinary approach, vascular surgery

023 Vascular injuiries combined with peripheral nerve trauma

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Trauma has become significant socio-medical issue and treatment of vascular injuries is a current problem! Expanding rate of traffic accidents, industrial trauma and trend of criminal raise leads towards more patients with needs for vascular reconstructive treatment! This is even more emphasized in case of a war! Endangered extremity or even life of patients dictates urgent vessel repair. Posttraumatic moderate ischemia potentially covers vessel injuries. This situation permits elective approach! Special kind of treatment is reserved for cases primarily treated in non qualified centers with suboptimal results.

However, vessel trauma linked with peripheral nerve injuries demands team work (23%). Routine angiography is a gold standard. Most common localization is a brachial (41, 7%), subclavial (25, 9%), axillar (11, 1%) and radial artery (11, 1%). Checking on venous system is imperative (CDS) prior to angiography!

This strategy requires multidisciplinary team, able to accomplish complicated aim in a short time. Patients treated in this manner had combined vascular and peripheral nerve injuries! Primary operated group consisted of 33 arterial and 25 venous reconstructive procedures (most often venous bypass on arteries and sutures on veins). In group of previously operated patients there have been four bypasses, one thrombectomy and one ligated AV fistula. The rest of the patients from this group had (28) vessel exploration made approach for peripheral nerves easier. As a conclusion it is obvious that vascular reconstruction can save the extremity, but without peripheral nerve reconstruction results will be suboptimal!

Keywords: bypass, vessel trauma, ischemia, peripheral nerve, trauma, reconstruction

024 Musculosceletal trauma associated with peripheral nerves injuries: a review of orthopaedic principles

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Introduction. Peripheral nerve injuries are in the focus of every orthopaedic surgeon due to the very nature of the morpho-functional closeness of the musculoskeletal system to these structures. Everyday surgical work in orthopaedic surgery and traumatology requires a good knowledge of the topographical anatomy of peripheral nerve structures. The frequency of combined injuries of skeletal elements and peripheral nerves, as well as the possibility of their iatrogenic injury, has not only practical surgical but also potentially medico- legal significance. Etiological and epidemiological factors of peripheral nerve injuries vary depending on whether it is wartime or peacetime circumstances, and differences between developed and so-called "third world"countries are noted in the literature.

Discussion. Adequate surgical care and treatment of these injuries implies not only familiarity with the anatomy of the specific region and structures that are injured, but also a training in microsurgical techniques as well as the presence of specific surgical equipment and instrumentsused in this surgery. There are also numerous factors that influence the success of the treatment in combined peripheral nerves and musculoskeletal injuries, from the type and extent of the skeletal injury, the nerve itself, the location of the injury, the interval from the injury to the operation, and even the biological characteristics of the patient himself.

Conclusion. Because of all this, the consistent application of orthopaedic trauma evaluation protocols (Hanover fracture scale, AO soft tissue injury classification, MESS, NISSSA) is of great practical importance in order to ensure adequate

recognition of all injuries and enable their proper treatment. The British Orthopedic Association (BOA) in its "Blue Book" edition from 2011, specified the procedures that have to be strictly followed by orthopaedic surgeons in the case of combined peripheral nerve injury with skeletal trauma:

Nerve preparation and release and/or visible marking of nerve endings Precise description of the mechanism, type and zone of nerve injury Precise description of the surgical procedures undertaken Photographic documentation

Informing the patient. Fast and thorough communication with orthopaedic microsurgeons

Keywords: Musculoskeletal injuries, peripheral nerves, orthopaedic principles

025 Complex injuries of lower leg and foot – our experience

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Introduction. Complex injuries of lower leg and foot represent great challenge and their treatment requires a team approach with variety of specialties: vascular, orthopedic, neuro and plastic surgeons. These injuries are often associated with multple trauma, making it even more difficult for treatment. First step is an assessment of the extremity and it includes examining the wound, vascular, bone, soft tissue and nerve status. Vascular status is evaluated by examinating pulses, temperature and color of the extremity. Evaluation of bones includes clinical examination and radiography. Soft tissue is evaluated by clinical examination. Neurological status includes evaluation of the peroneal and tibial nerves. If the extremity is not salvageable, than amputation is indicated, with goal of preserving maximal functional length. If it is salvageable, then reconstruction is done following protocol. Fracture management is done using various techniques: external fixation, internal plating or intramedullary rodding. Bone grafting can be done using vascularized or nonvascularized bone grafts, Ilizarov method for bone lengthening or using artifical bone matrix. Soft tissue and skin defects are managed after excesive debridement, using skin grafts and/or various types of flaps: local fasciocutaneous and perforator flaps, local muscle flaps or microvascular free flaps. Vascular and nerve repair can include usage of grafts. The main goal of the treatment of complex injuries of lower leg and foot is preservation of functional extremity. Careful selection of patients for reconstruction is very important for favorable outcome. Fully functional repair is rarely achieved, but most of the patients are satisfied when final result is salvaged extremity. We present our experience in treatment of complex injuries of lower leg and foot.

Methods. This study included 498 patients with complex lower leg and foot injuries which were treated in our Clinic during the war time period in former Yugoslavia, out of which 113 had bone injury and 107 peroneal or tibial nerve injury. Combination of skin grafts and secondary sutures was performed in patients with the least extensive injuries. Local flaps were applied in patients with good local reconstruction potential. For bone injuries external fixation or Ilizarov method was applied. When possible, immediate nerve repair was performed, or nerve ends were marked for secondary reconstruction.

Results. Almost half of the skin and soft tissue defects were treated with local flaps (239), 29,71% were treated with microvascular flaps (148) and 111 patients (22%) were treated with skin grafts and secondary sutures. Partial necrosis of skin graft or local flaps was seen, but we had no experience with serious surgical complications and these patients had full recovery. Final success of applied microvascular flaps was 98,5% and only 2 patients resulted in bellow knee amputation, while the rest had functional salvaged extremity.

Conclusion. Complex injuries of lower leg and foot are difficult to treat, but with good team of surgeons and adequate patient evaluation and selection it is possible to achieve good results with majority of patients being satisfied with, not only salvaged, but also functional extremity.

Keywords: injuries, lower leg and foot, reconstructive surgery, microsurgery

026 Reconstruction of the orbit and eyelids in explosive injuries

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Orbital reconstruction after explosive injury is often a long process and numerous interventions are required to achieve a good functional and cosmetically satisfying result for both the patient and the surgeon. Orbital defects resulting from such injuries can present a significant challenge to the oculoplastic surgeon because of the destruction and compromise of the available surrounding tissues, secondary scaring and tissue contraction, as well as to the limited financial resources available in most cases.

Cases usually involve multistep approaches which require time and patience on both ends. The approach that is selected varies on the extensiveness of the injury, the duration from the time of the injury and the planned surgical intervention, as well as the understanding of the possibility and end result of the reconstruction in each individual case. Primarily in extensive injuries the goal is to start off with a socked reconstruction which would provide the patient with the ability to wear a cover shell eye prothesis. Fat grafting is inserted to restore volume

which is followed by dermis-fat graft insertion was needed for further volume augmentation. Various local skin flaps are used to reconstruct the upper and lower eyelid. Our multi step plan of management comprises of a primary focus on the correction of the external deformities in order to allow the proper fitting of an aesthetically acceptable ocular prosthesis. Various methods were implemented on the reconstruction of the peri-ocular area among patients presenting with delayed presentation of complicated orbital injuries.

Keywords: reconstructive surgery; orbit; eyelids

027 Cognitive nerve transfers for spasticity treatment in upper motor neuron syndrome

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Introduction. Stroke is nowadays a leading cause of disability with devastating sequelae. Nevertheless, not all the muscles are equally affected, as some may turn spastic or paretic and other remain intact. This unique pathophysiological mosaic dictates a precise therapeutic plan. A life-lasting treatment, precisely adapted to every single patient's needs and to disease pattern, is currently missing. Hyperselective muscle denervation and subsequent cognitive reinnervation with appropriate donor nerves may break the pathological spastic circuit and provide volitional muscle control. We performed cognitive nerve transfers in stroke patients and prospectively investigated their effects on clinical and functional level.

Methods. To provide volitional muscle control of finger flexors and wrist/fingers extensors we transferred the nerve branch to brachialis muscle to the anterior interosseous nerve and the nerve branch to the lateral head of triceps to the deep radial nerve in a total of four hemiplegic patients. We additionally reinnervated the spastic pronator teres muscle with a branch to the pectoralis major muscle using a graft. Supplementary surgical steps were performed as needed. Nerve donors had always been carefully selected with a minimum of M4 strength. Clinical and functional outcomes are evaluated 6 and 12 months after surgery.

Results. At 6-month follow-up, all patients had improved functional scores and modified Ashworth scale revealed no abnormality in muscle tone and resistance to passive stretch. Muscle activity of the newly reinnervated muscles could be observed only electrophysiologically. The 12-month follow-up revealed an improvement in all clinical and functional scores with statistical significance ($p<0.05$) for DASH and modified Ashworth scale.

Conclusion. Cognitive muscle reinnervation through selective nerve transfers reduces spasticity and offers the possibility for permanent biological restoration of hand function.

Keywords: motor neuron syndrome, spasticity, cognitive nerve transfer, treatment

028 Gunshot injuries of the hand

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Introduction. Gunshot injury of the hand, although rare, due to the forces acting on the soft tissue and bony structures leave a significant degree of disability. Adequate initial care, and primary reconstruction of blood vessels, nerve, tendon, muscle and bone tissue can reduce the resulting disability and increase the possibility of establishing normal function of the hand. The aim of this paper is to show the importance of the initial treatment of hand gunshot injuries and highlight the importance of primary reconstruction of damaged tissue.

Materials & Methods. At the Department of Microsurgery and Hand Surgery in the last five years we treated 19 patients with gunshot injuries of the hand. After adequate initial wound debridement and hemostasis, all patients underwent emergency surgery within 8 hours of injury. Primarily we tried to reconstruct all injured tissue. Fractures were stabilized with K wires or external mini fixation devices. Tendons were primarily or secondary reconstructed with 2-0 braided polyester suture. Vessels and nerves were reconstructed using microsurgical technique. Patients were treated with three antibiotics. All patients went through 20 sessions in hyperbaric chamber. After the wounds and fractures healed, patients were sent to physical therapy. To assess recovery, we used the DASH score and "pinch" and "grip" tests.

Discussion. There were 8 patients with accidental self-inflicted injuries. All injuries were civilian injuries. In 2 patients, there was a postoperative infection that was subsequently treated with antibiotics according to microbiology findings. Fractures healed in all patients. One patient underwent finger amputation as a result of severe damage to the vascular structures and soft tissue. Average DASH score was 26, and “pinch” and “grip” tests showed 12% less strength compared to uninjured hand.

Conclusion. The initial wound treatment, which involves soft tissue and bone debridement, wound toilet and hemostasis as well as surgical treatment within the first 8 hours of injury significantly reduce the possibility of postoperative infection. Primary reconstruction of all injured structures reduces postoperative complications, length of hospital stay and consequent disability.

Keywords: gunshot injuries, hand, microsurgery

029 Heterogeneity of spinal extramedullary tumors, treatment modalities and outcomes

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Objective. Extramedullary tumors are a wide group of different tumors that can have serious consequences in terms of neurological deficit and pain syndrome. We present the experience of our center in the treatment of spinal extramedullary tumors.

Methods. By retrospective analysis of 6 years period we discover 39 patients who suffered from spinal extramedullary tumors. The variables that were monitored were the patient's sex and age, spinal level of the lesion, preoperative and postoperative neurological findings, length of hospital stay, pathohistological findings and complications during treatment.

Results. The most common were meningeomas (13/39, 33,3%) and neuronimas (10/39, 25,6%), other less frequent tumors were perineural cysts, dermoid cyst, lipoma, metastatic lesions. The average age of the patients was 61.66 years (range 39-77), there were 22 female and 17 male. Postoperative complications occurred in 6 patients (15.4%). In 33 patients (84.6%), the treatment led to the regression of the initially present neurological deficit and in 6 patients there was no recovery or further deterioration occured.

Conclusion. Preoperative neurological deficit and patient's age were poor prognostic factors for the final clinical outcome. We also found that less invasive operative technique for intradural extramedullary tumors significantly reduced hospital stay.

Keywords: spinal, extramedullary tumors, prognostic factors

030 Functional recovery after surgical treatment of the radial nerve injury

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Introduction: The radial nerve is the main extensor of the upper extremity and its injury leads to hand drop and inability to put a hand in a functional position, which produces disability in patients every day and work activities with big socioeconomic problems. Most previous studies showed excellent recovery after surgical treatment of the radial nerve, which can be explained by the fact that the radial nerve is predominantly motor, it innervates synergistic muscles and doesn't innervate intrinsic hand muscles.

Aim: To evaluate functional outcome and quality of life after radial nerve injury surgical treatment. Cases with bad recovery were further analyzed, in order to evaluate the diagnostic and therapeutic protocol and to improve final outcome.

Material and methods: Our study included 140 patients surgically treated due to radial nerve injury during 20 years period. Muscle strength was evaluated using the „British Medical Research Council" scale (MRC scale), while the level of motor recovery was classified using a modified scale of Highet and Holmes. Extension of the wrist, extension of the fingers and thumb, and thumb abduction were evaluated. The quality of life study included 129 patients who agreed to participate in a survey and they were evaluated with the DASH („The Disabilities of the Arm, Shoulder and Hand") and PNSQoL („Peripheral Nerve Surgery Quality of Life") questionnaire.

Results: Out of 140 patients, more than 2/3 were males and the mean population age was 38. The most common mechanism of nerve injury was fracture-related contusion. Disruption of nerve continuity was significantly more common in high- energy traumas. The majority of the patients were treated by neurolysis (68%) and sural nerve grafting (26%), while only a few were treated by direct suture or nerve transfer. Useful motor recovery was achieved in 91.4% of the analyzed patients, as well as in 96% of the cases with neurolysis, 78% of the cases with sural nerve grafting, and all cases with direct suture and nerve transfer. Surgical treatment in the first 6 months since the injury, low-energy trauma, lesions with preserved continuity and lower graft length were associated with better motor recovery. Mean DASH and PNSQoL scores were 18.2 and 66.2, respectively, which indicates good functional recovery and a low rate of postoperative disability. The patients with the nerve disrupted in continuity more commonly reported difficulties in performing some activities and were less satisfied with the result of the surgery.

Conclusion: Functional recovery after surgical treatment of the radial nerve palsy, as well as the quality of life and patient satisfaction were excellent. High-energy trauma is more commonly related to nerve continuity disruption and requires closer evaluation and earlier surgical treatment. Late patients' referral and the need for long grafts were associated with the poorer recovery and the need for nerve and tendon transfer.

Keywords: radial nerve injury, surgical treatment, recovery

031 Epidural use of corticosteroids and anesthetics- our experience

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Introduction. Epidural use of corticosteroids is a frequently used method of non-operative treatment of lumbar pain. Data from the literature are different, so there are no clear guidelines regarding indications, performance techniques, types of preparations and percentage of success. In our institution, this type of intervention has been in routine use since 2010.

Methodology. Patients who underwent this type of treatment in our institution between July 1, 2019 and July 1, 2022 were analyzed. All patients had an MR examination of the LS spine. Patients were admitted and discharged on the same day, except in two cases that remained in the hospital for several days. The VAS score at admission and at discharge was compared. The study was designed as a cross-sectional study, and the data were analyzed using descriptive statistics methods.

Results. A total of 338 patients were treated. 222 patients had not been previously operated on, and 116 of them had previously undergone surgical treatment. The VAS score on admission was 7 or higher, with an average value of 8.6. The VAS score on discharge was on average 4,2 and all the patients were without new neurological deficit. Complications were mostly mild and transitory, except in two cases where there was subdural placement of the drug, after which the patients remained in the hospital for several days (complete recovery).

Conclusion. Epidural infusion of corticosteroids and anesthetics is a very effective method in the treatment of both acute and chronic lumbar pain and leads to rapid and convincing improvement of the condition. this type of treatment can be carried out as part of non-operative treatment of lumbar pain, as well as part of the treatment of postoperative complaints (failed back syndrome) complications are rare, mostly mild, transitory and do not lead to neurological deterioration.

Keywords: epidural, corticosteroids, lumbar pain, VAS score

032 Post-traumatic cervical epidural hematoma: clinical characteristics and management

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Post-traumatic epidural hematoma of the cervical spine is a rare and serious condition characterized by the presence of blood in the cervical epidural space. Due to the compressive effect on the underlying neural parenchyma, it can lead to the development of various neurological deficits and lethal outcome.

The mechanism of injury does not always correspond to the characteristics of cervical epidural hematoma. Given that this entity has not been sufficiently researched and elucidated in the scientific literature, the aim of our work was to examine the clinical characteristics and treatment modalities for this injury by reviewing the relevant literature. This review included available scientific literature from internet databases (MEDLINE, PubMed, Embase, ClinicalTrials. gov) where 34 papers published in the period from 1980 to 2022 were analyzed together with references and relevant conference abstracts.

The criteria for inclusion in our research were met by 12 scientific papers. Retrospective studies and literature reviews with case reports were considered. Patients with severe polytrauma as well as patients with poor coagulation screening values have an increased risk of developing spinal epidural hematoma. If patients show good results to the applied conservative therapy and do not have gross neurological deficits, surgical decompression may not be necessary.

Keywords: Cervical epidural hematoma; Spinal epidural hematoma, Spinal trauma; Computed tomography; Magnetic resonance imaging

033 Difference between complete and incomplete spinal cord injuries and treatment

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A traumatic spinal cord injury (SCI) is a lesion to the spinal cord that causes temporary or permanent impairment. Traffic accidents, falls and violence are the most common causes of SCI. Estimated annual incidence is approximately 54 cases per

one million people or 250.000 - 500.000 people every year worldwide. Mortality risk is highest in the first year after SCI. Estimated average lifetime cost of health and social care for a patent with SCI is about 1.3 million Euros.

There are two main types of SCI: complete and incomplete.

A complete SCI indicates that spinal cord is fully severed causing total loss of all motor and sensory function below the site of injury. Complete lesions represent roughly 50% of all SCI. The spinal cord is infrequently cut or transected and usually loss of function is a result of contusion or impaired blood flow of the injured segment of the spinal cord.

An incomplete SCI indicates that the ability of the spinal cord to transport messages to or from the brain is not completely absent. Furthermore, incomplete SCI victim might still retain some function and sensation below the level of the injury. Patients with incomplete SCI generally tend to have a better overall outcome and are able to recover much faster.

The symptoms of a complete and incomplete SCI are almost indistinguishable. Those symptoms include: loss of sensation below the level of the injury, complete loss of motion below the level of the injury, impaired control of bladder and bowels and breathing difficulties if the level of injury is high enough.

Personalized treatment for patients with SCI consists of spinal stabilization and rehabilitation. Spinal stabilization emphases on minimizing spinal cord edema, neuronal cells deaths, and neuroinflammation. This is crucial for minimizing total damage to the spinal cord and preserving its function. Following spinal stabilization, treatment will focus on physical, mental, and cognitive rehabilitation to maximize functional recovery.

The authors make their remarks about neurological, therapeutical, and socioeconomic burden of SCI.

Keywords: spinal cord injury, complete, incomplete, treatment

034 Cervical radiculopathy VS. carpal tunnel. syndrome- the shared territory

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Carpal tunnel syndrome and cervical radiculopathy are the common conditions in neurosurgical practice. The clinical signs of those conditions includes the chronic pain, in many cases with parestesis-painful numbness, that may radiate along the involved arm. The shared pain theritory ofthese two conditionsnecesitates the proper assesment of the respective pain mehanism. In the consecutive prospective series of 126 patients, 27 males (21,42%) and 99 females (78,58%) in the period from 2011-2022, excluding 2020 and 2021 when Clinical Hospial Centar Zemun–Belgrade was in the the complete Covid-19 system due to worlwide pandemic. Operated for carpal tunel syndrome of the clinical characteristics of pain syndrome were analyzed in the order to define cinical distinctions between cervical radiculopathy and carpal tunel syndrome.

Our results showed that the most significant clinical sign of the carpal tunel syndrome were the pain and numbnes that are elicited or aggravated by the additional narrowing of the carpal tunel, producin additional compression on the median nerve (Phalen sign). We found that provoked pain such as during cervical spine manipulation (Spurling sign) is of essential value for the correct diagnosis of the pain origin. So, clinicians should allway perform specific test such as: McMurty, Tinell, Phalen and contra-Phalen, as well as Spirling test in order to determen the origin of pain.

Keywords: cervical raiculopathy; Carpal tunel syndrom

035 MIS 9-year experience- lessons learned

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Introduction: Various minimally invasive spine surgery (MISS) techniques have been developed over the last decade with the goal of reducing approach-related soft tissue trauma and its associated complications while achieving the clinical and radiological outcomes of open techniques. The MISS quickly established itself as a viable treatment option not only for short-segment spinal pathology but for complex spinal pathologies, trauma, and deformities. However, there is still a debate about some of the potential drawbacks of MISS techniques, such as longer operating times and increased intraoperative radiation.

Aim: We present our institutional experience and personal impressions using MISS, to describe our learning curve and how gaining experience influence different parameters of the surgical procedure.

Materials and methods: For the period 04.2013-04.2022 252 patients were operated in the Department of Neurosurgery in University Hospital Pirogov using percutaneous posterior transpedicular technique. Patient demographics, type of pathology, type and number of implants used, blood loss, duration of surgery, radiation exposure, length of hospital stay were reviewed. The cohort was divided into consecutive quarters (each group included 63 patients). Comparison of the results for each quarter and timeline analysis were made to assess the learning curve and how different parameters of the surgical procedures evolved.

Results: 252 patients were operated. The average patient age at the time of surgery was 51 years (range 17–81 years) and the series included 118 women (47%) and 134 men (53%). Only

percutaneous transpedicular screw fixation was performed in 113 cases, MIS-TLIF in 132 cases and vertebral body replacement in 7 cases. Average blood loss was 114.3 ml, 116 ml, 106.8 ml and 107.3ml for each quarter, respectively. Average operative time was 154.0 min, 143.7 min, 134.2 min, and 133.6 min. Average time of radiation exposure was 105.3 sec, 85.7 sec, 47.1sec, and 44.8 sec. Differences of the operative time and the time of radiation exposure between the 1st –3rd quarter and the 1st –4th quarter were statistically significant.

Conclusion: When compared to the standard operative approach, the utilisation of minimally invasive percutaneous spinal fixation and gradual improvement of the technique resulted in a less traumatic and equally effective approach. The disadvantages of MISS techniques can be significantly reduced once the learning curve is overcome. Surgical experience, team familiarity with MISS instrumentation, and good patient selection are critical for deploying all of MISS's benefits. Introduction of new technologies such as computer-assisted navigation and surgical robotics has the potential to further improve the results of MISS.

Keywords: minimally invasive technique, spine surgery, pedicle screw, radiation exposure, learning curve

036 Ameliorative effects of mildronate on the experimental ischemia/reperfusion injury model in the rabbit spinal cord

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Introduction: Mildronate is useful anti-ischemic agent and has antioxidant, anti- inflammatory, and neuroprotective activities. This study aimed to investigate the possible neuroprotective effects of mildronate in the experimental rabbit spinal cord ischemia/reperfusion injury (SCIRI) model.

Methods: Rabbits were randomized into four groups of eight animals as groups 1 (control), 2 (ischemia), 3 (vehicle), 4 (30 mg/kg methylprednisolone (MP)), and 5 (100 mg/kg mildronate). The control group only underwent a laparotomy. All the other groups have the spinal cord ischemia model by a 20-min aortic occlusion just caudal to the renal artery. The malondialdehyde and catalase levels were investigated, as were the activities of caspase-3, myeloperoxidase, and xanthine oxidase. Neurological, histopathological, and ultrastructural evaluations were also performed.

Results: The serum and tissue myeloperoxidase, malondialdehyde, and caspase-3 values of the ischemia and vehicle groups were statistically significantly higher than the MP and mildronate groups ($p < 0.001$). Serum and tissue catalase values of the ischemia and vehicle groups were statistically significantly lower than the control, MP, and mildronate groups ($p < 0.001$). The histopathological evaluation revealed a statistically significantly lower score in the mildronate and MP groups than the ischemia and vehicle groups ($p < 0.001$). The modified Tarlov score values of the ischemia and vehicle groups were statistically significantly lower than the control, MP, and mildronate groups ($p < 0.001$).

Conclusion: This study presented the antioxidant, anti-inflammatory, antiapoptotic, and neuroprotective effects of mildronate on SCIRI. Future studies will elucidate its possible use in clinical settings in SCIRI.

Keywords: Anti-inflammatory, antiapoptotic, antioxidant, ischemia/reperfusion, mildronate, neuroprotective

037 Investigation of antiinflammatory effects of isoalantolactone on experimental traumatic spinal cord injury model in rats

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Background. Spinal cord injury stimulates an inflammatory reaction that causes substantial secondary damage inside the injured spinal tissue. The purpose of this study was to determine the anti-inflammatory effect of Isoalantolactone on traumatized spinal cord.

Material & Methods. A total of 32 male Wistar rats (n = 8) were used in the study. The groups were divided into four groups as sham group, trauma group, trauma and methylprednisolone group, trauma and isoalantolactone (IAL) group. Spinal trauma model was created by dropping 15 gr free weight from 10 cm height under ketamine / xylazine anesthesia to rats. Neurological

examination were performed in all groups before sacrification. At the end of 24th hour, rats were sacrificed and histopathological and immunhistochemical findings of spinal tissues were compared between groups.

Conclusion. In conclusion, Isoalantolactone (IAL) contributed to improvement of neurological functions in moderate spinal cord injury by inhibiting macrophage, microglial activation and NFkB pathway of the neuroinflammation process.

Keywords: Traumatic Spinal Cord injury, methylprednisolone, isoalantolactone, neuroinflammation, nfkb

038 Hydrocephalus after intracranial hypotension: a rare and severe complication of spinal surgery

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Introduction. Cerebrospinal fluid (CSF) leakage is frequent complication after cerebral or spinal surgery. Lumbar spinal fluid drainage insertion is commonly used to reduce CSF leakage after transdural procedures. Nonetheless, this simple and effective procedure associated with several lethal complications such as; meningitis and overdrainage. Here, we present a rare case of lumbar over- drainage which resulted in hydrocephalus and infratentorial herniation after cervical corpectomy.

Case. A 62-year-old female patient applied to the hospital with pain in bilateral upper extremities. She had mylepathy and radiculopathy symptoms. A cervical magnetic resonance imaging(MRI) revealed C4-5 nad C5-6 ossification of the posterior longitudinal ligament. She underwent a cervical corpectomy. After surgery a lumbar drainage was inserted due to CSF leakage. After 5 days, the lumbar drainage removed. One week after the removal of the drain, the patient started complaining about a severe headache. Within a short time, she lost consciousness and had a sudden respiratory arrest. The MRI and Computed Tomography (CT) revealed subdural hygroma and hydrocephalus.

She was diagnosed with intracranial hypotension due to CSF leakage- which resulted in infratentorial herniation and obstructive hydrocephalus. She was surgically treated with External Ventricular Drainage (EVD) and Ventriculo-peritoneal Shunt (VPS). She was discharged without any neurological symptoms.

Discussion. After spinal surgery, headache and confusion may be associated with acute hydrocephalus due to Intracranial Hypotension Syndrome. Hydrocephalus may develop after removal of lumbar drainage in patients with dural tear. There may be continuous CSF leakage at the entrance of the dural drainage. Close monitoring of the patient is recommended for symptoms of intracranial hypotension.

Conclusion. Overdrainage and hydrocephalus are one of the most severe complications of spinal surgery; yet with early detection, these complication can be treated without causing any neurological deterioration through more awareness.

Keywords: intracranial hypotension, over drainage, hydrocephalus, cervical corpectomy

039 Gunshot head injuries- our experience in treatment

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Introduction: Traumatic brain injury (TBI) caused by gunshot wound is a complex injury with a broad spectrum of symptoms and high rate of mortality and morbidity. This study presents an evaluation of TBI caused by gunshot wounds for a period of 18 years in General Hospital Ćuprija and discusses possible predictive factors for the outcome of surgical intervention.

Patients and methods: The study sample consisted of 18 patients who underwent surgery for TBI. All injuries were caused by bullets of different caliber, from 7.62mm to 9.1mm (.357in). Test and parameters which were included: Glasgow Coma Scale, pupil reactions, bullet trajectory, time between injury and hospitalization and way of reconstruction.

Results: Almost all patients were male (16-88,88%), and the mean patient age was 43,8 years. Causes of injury were predominantly suicidal (55.55%). The Glasgow Coma Scale (GCS) at admission was below 5, average 3.33. In total, 5 patients survive (27,7%). Others died despite surgical management, with diffuse brain injury the most common cause of death.

Conclusion: Bi-hemispheric injuries, ventricular injuries are correlated with bad prognosis. Early and less invasive surgery in conjunction with short transport time to hospital decrease mortality rates.

Keywords: Gunshot head injury, Gunshot wounds, Brain injury, Bi-hemispheric injuries

040 Clinical prediction rules for positive computed tomography scan in patients with mTBI

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Introduction: There is much controversy about the use of computed tomography (CT) and it is very difficult to define prediction factors for positive head CT findings among the patients with mild traumatic brain injury (mTBI). We aimed to identify predictors of positive head CT scan findings in terms of presence of any kind of intracranial hemorrhage after mTBI.

Materials and Methods: We carried out retrospective cohort study for a period of a two years in the Emergency department of Clinical centre of Vojvodina and included consecutive adults who presented with a Glasgow Coma Scale (GCS) score of 13-15 after head injury. We did standardize clinical assessments before the CT scan (CT scan indicated after Canadian head CT rule). The variables used for detection of positive head CT scan were age, gender, cause of injury, coexisting severe diseases, anticoagulation therapy use, antiplatelet therapy use and GCS score. SPSS was used as a statistical tool with the aplication of Chi Square, Logistic regression and T test.

Results: A total of 658 patients were included in the study and 21% of all patients analysed had positive CT findings. Average age was 56.02 years and there were more male than female patients. Majority of patients were hurt by falls and RTAs. 24% of patients were hospitalised and 6 of them underwent craniotomy for haematoma evacuation. 10.1/10.5% of the examined group was taking anticoagulant/antiplatelet therapy. Higher age, male sex, coexisting severe diseases and lower GCS score at the point of admission have found to be statistically significant in predicting positive CT result. Cause of injury, anticoagulation therapy and antiplatelet therapy did not show significant statistical coorelation with prediction of positive CT finding.

Conclusion: Combinations of history and physical examination features in clinical decision rules can identify patients with mTBI at high risk of presence of intracranial injuries on head CT scan. Well known Canadian CT Head Rule is a highly sensitive tool for the use of CT.

Keywords: mild traumatic brain injury, computed tomography, indications, prediction

041 The role of decompressive craniectomy in traumatic brain injury

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Traumatic brain injury remains a leading cause of mortality and disability worldwide. The annual incidence is estimated at 260 per 100,000 in Europe, with a fatality rate between 0.9 and 7.6%. Surgical interventions are a key component of severe TBI management. The use of decompressive craniectomy remains a controversial topic in management of traumatic brain injury and is regarded as the last tier in the management of raised intracranial pressure.

Clear benefits have been demonstrated in terms of ICP reduction and improvements in brain tissue oxygenation, cerebral perfusion. However, the improvement in terms of patient outcome were less apparent and led to the launch of two large randomized trials recently. Reduction in mortality achieved by surgical intervention in these trials, was due to an almost direct increase in the number of survivors with severe disability or in a vegetative state.

This study retrospectively analyzed patients who underwent unilateral decompressive craniectomy from 2012 to 2018 for traumatic intracranial hypertension or acute subdural hematoma. A total of 180 patients (138 males and 42 females) were included in this study. The median age of the cohort was 56 years (range 18–79 years). 152 patients underwent DC due to acute subdural hematoma and 28 patients suffered from traumatic intracranial hypertension. Glasgow Outcome Scale was used to assess functional outcomes of all patient enrolled in this study. Factors associated with poor outcome were identified and analyzed based on preoperative clinical status and CT findings. The decision to perform decompressive craniectomy is challenging and the question remains as to whether there is a subset of patients who can profit from surgical decompression.

Keywords: Decompressive craniectomy, Traumatifc brain injury, Outcome

042 Civilian penetrating traumatic brain injuries inflicted by low-muzzle velocity weapons; Case report

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Introduction: Civilian gunshot wounds to the head are the most severe form of craniocerebral injuries with a mortality rate of about 50% in hospitalized patients.

Case outline: We present a case of a 50-year-old patient who suffered a penetrating traumatic brain injury (pTBI) while attempting suicide with a low muzzle velocity projectile from a close range in the temporal region on the right side. The patient was confused at admission (GCS 13), with no gross pyramidal neurological deficit, and a neuroradiological finding indicated a bifrontal missile track with a communitive skull fracture at the site of entry and exit wound. The treatment of the patient consisted of debridement of the entrance and exit wounds and monitoring of the patient with the use of supportive therapy. After completing hospital treatment and clinical follow-up for one year, the treatment outcome was a good recovery according to the Glasgow Outcome Scale (GOS).

Conclusion: Conscious patients, without intracranial mass lesions and with injuries inflicted by low-muzzle velocity projectiles should be treated with less aggressive surgical procedures with regular follow up, and treatment of other civilian penetrating traumatic brain injuries should be streamlined depending on independent predictors of outcome.

Keywords: Civilian penetrating traumatic brain injury, Low muzzle velocity projectiles

043 Intrathecal baclofen therapy and Covid-19 infection – report of three cases

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Introduction: Patients with severe spasticity are effectively treated with intrathecal baclofen therapy (ITB), but because of their invalidity, in case of infection, prognosis is poor.

Case outline: We present three cases (two men and one woman) of patients treated with baclofen intrathecal therapy due to spasticity of all four extremities who underwent SARS-CoV2 virus infection. Two of them have multiple sclerosis, and one has trauma of the cervical segment of the spinal cord. In all three patients, the clinical presentation of Covid-19 infection occurred within six months of implantation of the pump for ITB. They were successfully treated in hospital with same dose of the drug and without exacerbation of neurological status. Barthel index and modified Rankin score were same before and after Covid-19 infection. In two cases Barthel index (BI) was 20, and in one 69; and modified Rankin score (mRS) was 3 in one case, and 5 in two cases.

Conclusion: Patients with severe spasticity who require intrathecal baclofen therapy can be safely treated regardless of the pandemic.

Keywords: Intrathecal therapy, Baclofen, Covid-19

044 Use of preoperative fused deposition modelling in neurosurgical treatment of intracranial tumours

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Background: 3D fused deposition modelling technology has been utilized in neurosurgery for the past couple of years. In this original submission, we discuss our experience with 3D printing in neurosurgery that was singlehandedly done by a neurosurgeon.

Methods: A database with clinical data and images was created for the patients that were treated with the help of either 3D printed devices, or 3D printed implants that were designed by a neurosurgeon.

Results: This article had 20 patients treated in a single centre analysed for the type of disease, complications, aesthetical outcome and surgeon's accuracy and confidence during procedure. Patients were treated in the field of mostly neuro-oncology and traumatic brain injury. All patients included did not have significant complications, and did not defer from centre's database. Aesthetical outcome was satisfactory. Accuracy and precision were highly improved where it was reported that the process of designing the 3D model for the patient immensely helped during surgical procedure.

Conclusions: This process of surgeon approached 3D printing is very practical, despite being time consuming, and can result in producing patient specific 3D models that will help in

achievement of better functional and aesthetical results after neurosurgical treatment.

Keywords: Deposition modeling, Neurosurgery, Intracranial tumors

045 Head trauma management in the great war- a historical perspective

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During the First World War, new surgical techniques and treatments were developed in relation to the nature of wounds as a result of new warfare. Because of need for immediate treatment, transport and evacuation of great numbers of injured, many of the improvements and innovations in military medicine were set into place that are still valid today.

The main advances were notable in surgery, which is understandable given the type and nature of the injuries. In fact, surgical procedures were very similar to those of today. The pathology at the front was different. Most were war injuries, but there were also many complications, various infections, all kinds of abrasions and wounds, infectious diseases, psychoses, burns and frostbite, skin and venereal diseases. Head trauma was a frequent cause of morbidity and mortality. Because of such a high number of injured, military surgeons in Great War were relatively unprepared for the nature and extent of intracranial injuries. Rapid triage, disorganized transportation, incomplete surgery and infection after brain trauma resulted in a mortality rate from 30 to 50%. Military physicians therefore focused their efforts in the clinical and experimental treatment of TBI. The wound area was disinfected with iodine tincture and coarse foreign bodies were cleaned with tweezers and a sterile swab. Morphine analgesia had to be administered before wound care. Simple gunshot wounds were covered with gauze and cotton wool and all dressed with a sterile bandage. For major soft tissue defects with large entry and exit wounds, the gunshot canal was inspected and necrotic tissue was excised, foreign bodies were removed and the wound was swabbed with iodoform tape. This transformed the wound into an aseptic wound.

Deep head injuries were usually operated on unless the condition of the injured soldier was stable and not deteriorating neurologically. Brain tissue injuries were also operated on, if possible in the rears. The surgical techniques included *en bloc* bone resection under local or general anaesthesia with suction debridement, metal fragment removal and primary two-layer closure. Blood loss was treated by infusion of saline solution, which was prepared as a sterile solution of table salt (prepared in the field), oxygen treatment, Trendelenburg position and 'autotransfusion'. We review the historical perspective of head trauma treatment in the First World War.

Keywords: Head trauma, Great war, Management

046 Number of microcapillaries, sinusoids correlated with the increase in chronic subdural hematoma

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Chronic subdural hematoma represents extra axial encapsulated, in a slow- growing cluster of blood, which, as time passes by doesn't subject to coagulation process. A result of that is bleeding of microcapillary formed around neo membrane hematoma. The proliferation of microcapillary, sinusoids follows the increase of volume hematoma with clinical manifestation of compressive effect.

Chronic subdural hematoma belongs to a group of extra axial hemorrhagic primary cranio cerebral injuries whose principles of operative treatment through the development of neurosurgery have not significantly changed.

Introduction: Chronic subdural hematoma is defined as the accumulation of blood in the virtual space between the hard mater and arachnoid which is most often the result of minor, often unnoticed head injuries with characteristics of slow and progressive growth that is not subject to the expected processes of coagulation but over a longer period of time it behaves like spacious / compressive lesion. (1, 4, 5, 7)

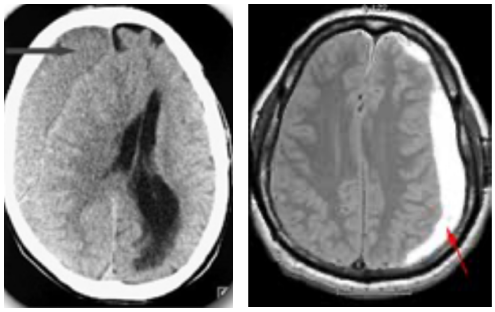

Figure 1.

Virtual space between the dura and arachnoidea is the subdural space. In the dura-arachnoid compound, which is potentially appear as a result of pathological/ traumatic process, are placed flat fibroblasts - dural border cells, without the extracellular collagen and without cellular compounds, which speaks in favor of his vulnerability. Meningeal (bridge veins) thickness of 1-3 mm and a length of 1-2 cm drain external brain membrane. The thickness of the wall of these veins showed on electric microscope in subdural portion is significantly thinner (10- 600 μm) than thick wall of the veins of subarachnoid portions (50-200 μm), and due to these characteristics are more susceptible to trauma. (8, 11)

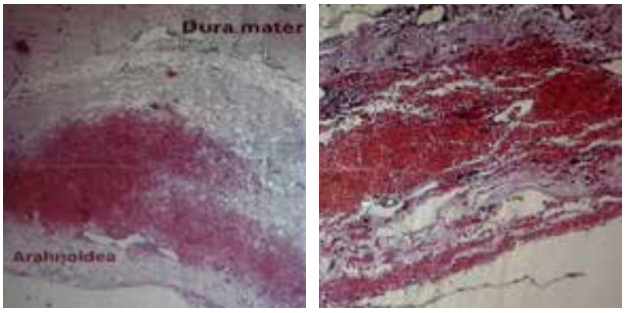

Figure 2. Histological view duro arahnoid compound

The dura mater consists of a two lamellar layer, compact and loose. First one is composed of a tight fibrous tissue and a few blood vessels. Second one has a much more blood vessels. The outer (parietal) hematoma membrane contains numerous microcapillaries, SINUSOIDS, with wide vascular lumen more than 40 μm in diameter. The inner side of hematoma also creates its pseudomembrane that separates the clot from arachnoidea. Putaman and Cushing reported that the outer membrane of subdural hematoma is very rich in blood vessels and it contains capillaries with a giant diameter up to 80 μm. Watanabe and associates have demonstrated that the increase of experimental SDH is proportional to the thickness of the layer of microcapillaries and the degree of leakage. (10)

For SDH, often in everyday clinical practice is used the term to represent one of the largest "imitators" in the clinical picture due to the wide range of non-specific symptoms. (6)

Symptoms of chronic subdural hematoma in most cases are following: a headache, changes in the intellectual sphere, behavioral changes, dizziness, nausea and vomiting, lethargy and excessive sleepiness, weakness, apathy, and epileptic seizures.

The goal of the work: Each year about 50 patients are surgically treated at the Clinic of Neurosurgery due to SDH. The aim is to show the correlation between the proliferation of blood vessels, sinusoids, osmolality hematoma with a magnification and form of hematoma.Review of pathohistological patterns of chronic subdural hematoma capsule taken from operated patients wherein the microscopic blood vessels are counted in one mm2 and analyze their structure on the microscope with 40x magnification. Obtained number of microcapillaries we compared with the volume of hematoma, which was determined by the formula ABC / second.

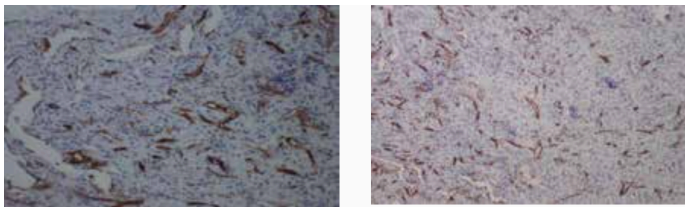

Figure 3. Number of sinusoids in the capsule hematoma marked with a CD 34

Results: The total sample in the first phase has had 11 respondents. Of this number, there were 9 (81.8%) men and two (18.2%) women.

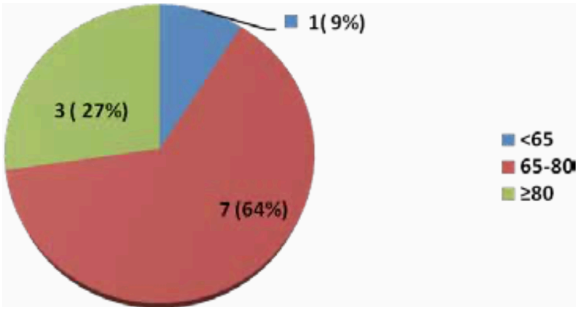

Chart 1. Age structure of patients

From the standpoint of the number of blood vessels in one mm2 all patients were classified into three categories. The first consists patients whose value is less than 30. The second consists patients whose value is between 30 and 80s. The third consists patients whose value of this indicator is higher than the 80s. In the observed sample, 73% of patients had a value of this indicator between 30 and 80 mm2, while 27% had a number of vessels more than 80 per mm2. The structure of the sample by the number of blood vessels per mm2 are shown in the chart second.

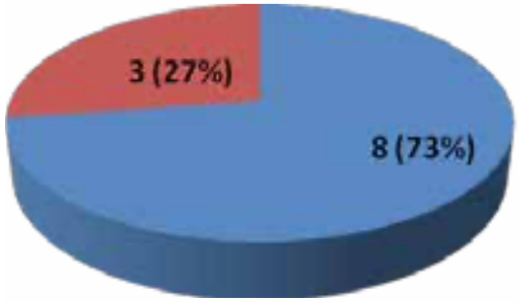

Chart 2. Structure of the patients according to the number of blood vessels /mm2

Table 1. Number of blood vessels and the diameter of the hematoma by gender

		Men	Women	χ^2	p
Number of blood vessels	30-80/ mm²	8(88,9)	0(0,0)		
	>80 / mm²	1(11,1)	2(100,0)	6,519	0,011
The largest diameter	<10	4 (44,4)	0(0,0)		
Hematoma	13-30	4 (44,4)	2(100,0)		
	≥30	1 (11,1)	0(0,0)	2,037	0,361

Table 2. Number of blood vessels and the diameter of the hematoma

		<65 years	65-80 years	≥85 years	χ^2	p
Number of blood	30-80/ mm²	1(100,0)	5(71,4)	2(66,7)		
vessels	>80 / mm²	0(0,0)	2(28,6)	1(33,3)	0,473	0,804
The largest	<10	1(100,0)	3(42,9)	0(0,0)		
diameter	13-30	0(0,0)	4(57,1)	2(66,7)		
Hematoma	≥30	0(0,0)	0(0,0)	1(33,3)	5,587	0,323

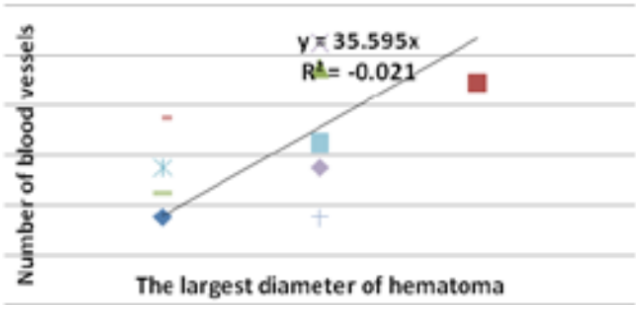

Chart 1. Correlation chart of the number of blood vessels and the largest diameter of hematoma

Discussion: In the beginning of this discussion, we exclude gender through the statistical analysis as a favoring factor wich influenced the increase in volume of hematomas. Definition of SDH represents an intracranial expansive cluster of blood that is not subject to the processes of coagulation and is characterized by a slight increase in encapsulated growth. The results clearly indicate to conclusion wich shows that the greatest determinant diameter of hematoma can be observed in relation to the number of blood vessels (sinusoids). The value of the correlation coefficients between the largest diameter of hematoma and the number of blood vessels, to 1mm2, of patients is more than 0.5, to be specific 0.602. The value of correlation coefficients for more than 0.5 obtained by this statistical method indicates to the importance of increasing the number of blood vessels in the hematoma growth as another significant component. Microscopic findings of fresh erythrocytes (3, 2) in hematoma and increased concentration of potassium in the hematoma coincides with data from the literature, where erythrocytes are marked with 51Cr, found in significant numbers in the hematoma, and whose movement is followed from sinusoids through increased GAP junction to the hematoma. This, in some way, favoring the theory of vascular hematoma considering that themselves, sinusoids, are very fragile because of its atypical morphology. So fragile, they are subject to continuous splashing due to the constant pulsations brain parenchyma.

Conclusion: If we consider that the number of blood vessels to 1mm2 has a coefficient "Significant" of less than 0.05, we conclude that there is a statistically significant unique contribution to the prediction of the dependent variable. In other words, a number of blood vessels to 1mm2 is a statistically significant determinant of the largest diameter of hematoma of patients analyzed. In this way our starting assumption is confirmed, that the number of blood vessels to 1 mm2 has a statistically significant influence on the largest diameter of hematoma. (9)

In this paper, we didn't follow the dependency in relation to the age of patients, but we wanted to emphasize the importance of vascular theory in the development of a hematoma. In the literature, that we analyzed, data does not exist on the monitoring of the number of sinusoids in relation to the volume of the hematoma.

Keywords: Chronic subdural hematoma, Sinusoids, Microcapillaires

047 Dural metastasis of prostate carcinoma misdiagnosed as a bilateral subdural hematoma

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Dural metastases originating from prostate cancer are exceedingly rare and may clinically mimic a subdural hematoma. Additionally, head computed tomography scan (CT) findings can be mistaken for meningioma or subdural hematoma.

We present a 75-year-old male patient with dural/subdural metastasis as a first presenting sign of prostate cancer, misdiagnosed as a bilateral subdural hematoma on initial non-contrast brain CT scan. Also, a review of literature is presented.

We found 12 cases of dural metastasis of prostate cancer mimicking subdural hematoma described in the literature, and unlike in our case, prostate cancer was already diagnosed.

Keywords: Dural metastasis, Prostate cancer, Subdural hematoma

048 Practice trends in the utilization of intraoperative neurophysiological monitoring in neurosurgery

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Intraoperative neurophysiology monitoring (IONM) has arisen over the last decades as one of the main neurosurgery progress routes. IONM has traditionally been used to identify important neural structures that cannot be recognized solely based on anatomical landmarks, to continuously assess the functional integrity of neural pathways, minimize neurological damage and avoid significant postoperative impairments. The thriving interest in IONM is registered by the growing number of publications and scientific meetings. A recent study employed the largest inpatient database in the United States demonstrated a gradual yearly increase in the number of IONM procedures from 2008 to 2014 by 296%.

IONM has been utilized extensively in the spine, brain, peripheral/cranial nerve, and various other potentially risky surgical procedures, such as vascular surgery, thyroid, parathyroid, and esophagus surgery. Some of the primary modalities used are somatosensory evoked potentials (SSEP), transcranial motor evoked potentials (TcMEP), brainstem

auditory evoked responses (BAER) as well as spontaneous (EMG) and triggered electromyography (tEMG). Standard protocols for various IONM modalities are available nowadays, offering reproducible and reliable parameters to predict the outcome of the surgery both qualitatively and quantitatively. However, there are some limitations, and new methods must be developed.

For example, in patients who are poor candidates for awake surgery, due to lack of intraoperative communication, seizures, airway management, or some other unexpected factors, developing methods to map cortico-cortical and cortico-subcortical connectivity under anesthesia is of primary importance. Additionally, since the motor and visual functions are at risk during parietal lobe surgery, there has been an idea to perform simultaneous real-time monitoring of motor and visual pathways using two subdural strip electrodes. Furthermore, the intraoperative cortico-cortical method allows for mapping another language pathway and detecting connectivity between the primary and supplementary motor areas in the frontal lobe large-scale network.

In some other examples, during minimally invasive spine procedures for discectomy, laminectomy, or fusion, narrow visualization may lead to increased spinal root injury, especially in far lateral approaches. Despite the guidelines for commonly used modalities (tEMG, TcMEP, SEP), there are challenges to the reliability and validity of these methods. Therefore, transabdominal motor evoked potentials have been introduced as an alternative monitoring technique that may signal imminent injury or postoperative deficit.

Nevertheless, to be helpful in clinical practice, all the techniques above must be standardized, deterministic, and have a substantial predictive value. Before a clinical use could be proposed, the novel methods require further and thorough research. The type of IONM that a neurosurgeon favor should be reliable, practical, affordable, and granted by the medicolegal guidelines. The tailored approach in specific surgeries contributes significantly to the accuracy of IONM and the prevention of neurological injury.

Keywords: Intraoperative neuromonitoring, Brain mapping, Functional connectivity, Cortical stimulation, Evoked potentials.

049 Chronic subdural hematoma surgical vs endovascular treatment

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Subdural hematoma is a form of intracranial hemorrhage in the space between the dural and arachnoid membrane. Chronic subdural hematoma is a subtype where we have encapsulation of the blood clot. Mostly it occurs after initial head trauma. Pathophysiology process begins with blood resorption, collagen synthesis and spreading of the fibroblasts which makes inner surface of dura to form a thick outer membrane and thinner inner membrane. This process occurs in approximately two weeks.

Patients with Chronic subdural hematoma (CSH) mostly develops nonfocal neurologic symptoms, such as Headache, Light-headedness, Cognitive impairment, depression, Parkinsonism, gait ataxia, somnolence, seizures etc.

Diagnose is made by neuroimaging, mostly computed tomography (CT) of the head.

Management of CSH can be observation, surgical or endovascular treatment.

Observation is warranted for patients with small CSH that are asymptomatic or causing minimal symptoms such as headache.

Surgical treatment is option for patients with large and symptomatic CSH, with brain herniation and symptoms of elevated ICP. Usually, those patients have on CT scan clot thickness >10mm or midline shift >5mm. Treatment is mostly burr hole and drainage for 48 hours.

Endovascular treatment is option for older patients who are on antiplatelet or anticoagulant therapy, patients with CSH recurrence or patients with high risk for surgery, patients with mild or without any neurologic symptoms. Treatment is embolization of Middle meningeal artery.

Keywords: chronic subdural hematoma, surgery, endovascular

050 Comparative analysis of clinical and radiological presentation, surgical approaches and operative outcome of breinstem tumors

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Purpose: Our main goal is to define a detailed understanding of the regular anatomy with its possible variations and anatomy of the brainstem pathological processes as a key for defining surgical approach for achieveing the best possible operative outcome.

Object: The point of this study lies in improvement of enhancing of planing and using microsurgical resection techniques for Brainstem tumors with better defining of anatomical safe entry zones.

Method: We reviewed the records of 51 patients with brainstem tumors treated at the Institute of Neurosurgery, Clinical Center

of Serbia in Belgrade between 1998 and 2012.With several used approaches each entry zone was chosen depending on anatomical and radiological knowlegde to ensure best possible trajectory to the lesion.

Result: This study contains detailed discussion of safe entry zones that are used for approaching brainstem tumor and their possible limitations.

Conclusion: Because of its localization brainstem tumors are highly defined challange in neurosurgery for improving patients outcome avoiding potentially adverse effect of treatment.

Keywords: Brainstem tumors, Approaches, Safe entry zones

051 Role of the intraoperative fluorescence in the extent of surgical resection of high-grade gliomas on prediction of clinical outcome and progression free survival. case series

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Introduction: High grade gliomas are the most common type of primary malignant brain tumors in adulthood. This is a case series presentation in which we present three patients harboring HGG treated at the University Clinic of Neurosurgery – Skopje with fluorescence guided surgical resection.

Material and methods: Parameters that we have taken in consideration were: sex, age, neurological status before surgery, tumor location, Karnofsky performance score on admission, extent of surgical resection measured by conducting postoperative MRI volumetric analysis, disease recurrence and molecular status of the operative material.

Results: Case 1. A 32-year-old man presented with a 2-months history of epileptic seizures. He experienced severe generalised tonic clonic seizures. MRI postcontrast images showed limited heterogeneous contrast enhancement. The patient underwent a right parasagittal frontal craniotomy and supramarginal intersulcal resection of the superior frontal gyrus on the right side. Pathohystological finding showed anaplastic oligodendroglioma WHO gr III.

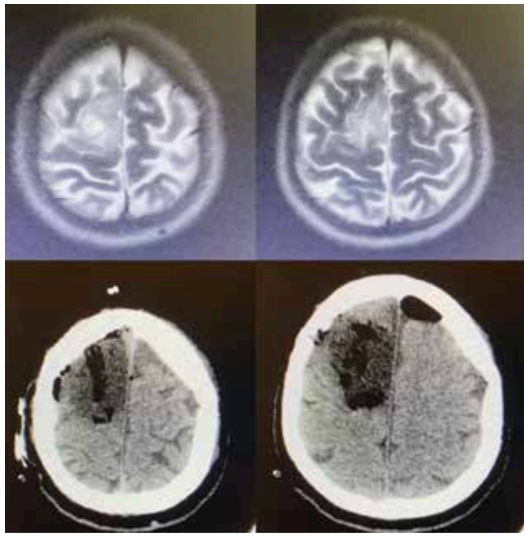


Figure 1. Preoperative MRI and postoperative CT scan

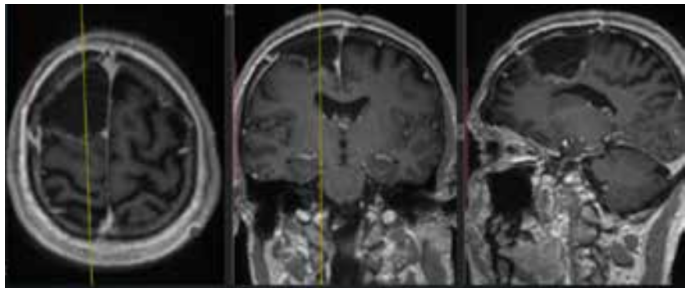


Figure 2. Postoperative MRI postcontrast series showing supramarginal resection of the tumor with PH finding of anaplastic oligodendroglioma WHO gr III

Case 2. A 48-year-old man previously treated in another institution five years ago from diffuse astrocytoma WHO grade II in the left frontal lobe. After surgical treatment he underwent concomitant STRUP protocol treatment followed with 12 cycles of temozolomide. He was admitted in our institution complaining of intermittent headache and epileptic seizures. MRI scan revealed a left frontal lobe infiltrative solid/cystic tumor with subfalcine brain herniation and heterogeneous contrast enhancement. The patient underwent surgical treatment with supramarginal left frontal lobectomy. The postoperative course was uneventful, without neurologic deficits. Postcontrast CT scan showed maximal resection of the tumor. Pathohystological finding showed Glioblastoma WHO gr IV.

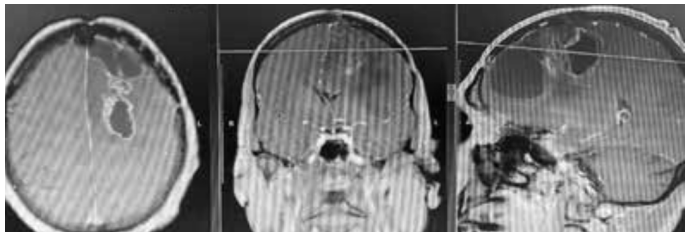
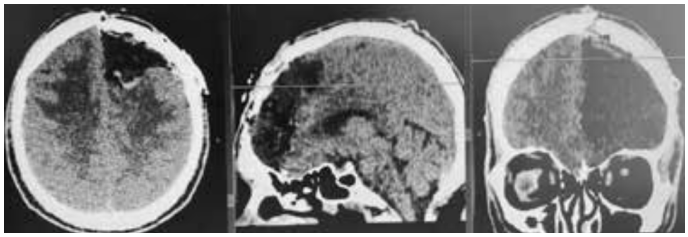
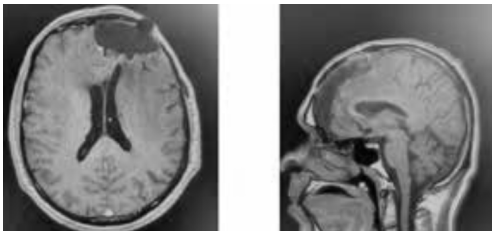


Figure 4. Preoperative MRI postcontrast series showing infiltrative solid/cystic HGG



Picture 5. Postoperative CT scan



Picture 6. Postoperative MRI postcontrast series showing maximal surgical removal without any complicating features

Case 3. A 59 years old female was admitted as an urgency case with compliant of headache and left sided hemiparesis. MRI postcontrast series showing infiltrative solid/cystic tumor with heterogeneous contrast enhancement on the right frontal parasagittal region with signs for subfalcine herniation. The patient underwent supramarginal resection of the tumor using fluorescence guided surgery. Pathohystological finding showed Glioblastoma WHO gr IV.

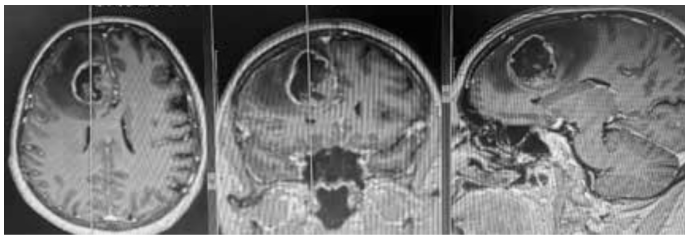


Figure 7. Preoperative MRI postcontrast series of an infiltrative solid/cystic right frontal parasagittal HGG

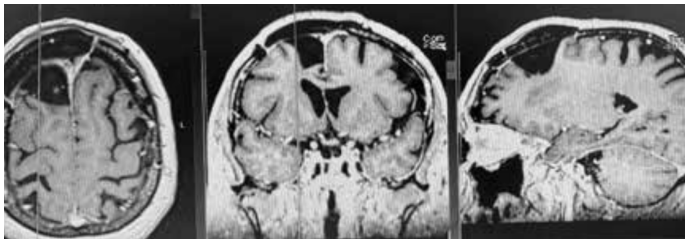


Figure 8. Postoperative MRI postcontrast series showing maximal surgical removal without any complicating features

Conclusion: The extent of safe tumor removal without causing any new neurological deficits, the Karnofsky performance score at admission, presence of neurological deficit at admission and determination of glioma molecular profile is of essential clinical importance in overall survival, understanding the evolution of these tumors and modeling the optimal approach for further treatment of these patients. The use of fluorescence guided surgery is of great value for obtaining maximal safe surgical resection.

Keywords: Fluorescine, Surgical resection, High-grade glioma

052 Evaluation of cerebral venous sinus thrombosis by CT examination at the emergency center University clinical center of Serbia

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Introduction: Cerebral venous thrombosis (CVT) is rare and urgent neurological disorder that requires rapid anticoagulant treatment. The right diagnosis can be extremely challenging to confirm due to the variety of clinical symptoms and in that CT, imaging has significant role. The causes of venous thrombosis could be: dehydration (most common cause in neonatal period), coagulopathy, local infection (such as mastoiditis), oral contraceptives, pregnancy, high blood density, and in the COVID era, infections and coagulopathy caused by this virus.

Aim: The aim of this study was to summarize all signs of occlusion of intracranial venous structures and to estimate any damage to the brain parenchyma in the field of thrombosis, looking for a sign of venous cerebral ischemia. In addition, the aim of this study is to discover the origin or pathology connected to cerebral venous thrombosis.

Material and methods: The retrospective study included all patients who were consecutively referred for CT examination of the endocranium by neurologists and neurosurgeons in whom intracranial venous thrombosis has previously been suspected, in the period from January 2016 to June 2021. A total of 356 patients were referred to CT diagnostic unit during this period under suspicion of intracranial venous thrombosis by neurologists and neurosurgeons. The diagnosis was confirmed on non-contrast neuroimaging, contrast examination or CT venography in 215 patients using direct and indirect signs of venous thrombosis.

Conclusion: Adequate therapy with rapid onset has a great impact on the clinical outcome, so the early diagnosis is necessary. Fast, affordable and widely available CT and CT venography remain imaging techniques that could be selected in the evaluation of patients with suspected CVT.

Keywords: cerebral venous sinus, thrombosis, CT

053 Health care of patients before and after disc herniation surgery

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Introduction: A herniated disk refers to a problem with one of the rubbery cushions (disks) that sit between the bones (vertebrae) that stack to make your spine. A spinal disk has a soft, jellylike center (nucleus) encased in a tougher, rubbery exterior (annulus). Sometimes called a slipped disk or a ruptured disk, a herniated disk occurs when some of the nucleus pushes out through a tear in the annulus. A herniated disk, which can occur in any part of the spine, most often occurs in the lower back. Depending on where the herniated disk is, it can result in pain, numbness, or weakness in an arm or leg.

Aim: Show the role of nurses in the preoperative and postoperative care of patients after DISC herniation surgery.

Discussion: Nurses will refer to keep the patient in a supine position on the bed, and change to a normal position 6-8 hours later; There must be 24 hours of bed rest insured. During bed rest, nurses help the patient. Turn once every 1-2 hours, making sure the patient is inside axial position and the spine is kept in a horizontal line when flip over. Nurses will also tell the patient not to twist the body violently from itself for fear that its backbone twisted, slipped or displaced or has other conditions. At the same time, the patient will be instructed to relieve/alone in bed during 24 hours of bed rest and to wear waist support during coughing and defecation, to prevent exacerbation or recurrence of the hernia. ECG monitoring is performed for the patient after surgery to closely observe changes in blood pressure, heart rate, heart rate rhythm and other vital signs, so complications can occur discovered in time. At the same time, attention will also be paid to changes in the patient's mind and pupils, deterioration pains and sensations in the patient's lower limbs, and any abnormality, if any, should be reported to the physician immediately treating physician. Nurses will also pay attention to bleeding or exudation from the patient's wound within 24 hours after surgery, making sure the wound dressing is dry and clean and that a bandage found to be contaminated be replaced in a timely manner to avoid wound infection. The patient's skin should be cleanand the leaves are clean, dry and flat.

Conclusion: Despite the disadvantages such as large demand for nurses and more pressure on nurses, post-operative comprehensive care can not only effectively reduce pain and improve the postoperative therapeutic effect, but also promote the recovery of their limb function and improve their ability to perform the activity everyday life, which improves the quality of life of patients and the happiness of patients and their families.

Key words: Herniated disk, Health care, Nurses.

054 Health care of the patient after subdural hematoma evacuation

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Introduction: Subdural hematomas (SDH) are usually classified as acute or chronic SDH. Those definitions are arbitrarily made according to the time of creation and characteristics of the image, without clear criteria or consensus literature. Acute SDH in the setting of severe traumatic brain injury (TBI) is usually associated with an underlying brain parenchymal injury, whereas non- traumatic SDH or SDH after minor to moderate trauma is often isolated. Acute to chronic SDH occurs if a patient with chronic SDH develops acute bleeding over the chronic SDH. The approach to treating this underreported entity is highly dependent on the relative magnitude and effect of the acute component, and is similar to either acute or chronic SDH in most cases.

Aim: Show the importance of postoperative care of patients after subdural hematoma evacuation.

Discussion: Postoperative care after SDH evacuation is similar to that of other cranial procedures. The patient is ideally extubated and transferred to an intensive care unit. Immediate clinical follow-up usually consists of hourly neurologic examination checks and a postoperative CT scan of the head. Perioperative antibiotic prophylaxis is continued for a period of 24 hours after surgery. The use of subdural or subgaleal drains after acute SDH is often surgeon-dependent and is yet to be evaluated in the literature.

Similarly, there is no set time for drain removal, and there are large variations between institutions. Typically, removal will be approached hours to days later, when the draining fluid has assumed a serosanguinous quality and the output decreases. The patient is then mobilized, starting with the bed elevation and then ambulation if possible. During the period of mobilization, it is important to monitor for the development of headaches or other symptoms or signs of pneumocephalus. Furthermore, monitoring for the reaccumulation of the SDH is important. The exact incidence of re-hemorrhage for acute SDH is unknown and varies with the patient population.

Conclusion: When caring for patients, the nurse must understand the risk of neurological deterioration. This can result spontaneously or from factors such as uncontrollable hypertension, cough, vomiting, or falls. Health care for these patients must be comprehensive because they are at risk of many complications, including changes in sleep-wake cycles, malnutrition, pain, confusion, delirium, falls, pressure injuries, dysphagia, damage or loss of airway protection reflexes, infection, stroke, and venous thromboembolism.

Nurses must be prepared to perform admission and serial standardized neurological assessments, including mental state,

cranial nerve function, motor system, sensory system, deep tendon, and abdominal and plantar reflexes.

Keywords: Subdural hematomas, Postoperative care, Health care

055 The importance of the nurse in the recovery of a patient with subarachnoid hemorrhage

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Introduction: A subarachnoid hemorrhage means that there is bleeding in the space that surrounds the brain. Most often, it occurs when a weak area in a blood vessel (aneurysm) on the surface of the brain bursts and leaks. The blood then builds up around the brain and inside the skull, increasing pressure on the brain. Subarachnoid hemorrhage is an often-devastating intracranial hemorrhage resulting from acute bleeding into the subarachnoid space. Although its overall incidence is less than that of acute ischemic stroke, subarachnoid hemorrhage carries increased risks of both mortality and disability. Although many patients with subarachnoid hemorrhage are transferred to specialty centers, they might initially present to small community-based hospitals. Treatment for these patients is complex, requiring specialized care and knowledge, and various complications can occur quickly and without warning. Therefore, all health care team members who care for these patients must understand proper management. Nurses in the intensive care unit play an important role in influencing outcomes, as they are best positioned to recognize neurological decline and provide rapid intervention.

Aim: Show the importance of the nurse in the treatment of patients with subarachnoid hemorrhage

Discussion: The role of the nurse in patients with SAH is significant. By planning health care, it is necessary to ensure adequate care. A complete neurologic assessment is performed initially and includes evaluation for the following: altered level of consciousness, sluggish pupillary reaction, motor, and sensory dysfunction, cranial nerve deficits (extraocular eye movements, facial droop, presence of ptosis), speech difficulties, and visual disturbance, headache and nuchal rigidity or other neurologic deficits. Based on the assessment data, the patient's major nursing diagnoses may include ineffective tissue perfusion related to bleeding or vasospasm, disturbed sensory perception related to medically imposed restrictions, anxiety related to illness, and/or medically imposed restrictions (aneurysm precautions). The goals for the patient may include improving cerebral tissue perfusion, relief of sensory and perceptual deprivation, relief of anxiety, and absence of complications.

Conclusion: Management of SAH is a complex process. Yes, these patients require highly specialized care and management before the intervention; all caregivers must understand the diagnosis and management. Small changes in the neurological examination may indicate significant physiological changes. The hospital nurse is uniquely positioned to constantly evaluate and monitor patients with SAH for these subtle changes. Frequent neurological examinations and change recognition can mean life or death for these patients. Although some complications cannot be prevented, a series of important interventions can lead to better patient outcomes. Studies are limited in patients with SAH, and there are many areas of opportunity for future investigations. Meanwhile, knowledge and understanding of current guidelines for the management of SAH are vital to improving patient outcomes. Nurses who care for these patients must be informed and aware of appropriate stabilization and care from initial presentation to discharge.

Keywords: Subarachnoid hemorrhage, Nurses, Recovery

056 Health care of patients after surgery due to intracranial bleeding

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Introduction: Intracerebral hemorrhage (ICH), defined as bleeding within the brain parenchyma, remains a challenging and controversial neurosurgical entity to treat. ICH has a broad range of etiology-stemming from complications associated with a traumatic head injury tocomplications of hemorrhagic stroke.

Aim: The aim is to describe the specifics of health care for patients operated on due to intracranial bleeding.

Discussion: Medical management aims to optimize blood pressure, intracerebral pressure (ICP), coagulopathy, seizure control, fever control, and deep vein thrombosis prophylaxis. The role of medical management lies in optimizing blood pressure and intracerebral pressure, preventing secondary injury from complications of the hematoma, such as seizures, and correcting coagulopathy. Given the mass effect of a hematoma and the possibility of expansion, surgical interventions attempt to evacuate the clot to restore normal intracerebral pressure and prevent worsening neurologic injury. The goal of care for neurosurgical patients is to provide quality health care focused on helping the patient return to everyday life as productive and independent as much as possible.

Conclusion: Intracerebral hemorrhage remains a serious complication associated with head trauma and the sequelae of hemorrhagic stroke. Appropriate diagnosis and management of intracerebral pressures and ventilation before surgery remains an important opportunity to improve patient outcomes.

Keywords: Intracerebral hemorrhage, Health care, Nurse

057 Artificial intelligence and virtual reality

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Introduction: Artificial intelligence-powered medical technologies are rapidly evolving into applicable solutions for clinical practice. Deep learning algorithms can deal with increasing amounts of data provided by wearables, smartphones, and other mobile monitoring sensors in different areas of medicine. Currently, only very specific settings in clinical practice benefit from the application of artificial intelligence, such as the detection of atrial fibrillation, epilepsy seizures, and hypoglycemia or the diagnosis of disease based on histopathological examination or medical imaging. The implementation of augmented medicine is long-awaited by patients because it allows for greater autonomy and a more personalized treatment; however, it

is met with resistance from physicians who were not prepared for such an evolution of clinical practice. This phenomenon also creates the need to validate these modern tools with traditional clinical trials, debate the educational upgrade of the medical curriculum in light of digital medicine, and ethical consideration of ongoing connected monitoring.

Aim: This paper aims to discuss recent scientific literature and provide a perspective on the benefits, future opportunities, and risks of established artificial intelligence applications in clinical practice on physicians, healthcare institutions, medical education, and bioethics.

Discussion: As reported in several studies, electronic health records can be an important administrative burden and a source of burnout, a phenomenon that is increasingly present among physicians. Although solutions are increasingly capable of helping the physician deliver complete medical records, further solutions are needed to address the increasing time devoted to indirect patient care. One of the major obstacles to adopting intelligent medical technologies by health workers is the fear of dehumanizing medicine. This is mainly due to the increasing administrative burden imposed on healthcare professionals.

Conclusion: The implementation of artificial intelligence in clinical practice is a promising development that rapidly evolves with the other modern fields of precision medicine, genomics, and teleconsultation. While scientific progress should remain rigorous and transparent in developing new solutions to improve modern healthcare, health policies should now be focused on tackling the ethical and financial issues associated with this cornerstone of the evolution of medicine.

Keywords: Artificial intelligence, Medical technologies, Clinical practice

058 Quality of life after brain tumor surgery

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Introduction: Diagnosis and treatment of brain tumors significantly impact patients' quality of life. The quality of life of cancer patients is defined as their subjective sense of well-being as a whole and multidimensional concept that includes physical, occupational, psychosocial, and spiritual components. While both definitions may also be appropriate for brain tumor patients, comprehensive information on many aspects of the quality of life in these patients is scarce. Some studies have emphasized physical and professional over psychosocial aspects or focused on cognitive performance.

Aim: Analysis of the available literature on patients' quality of life after brain tumor surgery.

Discussion: Analysis of available research indicates that the lowest quality of life was recorded on the 5th day after surgery. Many symptoms, such as fatigue, nausea and vomiting, pain, dyspnea, insomnia, and deficiency of appetite, increased (especially on the 5th day after surgery). Moreover, the histopathological diagnosis of the tumor affected the quality of life. In the first postoperative period, reduced quality of life was observed in the group of low-grade glial neoplasms and benign tumors, such as meningiomas and neuromas. In contrast, 30 days after surgical treatment, the lowest quality of life was recorded in patients with metastatic tumors.

Conclusion: In the approach to the oncology patient, quality of life has become a parameter as important as other parameters characterizing the success of the treatment. Malignant brain tumors are generally divided into primary brain tumors (arising from brain tissues) and secondary tumors (metastases). So, maintaining good quality life is a priority in patients with malignant brain tumors. Surgical treatment of brain tumors is more favorable than other methods, because it enables histopathological diagnosis; as a result of a surgical procedure, there is a rapid reduction of the tumor mass, which will reduce or eradicate the patient neurological symptoms and cognitive deficits. On the other hand, surgical treatment and perioperative injuries can lead to neurological and cognitive deficits. These deficits can be short and lead to a temporary reduction in quality of life.

Keywords: quality of life; brain tumor; surgery.

059 The importance of the scrub nurse during stereotaxic biopsy of brain tumors-neuronavigation

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Stereotaxis is a procedure for precisely determining the position of anatomical structures and pathological processes inside the patient's head. The modern method is based on the global positioning system (GPS) and is called neuronavigation. For navigation, determining the target of interest, previously performed CT and MR images of the patient's head are used. Brain tumor biopsy requires great precision in order to obtain quality samples for analysis and, on the other hand, to cause minimal damage to the brain.

Scrub nurses are unavoidable members of the surgical team that performs the biopsy.

The job of a scrub nurse begins before the operation by checking the sterility of the instruments and preparing them instruments for intervention.

This operation requires a box with instruments for stereotaxy, an electric drill and a box with instruments for craniotomy.

The surgeon first registers the patient, that is, connects the images with the actual anatomical structures of the patient's head. No sterile instruments are required for this procedure. This is followed by determining the place of skull trepanation and the biopsy needle's trajectory.

Preparation of the operative field involves shaving and washing with aseptic solutions.
The next step is the aseptic preparation of the surgeon and the instrument technician, followed by the isolation of the operative field and mounting of the sterile parts of the neuronavigation system.

After the surgeon performs the craniotomy, he mounts and fixes the biopsy needle guide according to the images. Depending on the pathological process, the surgeon takes one or more samples that the scrub nurse accepts and sorts for ex tempore analysis and for permanent preparation.

The success and safety of frameless stereotaxic biopsy using a neuronavigation device is highly dependent on the training of the scrub nurse and her synchronization with the surgeon.

Keywords: scrub nurse, stereotaxic biopsy, neuronavigation

060 The importance of the instrument case during cervical disc herniation surgery

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A cervical spine instrument case is a dedicated surgical set of instruments intended for use most commonly in patients with degenerative disc disease for temporary stabilization of the cervical spine segment. Anterior cervical discectomy and fusion (ACDF) procedure either with an interbody fusion device made of artificial materials (e.g., polyether ether ketone [PEEK] or carbon fiber) or autologous tricortical bone graft is the most widely used and conventional approach for cervical degenerative disease. In carefully selected patients, another option includes the use of an artificial cervical intervertebral disc intended to maintain the range of motion, restore physiological alignment, and delay degenerative changes in the adjacent level.

In spite of the minute observed differences between the manufacturers, the dedicated spinal set generally contains instruments for the approach and soft tissue retraction, for vertebral body distraction, instruments for discectomy and preparation of graft site, and instruments for graft harvesting and impaction of bone graft or artificial cervical disc or interbody fusion device implantation. Due to the strict stepwise nature of the procedure, it is essential that instrument cases are carefully and meticulously arranged in a logical order for the surgical team to be efficient.

The purpose of this report is to make a brief overview of common instruments present in the spinal set for cervical disc herniation surgery.At the initial step, basic instruments for the approach include a scalpel for single use, curved scissors, surgical forceps, skin retractor (e.g., Anderson-Adson self-retaining retractor), and bipolar forceps. Next, soft tissue retraction instruments include hand-held retractors (e.g., Langenbeck hand retractor), basic cervical retractors (usually double hinge, with tiltable butterfly screw) together with various retractors blade lengths. The vertebral body distraction set contains a screwdriver and corresponding distraction screws along with a distractor with a toothed bar. Discectomy is performed with mounted scalpel blade No.11 and Caspar straight rongeur. Subsequent preparation of graft site done with a set of straight and curved curettes of various dimensions. The set also contains exploration hooks and blunt dissectors of different sizes. For further graft site preparation, separate set of high-speed tools is used, containing Rosen, diamond, barrel etc. burrs in different available sizes. Kerrison rongeur, commonly with width from 1 to 3 mm is used for final removal of posterior osteophytes. In conclusion, established step-by-step nature of the ACDF procedure dictates arrangement of surgical instruments for them to follow each phase of the procedure.

Keywords: physician-nurse relation, nurse's role, anterior cervical discectomy and fusion, cervical disc herniation, instrument set

061 Nursing care of patients after transsphenoidal pituitary tumor surgery

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Pituitary adenomas grow from the tissue of the anterior lobe of the pituitary gland, and according to the hormonal secretory activity, pituitary tumors can be active or inactive. According to their size, these tumors are divided into microadenomas, up to 10 mm in size, and macroadenomas, which are over 10 mm in the largest diameter. Treatment of pituitary tumors can be medical, surgical and radiotherapeuthical. Operative treatment is performed by transsphenoidal and transcranial approach. Transsphenoidal access is performed using an endoscope through the nasal cavity. The most serious complications that can occur after surgery are electrolyte imbalance and polyuria.

The tasks of the nurse in the postoperative course are complex and include: monitoring the general condition of the patient, control of vital parameters, namely body temperature, arterial blood pressure and pulse every 2 hours. All measured parameters must be documented on the patient's temperature chart.

When talking to the patient, paying attention to whether the patient complains of a "runny nose" or "feels like salty liquid is running down his throat." It is necessary to warn the patient not to snort, blow his nose or draw liquid into his nose if he feels a runny nose. Immediately bring gauze to the patient and observe the discharge on the gauze. If the nurse notices that there is a yellow trace of liquid on the gas, or a bloody 'target mark' with a halo, she must immediately inform the attending physician. One of the complications after pituitary tumor surgery is nasoliquorrhea, so it is necessary to react quickly and prevent a possible infection.

Monitoring the daily intake and amount of fluids is extremely important because of the possibility of diabetes insipidus after surgery. If the patient is in bed and does not get up and has a urinary catheter, diuresis is monitored when emptying the urinary bag. Record each emptying of the urinary bag in the list of entries and amounts. In more severe cases, it is necessary to monitor hourly diuresis, and then the most suitable urinary bags are specially designed. If the patient does not have a urinary catheter, it is necessary to record the amount each time the patient's night container is emptied. If the patient is mobile and can go to the toilet by himself, explain to him and show him the container in which he will urinate, which is set aside just for him, and emphasize to him that after each urination, he should leave the container in a certain place and immediately inform the technician's nurse in order to the amount was recorded in a timely manner. When checking the fluid balance, it is mandatory to enter the amount of fluid that the patient has taken intravenously.

Every two days, it is necessary to control the patient's complete blood count, electrolytes and urine examination. After the operation, the patient is followed by a check-up by an endocrinologist and an otorhinolaryngologist.

Keywords: nurse, transsphenoidal pituitary tumor, surgery

062 The importance of the interprofessional team in the care of a patient with diffuse traumatic brain injury- case report

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The role of nurses has changed significantly since the initial concept of nursing and comfortingthe patient, which is why nursing today is not only a profession, but also a scientific discipline in itself. The biggest influence on changing the concept of nursing was interprofessional education, according to the model of which solving problems related to the patient is not the responsibility of an individual, but of a group made up of experts from different professions, which achieves that team members learn with,from and about each other in order to improving cooperation, providing better quality health care, as well as providing promotional, preventive, curative, rehabilitation and other health services.

The importance of the interprofessional team is particularly reflected in the care of patients with traumatic brain injury, which is the leading cause of mortality in polytraumatized patients, and occurs most often in the working-age population, most often as a result of traffic trauma.

We will present the case of a thirty-six-year-old man who suffered a diffuse axonal brain lesion as a passenger car driver. After stabilization of the general and neurological condition in the Intensive Care Unit, the patient was transferred to the Semi-Intensive Care Unit of the Clinic for Neurosurgery, somnolent, psychomotor agitated, with an endotracheal cannula, without gross pyramidal deficit. During his hospitalization in an interprofessional team, he was cared for by a neurosurgeon, clinic nurses,physiatrist, physiotherapist, pulmonologist and infectious disease specialist, and he was discharged for further rehabilitation conscious, oriented, communicative, without pyramidal deficit.

The complexity of diagnosis, care and treatment of patients with traumatic brain damage implies the participation of a large number of members of the interprofessional team, whose equal member is a nurse, with the common goal of functional recovery of the injured to the greatest extent possible.

Keywords: trauma, diffuse brain injury, multidisciplinary

063 The role of the instrument technician in the standardized surgical steps of deep brain stimulation (DBS) with neurophysiological testing

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Deep brain stimulation (DBS) is a neurosurgical procedure that involves the placement of a neurostimulator, which sends electrical impulses, via an implanted electrode, to a specific target in the brain (cerebral nucleus) in order to treat movement disorders, including Parkinson's disease, essential tremor, dystonia and other disorders such as which are epilepsy, obsessive-compulsive syndrome.

Material and methods. Material required for performing DBS - a basic set of instruments is used with the addition of neuronavigation and x-rays, as well as material used only for this procedure (electrodes, battery, ...).

The operation is performed in an awake state, the patient lies on his back with the head placed in a Mayfield clamp. The procedure consists of two phases: the first phase of the operation is the placement of the electrodes on both sides, and the second phase of the operation is the placement of the battery and connection to the electrodes.

Results. So far, 6 such operations have been performed, 4 men and 1 woman with parkinsonism and 1 girl suffering from dystonia.

Discussion. Complications with this type of operation can be infections, separation of the electrode from the battery, thromboembolism (due to the length of the operation).

Conclusion. Familiarity with the instrument and all the steps in performing this procedure is of crucial importance. The implementation of this procedure is also of great importance for patients suffering from Parkinson's disease, dystonia, because it provides them with better functioning in everyday life.

Keywords: surgery, DBS, brain nuclei, neurostimulator, Parkinson's disease

064 Health care standards in patients with peripheral nerves injury

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The human nervous system is consisted of central and peripheral nervous system, whilst the peripheral nervous system is divided into somatic and autonomous nervous systems.

Peripheral nerves represent a connection or bond between the central nervous system (brain and spinal cord) and peripheral organs. So, when treating peripheral nerves disorders, they cannot be considered as a separate organ, but as a unity or wholesome unit with the central nervous system.

The first acknowledgment of the peripheral nerves and their function dated back to Hippocrates (460 BC) as well as the first suture of nerves which was done with a thread of woman's hair. The era of modern peripheral nervous system surgery began around 1960's with the introduction of operative microscope (1964).

The aim of this study is to display health care standards in patients with peripheral nerves injuries and the significance and role of nurses and nursing in a postoperative care.

Peripheral nerves injuries are not that frequent, but represent a significant cause of invalidity, cause major social economic problems and can leave a large psychosocial consequence on the patient.

Role of a nurse is not only to provide adequate pre and postoperative care, but also to provide a faster and facile recovery with their knowledge and skills.

An on time diagnosis of peripheral nerves injuries, then a adequate surgical treatment, a duly convey of health care procedures through all phases of treatment, secures an excellent prognosis for recovery and quality of life in patients.

Keywords: peripheral nerves, injury, health care

065 Modern aspects in the care and treatment of children suffering from tumors of the central and peripheral nervous system

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Dealing with a health care of the youngest population implies continual improve- ments of the quality of health services. The pediatric neurosurgical patient, a few hours old or at the end of adolescence, is not just a model reduit (fr. small original model)

of an adult, primarily due to the specificity of the developing brain as well due to diverse psychological requirements of small patients. Pediatric neurosur- gery persists in respecting the specifics of the developmental age. Our determi- nation is that children should be admitted to adequate pediatric units where they can be provided with the supreme quality of treatment as well as the environment most suitable for preserving their psychological health, with the continuous pres- ence of their parents.

A good organization suggests: highly specialized ward staff, attaining a suitable technological standard, interdisciplinary approach, rational use of existing and planning of future capacities.

The pediatric department of Neurosurgery of Neurosurgery Clinic was established by the official regulation of the University Clinical Center of Serbia in January 2011 and encompass 16 beds, 4x2 for older children and 8 for newborns and infants. In the presence of high-tech diagnostic and therapeutic equipment (MR, CT, X-ray, angio room/digital angiography, operating microscope, neuroendoscopy, stereotaxy, neuronavigation, neuromonitoring, minimally invasive devices, CUSA, intraoperative X-ray, modern intensive care units, gamma knife unit), we are able to provide modern approach in the treatment and health care of all pediatric patients treated at Neurosurgery UKCS.

Keywords: central nervous system, peripheral nervous system, tumor, children, care

066 Work area of nurse in the stereotaxic radiosurgery department- x knife

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The linear accelerator first came into clinical use in the early 1950s in London. The first patient was radiated in August 1953. The X knife (The Varian EDGE Radiosurgery System), as a radiosurgical device, is a revolution in the way advanced radiosurgery is delivered, and health care users are offered rapid and affective radiosurgical treatment of tumors without incision and further clinic retention.

Many studies point to the advantage of using high doses in a small number of treatments, on which stereotaxic treatment is based, the radiosurgical method being hypofractionate radiation in one of five fractions. Intracranial changes can be radiated on the X knife, as well as changes troughout the body with maximum protection of healty tissue, it is a very convenient method of treatment in inaccessible and inoperable tumors.

The role of the nurse in radiosurgery is complex and requires a comprehensive, holistic approach to the patient and his or her family. It performs an independent function through the nursing process but is realized through interdependent functions with other members of the multidisciplinary team. The nurse is usually the first contact for the patient, but also a person who is very present through the treatment process from the first examination, participating in the diagnosis, pre-treatment, the treatment itself until every control after the completion of treatment in the radiosurgery department.

At the University Clinical Center of Serbia X the knife began its operation on October 31, 2018. Until now, a large number of patients (at present over 400) have been treated mainly with endocranial and bone system changes, with a tendency to expand the list of indications. The advantage of having such apparatus in Serbia is the shortening of patients stay in health care facilities, the possibility of treating multiple regions in the same day, but also providing complete comfort to our users.

Keywords: X knife, radiosurgery, nurse

067 The scope of the nurse's work in the neuro-oncology department

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Hospitalization, preparation, and a specific form of neurosurgical treatment of patients suffering from central nervous system tumors are carried out at the Department of Neuro-oncology of NHK KCS.

As part of the work of the Neuro-Oncology Center, chemo and specific stereotaxic radiosurgery (X knife and Gamma knife), the only such Center in the region, is carried out. The nurse is always by the patient's side when the patient is admitted to the ward.

The nurse organizes: placing the patient in bed; introduces him to the house rules of the department; performs preoperative preparation of the patient (blood sampling, accompanying the patient to all diagnostic procedures); performs personal hygiene of the patient; carries out health education work with the patient and his family • accompanies the patient to the operating room; provides postoperative care to the patient; applies prescribed drug therapy

Along with all the mentioned procedures for neurosurgical patients, the smile, kindness, and empathy of the nurse and the entire team are equally important, which is particularly important in the early rehabilitation of the patient.

There is a pleasant, homely atmosphere at the Department of Neuro-oncology, which our patients and their families always emphasize as a great relief in treatment and early rehabilitation.

Keywords: Neuro-oncology, nurse, patient care, empathy, smile

068 Health care of patients with lumbar disc herniation

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Lumbar disc herniation. A disc herniation is the displacement of a disc from the intervertebral space in the lumbar spine, resulting in pinching of the nerve root.

Discs are gelatinous plates placed between the vertebral bodies that act as shock absorbers - absorb microtraumas, protecting the intervertebral joints and other structures of the spinal column

Disc herniation mainly occurs in the population of working-age people, most often between the ages of 25 and 45, and has great public health significance, since it negatively affects the work ability and quality of life of the sufferers. As a result, this all causes long and frequent sick leave, limitations in the ability to perform professional tasks at the workplace, and often permanent disability.

The diagnosis is confirmed by radiography that reveals the herniation site, while CT and NMR can show the severity of the changes and help in the prognosis of the disease and the decision to apply conservative or operative treatment.

Care of patients with lumbar disc herniation. The goal of applying health care interventions in the acute phase of disc herniation is the elimination of subjective complaints, primarily pain that prevents the patient from self-care activities, as well as the education of the patient for the application of protective positions when performing them.

Treatment in the acute phase involves bed rest, the use of prescribed drug therapy and the use of some forms of physical therapy, which is carried out by a nurse during that period. The length of bed rest depends on the severity of the patient's clinical condition and lasts 3-4 days on average.

The hospital bed must be sufficiently firm and comfortable. In this phase, positions should be applied that provide the patient with relaxation of the spastic paravertebral musculature and extension of the spinal column, i.e. its relief by increasing the intervertebral spaces. In this way, it is possible to calm the inflammation and create conditions for the possible return of the protruding disc to its natural position.

Since pain dominates in the acute phase, and all healthcare interventions and patient care take place inside the patient's room, the nurse should use that time to actively educate the patient to apply protective positions and movements in bed, when getting out of bed and returning to it , as well as when performing self-care activities.

If conservative therapy does not show an effective effect or if there is an indication, disc herniation can be treated surgically.

The health care plan after herniated disc surgery includes the following interventions:

• Monitoring of the patient's general condition
• Placing the patient in a forced position in bed and absolute rest until the

attending physician orders otherwise • Postoperative pain and wound control • Control of micturition and defecation

All the time, the operated person should be educated on the application of protective positions. As soon as there are favorable conditions for this, the patient is immediately demonstrated a safe way to get out of bed 12-24 hours after the operation. The patient should not be forced, but he should be given physical help and psychological support, since most patients are afraid before getting out of bed for the first time after surgery.

Rest is advised for 4-6 weeks. You should not rush to return to your daily activities, because research shows that a large number of postoperative complications arise precisely for this reason. Patient care requires a holistic approach by the nurse in planning care interventions and adapting the individual care plan to the current needs of each individual patient. The implementation of care activities in the pre- and post-operative period is aimed at the highest possible degree or complete recovery of the patient, pain relief, prevention of recurrence, as well as the achievement of complete medical, work and social rehabilitation.

Keywords: lumbar spine, herniation, health care, nurse

069 Activities of the nurse in the care of patients with operated aneurysm

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Introduction: Cerebral aneurysms are abnormal expansions of cerebral arteries at the point of their branching. Aneurysms are created as a result of incomplete obliteration of the embryonic beginning of vessels. The most serious and important consequence of aneurysm rupture is SAH (Subarachnoid Hemorrhage).

Diagnosis: It is established on the basis of native imaging, CT (Computerized Therapy), NMR (Nuclear Magnetic Resonance) and Digital Angiography.

Preoperative care for aneurysm surgery:

Continuous 24-hour monitoring, monitoring of vital parameters, no constipation (preferably regular stools), special diet (non-salty diet), laboratory analyzes and anesthesiology conclusion.

Treatment: Exclusively operative.

Nursing interventions: Continuous monitoring of the operative wound and drain, maintenance of vital parameters, implementation of therapy, monitoring of neurological parameters, prevention, early detection and treatment of complications.

Purpose: Providing adequate care to the patient in the post-operative period.

Keywords: brain aneurysm, care, nurse

070 Nursing the patient with craniocerebral injuries

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Introduction: Craniocerebral injuries are very common. The most common types of injuries occur after traffic accidents, falls from a height, injuries in a fight, gunshot wounds, stab wounds.

They can be divided into:
• Scalp injuries,
• Skull injuries, i.e. fracture cranii, referring to the fracture of the base of the skull, andthefracture of the cranial vault.
• Brain injuries, such as Commotio cerebri, Contusio cerebri, hematoma

(epidural,subdural, and intracerebral)

Diagnosis: It is based on anamnesis, as well as the results of an emergency CT scan of the endocranium, an X-ray, and an MRI. Patient Care is extensive and the role of a nurse is multifaceted, with the possibility of it lasting for several months in hospital conditions. In such cases, the patient's health status is severe, and it is of vital importance to continuously monitor their state of consciousness, which is crucial in assessing the severity of the craniocerebral injury andis based on the Glasgow Coma Scale. A timely medical assistance can prevent a potential disability and save a life. The main goals and the tasks of a nurse are to help maintain patient's personal hygiene regularly, carry out the alimentary (diet) plan and the prescribed therapy. **Dysphagia**, swallowing and feeding disorders are common in these patients. The nurse is to assist the patient with feeding (chewing and swallowing easily and without difficulties).

Respiratory complications are another common occurrence in patients on a prolonged bed rest, due to decreased lung ventilation, or stagnant secretions and infection. The goal is to prevent the occurrence of respiratory infections by thorough planning, implementing and encouraging a high Fowler's position, regular breathing exercises, expectoration, aspiration in tracheostomized patients, cannula maintenance, as well as proper personal hygiene.

Nursing interventions: The duty of a nurse is to plan, implement, and encourage passive and active motion exercises for the lower extremities, deep breathing exercises, proper posture and position switches during bed rest, wearing elastic bandages or adequate socks for patients with varicose veins, and getting the patient out of bed as early as possible.

Pressure ulcer is a localized skin and subcutaneous tissue disorder that occurs in places thatare vastly exposed to pressure or friction, called predilection sites. **Constipation** is a condition in which a patient has irregular and infrequent bowel movements, due to immobility, insufficient fluid intake, and general weakness caused by craniocerebral injury.

Surgical interventions are quite common in treating a patient with a craniocerebral injury,requiring a urinary catheter placement and a 24-hour urine volume monitoring. Since there is a high risk of urinary tract infection, the nurse should help maintain the proper hygiene of the perianal area.

Conclusion: The main duty of a nurse is to prevent the occurrence of all the above- mentioned complications, and in case they do occur, to expedite the recovery and healingprocess ofa patient.

Keywords: craniocerebral injury, nurse, care

071 Preoperative preparation of patients with a brain tumor

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Tumors are cells with a high proliferative capacity. When it comes to brain tumors, they represent intracranial neoplasms. They could be primary or metastatic which metastate from other cancer centers in body, but by type they are divided into benign and malignant.

Important thing about a brain tumor is that no matter what type the tumor is, it can cause very dangerous problems by putting pressure on the brain.

Most common symptoms that could refer to brain tumor are: headache, vomiting, nausea- all caused by elevated intracranial pressure; epileptic seizures, disturbance of consciousness, etc.

In order to confirm the diagnosis, medical tests that should be done include CT (computed tomography), MRI (magnetic resonance imaging), EEG (electroencephalogram), cerebral angiography, lumbar puncture and analysis of lumbar fluids.

Nurse has the main role in making sure that all of the tests are done so that results could be given to doctors to decide how they are going to treat the tumor. Of course, what treatment will be used depends on type of the tumor, growth speed and localization.

Preoperative patient care includes psychological and physical preparation.

Nurse's job is to make sure that the patient is aware of his illness, explain how the treatment will be done, tell the patient what he

can expect after being treated. Nurse is obligated to answer to all of the patient's questions and to try to minimize his fear. The most important part of preoperative preparation is communication. Every person who works in medical field should be able to comfort the patient and to build an empathetic relationship. Nurse should talk calmly, slowly and should use understandable expressions during a conversation. Always ready to encourage positive thinking.

Physical preparation is different than psychological. It consists of few steps that should be done before surgery. Those include physical exam, blood tests, ECG (electrocardiogram), heart and lungs x-ray, blood type... All of these procedures need to be done thoroughly otherwise it can cause harm to the patient during the surgery.

Keywords: brain tumors, preoperative, nurse

072 Specificity of health care for patients with head and brain injuries

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Head injuries caused by an external force caused by a direct or indirect mechanism, open or closed, is the general name for craniocerebral injuries.

Clinical manifestations can be varied from disorders of the state of consciousness, disorders of sensorimotor functions and disorders of brainstem functions.

The aim of procedures carried out by nurses in the care of patients with craniocerebral injuries is to avoid and mitigate unwanted consequences, to influence the awakening and development of preserved potentials.

The health care plan includes an assessment degree of motor-sensory impairment (functional diagnosis), state of consciousness (possibility of establishing communication), presence of secondary deficit (skin damage or cotracture), active change of position in bed, control of bladder and colon function, method of food and liquid intake with monitoring of the act of swallowing, measurement of vital parameters, maintenance of personal hygiene.

The treatment and care of the patient are of great importance, because the patient degree of recovery will depend on the quality of the

Keywords: brain, injury, health care

073 Functional recovery of the patients with SCI level C5

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Damage to the spinal cord results in death of nerve cells, destruction, and demyelination of descending and ascending axons. The consequence of the mentioned processes is the loss of motor and sensory function below the level of the lesion with clinical manifestations of paraplegia and tetraplegia. Endogenous recovery attempts fail to repair the lesion and therefore the functional damage is usually permanent.

Treatment of spinal cord injury (SCI) incudes an acute and chronic phase. It is considered that the acute phase lasts 72 hours from the onset of the injury and the chronic phase lasts about 12 months. Since the SCI is most often the result of severe polytrauma, patients are treated in the intensive care unit in the acute phase for more precise monitoring of respiratory and hemodynamic complications. Depending on the type of lesion, surgical intervention is considered in terms of decompression or stabilization of the dislocated vertebrae and spinal column.

During the chronic phase, the main attention is focused on the prevention and treatment of complications such as: pain, autonomic dysreflexia, disordered emptying of the bladder and colon, reduction of fertility, respiratory insufficiency, pneumonia, pulmonary embolism, decubitus ulcers, sepsis, periarticular ossifications and psychological consequences.

Rehabilitation begins as early as possible after spinal cord injury to improve outcome and reduce complications. An interdisciplinary team approach is needed, which includes a physiatrist, nurses, physio and occupational therapists, a psychologist and a social worker etc.

Complete C5 lesions present with loss of sensation below chest level. In most patients, the mobility of the shoulder remains preserved and the mobility of the arm is limited. Limitations are due to absence of m. triceps, wrist extension and absence of mobility in fingers. We have functional elbow flexion at our disposal. That is why it is important to prevent flexion contracture in the supinated position due to excessive activity of the biceps. With the aid of special tools, these people are trained to feed themselves. They assist when putting on the upper parts of clothes and when changing the position in bed. These patients use an electric wheelchair, manual wheelchairs are used only for moving on a flat surface. Patients require the assistance of others for most self-care activities, for performing transfers and emptying the bladder and colon.

The goal of rehabilitation of patients with SCI C5 level is to achieve the maximum possible independence in activities of daily living as well as the best possible reintegration for the family and society.

Keywords: spinal cord injury, C5, functional recovery

074 The importance of psychosocial risk factors for the quality of life of patients with brain aneurysms

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Introduction: Psychosocial factors, such as stress, adversity, socioeconomic status, depression, and anxiety, are associated with overall health and patients cerebrovascular in particular.

Aim: The aim is to show the association of psychosocial factors with the quality of life of stroke patients with brain aneurysms.

Materials/methods: This is a cross-sectional observational study of cognitive and psychosocial functioning in glioma survivors. We examined neuropsychological, self-reported cognition, mood and QoL correlates of work daily functioning in stroke survivors, and carried out linear models of the best predictors. The research instrument was a questionnaire for assessing the psychosocial status of patients ANA/AHA.

Results: Male gender and lower education, older age, living in a rural environment, single life and introverts have a worse quality of life ($p<0,05$) that is associated with psychosocial risk factors. give a statistically significant difference. In the examined sample, 20% of respondents have some form of depression after a stroke. This is further related to the fear of recovery

Conclusion: Importantly, psychosocial factors have different prevalence among different demographic groups, and as such, may be key for addressing disparities in the development of cerebrovascular disease and its morbidity and mortality. Keys words: quality of life, psychosocial factors, stroke, aneurysm of brain

Keywords: brain aneurysm, quality of life, psychosocial risk

075 Health care of patients with subarachnoid hemorrhage

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Introduction: Subarachnoid hemorrhage (SAH) means the presence of blood in the subarachnoid space. The cause can be trauma or spontaneous bleeding (from an aneurysm)

Aim: To review the specifics of health care and to show nursing interventions in patients with subarachnoid hemorrhage according to the health care process. Research methodology: The research was conducted in the Special Hospital for Cerebrovascular Diseases, "Sveti Sava" in Belgrade in the period from 16.10.21 to 05.11.21.

Method of work is a presentation of the case of a female patient hospitalized at the Department of Interventional Neuroradiology. Research methods: observational-indirect, descriptive and analysis of medical documentation. The research instrument is the documentation of the health care process. Results: Patient V.G., 66 years old, hospitalized in ICU, diagnosed with SAH, confirmed by CT. Referred from KBC Zemun - where she fell, lost consciousness and injured her head the previous day. Personal history: HTA, denies other diseases and drug allergy. Vaccinated and revaccinated with the Pfizer vaccine, May 2021. She did not suffer from a Covid infection. In our institution, embolization of the a. comunicans anterior aneurysm was performed in the Angio room.

Discussion: Research shows that nursing interventions are extremely important for the further recovery of patients, namely: assessing the patient's condition, observing the patient, placing the patient in the appropriate position, monitoring vital parameters, recording vital parameters in the monitoring list, placing and maintaining the IV toilet times, monitor the appearance of the tissue and the patency of the vemicular tract.

Conclusion: Following modern trends in health care and medicine, as well as the implementation of continuous education of all team members who participate in the process of health care and treatment, are key factors for a quick and successful recovery of the patient.

Keywords: subarachnoid hemorrhage, care, interventions of nurse

076 Management of soft tissue injuries in the maxillofacial region

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Soft tissue injuries are one of the most commonly encountered injuries in head and neck region and present especially in the emergency department or surgical casualty. In most of the cases they are isolated soft tissue injuries, or injuries having concomitant skeletal trauma. The frequent facial soft tissue injuries include simple lacerations, abrasions, contusions, bites, avulsions, and burns. These injuries are complicated by presence of vital anatomical structures like vessels, ducts, nerves, and muscles. Presence of foreign debris and hematoma further complicates the soft tissue injuries and increases the chance for infection. The face is a region of high esthetics and functional importance. Hence, there are many factors that help to manage such injuries.

Factors that guide facial soft tissue injury management are: **Nature of the injury**—Helps in logical treatment planning that ultimately results in better esthetic and functional outcomes. **Extent of injury**—Many facial soft tissue injuries that are

relatively minor are treated in emergency department by the oral and maxillofacial surgeons. These wounds are managed by thorough cleaning, irrigation, debridement, primary suturing, and cleaning whenever needed. More complex wounds require special intervention by taking the patient into operation theatre and reconstructing using various grafts and flaps. **Timing of the injury**—Any type of injury, by default, should be attended at the earliest to maximize the prognosis. The bottom line of many past and present literature is that the wounds of face and scalp should be primarily closed as soon as they are seen and as long as active infection is not present. To achieve this, the surgeon needs to understand the etiopathogenesis, surgical anatomy, biomechanics of tissue wound, biology of wound healing, and the art of soft tissue repair. Due to excellent vascularization the soft tissue wounds can be primarily sutured even 24-48 hours after the initial trauma **Evaluation and assessment of function of important anatomical structures** – Trauma to the peripheral branches of facial nerve could be devastating to the patients and early diagnosis could be significant factor. Trauma to the orbit, salivary gland ducts, large diameter vessels needs to be evaluated as early as possible **Reconstruction of the tissue defect** -here are several options for soft tissue reconstruction using flaps. Starting from local, regional, distant flaps and free microvascular flaps, depending on the type, location, and extent of the injury.

Keywords: soft tissue injury, maxillofacial, head and neck

077 Epidemiology and treatment of maxillofacial bone fractures in Vojvodina: single center experiences

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In western countries, trauma is the first leading cause of death before the 4th decade of life, as well as the third major cause in patients over 40 years old, being preceded only by cardiovascular diseases and neoplasms. Maxillofacial injuries are frequently associated with multiple trauma, and may cause functional and aesthetic bad outcomes, because of the frequency of permanent deficits and potentially disfiguring scars that can dramatically affect patient's quality of life. These traumas are often complicated by traumatic brain injuries and/or serious facial substance loss. Fractures involving the middle and upper third of the face are more frequent compared to mandibular ones. The former are classified according to Le Fort whereas the latter can be isolated or associated with lesions of the inferior alveolar ridge. In the worldwide literature, epidemiological data vary mainly according to different geographical areas. Diagnostic accuracy together with type and timing of treatments significantly affect the clinical evolution of such traumas, allowing to improve functional results and limit cosmetic damages. Interestingly, the severity of maxillofacial injuries may be considerable, and can divert clinicians' attention from other concomitant injuries that are less evident but potentially life-threatening. The aim of this study is to evaluate epidemiological data on the fractures of the maxillofacial area in the Vojvodina region during 10-year period.

At the University Medical Centre of Vojvodina, Clinical Department of maxillo- facial and oral surgery, around 500 trauma patients per year are evaluated, around 150 have to stay in the hospital. Male : female ratio is 4 : 1, the patients age is from 1 to 98 years. The most common cause of the injuries were traffic accidents and trauma due to physical contact. We observe mandibular fractures in 30%, zygomatic bone fractures in 42%, fractures of the orbit in 19%, fractures of nose in 6%, fronto naso orbital bone fractures (FNO) in 5%, temporal bone fractures in 3%, nasoorbitoetmoidal fractures (NOE) in 2%, panfacial fractures in 6%. In 10% we observe serious injuries of teeth. The average hospitalization time is 5 days. Open reduction and internal fixation (average time for operation is about 100 min) is standard treatment in most cases. In average we use 2 titanium plates and 8 screws per patient. The number of complications is in direct proportion to the severity of the injuries. In single bone fracture, most common complications is sensory disturbance, in multiple mandible fractures occlusion disturbances are common. In severe orbital fractures, in NOE and FNO, the main problem is double vision and nasoliquorhea. Postoperative infection was rare. Most casses need just one operative procedure, but 5% of the patients, need more than one operation.

Keywords: maxillofacial, bone fracture, epidemiology, treatment

078 Cranial missile injuries

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Cranial and Spinal Missile Injuries carry a very high Morbidity and Mortality. The higher the velocity the more damage it can cause. Also important is the trajectory of the bullet.

Blast injuries have an impact from shock waves along with shrapnel.

The immediate management is same as all brain and injuries. The advent of antibiotics has reduced mortality greatly. It has been noted that giving anticonvulsants in the first seven days is beneficial in Cranial Missile Injuries.

Keywords: cranial, spinal, missile injuries

079 Craniofacial approaches in skull base surgery

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The complex anatomy of the vital structures at the base of the skull and difficult accessibility make surgery very challenging and sometime extremely difficult. Tumors and tumor like lesions of the nasal cavity, paranasal sinuses, orbit, scalp and calvarium may extent to the anterior cranial fossa through skull base. beside tumors, severe craniofacial trauma also requires skull base approaches in order to reconstruct the defects and prevent or treat already persisting CSF fistulas and consequent infections.

Two stage surgery in cases of tumor removal are no more options, so combined access by neuro and craniofacial surgeons are contemporary way to successfully remove tumors and reconstruct the defects. There are variety of approaches which depends of tumor or defect localization. We have performed for central part of anterior cranial fossa transracial approach, and for lateral part bifrontal through bicoronal incision or pteroneal approach if lesions are laterally positioned or invading infratemporal and retromaxillary spaces. Sometimes, we had do temporary zygomatic and maxillary bone osteotomy and swing to enable wide access to the skull base. Using these types of osteotomies and approaches we have done so far 46 tumor removals and skull base reconstructions avoiding major complications. In this presentation it will be pointed out the anatomy of skull base region, surgical approaches and results obtained in a single stage surgery performed by neuro and craniofacial surgeons as a team.

Keywords: skull base, surgery, craniofacial approach

080 Integrating civilian and military resources to improve global healthcare: mass casualty center project

R.J. Andrews

Background: Improving global healthcare – both routine day-to-day care and mass-casualty disaster response – depends upon cost-effective programs. One- third of deaths worldwide are due to conditions requiring surgery; nearly one-half of deaths in the USA among those less than 50 years old are due to trauma, a condition requiring surgical resources. Of total worldwide GDP (Gross Domestic Product), 10% is the cost of violence. Cost-effective programs to expand surgical care are essential to improve global healthcare.

In many countries military medical resources are better developed than the public civilian resources – yet the military resources are frequently underutilized. Over the past several decades in the USA there have been efforts to integrate civilian and military medical resources – primarily to improve trauma care nationwide.

Methods: The trauma/stroke center model addresses the need not only for surgical resources 24/7/365 but also for ancillary services such as radiology, blood bank, and laboratory that are necessary for both surgical and non-surgical conditions. A complete trauma/stroke center is full-service: community education, pre-hospital (ambulance) care, acute care, rehabilitation, medical education/training. A trauma/ stroke center closely resembles the most extensive emergency medical team facility (Type 3 Specialized Care) specified by the World Health Organization (WHO). WHO has also noted that effective response to both natural disasters and man-made mass casualty situations requires a robust and resilient local medical infrastructure: external resources (e.g. the Red Cross) that arrive days to a week or more after the event are not effective for acute surgical conditions.

Results: A prime example of civilian-military integration comes from Israel. The Israeli Defense Forces Field Hospital, combined with civilian sector healthcare resources, optimizes injury prevention, prehospital transport and care, acute care, and rehabilitation. Other examples of integration of civilian and military medical resources in Australia and Chile are considered. For example, Chile has created a separate Ministry for Emergency Response (ONEMI), facilitating civilian- military joint response for mass casualty events.

Civilian-military integration of advanced technology - e.g. resilient portable battery-powered equipment (ultrasound, CT/MRI scan, oxygen generators), telemedicine/digital technology, drones and robots - can expand healthcare in a cost-effective manner.

Discussion: By combining the advanced resilient resources of the military for emergency response with the breadth and depth of the civilian healthcare system for day-to-day care, the trauma/stroke center model can be expanded into the mass casualty center model that cost-effectively augments both emergency mass casualty care and routine day-to-day care for the entire population.

Keywords: global healthcare, mass casualty, trauma

081 Global neurosurgery projects after war - myth or reality?

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The WWI induced reshape of the world with emphasis on democracy and economic relations. The first international neurosurgical meeting was organized in Bern, 1931, while just before onset of WWII, Norman Dott suggested an organisation of European neurosurgical societies. After the WWII, the United Nations (UN) was established to maintain peace and achieve international cooperation. Despite the economic crisis and post-war tensions, the idea for improvement of neurosurgical community continued to evolve. In 1951 Herbert Olivecrona wrote to several European neurosurgeons, expressing a need for an international European society. Following foundation of World Federation of Neurosurgical Societies (WFNS) in 1955, few European neurosurgeons led by Marcel David, Wilhelm Tönis, and Hugo Krayenbühl initiated the idea, and the First European Congress of Neurosurgery was held in Zürich, 1959. The European Association of Neurosurgical Societies (EANS) was officially founded in 1971 and today, as same as WFNS, it aspires to promote global improvement in neurosurgical care.

The Yugoslav wars and NATO interventions at the territory of Balkans led to deterioration of relations between former allies. However, to cope with both global and local challenges South East Europe Neurosurgical Society (SeENS) was established in 2012, with a clear sense of purpose – to improve neurosurgical care, training, and research in Southeast Europe by promoting expertise exchange and cooperation among neurosurgeons in this exciting region. Neurosurgeons in South East Europe genuinely implement the concept of thinking globally and acting locally, working together to expand the horizons to the benefit of our patients, but also for our own good being and recognition in the modern world.

Present conflicts at the territory of Ukraine should not stop development of neurosurgical community. Leaning upon the strong foundations of tradition and experience and following contemporary professional accomplishments, trends, and innovations, we strive for neurosurgery and neuroscience without geo- political frontiers and aim at building bridges of knowledge and understanding across disciplines, institutions, individuals, and generations.

Keywords: neurosurgery, war, global projects

082 Civilian and military head gunshot injuries: Prague experience

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Penetrating traumatic brain injury caused by gunshot is one of the most severe injuries. In the past, nihilism was the predominant treatment approach, and such injured patients were not considered promising. In recent years, a more active approach has been promoted by adopting damage control resuscitation measures and early surgical decompression in both a civil and military setting.

In this paper, we summarize current knowledge about gunshot injuries of the brain and present a helpful understanding of this topic to neurologists, neurosurgeons, and intensivists.

Methods: A retrospective analysis of the results of patients with gunshot head wounds hospitalized in the Military University Hospital in Prague during the period 2000–2018 was performed. Epidemiological data; Injury cause, type, and motive; Glasgow Coma Scale (GCS) on admission; CT scan fi ndings; therapeutic approach; and clinical outcome according to the Glasgow Outcome Score Extended (GOSE) were evaluated and statistically analyzed.

Results: 81 patients were enrolled in the study. Out of these 81 patients, 71 (88%) were injured in a civilian and 10 (12%) in a military setting. Mean GCS on admission was 5.8 (3–15). We operated on 18 patients. Mean GOSE after surgery was 2.8 (1–8). Patients with an overpenetration type of injury, with low GCS value on admission, with a higher number of injured brain lobes and with a bullet trajectory crossing the midsagittal and/or midcoronal plane had statistically significantly worse outcome ($P \leq 0.0001$).

Conclusion: GCS on admission, injury cause and motive, and CT findings proved to be significantly important predictive factors. Chosen therapeutic approach should reflect these factors as they correlate with patient's prognosis.

Keywords: gunshot injury, head, civilian, military

083 The role of contemplation in military neurosurgical challenges

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Objective: There is considerable literature on the harmful effects of distress in medically critical situations which characterized military situations. There is just as much literature available on psychological methods aimed at relieving stress. One can make creative and fast decisions without stress much more effectively. We will discuss these acute decisions and investigate them with a scientific approach, attempting to judge the propriety of decisions made in emergencies by medical personnel. We will investigate the results of our contemplative approach to this phenomenon through concrete examples which often occurs in military situations.

Methods: Deliberate practice of contemplative behavior daily gives one the ability to quickly retrieve the learned approach, previously studied and experienced in contemplative behavioral practice, during a given procedure. Once the information is retrieved regarding a certain procedure, it can be synthesized with the situation at hand, which allows for the formulation of an enhanced creative option that may increase the possibility of a successful procedure. Thus, the procedure together with the application of the contemplative approach could be acknowledged as a real innovative treatment after gaining scientific approval. This presentation gives an account of the application of the practiced contemplative approach during different brain injury situations like acraniopagus craniopgos separation was.

Results: These innovations eventually gained wide recognition, applied by many, leading to progress in neurosurgical challenges not conquerable before. The study in which the engraved spiritual algorithms of the stress-distress situation there because of contemplative practice led to the innovation of surgical techniques responsible for the success of the procedure which was the extreme brain injury.

Conclusion: Spiritual silence is a helpful aid, swiftly attainable if the invocation of it is practiced every day. Ensuring the presence of spirituality during the mindful contemplation of procedures results in professional success of emergencies, demonstrated in the different cases of the neurosurgical situation like the different type of severe brain injury like the separation of a craniopagus was. Alongside a strong intellectual understanding of the profession, emphasis on spirituality allows for successful execution.

Keywords: distress situation, craniopagus, conjoined twins, fresh cadaver

084 Elective neuroendoscopy in field hospital

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The use of new technological achievements and the number of less invasive procedures in medicine are increasing. With the advent of new technological capabilities that support the development of neuroendoscopic and neuronavigational techniques and instruments, surgeries are also becoming less aggressive for patients. In recent decades, neurosurgeons have developed and refined surgical techniques that make operations less invasive and more efficient, optimize surgical outcomes and help limit the potential of neurologic morbidity. Military medicine also benefits from these advances.

When considering neuroendoscopic brain surgery in the field, it is essential to recognize that the primary goal of this surgery is saving lives in improvised situations. The goals, of course, depend on the pathology. These include relieving the increased intracranial pressure for various reasons, especially trauma, treating acute vascular pathology or haemorrhage, evacuating the hematomas, removing foreign bodies from the brain as safely as possible and repairing the head injury. Neuroendoscopy involves the use of endoscopes to treat various pathologies of the central nervous system. The technique dates back to the early 20th century and has significantly evolved since then. In the beginning, neuroendoscopic procedures were limited to the ventricles (ventriculostomy).

Today, however, navigated neuroendoscopy is used to treat a wide range of intracranial pathologies in and outside the ventricles, in the brain parenchyma and in the subdural space. Neuroendoscopy is considered as minimally invasive technique to reduce related brain trauma and improve the visualisation of the tissue through better magnification and illumination. Skin wound, craniotomy and brain exposure are minimal, as is brain retraction.

This is especially useful in emergencies and war conditions, not to mention technical superiorities, size and weight of equipment, making it especially suitable for military use. In full-endoscopic surgery, access is gained through the working channels of the neuroendoscope, usually one or two. The simultaneous use of two instruments allows some tissue manipulation. In endoscope-assisted surgery, on the other hand, the neuroendoscope is used only as a visual aid instead of the surgical microscope. The instruments are positioned to the side of the endoscope, and microsurgical technique is possible. Neuronavigation can be used in conjunction with neuroendoscopy to select the optimal burr hole or neuroendoport position and to choose the safest trajectory to the lesion, reducing the risk of damage to vital structures.

We review the use of neuroendoscopy and its importance in the field hospital.

Keywords: neuroendoscopy, elective, field hospital

085 Step ladder expansive cranioplasty

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Background. In face of a refractory raised intracranial pressure (ICP), surgeons most commonly resort to Decompressive craniectomy (DC). Procedure leaves an unprotected brain underlying the craniectomy defect and Monro Kellie doctrine: disrupted. Different variants of Hinge craniotomies (HC) have been used with clinical outcomes comparable to DC as single stage alternatives. However, both DC and every variant of HC have a limit to the achievable volume augmentation and all invariably cause a compression of the cerebral cortex and its vasculature at the craniotomy site. We believe both these limitations adversely affect the outcome.

Methods. A team of neuroscientists in Indian Armed Forces Medical Services has been working for last nine years towards developing a Novel surgical technique that can mitigate both these drawbacks. Desired procedure should take the centripetal pressure exerted by the combination of the tensile strength of the scalp (with or, without an underlying bone flap) and atmospheric pressure off the brain surface while achieving an assured augmentation of intracranial volume that can be optimized on a case-to-case basis. We call it a "Step ladder Expansive cranioplasty".

Results. The distance of the parietal eminence was found to have increased by 10.2 mm on the operated side after expansive cranioplasty.

Conclusions. From drawing board to bedside, we have made some progress towards our goal but it is still far away from complete. More studies are required to fill in the gaps in our knowledge necessary to optimize the various parameters of the surgery. Procedure has promise to be of special role in field in war scenarios.

Keywords: Refractory raised ICP, Expansive cranioplasty, Decompressive craniectomy, Cranial Volume augmentation

086 Early high-flow bypass and trapping for ruptured blood blister-like aneurysms of the internal carotid artery: battle plans and clinical results

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Objective: The aim of this study is to clarify the efficacy and safety of early surgery using trapping of the affected internal carotid artery (ICA) and high-flow bypass between the second portion of the middle cerebral artery and cervical external carotid artery with radial artery graft for ruptured blood blister-like aneurysms (BBAs) arising from the anterior wall of the ICA.

Methods: Medical charts of 24 consecutive patients (10 men and 14 women; mean, 58 years) with subarachnoid hemorrhage (World Federation of Neurosurgical Societies grade I, n = 3; grade II, n = 6; grade III, n = 3; grade IV, n = 7; grade V, n = 5) caused by ruptured BBA surgically treated between 2010 and 2021 were retrospectively reviewed. 18 patients underwent acute surgery within 24 hours after the onset, whereas surgery was performed between 3 and 17 days after the onset because of referral delay or associated vasospasm in 6 patients. All patients underwent the same surgical procedure.

Results: Elimination of the BBA and patency of the bypass were achieved in all patients. Postoperatively, 3 patients showed small infarction in the Heubner artery area, and 3 others suffered symptomatic vasospasm, but no patient suffered infarction in the posterior communicating/anterior choroidal artery territories. Identically, no patient showed ischemic optic neuropathy. At the last follow-up (mean, 52 months), favorable clinical outcome (good recovery or mild disability in Glasgow Outcome Scale) was achieved in 21 (87.5%) of the patients without rebleeding or refilling of the aneurysms.

Conclusions: Early surgical repair of BBAs by trapping of the affected ICA with high-flow bypass is safe and effective treatment with satisfactory midterm outcome.

Keywords: Blood blister-like aneurysm; High-flow bypass; Internal carotid artery; Subarachnoid hemorrhage; Trapping

087 Advanced endovascular techniques for treatment of complex intracranial aneurysms

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In the past two decades the diagnosis and management of intracranial aneurysms have evolved dramatically. With development of sophisticated diagnostic tools such as MR angiography and CT angiography, it is now possible to diagnose most intracranial aneurysms in non-invasive manner; from the other hand, the improvement of non-operative endovascular techniques makes their treatment increasingly safer and more and more effective and provides a valuable alternative to surgery.

First endovascular treatment (EVT) of intracranial aneurysm was described in the early 1970s by a Russian neurosurgeon, Fedor Serbinenko who used vascular catheter with a detachable latex balloon to treat aneurysms, either by putting the balloon directly into the aneurysm lumen or by occluding the parent artery. In 1991, Guido Guglielmi , Italian neurosurgeon, was the

first to describe the technique of occluding aneurysms from an endovascular approach with electrolytic detachable platinum coils, termed Guglielmi detachable coils (GDCs). GDCs are introduced directly into the aneurysm through a microcatheter and detached from a stainless- steel microguidewire by an electrical current. The first such EVT was realized in 1991. at UCLA, when the intracranial aneurysm was obliterated by GDC. Since then, with use of different new materials, the endovascular technique developed revolutionary, that changed completely the attitudes about intracranial aneurysms treatment.

Coiling alone
The development of coils with controlled detachable system was the first important step for widespread use of EVT. Initial large series showed acceptable mortality(≈2%) and morbidity (between 4% and 9%) (Pierrot 2013), related mostly to thromboembolic complications and intraoperative rupture that are the two most frequent complications of aneurysm coiling. Two main disadvantages in this technique are:
(1) Some aneurysms are difficult to treat because of their shape (large and giant aneurysms, fusiform aneurysms, large neck aneurysms).
(2) The durability of aneurysm coil embolization cannot be achieved in all aneurysms. A systematic review of a large number of studies showed that aneurysm recanalization occurred in 20.8% of cases, requiring retreatment in 10.3% (Ferns 2009).

This led to development of new techniques, including balloon-assisted coiling (known as the remodeling technique), stent assisted coiling, and more recently, introducing of flow diversion and flow disruption.

Baloon-assisted coiling (BAC). Moret et al (1997) initially described the balloon-assisted coiling (remodeling technique) for EVT of wide-neck aneurysms. A non-detachable balloon is temporarily inflated in front of the neck of the aneurysm during each coil placement. This method expanded a spectrum of, until then, untreatable aneurysms. It was also useful as a rescue in cases of intraoperative ruptures, but the overall results from many studies did not bring a clear conclusion whether the results of BAC were better comparing to coiling alone.
Stent – assisted coiling (SAC). This new technique was introduced >10 years ago to overcome some limitations of standard coiling in the treatment of some complex aneurysms. SAC was also used as rescue approach in coil herniation or migration of coils into the parent vessel.
As stents are implanted into the parent artery, over the aneurysm neck, risk of in-stent thrombosis is higher than with coiling alone, so the preoperative and postoperative antiplatelet treatment is mandatory. This initially limited SAC to unruptured aneurysms. However, with gaining experience during the past years, stenting has been used in ruptured aneurysms. Stenting is also considered as a help in preventing aneurysm recanalization.

Flow diversion and flow disruption. In the last 8 years flow diverters (FDs) were introduced into the clinical practice. FDs are low porosity stent-like implants that function in two ways:
• Flow redirection: The FD bridges the aneurysm neck and reduces the blood flow into the aneurysm sac because of dense mesh of the implant, yet providing blood flow through adjacent perforators and side branches. This enables a redirection of the blood flow away from the aneurysm toward the distal parent artery. Reduction of blood circulation within the aneurysm leads to flow stasis and induces formation of a stable aneurysmal thrombus.
• Tissue overgrowth: The FD provides a scaffold for neoendothelization across the aneurysm neck. FDs are mainly used in large and giant aneurysms (including fusiform), wide-neck aneurysms, multiple aneurysms within a segmental diseased artery, and recurrent aneurysms. Dual antiplatelet is recommended, so most aneurysms treated are unruptured. However, some complications with FDs are observed, not documented with standard coiling or BAC, such as delayed aneurysm ruptures and remote parenchymal hematomas. Most of those complications have occurred in large and giant aneurysms that have a high natural incidence of bleeding or were neither surgically or otherwise endovascularly treatable.

Intrasaccular flow disruption is an endovascular approach similar to the intraluminal FD method. The mesh of the flow disruptor is placed within the aneurysm sac and creates blood flow stasis with subsequent thrombosis. Adjunctive devices for wide neck aneurysms treatment (Waffle-cone technique, pCONus stent, Pulse Rider, eCLIPS, pCANvas, Contour, Neqstent).

During the last decade novel stents and stent-like devices have been designed to serve as adjunctive treatments for endovascular coiling of wide-neck aneurysms. Some of them are used together with coiling to prevent a migration of coils into parent artery, while pCANvas, eCLIP, Contour and Neqstent have also a flow modifing properties.

Temporary neck bridging devices for coil embolization, such as Cascade and Comaneci, have some advantages over other adjunctive devices such as permanent stents. Although the placement of permanent stents during coiling is associated with greater durability, it is also associated with higher risk of thromboembolic complications. The Cascade and Comaneci devices provide support during coiling and do not require patients to undergo antiplatelet therapy as they are not permanently deployed. Moreover, unlike balloon-assisted embolization, these devices do not occlude the parent vessel, thus posing lower risks of ischemia or thrombus formation.

Conclusion
Progress in imaging and device manufacturing is providing more sophisticated tools that have expanded EVT to aneurysms that were previously neither surgically or endovascularly treatable. Randomized trials are still necessary to evaluate the safety and efficacy of various emerging new technologies for aneurysm treatment.

Keywords: high-flow bypass, blood blister-like aneurysm, internal carotid artery

088 Endovascular treatment of cerebral aneurysms, the new concept

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Background: Nowadays, endovascular treatment of cerebral aneurysms is the most popular treatment of them. However, the large or giant aneurysms and wide neck aneurysms are not still good candidate for endovascular treatment such as intrasaccular coil embolization with or without some adjunctive technique (balloon assisted or stent assisted technique). Recently, in order to overcome this situation, many new devices, such as flow diverter or intrasaccular flow disruptor, are invented and applied clinically.

Methods: We will show conventional intrasaccular coil embolization with or without some adjunctive technique, and then new approach using flow diverter or intrasaccular flow disruptor.

Results: Conventional intrasaccular coil embolization with some adjunctive technique is still useful for many aneurysms, and even for difficult aneurysms by conventional intrasaccular coil embolization, the new approach using flow diverter or intrasaccular flow disruptor are very effective and better method.

Conclusion: Endovascular treatment of cerebral aneurysms is greatly in progress and it is one of the first-choice treatments for the cerebral aneurysms.

Keywords: endovascular, cerebral aneurysm, intrasaccular flow disruptor

089 Endoscopic intracranial hematoma evacuation for several etiologies and sites

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Evacuation for intracerebral hemorrhage is weak recommended in Japanese stroke treatment guidelines, but we often experience cases in which it is necessary.

Hematoma removal was originally performed by craniotomy, but with the improvement of endoscopic image quality and the development of neuroendoscopic surgical instruments, endoscopic intracerebral hematoma removal has recently been established as a treatment covered by insurance in Japan.

Neuroendoscopic surgery is effective not only for hypertensive intracerebral hematomas, but also for patients with cerebral hemorrhage based on vascular abnormalities such as cerebral arteriovenous malformation or moyamoya disease.

In this report, we describe the following cases in which neuroendoscopic hematoma removal was performed alone or in combination with neuroendoscopic hematoma removal.

Case 1) Putaminal hemorrhage

Case 2) Intraventricular hemorrhage

Case 3) Cerebellar hemorrhage

Case 4) Hemorrhage onset moyamoya disease

Case 5) Cerebral hemorrhage due to rupture of cerebral arteriovenous malformation

Case 6) Cavernoma

Keywords: endoscopic evacuation, intracranial hematoma, arteriovenous malformation

090 Spontaneous chronic subdural hematoma in elderly people- arterial hypertension and other risk factors

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Background: The risk factors implicated in the genesis of chronic subdural hematomas include old age, alcoholism, diabetes mellitus, arachnoid cysts, coagulopathy, anticoagulant (ACTh) and antiplatelet drugs. However, no study has reported an association between arterial hypertension (HTA) and chronic subdural hematomas. Therefore, the aim of this study was to investigate whether HTA is a risk factor for spontaneous chronic subdural hematomas (SCSDHs).

Methods: This multicenter study included patients aged over 60 years. One hundred and twenty-two patients with SCSDHs and 111 controls treated for other reasons with no evidence of intracranial hemorrhages on brain computed tomography were enrolled. The patients were separated into three age subgroups to provide a better insight into the role of risk factors with age.

Results: The average age in the SCSDH group was 74.45 ± 8.16 years, compared to 71.28 ± 6.69 years in the control group. The SCSDH group was significantly older than the control group ($p = 0.0014$). The patients in the 60-69 years age group diagnosed with SCSDHs had significantly higher rates of HTA ($p = 0.0519$), ACTh treatment ($p = 0.0292$) and alcoholism ($p = 0.0300$) than the control group. The patients in the 70-79 years age group diagnosed with SCSDHs had significantly higher

rates of HTA (p = 0.0071) and ACTh treatment (p = 0.0158) than the control group. In the subgroup of patients older than 80 years, there were no statistical differences.

Conclusion: The incidence of HTA had borderline significance in the patients aged 60-69 years with SCSDHs and statistical significance in the patients aged 70-79 years with SCSDHs. Anticoagulant therapy was the most significant risk factor. Among the patients with SCSDHs aged 60-69 years, the percentage of heavy drinkers was significantly higher than in the control group.

Keywords: Alcoholism; Blood coagulation disorders; Chronic subdural hematoma; Hypertension; Risk factors.

091 Middle cerebral artery aneurysms- our seven years' experience. Role and place of the microsurgery in the endovascular center

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The Center for Neurosurgery of JSC "Central Clinical Hospital" was founded in 2016. Currently, the department employs 6 neurosurgeons and 2 neurologists, 22 nurses, as well as residents and interns. The doctors of the department provide round-the-clock elective and emergency highly qualified medical care. There are currently 30 beds deployed in the department. As of the end of October 2022, about 6,000 surgeries have been performed. About 70% of them are operations performed by the endovascular method: angioplasty and stenting of intracranial and extracranial stenoses, embolization of aneurysms, AVM embolization, tumor embolization. Extra-intracranial bypass, aneurysm clipping, AVM removal, microvascular decompression of cranial nerves, removal of tumors of the brain and spinal cord, surgical treatment of Arnold-Chiari pathology, spinal surgeries are performed using the microsurgical method.

Despite the advances in endovascular technologies, microsurgery retains its place in the treatment of middle cerebral artery aneurysms. The aim of this work is to review the methods of surgical treatment and determine the roles of endovascular surgery and microsurgery in the treatment of aneurysms of the middle cerebral artery based on the experience of the Neurosurgery Center JSC "Central Clinical Hospital". Statistical data for the study was collected through a retrospective analysis of the medical histories of patients who received surgical treatment of cerebral aneurysms at the neurosurgical center of JSC " Central Clinical Hospital" in the period from 2016 to 2022. All obtained results were processed using descriptive statistics and visualized in Microsoft Excel 2010. The data of 310 patients, of which 65% were women and 35% - men, aged 21 to 83 years were analyzed, the average age was 55.9±11.5. In our practice, MCA aneurysms accounted for 28% of all aneurysms, about 70% of aneurysms are localized in the bifurcation of the middle cerebral artery. Among operated patients, 12% patients were hospitalized in the acute period of stroke (mean MRS at admission - 4, after discharge - 3). In elective surgery the average MRS at admission was 1, after discharge - 1. 298 patients were treated only by the endovascular method, 7 patients underwent aneurysm clipping, and 4 patients underwent both methods sequentially. 43 patients (11.5%) underwent re-embolization due to aneurysm recanalization. More than 95% of recanalization occurred in the bifurcation of the middle cerebral artery.

For aneurysm embolization, we used coils with optional balloon, stent or stent- balloon assistance, flow diverting stents, and Stent Mono Therapy technique. In the clipping group, 6 patients underwent surgery after acute aneurysm rupture (on average after 3.5 days), the remaining 5 patients underwent elective surgery. In patients with acute aneurysm rupture, according to indications, the intracerebral hematoma was additionally removed, two patients underwent cisternostomy, and one patient underwent reoperation to reinstall the clip due to narrowing of the vessel lumen in the area of the clip installation. In this group, there were higher scores on the MRS (poor outcome scores of 3–6). In the elective surgery group, a patient with a large bifurcation aneurysm of the middle cerebral artery and ipsilateral stenosis of the M1 segment of the middle cerebral artery underwent simultaneous clipping and revascularization through extra-intracranial bypass. All patients in the elective clipping group had a good outcome (scores 0–2). Complications of the perioperative and postoperative periods in endovascular treatment amounted to approximately 3.2%. The overall postoperative mortality was 0.97%.

To select a surgical treatment technique, we rely on the individual characteristics of the patient, such as: the patient's condition, the presence of complications (massive hemorrhages and severe vasospasm), the location and configuration of the aneurysm, the number of aneurysms, concomitant stenoses, the effectiveness of drug (antiplatelet) therapy. The patient's opinion regarding the choice of treatment tactics should also be considered. Based on the foregoing, due to the low incidence of complications in endovascular treatment of aneurysms of the middle cerebral artery and the low percentage of recanalization, we consider the endovascular method of treatment to be preferable, and we suggest using microsurgical clipping in individual cases if indicated.

Keywords: middle cerebral artery, aneurysm, endovascular, microsurgery

092 Endovascular treatment of multiple aneurysms

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Introduction. Brain (cerebral) aneurysms are pathological, localized dilatations of blood vessels of the brain. The divisions of cerebral aneurysms are complex and numerous, and in practice the morphological division of aneurysms are: saccular (bag-shaped, English "berry" aneurysms) and non-saccular aneurysms. Saccular aneurysms account for 90% of the total number, of which 85% of aneurysms are localized on the blood vessels of the arterial ring of Willis, the base of the brain.

The most common sites include: AcomA (35%), ACI (30%, including PcomA and a .Ophtalmica), followed by ACM (22%), and AB (7%). The exact prevalence of cerebral aneurysms is not easy to determine and it differs primarily in asymptomatic patients, in whom the aneurysm is detected "accidentally" or as part of the detection of another disease, and in symptomatic patients, when the aneurysm ruptures with consequent bleeding (intracerebral, SAH) or as compressive effect on the surrounding brain tissue in unruptured aneurysm or consequent thromboembolic events. The importance of these aneurysms is reflected in the serious complications and mortality which follows the rupture of an intracranial aneurysm, most often in the form of subarachnoid hemorrhage (SAH), but also can be intracerebral and intraventricular hemorrhage. The incidence of SAH in the Western world is 9-15 per 100,000 people.

Minimally invasive, endovascular treatment, that involves aneurysm embolization, represent a modern therapeutic modality. Performing an intervention under local anesthesia, with constant monitoring of the patient's vital parameters, allows therapeutic treatment of multiple aneurysms in the same patient, mostly in the same act.

Keywords: cerebral aneurysm, subarachnoid hemorrhage, endovascular

093 Proposal of minimally invasive endoscopic neurosurgery in emergency situations

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In our country, we are fortunate to live in a period of peace, but in the recent unstable international political balance, it may be important to consider neurosurgical treatment in emergency and wartime situations, especially in peacetime.

Endoscopes are commonly used instruments in the field of surgery, gynecology, orthopedic surgery, urology, otolaryngology and oculoplastic surgery. The instruments used in otolaryngology in particular match those in neurosurgery in size. They can be used if they are 2.7 mm or 4 mm in diameter and 12-15 cm long. Even without dedicated neurosurgical equipment, minor operations can be performed with bipolar coagulators and dissectors.

Storz has an endoscopic system that integrates an endoscope, camera, light source and monitor, which is used for hands-on educational purposes. These are important as surgical equipment in wartime and emergency situations. With the advent of 3D exoscopes, we are now proposing a method of neurosurgery that, in addition to endoscopic surgery, allows the viewpoint to be switched between inside and outside the surgical field as required.

In the absence of widespread use of 3D exoscopes, or in emergency situations, 2D exoscopes that can be connected to an endoscopic camera may play an important role as a surgical microscope with a fixing system. They can replace microscopes and can be replaced with endoscopes as appropriate to perform appropriate neurosurgical procedures.

We present neurosurgical endoscopic procedures for intracerebral hematoma, subdural hematoma, intraparenchymal tumors in our practice. We will also report on our experience with combined exoscopic and endoscopic surgery. And we hope that our experience can be of some help, especially to neurosurgeons who are currently in a difficult wartime situation.

Key words: emergency, minimally invasive, endoscopic

094 Artificial intelligence and modern trends in treatment of acute ischemic stroke, our experiences

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Stroke is a major cause of death. Early identification remains reducing morbidity and mortality. Artificial intelligence (AI) improve imaging techniques so strokes might be identified faster.

AI is a rapidly expanding with many applications in acute stroke imaging, including ischemic and hemorrhage subtypes. AI uses computers to perform tasks that typically require human knowledge. Rapid detection of ischemic infarction is important for triaging patients as potential candidates for thrombectomy because of the narrow window of therapeutic efficacy. The algorithm was integrated into the radiologist’s workflow, and time to detection was reduced to 6 minutes. In the time-critical

setting of acute stroke, AI offers the tools to rapidly evaluate available information from non-contrast computer tomography (CT), CT perfusion (CTP) and CT angiography, extracting specific predictions from rich data. It has been applied to the automatic detection of stroke lesions on imaging and can guide treatment decisions through the prediction of tissue outcomes and long-term functional outcomes.

Mechanical thrombectomy (MT) is the most effective treatment for patients with an acute ischemic stroke. Barriers in access to MT include delays in evaluation and accurate diagnosis leading to inappropriate triage, logistical delays. The numbers of patients who may benefit from MT have increased with the advent of 'tissue-based' patient selection and the extension of the 'time window' for MT to up to 24 hours. However, many patients are excluded from treatment or do not receive maximal benefit of MT because of access delays. Every 10-minute delay in revascularization lowers a patient's lifetime by approximately 40 days.

Due to the narrow window of therapeutic efficacy, the speed of recognizing patients who are candidates for this therapy is vital. AI algorithms have the potential to speed up the process of infarction identification from CT or MR and is successful in determining core infarct volumes on diffusion-weighted images (DWI) and CTP via automatic lesion segmentation. Establishing infarct volumes is vital to assisting in patient triage.

The software automatically sends and alert to the attending physician's smartphone with links to the imaging for a final human assessment to help speed the time to diagnosis and treatment. Depending on the type of stroke, quick action is needed to either activate the neuro-interventional teem. If a stroke is diagnosed immediately, the patient may fully regain their mobility, self-care and social skills, progress sooner.

AI's superpower also helps define the stroke type shortly after the onset, detecting the slightest deviations on the CT and MRI scans. AI algorithms can distinguish an ischemic stroke from a hemorrhagic or other types such as meningitis, seizure, encephalitis, acute demyelination, abscess and subdural hematoma.

Conclusion. AI is making a big impact in healthcare. In acute stroke, application of AI in this field has allowed for opportunities to improve treatment selection and clinical outcomes by aiding in all parts of the diagnostic and treatment pathway, including detection, triage, and outcome prediction.

Keywords: artificial intelligence, acute stroke, mechanical thrombectomy

095 Anterior brain circulation aneurysm surgery- single center experience

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Cerebrovascular surgery is associated with relatively higher mortality and morbidity in comparison to other sub-specialties of neurosurgery. Surgery of brain aneurysms is a surgical challenge. Because it is a benign pathology, and surgery means healing, the surgical technique and the experience of the surgeon is of crucial importance.

In patients with intracranial aneurysms, the modality of treatment should be decided individually for each patient.

Our experience is based on more than 1000 operated aneurysms of the anterior circulation in the period 2008-2018.

Keywords: brain aneurysm, anterior, surgery

096 Endovascular treatment of the distal dissecting large aneurysm of posterior cerebral artery using flow diverting stent – case report

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Flow diverting (FD) stents have become game changers in the treatment of complex aneurysms that were once considered to be almost impossible to treat without certain neurological consequences. Although, it's usage in posterior circulation is a still subject of many debates, there are certain carefully considered cases in which they can be used due to favourable benefit/risk ratio.

The aim of this case report is to present a possibility to successfully treat large distal posterior circulation aneurysm with the application of the FD stent. A 61-year-old female patient with mild to severe headaches and visual disturbances, diagnosed on the DSA with the dissecting heart-shaped aneurysm of the right P1 measuring 17,5 x 15,5 mm, with large neck that was involving almost whole P1 segment. It was decided that the best course of therapy would be endovascular treatment. In order to preserve parent vessel patency, small caliber FD was implanted across the aneurysm neck and patient was placed under corticosteroid therapy for seven days (methylprednisolone, 40 mg/day) in case of edema.

Also, dual antiplatelet therapy consisting of clopidogrel 75 mg per day next 3 months and acetylsalicylic acid 100 mg per day for the rest of her life, was prescribed. Although patient was in good general state and stopped complaining about headaches,

she was advised to remain hospitalised for the whole week. After that period, she underwent routine control computed tomography and was discharged in the same condition as postoperatively.

Due to specific localisation and size of the aneurysm we are making periodic phone call controls until first digital subtraction angiographic control is performed.

Keywords: dissecting brain aneurysm, posterior cerebral artery, endovascular, flow diverting stent

097 Intracerebral hemorrhage and anticoagulant therapy

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Intracerebral hemorrhage (ICH) is the most serious complication of oral anticoagulant (OAC) therapy. The mortality rate in these patients exceeds 50%. Almost half of patients with OAC-related ICH experience early clinical deterioration due to hematoma enlargement. Prevention of ICH expansion is therefore one of the primary goals of treating acute ICH. Blood pressure control and rapid reversal of coagulopathy are the mainstays of acute medical management. Specific reversible agents for vitamin K antagonists, direct thrombin inhibitors, and factor Xa inhibitors are now available for clinical use and may improve outcomes when given early enough in the clinical course.

European Stroke Organization guidelines recommend the use of prothrombin complex and fresh frozen plasma in patients on VKA plus vitamin K, the use of idarucizumab in patients on dabigatran, and the use of andexanet alfa in patients on rivaroxaban and apixaban. Some studies have shown that among patients with ICH, prior use of non-vitamin K oral anticoagulants (NOACs) or warfarin was associated with higher in-hospital mortality compared with no OACs, but prior NOAC use, compared with prior warfarin use, was associated with a lower risk of in-hospital mortality. Several observational stides showed that restarting of OAC after ICH was associated with a lower risk of thromboembolic complications and a similar risk of ICH recurrence.

However, clinicians must carefully balance the risks of thromboembolism and recurrent ICH in individual patients.

Keywords: intracerebral hemorrhage, anticoagulant therapy, oral anticoagulants

098 Hypopituitarism after spontaneous subarachnoid hemorrhage of the aneurysmal origin

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Summary. Recent studies have shown significant frequency of hypopituitarism in patients after spontaneous subarachnoid hemorrhage (SAH) of the aneurysmal origin, tested several months or years after the attack. In our study we present endocrinologic examination of a group of 91 patients (61 women and 30 men, aged 48.0 ± 1.1 years, and body mass index TM 24.7 ± 0.5 kg/m') who had SAH of the aneurysmal origin at least one year earlier (approximately 1.8 ± 0.2 year).

Endocrinologic treatment of these patients included basic hormonal status obtained after fasting during the night, at 8:00 hrs in the position of resting.

The level of the following hormones was analyzed: insulin like growth factor 1 (IGF1), thyroxin (T4), thyreo-stimulating hormone (TSH), follicle-stimulating hormone (FSH), luteinizing hormone (LH), testosterone in men, estradiol in women, cortisol and prolactin. Appearance of vasospasm, hydrocephalus and localization of the aneurysm were analyzed. The obtained results were compared to the standard ranges of hormone levels in the blood according to age, sex and ITM, as the control group.

We have concluded that more than half of the patients (53.8%), surgically treated for symptomatic aneurysm, have some degree of hypopituitarism after one year. Isolated hormone deficit is dominating, most often it is the growth hormone and cortisol. Hormonal screening is suggested to be done after 3-6 months in clinically clear patients, and after a year in all other patients, regardless of the presence of symptoms and signs of the illness.

Keywords: spontaneous subarachnoid hemorrhage (SAH), aneurysm, hypopituitarism

099 Pediatric neuronterventional procedures: an update

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Introduction. Safe endovascular treatment in children presents a unique challenge due to the size and fragility of the access blood vessels, as well as the particularity of the cerebrovascular pathology of the pediatric population. Although complication rates for neurointerventional procedures in children have not been precisely determined in the literature, endovascular

treatment in pediatrics is performed with materials and devices used in the adult population.

Material and methods. A retrospective analysis of the prospective database between 2007 and 2021 of the UKCS Department of Neuroradiology, as well as of children treated at the University Children's Hospital Tiršova, was performed, creating a cohort of pediatric patients who underwent endovascular treatment of various vascular malformations and tumors of the head, neck and spine.

Results. Our cohort included intracranial arteriovenous malformations (AVMs), intracranial arteriovenous fistulas (AVFs), intracranial aneurysms, vein of Galen malformations (VGM), extracranial AVMs and AVFs, spinal AVMs, head and spine tumors, acute ischemic stroke. A total of 5 intraprocedural and 1 postprocedural complications were recorded, 3 of which were accompanied by a permanent neurological deficit.

Conclusion. With the technological progress achieved in recent years, endovascular treatment of complex pediatric diseases of the brain, spinal cord, head, neck and spinal column is possible, with acceptable morbidity and mortality. Treatment of the pediatric population should be centralized in institutions with sufficient experience in endovascular treatment of adults and children.

Keywords: neurointervention, pediatric, vascular malformations

100 Endovascular treatment of extracranial carotid artery disease- experience from University Clinical Center of Serbia

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Introduction: Carotid artery stenting (CAS) has become a standard alternative to surgical treatment of patients with hemodynamically significant carotid stenosis. Purpose: The aim of this study was to evaluate the results of endovascular therapy on the treatment of carotid artery stenosis.

Materials and Methods: According to literature recommendations respecting the indications for CAS, starting from June 2006 to October 2022 at Clinical Center of Serbia more than 1000 patients with carotid artery stenosis underwent CAS (31% had restenosis after carotid endarterectomy, 7% patients had surgically unapproachable lesions, 2% were treated after radiation therapy, and more than 50% of the patients were with severe coronary or pulmonary disease). There were more asymptomatic, than symptomatic patients. Because of anatomical reasons we didn't finish the procedure in approximately 2% of patients.

Results: The overall rate of in-hospital adverse events (transient ischemic attack, minor stroke, major stroke, myocardial infarction, and death) was less than 4%. Implanted carotid stents open and closed design, and dual layer stents depending on the type of the lesions, with mandatory use of cerebral protection devices. Conclusion: CAS seemed feasible and relatively safe in our experience. CAS is the method of choice in the treatment of carotid disease in appropriately selected patients with a selection of the optimal material. Identifying complications during endovascular treatment of carotid stenosis, and the possibility of their solution is conditional upon the learning curve, experienced operator and the number of procedures performed in the specialized centers.

Keywords: extracranial carotid artery, endovascular, carotid artery stent

101 Applied artificial intelligence in the spine biomechanics

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Main applications of Artificial Intelligence (AI) and Machine Learning (ML) algorithms related to the spine are the localization of vertebrae and discs in radiological images, image segmentation, computer-aided diagnosis, prediction of clinical outcomes and complications, decision support systems, content-based image retrieval, biomechanics, and motion analysis. Machine learning algorithms have been used for automatic segmentation of regions of interest (vertebrae, discs etc.) as a step towards a decision support system for spinal problem diagnosis.

The results for segmentation show high accuracy both on sagittal and axial view images, with possibilities for improvement. Finite element analysis, performed on a 3-dimensional model automatically created from scans using ML, for a healthy and herniated disc, can provide an additional insight into the processes and different effect of the herniated disc onto the spine (i.e. back pain). A computer diagnostic system can be helpful in generating diagnostic results in a short time. In addition, the accuracy of the diagnosis can be increased and human errors caused by consequences of being tired and exhausted and possible visual errors of the non-experienced radiologist can be eliminated.

The effects of elastic modulus equations on the biomechanical behavior of the finite element spine model by taking the range of angular motion, stress, and strain responses into account have been investigated. Finite element analysis tools have been used to develop an accurate human lumbar spine biomechanical model to analyze its mechanical behavior.

The presented approach will open a new avenue for a computer diagnostic system which will be helpful in generating diagnostic

results in a short time and full application of new modeling approaches for studying the biomechanics of the spine.

Keywords: artificial intelligence, spine, machine learning

102 Hormonal changes in neurotrauma syndrome

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Acute brain injuries are associated with high mortality rates and poor long-term functional outcomes. Whether it occurs as part of polytrauma or in isolation, the injury leads to a local reaction of the damaged tissue and a general reaction of the uninjured part of the organism. These protective reactions of the organism aim to preserve the homeostasis that has been disturbed by the trauma Traumatic and trauma-induced ischemic brain lesions often result in more extensive damage than similar injuries to other organs. This indicates the importance of preserving the integrity and function of the CNS, and thus the central mechanisms of regulation of the body's general response to injury. In accordance with its integrative and regulatory role, the central nervous system connects the regulatory bases of the interaction peripheral organs-CNS-peripheral organs. Metabolic and functional changes in the CNS that occur as a result of peripheral tissue trauma significantly influence the course and outcome of both local and general reactions.

We conducted a prospective clinical study in which we monitored changes in hormonal indicators: TSH, T3, T4, cortisol, testosterone and prolactin in the blood of injured people with direct and indirect neurotrauma. By comparing the dynamics of changes in the above indicators in patients with and without direct head injury, we evaluated their specificity and usefulness in assessing the course and outcome of direct neurotrauma.

There is a regular fluctuation of the hormonal status both to indirect and direct neurotrauma. Immediately after the injury there is a drop in T3 immediately after the injury, in indirect and severe neurotrauma, but not in mild neurotrauma. By monitoring the dynamics of this hormone, there is an equalization of concentrations in indirect neurotrauma (INT) and mild direct neurotrauma (MDNT), but there is a continuous trend of low concentrations in patients with severe direct neurotrauma (SDNT) - this has prognostic significance in terms of the most severe outcome, throughout the entire monitoring period. A similar thing happens with T4 hormone, with a significant increase in patients with SDNT, but only the significance of the difference in concentrations at the end of the follow- up period is registered for the SDNT group compared to control group (CG). TSH in the group of patients with SDNT has a consistent trend of low concentrations, with predictive significance for the most severe outcome.

There is a clear correlation between the severity of neurotrauma and changes in neuroendocrine parameters. The intensity of neurohormonal disorders may have predictive value in relation to the outcome. There is a significant association between the drop in TSH, T3 and testosterone and the severity of the injury. Cortisol concentrations fluctuate widely, but with a predictable rise in concentrations between days 5 and 7 in the SDNT group. Prolactin is the most sensitive marker of the severity of neurotrauma, both in terms of the severity of the clinical syndrome and the outcome of the neurotrauma. The results indicate that reactions in response to neurotrauma, during the early post-traumatic period, are amplified and propagated in an autocatalytic sense. Hormonal changes that occur in the brain as a result of an injury represent a set of closely related reactions that cause each other, modulate each other and in the form of a metabolic cascade at one point in their propagation lead to cell damage and death. These changes result in disruption of central regulatory mechanisms and disruption of the regulatory axis central nervous system - peripheral organs, which in conditions of combined injury to peripheral tissues and the central nervous system leads to deterioration of the body's general response to injury.

Keywords: neurotrauma, hormones, TSH, T3, T4

103 Reviving matrix for reconstruction of traumatic injuries to the peripheral nerves and spinal cord

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Aim: Guiding Regenerative Gel (GRG) and Anti-Gliotic GRG (AGRG) were developed to support axonal growth, overcome astro-glial scar barrier and serve as a regenerative and repair source for nerve tissue reconstruction.

Materials: Efficacy of GRG and AGRG for peripheral nerve (PN) and spinal cord (SC) reconstruction was evaluated: - in acute rat PN injury model and chronic rabbits (2 months post injury) PN injury model. - in rats on acute and chronic (1-month post injury) SC injury models.

Results: Peripheral nerve reconstruction *I- rat Model*: In vivo study on PN with massive nerve loss showed that GRG loaded into a commercial-collagen tube enabled massive growth of myelinated axons and continuation of axonal sprouting through

the tube to the distal part of the nerve in a 15mm long nerve gap in comparison with bridging with an empty tube. In a 6 months study, the GRG was shown to exhibit regaining of function to the paralyzed limb. *II- Chronic rabbit Model:* In a long-term (8 months) study on PN with massive nerve loss and reconstruction 2-month post injury (representing human condition: chronic, large gap), GRG and especially AGRG loaded into a commercial-collagen tube enabled massive growth of myelinated axons and continuation of axonal sprouting through the tube to the distal part of the nerve in a 25mm long nerve gap, enhanced significantly in comparison to bridging with an empty tube.

Spinal cord reconstruction: In a pilot study evaluating AGRG in promoting nerve regeneration following complete SCI (2 mm segment removal) the results showed AGRG to be efficient in regaining movement, conductivity and axonal penetration through glial scar barrier.

Conclusion: These results highlight AGRG potential to promote regeneration of nerve tissue.

Keywords: peripheral nerves, spinal cord, trauma, reconstruction

104 The impact of a robotic digital microscope on the ergonomics in a neurosurgical operating theatre

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The optical magnification of the intraoperative microscopes revealed another dimension in our understanding of neuroanatomy, enabling better visualization and dissection. Ergonomics is an emerging concept at the neurosurgical operating theatre, where neurosurgeons work under great concentration and frequently neglect their uncomfortable body posture. Work-related musculoskeletal disorders (WMSD) are becoming a widespread burden in the neurosurgical society. WMSD have a negative impact on the surgical performance and decrease the surgeons' quality of life. Here we present our single-center 2-month experience with the Aesculap AEOS® Robotic Digital Microscope (RDM) and prospectively calculating the REBA/Rapid Entire Body Assessment/ scores and comparing them with similar neurosurgical cases operated with a conventional operative microscope /OPMI/.

Materials and methods: For a period of two months at the Department of Neurosurgery of the University Hospital Pirogov, Sofia, Bulgaria, 41 consecutive patients were operated on using RDM. The REBA employee assessment worksheets were filled in prospectively to assess the ergonomics of the senior author /N.G./ while using the RDM and the OPMI in our center.

Results and Conclusion: The ergonomics during neurosurgical operations could be substantially improved with the implementation of the exoscope. For challenging cranial approaches, where the operator must frequently "look around corners" the exoscope has a major advantage compared with the OPMI – the REBA score is 2.6 times lower for the exoscope and reaching a low risk for WMSD. For spinal operations the neck score as part of the REBA score is 3 times lower for the exoscope.

Keywords: exoscope, robotic digital microscope, visualization in neurosurgery, ergonomics

105 Avanti neuroendoscopic technique

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Avanti Neuroendoscopic Technique - A 3 in 1 operative technique that combines the best of 3 treatment modalities namely - traditional burr hole, open craniotomy and endovascular middle meningeal artery embolization to effectively cure complex subdural hematomas (SDH) of varying ages (acute, subacute, chronic) with high risk of recurrence

Objective

Understand the pathophysiology of acute on chronic and subacute on Chronic Subdural Haematoma (SDH) formation and it's recurrence.
Describe a 3 in 1 Minimally Invasive Neuro-endoscopic technique – the 'Avanti technique', pioneered by the author, to prevent recurrences and effect a cure in complex SDH of varying ages.

Pathophysiology. Three processes are key to progression and recurrence of chronic SDH: fibrinolytic processes: recurrent hemorrhage due to reduced ability or inability to form solid clots (due to plasmin). Inflammation: neo or pseudo-membrane formation neo-angiogenesis with fragile leaky capillaries within pseudo-membranes encapsulating the chronic SDH resulting in fluid exudation & hemorrhage Three operation techniques in 1 advantage: avanti neuroendoscopy technique: Removing the solid, semi-solid and liquified clot, mass effect, inflammatory cells & molecules and fibrinolytic factors (Burr hole/ Craniotomy); Excision of fragile capillary rich, Neo or pseudo-membranes. This is important for preventing rebleed or exudate formation (Craniotomy); Cauterization of middle meningeal artery (MMA) branches (Cath-lab embolization of MMA).

Conclusions. Careful patient selection is essential for best outcomes. In simple homogenous chronic SDH, traditional single or double burr holes technique is usually adequate for a cure.

In complex cases like acute on chronic or subacute on chronic SDH with multiple neo-membranes, the 3 in 1 'Avanti Neuroendoscopic technique', can prevent recurrences and help achieve a cure.

Keywords: Avanti, neuroendoscopy, subdural hematoma

106 Complications in CPA surgery

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The "major" complications of such type of therapy are reviewed in the report. So- called "minor" complications won't be discussed in the presentation. It should be understandable that classification of complications into "minor" and "major" is very indicative. What surgeon calls "minor" complication, for example, deafness appearance in case of facial nerve decompression surgery due to damaged a. labyrinthine during dissection, may be very dramatic for a patient.

One of the most common approaches in neurosurgery is lateral suboccipital (retrosigmoid) approach. Unlike complex skull-base approaches demanding intensive drilling of bone structures, transposition and dissection of nerves and vessels, sinus suturing, etc., this surgical approach exists in armamentarium of practically each neurosurgeon.

Two groups of patients who had been operated on during the period from 2017 till 2021 inclusively are analyzed in the report. All the patients were primarily operated on without previous interventions. All of them were operated by the same surgeon. Group 1 consisted of 410 patients with cerebello-pontine angle tumors (predominantly schwannomas, meningiomas and cholesteatomas). The second group of 297 patients had hyperactive dysfunction syndrome of the cranial nerves. Minimal follow-up in the both groups of patients accounted for 10 months. Thus, late complications were considered what is especially important for rate of CSF leak.

The complications were divided into 2 large groups: the first group – complications associated with retrosigmoid approach; the second group – complications associated with manipulations on cerebello-pontine angle structures.

CSF leak was the most frequent complication associated with the approach. It made 5,6% in the group of patients with tumors and 7,7% in the group with MVD. Catastrophic vascular complications leading to ischemic stroke and residual deficiency arose in 26 patients with tumors (predominantly with firm meningiomas) (6,3%) and in 4 patients in MVD group (1,34%).

It's very difficult to classify complications directly associated with dissection on cerebello-pontine angle structures. Very often it is impossible to point up isolated vascular complications, nerves damages and traction injury of brain stem. A mechanism of neural structures ischemia is a cornerstone of any intraoperative complication in CPS surgery (on condition of anatomical maintenance).

Complications associated with petrosal superior vein appear more often in cases of microvascular decompression in patients with trigeminal neuralgia. Prosoparesis due to facial nerve traction appears more often in patients with hemi-facial spasm rather than vascular complications.

It's also very difficult to compare the surgical results of different types of tumors of this localization due to growth pattern and density of neoplasms. Vestibular schwannomas and petroclival meningiomas removal significantly differ from each other but surgical approach to these tumors may be the same.

The key to success in CPA surgery, apart from technical requirements, is precise anatomy knowledge in conditions of working in small area and tight arachnoidal space and also the surgeon's skills to work in narrow deep space. Such conditions may arise in neurosurgical divisions with big number of patients.

Keywords: CPA surgery, complications, CSF leak

107 Minor surgeries with major complications- myth or reality

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Various preoperative, intraoperative, and postoperative complications may be associated with the course of surgical treatment. Considering that peripheral nerve surgery mostly includes elective procedures, its complications are of great medical, socio-medical, and legal importance. Excluding the general complications, intraoperative complications during peripheral nerve surgery are extremely rare.

The aim of this paper was to analyze and describe most common complications associated with peripheral nerve surgery. A retrospective selected cases analysis with literature review was performed, which included series of patients treated due to peripheral nerve lesion at Clinic for Neurosurgery, University Clinical Centre of Serbia. Regarding the results, complications occurring during peripheral nerve surgery are very rare, while the direct intraoperative complications are extremely rare.

The complications related to surgery are more "surgeon-related" and should never occur in experienced subspecialist of peripheral nerve treatment. Some specific complications are associated with peripheral nerve tumor surgery, mostly associated with malignant peripheral nerve sheet tumor. Direct

injuries to the nerves during surgeries without targeting peripheral nerve pathology mostly occur when the nerves are not visualized due to a relatively small size or when the nerves are mistaken for vessels. The risk concerns those regions in which the peripheral nerves lie superficial and are exposed during surgery.

The procedures carrying the highest risk of iatrogenic intraoperative peripheral nerve injuries are usually performed by specialist other than neurosurgeons, including osteosynthesis, lymph node biopsy, varicose vein surgery, and inguinal hernia repair.

Keywords: peripheral nerve surgery, complications, iatrogenic injury

108 The initial personal experience in exoscopic aneurysm surgery

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Introduction. Exoscopes were recently introduced in neurosurgery, and there are only limited departments empowered by and taking advantage of this new generation of magnification technology. The visualization possibilities are gigantically improved as is the surgical workspace, however, with some limitations (the learning curve and the need for glasses in personal opinion). Cerebrovascular surgery is one of the most demanding neurosurgical subspecialties, and it is mostly dependent from magnification, thus being affected by every improvement to the visualization systems.

Aim. To describe the pros and cons of the exoscope use in aneurysm surgery and an impact it might have to the field of neurosurgery.

Material & Methods. The cases performed in one month trial period with the use of operative KINEVO microscope with exoscope function (Carl Zeiss, Germany) are reviewed to emphasize the advantages of a new visualization option, evaluate the known limitations, and recognize the flaws in real-life use. The experience from our institution is then compared to that from a more experienced environment with an ORBEYE exoscope (Sony & Olympus, Japan) to determine the long- term benefits.

Results. The use of exoscope in aneurysm surgery allows for better visualization and higher magnification, especially when using a big-screen display. The display has to be oriented directly to the lead surgeon, and the assistant may have a hard time if not positioned directly opposing the display, which may be overcome with the use of secondary display. Scrub nurse and observers (as well as the other audience) will embrace much better view of the surgery in the same 3D environment as the lead surgeon. Learning curve is easy to cope with, especially with an experience in video games, as previously proposed, however, senior surgeons might struggle with the system for a while, but the vast majority will turn out satisfied. Hybrid systems' exoscope advantages are limited when compared to the dedicated exoscopes. The hands-on training in experienced environment is strongly advised and beneficial.

Conclusion. Surgical exoscopes are here to stay. The benefits clearly overcome the flaws, especially when considering the young neurosurgeons' and residents' populations who are ready and prepared to take advantage of this novel surgical appliance. Training is positively affected by 3-dimensional display, especially for the observers who share the same view as the leading surgeon, as well as the understanding of the surgery flow by the whole surgical team.

Keywords: brain aneurysm, exoscope

109 Case: cervico-thoracic spine metastasis & vertebrectomy

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Case presentation of painful metastasis to cervico-thoracic spine with impending instability. Surgery for vertebrectomy and vertebral body replacement with instrumented fusion carves the way for a series of consecutive complications expediting functional impairment.

Keywords: spine, metastases, vertebrectomy

110 Complications of ventriculoperitoneal shunt

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Ventriculoperitoneal shunt (VP) implantation is one of the most common operations in neurosurgery, and is required to treat the majority forms of hydrocephalus. Unfortunately, complications related to VP shunt are not rare, and multiple revision operations are almost expected throughout a patient's life. Shunt malfunction may be due to multiple causes, including infection, obstruction, pseudo-cyst formation, bowel or bladder perforation, and incorrect position of ventricular catheter.

The most common cause of VP shunt malfunction is obstruction of the ventricular catheter, while infection is the second most common cause of shunt malfunction.

Despite continuous attempts to reduce the incidence of complications, such as programmable valves, improved sterile techniques with antibiotic impregnated catheters, shunt malfunction remains a significant problem, which often leads to multiple and costly hospital admissions. In this paper, the most common complications of VP shunt are discussed, with several case reports and review of the literature.

Keywords: Ventriculoperitoneal shunt; Shunt malfunction; Infection; Obstruction

111 Complications in cerebral bypass surgery

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Cerebral revascularization is performed in cases of occlusion of precerebral or cerebral arteries, as well as in cases of an auxiliary technique in treatment of complex aneurysms of the cerebral arteries. Unfortunately, the technique of cerebral revascularization is complex and requires constant training from the surgeon. In addition, no one canceled the learning curve when mastering this technique.

The most common complications during such surgery are dysfunction of the created bypasses, which leads to ischemic complications, as well as bleeding from the created bypasses. Rarely, necrosis of the skin flap occurs.

Skin flap necrosis occurs twice often when both branches of the superficial temporal artery are harvested, because the skin flap undergoes devascularization. The treatment of this complication is extremely difficult, and in case of necrosis of the skin flap throughout the entire thickness and over a large area, it requires to closure using the technique of displaced skin flaps. In some cases, a bone flap may need to be removed to heal the wound.

The next formidable complication is when the created anastomosis is thrombosed. Moreover, it's good if only the donor artery is thrombosed, but often thrombosis of the recipient artery also occurs. The area of ischemia is the greater, the larger of the thrombosed recipient artery. In case of thrombosis of the anastomosis zone, it is always necessary to try intraoperatively to restore blood flow through it. To do this, several sutures are removed from the anastomosis zone and the thrombus is removed. In case of successful recanalization of the anastomosis zone, a heparin (2-3 thousand units) can be injected intravenously.

In the case of usage of bypass and proximal or distal occlusion of the aneurysm, we always risk getting potential ischemic complications in the territory supplied by perforating arteries that can arising from the aneurysm. Calculating the location of the distal anastomosis place in case of arterial bypass relative to the aneurysm is very difficult. Location close to the aneurysm guarantees a high level of pressure in the perforating arteries arising from the aneurysm, but does not guarantee its exclusion from the blood flow. Location far from the aneurysm

guarantees its complete exclusion from the blood flow, but does not save from potential thrombosis of the perforating arteries arising from the aneurysm.

Bleeding from the created bypass can be both from the anastomosis zone itself and from the holes from the lateral branches on the trunk of the donor artery. To prevent such complication, it is necessary to observe congruence when creating an anastomosis, as well as carefully coagulate the lateral branches arising from the trunk of the donor artery.

A rare complication is compression of the created bypass during wound closure. For example, tight tightening of the dura mater around bypass, or compression of the bypass by bone flap, or compression during suturing of muscles and aponeurosis.

Careful performing of all stages of the operation will avoid complications.

Keywords: cerebral bypass, surgery, complications

112 The immediate care of suspected spinal injury in the field

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Spinal cord injury is one of the most serious injuries seen in military conflict. Significant advancements in the treatment of spinal cord injury (SCI) were developed in the setting of military conflict. In particular, moving and handling principles including spinal immobilization and maintenance of cervical alignment

are especially important. Additionally, rapid referral to a multidisciplinary care facility with appropriate rehabilitation services is essential for optimal outcome.

During early stages of an injury, immediate diagnosis and management is key to minimizing further neurological damage and development of secondary complications. The first aid, emergency treatment and early treatment of spine trauma are introduced separately in three levels. In Level I facilities, the fast and accurate evaluation of spine trauma followed by fixation and stabilization are recommended during the first-aid stage. Re-evaluation, further treatment for possible hemorrhagic shock, dyspnea and infection are recommended at Level II facilities. At Level III facilities, it is recommended to strengthen the intensive care and the prevention of urinary system and lung infection for the wounded with severe spinal injury, however, spinal surgery is not recommended in a battlefield hospital.

Spinal cord injuries (SCIs) are complex neurotraumatic wounds affecting military Service members, their families, Veterans, and the general population. These are serious injuries with long-term consequences requiring lifelong care.

Keywords: spinal cord, injury, immediate care, battlefield

113 Intradural spinal tumors: surgical considerations and institutional experience

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Introduction. Intradural extramedullary tumors comprise schwannomas meningiomas and neurofibromas, while intradural intramedullary tumors include astrocytomas and ependymomas.

Objective. Evaluating the effect of surgical treatment on the symptoms – quality of life

Patients and methods. Retrospective analysis of the patients with intradural spinal tumors operated in UHC Sisters of Mercy from 2012 to 2021. Preoperative patient evaluation includes pain evaluation using VAS and evaluation neurological deficit (sensory, motor and sphincter deficit). Surgical procedure was done using prone positioning, X-ray evaluation, intraoperative evoked potentials, laminectomy, laminoplasty, hemilaminectomy and fusion.

Conclusion. Postoperative reduction of pain and neurological deficit was achieved in all patients. Histological type of the tumor has no impact on pre and postoperative neurological status and pain. Advanced age has not been shown to be a contraindication for surgery.

Keywords: intradural tumors, spine, quality of life

114 Anterior cervical approach for the treatment of cervical myelopathy

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Cervical spondylotic myelopathy is the most serious consequence of the degenerative changes of the cervical vertebrae. There are variety of surgical approaches in the management of cervical myelopathy.

The choice of the best surgical option for any patient requires the surgeon to be aware of the advantages and disadvantages of different approaches. Dorsal approaches were dominant until the 1950s, when ventral approach was developed and has become standard neurosurgical procedure.

As with any operation, the successful outcome ultimately depends on the surgeon`s judgment, experience, and patient selection.

This report discusses the surgical anatomy and surgical technique for decompression of cervical spinal canal by anterior approach.

Keywords: cervical myelopathy, anterior cervical approach, decompression

115 Surgical specificities of the cervicothoracic part of the spine

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The direct influence of the functional and anatomical complexity of the transitional regions of the cervical spine on the development of adequate surgical approaches is the result of the interconnection of structural components such as nerves, vascular and bone-ligaments. Spinal stability, which can be seen through dynamic and static stability, directly affects the maintenance of neurological stability in these regions. Achieving good stability of the spinal column in the transitional regions of the cervical spine is directly involved in the correction of neurological stability. Every change in the bone-ligament part leads to a functional load and the initiation of adaptation mechanisms aimed at maintaining neurological stability.

The surgical approach itself is directly dependent on the anatomical specifics of the cervico-thoracic spine. In addition, it is influenced by the pathological process affecting the appropriate region, as well as the number of pathologically altered segments of the cervical spine.

The cervicothoracic spine is composed of a number of segments that influence its static stability. Its dynamic function is significantly smaller compared to the dynamic function of the cervico-occipital junction. The static part of this segment extends to several thoracic vertebrae and several cervical vertebrae, so that the segment itself could extend from Th3 to C5. What is fundamental regarding this particular segment is that the disturbance of static stability leads to disorders and neurological stability. The anatomical specificity of this region requires that a surgical approach ensuring adequate static and neurological stability must achieve stability in at least two, if not three, columns of the spine. It is therefore very often necessary to apply a combined anterior and posterior surgical approach, in order to achieve adequate correction of the anterior column and static stabilization of the posterior and lateral columns. This approach is primarily related to the processes that led to the destruction of the C6 and C7 corpuses. Due to their localization, pathological changes in the Th1,2,3 segments are predominantly managed by applying the posterior operative approach. The need for corpectomy and removal of the pathological substrate with adequate replacement of the vertebral body in this localization should be done by bilateral removal of the costovertebral articulation and by replacement of the vertebral bodies, with simultaneous posterior stabilization and correction of static stability. The application of a corpectomy in this region with the opening of the thorax from

the front is not always sufficient to perform a 3D reconstruction of the affected region. This region requires multisegmental stabilization of the cervico-occipital part, at least from Th3 to C5.

However, their dynamic function must in some cases be eliminated due to the need to form static stability of the cervico-thoracic junction and ensure good neurological stability. The basic surgical principle for this region is achieving good neurological stability as well as good static stability by applying cervico- thoracic stabilization, even at the expense of dynamic stability of the region. The achievement of lasting neurological stability is directly dependent on the selection of appropriate surgical approach.

Keywords: cervicothoracic spine, surgery, stability

116 Skeptical approach to the spine surgery

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Aim: Elaborate new approach for treatment in patients with spinal cord or nerve roots compressive syndrome.

Materials and methods: We analyzed the results of the treatment in 581 pts., where admitted in our private hospital due to the compression of the spinal cord or of the nerve roots. 394 pts. (68%), where male and 186 (32%) female. 33- 84 y/old. The cause of the compression it was as follow: degenerative changes 400, epidural tumors 20, subdural tumors 5, epidural hematomas 3, epidural AVM 2, fractures 35, infections 10, disc hernia 79, synovial cyst 20, heredity 3, irregular growths of soft tissue 2, lipomatosis 1, Hirayama disease 1 pts. 479 pts had surgical treatment and 102 with conservative treatment.

Results: 3 pts were deteriorated neurologically post operative, recovery period 1-2 years (sign of ischemic problem during the surgery). 3 pts with post operative CSF leaking (Conservative treatment). 105 pts with implants fusion were re- operated in order to remove the implants (6 months-6 years). 8 patients had post operative infection (antibiotics for 3-6 months. 2 of them re-operated, removing the implants). 80 pts had 2nd surgery in adjusted segment. 290 pts declared satisfy from the treatment. 102 pts with conservative treatment declared satisfy.

Conclusions: The compression of the spinal cord or of the nerve roots is the consequence problem from different disease. The main cause of that is the degenerative change of the spine, especially in age 60-70 y/old. If the spinal cords and nerve roots compression are in stage II and III, the gold standard of treatment is the surgery. The age is not contra-indication for surgical treatment (without operation the patient will stay on the wheelchair until his death). The key of the success in spine surgery is including in the conceptual approach that means 5 R: right patient, right diagnose, right treatment, right surgery, right follow up.

Keywords: spine, surgery, compression

117 Efficacy of surgical treatment for degenerative cervical myelopathy

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Introduction. Treatment options for degenerative cervical myelopathy (DCM) are the topic for discussion due to lack of controlled randomized prospective study. Also, the natural history of DCM is unpredictable and efficacy of surgical decompression is still controversial.

Methods. Fifty-nine patients with symptomatic DCM were enrolled in this single center prospective study, at the end of follow-up period of 12 months, 50 patients were analyzed. All patients were operated, surgical decompression was performed by anterior or posterior surgical approach. Outcome evaluations were obtained preoperatively and 12 months postoperatively by using outcome measures: the modified Japanese Orthopedic Association (mJOA) scale, the Nurick score and the Neck Disability Index (NDI). Functional recovery ratio was calculated postoperatively by using the formula of Hirabayashi.

Results. According to our results, significant improvements were detected in all outcomes variables (mJOA score, Nurick score and NDI). Also, statistically significant improvement was observed in all three categories of patients according to preoperative mJOA score (mild, moderate, severe). Twenty-three (46%) patients had satisfied functional recovery, while twenty-seven (54%) had unsatisfied functional recovery rate.

Conclusion. Surgical treatment of DCM is a very effective and resulted in a significant improvement in all outcomes measures for a 1-year follow-up period.

Keywords: degenerative cervical myelopathy, surgery, outcome

118 Surgical challenges of solving adult scoliosis

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Adult scoliosis is a term that refers to all forms of scoliotic deformity in adults, regardless of whether the deformity occurred before or after bone maturity.

Adult idiopathic scoliosis (AdIS) is a type of deformity of unknown origin that arises during bone growth and continues with progression and degenerative changes during life. Symptomatic AdIS presents a challenge for the surgeon in terms the direction of correcting the deformity in order to help with pain relive, functions, aesthetic appearance and quality of life.

Numerous classifications have helped to differentiate the type of deformity into categories that can be compared and analyzed radiographically as well as clinically. Operative management and outcomes have been reviewed in recent decades to determine an adequate surgical approach based on clinical and radiographic parameters.

Despite everything, further research and comparisons are necessary.

This paper presents our experiences in the treatment of AdIS with challenges in the of correction difficulty with reference to the patient's sagittal balance which determines the levels of instrumentation and fusion, the need for various types of osteotomies of the spinal column, occurrence of surgical complications, amount of blood loss as well as duration of surgical intervention.

Keywords: scoliosis, adults, surgery

119 DREZ operation for intractable pain after spinal cord injury

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Paraplegia due to spinal cord trauma is one of the most devastating injuries in human pathology. Even more severe than the paraplegia itself is the one accompanied with the persistent, incapacitating, posttraumatic neuropathic chronic pain that occurred in 10 - 30% of injured. The loss of the motoric transmission is the one and obvious sequel of the injury. However, the loss of the sensory inflow is the other, although less obvious, consequence of such injury termed as the process of deafferentation. The interruption of the sensory inflow results in readaptation of the previously balanced and integrated sensory system that is still not well understood. Some of those changes might result in its mysterious consequence – chronic, unbearable neuropathic pain that could have different forms of the expressions with respect to its rhythm, topography, and quality.

Neuropathic pain appears as separate and independent phenomenon, the illness by itself, and it represents the unique treatment challenge for the patient and his physician. The underlying neuropathic mechanism of the pain is being of utmost importance for the decision of the pain treatment. Particularly, when consider the DREZ operation – the functional, ablative procedure performed in the cord dorsal horn that is hazardous surgery that could successfully relieve pain as well as it might failed. The operation could be successful only if it interrupts the neuropathic mechanism of the pain - thus the understanding of the mechanism of the pain plays a crucial role in determining success of the DREZ operation, and selection of the patients for DREZ surgery. The prediction of the pain mechanism based on the subjective sensory pain expression proved to be of utmost importance for the codifying the indications for the DREZ operation.

The pain of intermittent rhythm, mechanical sensory quality on confined territory proved to be most responsive on the DREZ surgery. The pathophysiology of the pain, its clinical expressions, the selection of the treatment modalities and indications for the DREZ Operation are discussed.

Keywords: spinal cord injury, intercostal pain, DREZ operation

120 Management of neurotrauma in low resource settings

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With a very large populations and too few Neurosurgeons Neurotrauma has been a major challenge. 84% of TBI Surgery is required in LMICs, and 78 % of Spinal Trauma is required in Lower- and Middle-Income Countries.

The role of Prevention awareness was realized and this was used as a tool to help in reduction of Neurotrauma.

A Neurotrauma Registry is being set up so that statistics are available to convince the government and public on taking Preventive measures and making rules.

It was realised that developing an ambulance service, improving Emergency care is need of the hour. And so, a concerted effort is being done on this front. Guidelines are being made to try and train doctors in the periphery and the Neurosurgeons to work according to a uniform protocol. These guidelines have now been tested in Columbia and will be peer reviewed soon.

Since ICP monitoring is not carried out commonly in most low resource settings, so ways on how to manage neurotrauma and how to improve outcomes have to be looked at. Also, rehabilitation of Neurotrauma patients is not available, so ways and means have to be seen to improve that.

Keywords: neurotrauma, management, low resource

121 Austro-Hungarian medical services in the Isonzo front- a glance at the past

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In the descriptions of military operations, battles and weaponry, the military medical service during the Great War is a frequently neglected topic. Care for wounded warriors has been an issue since the beginning of warfare. Military medicine grew in importance in the Napoleonic era and in the 19th century during the Crimean War as well as later with the establishment of the Red Cross organisation. Because of the new weapons, the nature of wounds and injuries changed during the First World War. Accordingly, new surgical techniques and treatments were developed.

There was a need for immediate treatment, transport and evacuation of great numbers of injured. Many of the improvements and innovations in military medicine also became indispensable in peace-time medicine and were the basis for further development. The major military conflict on Slovenian soil was the Isonzo front (Soča front). At no other time in history was this area burdened with so much weaponry as at that time. Alongside the suitable organisation and supply of material and troops, warfare also demanded the efficient transport of injured and sick soldiers to the rears.

This overview focuses mainly on the Austro-Hungarian army, although other combatant armies used similar medical services.

Keywords: Isonzo front, medical services, military medicine

122 Gunshot-induced radial nerve injuries: series of cases with literature review

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Gunshot wounds to the upper extremity result in complex injuries presenting a treatment challenge and requiring a multidisciplinary approach. Radial nerve lesions consequent to gunshot injuries are more common compared to other major nerves in the arm, and when occur must be assessed properly. According to an electrophysiological study, these injuries are similar to those caused by other trauma, regarding the level and completeness of nerve injury, as well as nerve involvement. Therefore, knowing the exact mechanism of their evolution in terms of direct nerve injury or indirect due to humeral shaft fracture or posttraumatic fibrosis is necessary for following the appropriate treatment protocol. (Figure 1-3)

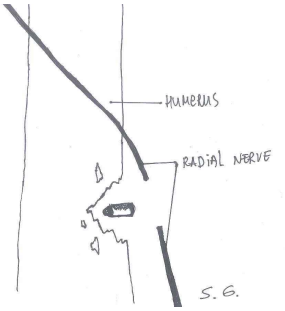

Figure 1. Schematic view of the direct radial nerve injury

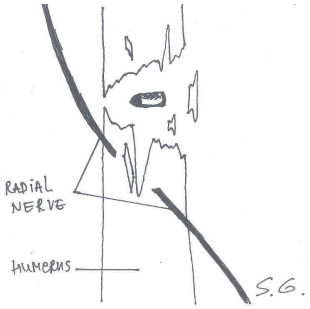

Figure 2. Schematic view of the fracture induced radial nerve injury

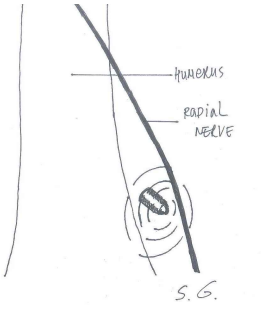

Figure 3. Schematic view of the radial nerve injury due to shock wave of posttraumatic fibrosis

In this paper we presented a series of 42 cases of gunshot-induced radial nerve injuries treated at the Clinic for Neurosurgery, University Clinical Centre of Serbia during a 30-year period. Treatment procedures included neurolysis and nerve grafting. Motor recovery was assessed by examining the wrist extension using the Medical Research Council (MRC) muscle scale. In most of the cases the score was M3 and lower, which is worse compared to other major nerves in the arm.

Despite the similarities in preoperative examination, poorer radial nerve functional recovery was verified compared to the radial nerve injuries caused by different trauma. Further research is necessary to explain these outcome differences.

Keywords: gunshot injuries, radial nerve, recovery

123 'One thing led to another' complications after surgical treatment of craniofacial injury – case report

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Fractures of the frontal sinus occur in 5-12% of craniofacial injuries, and considering the localization and the great force required to cause them, they represent one of the most complex injuries, most often associated with injuries to nearby structures. The decision on surgical treatment is made after an examination and adequate diagnostic modalities. Regardless of the characteristics of the patient, the fracture or the method of reparation, surgical treatment often leads to complications that need to be recognized in time.

We present to you the case of a 28-year-old man who suffered injuries when he fell from a height of 7 meters at the workplace. During the initial examination at the Emergency Center, he was assessed at GCS 12, and due to deterioration at GCS 7 he was sedated and intubated. At the initial exam, signs of nasoliquorrhoea were seen. A CT scan of the head revealed a fracture of the anterior and posterior walls of the frontal sinuses, the right wall of the sphenoidal sinus, the roof of the right orbit, a lamellar epidural hematoma frontally and contusions of the brain frontobasally. Among the associated injuries, he had a fracture of the distal end of the left femur. The described injuries were treated surgically.

Postoperative CT scan of the head showed no signs of new lesions. On the third postoperative day, fever up to 38°C occurred, as well as an increase in inflammatory markers. After extubation, a lumbar puncture was performed, which showed meningitis as the first complication, treated for the next week with antibiotics. On the forty-fifth day after the injury, patient reported diplopia, and signs of polydipsia and polyuria were observed. An ophthalmologist's examination revealed bitemporal hemianopsia and suspected paresis of the right upper oblique muscle. Suspicion of the appearance of delayed liquorrhoea was dispelled by a negative finding of β trace protein in fluid collected from nasal cavity.

Endocrinological expertise showed the presence of diabetes insipidus, central hypothyroidism, hypogonadotropic hypogonadism with preserved somatotropic function of the pituitary gland, which were treated by an endocrinologist. An MR examination of the head showed traction of the scarring base of the pituitary stalk to the right side towards the chiasm, which

was also pulled down to the right with signs of scarring gliosis. The presence of pseudomeningocele in the sphenoidal sinus was also shown and treated by ENT specialist. The patient was discharged home after 52 days of hospitalization with further regular follow-ups by a neurosurgeon and endocrinologist.

Complications of craniofacial injuries are most often insidious, involve multiple organ systems and must be recognized in time so that multidisciplinary management could provide optimal outcome for the patients.

Keywords: craniofacial injury, complication, endocrinology

124 Mechanical thrombectomy following mid-basilar artery thromboembolic occlusion - case report

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Background: Posterior circulation strokes are potentially devastating events that carry a significant risk of morbidity and mortality. Acute basilar artery occlusion stroke is a rare accounting for approximately 1% of strokes that needs emergent management. Early recanalization is crucial to achieve a good prognosis. Randomized controlled trials (RCTs) have demonstrated powerful efficacy of endovascular thrombectomy (EVT) for large vessel occlusion in the anterior circulation. The effect of EVT for acute basilar artery occlusion (BAO) in the posterior circulation has not been well studied and remains unproven.

Case: We report the case of a 76-year-old male who was admitted due to instability, speech difficultness and right-sided weakness. On the initial imaging computed tomographic (CT) revealed no any acute brain pathology and basilar dot sign as a direct sign of thromboembolic event, on the CT-angiography (CTA) acute mid-basilar artery occlusion was confirmed and CT-perfusion (CTP) showed cerebellar perfusion defect with large mismatch volume. The patient underwent mechanical thrombectomy (MT) using the Solumbra technique consisted of deployment of stent retriever distal to the clot with an intermediate catheter at the clot face with thrombus evacuation and complete recanalization and made immediate significant recovery.

Conclusion: It is possible to achieve excellent results with mechanical thrombectomy in acute basilar artery occlusion if timely diagnosis and reperfusion can be done to save the ischemic penumbra, and thus effectively improve the prognosis of patients, and reduce mortality.

We believe that the success in our case was a result of the prompt clinical diagnosis, good collateral circulation, fast access to the cathlab and early mechanical recanalization.

Keywords: mechanical thrombectomy, mid-basilar artery, thromboembolic occlusion

125 Spinal tumors: review of patients surgically treated in the MMA clinics for neurosurgery in the last seven years

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Spinal tumors are uncommon lesions and affect only a minority of the population. They can be divided into primary and metastatic tumors. Primary tumors are rare and represent 4 to 8% of all CNS tumors. Metastatic tumors are more common and usually originate from visceral organs. Regardless of their frequency of occurrence, these lesions can cause significant morbidity in terms of limb dysfunction and can be associated with mortality as well. Based on the vertebral level, they can be divided into cervical, thoracic, lumbar and sacral tumors. By their location within the spine, they can be classified as extradural, intradural- extramedullary or intramedullary. The most common primary spinal tumors are meningiomas, schwannomas and ependymomas.

In this article we will review cases of surgically treated spinal tumors in Military Medical Academy (MMA) from 2015 to 2022.

From January 2015 to November 2022 there were a total of 168 cases of spinal tumors surgically treated in MMA, of which 163 were primary spinal tumors and 5 were metastatic tumors. In terms of gender, 49,4% of tumors occurred in females (83 cases), and 50,6% occurred in males (85 cases). Average age of the patients at the time of operation was 55,04 years. In terms of vertebral level, in 33 cases (19,6%) tumors were located in cervical spine, in 69 cases (41,1%) thoracic spine was affected, 55 tumors (32,7 %) were localized in lumbar spine and only 11 tumors (5,6 %) were found in sacral spine. As for the localization within the spine, there were 58 extradural tumors (34,5%), 99 intradural- extramedullary tumors (59 %) and 11 intramedullary tumors (6,5%).

Among the patients with spinal tumors who were surgically treated in the MMA Clinic for neurosurgery in the past seven years, both genders were equally represented, most of the patients were middle- aged and elderly, thoracic spine was most

frequently affected and the most common were intradural-extramedullary tumors.

Keywords: spinal tumors, surgery, intradural-extramedullary tumors

126 Recovery of patients with peroneal nerve injury after surgical treatment – single center experience

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Introduction. In 2/3 of patients with peroneal nerve injury foot drop remains permanent and these patients are candidates for surgical treatment. Surgical options include various types of neurolysis (external, internal, intrafascicular), nerve repair (either by direct repair, nerve grafts or artificial conduits) and tendon transfers. Neurolysis was performed in cases with preserved continuity and reinnervation capacity, nerve repair when the nerve continuity was interrupted, but with preserved reinnervation capacity and TT when there was no reinnervation capacity. Although followed by extensive physical treatment, recovery after surgery in some patients may not be satisfactory.

Methods. During the period from January 2006 to December 2020 56 patients were surgically treated due to the peroneal nerve injury. Five of 56 patients (9%) had both peroneal and tibial nerve injury. Thirty-four patients (60%) were treated with neurolysis, 12 (22%) with nerve repair techniques and 10 (18%) with tendon transfer. Decision on the type of surgery which is going to be performed was individually tailored and depended on two factors: nerve continuity and reinnervation capacity. After finishing surgical treatment, patients were referred to the physical treatment. Recovery was evaluated with Medical Research Council Scale for Muscle Strength (MRC), residual pain with VAS of pain For Quality-of-Life evaluation, as an important part of recovery of these patients we performed: the Ulm Questionnaire, The Short Form (36) Health Survey, and Stanmore Questionnaire.

Results. Neurolysis was performed the least extensive nerve injuries and a motor recovery was achieved in 80%. Nerve repairs were followed by 58,33% of patients achieving M3+ recovery, while 41,66% recovered to the M4 or M5. All patients with tendon transfers achieved recovered to the M3+ and 66,7% to M4. Our results correspond to the results of previous studies. There was no statistical difference regarding the QoL in these groups. **Conclusion.** In terms of useful functional recovery and foot-drop related QoL there is an apparent advantage of neurolysis over nerve repair and tendon transfers, but these advantages decrease when involving all aspects of QoL.

Keywords: peroneal nerve; trauma; outcome; quality of life

127 Gliomas of the cerebellopontine angle – presumed origins, clinical presentation, management and the outcome

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Objective. Gliomas of the cerebellopontine angle are rare entities that were thought to arise as extensions from adjacent structures from the superficial part of the brainstem or cerebellum, or as primary tumors that develop from heterotopic glioneural islands present in the root entry zone (REZ). Considering their occasional occurrence and specific considerations of the anatomical region, literature discussing behavior, management, and overall survival is scarce. Therefore, we systematically reviewed relevant literature to carry out an integrative analysis of glioma cases and investigated the influence of different factors on these patients' outcomes.

Methods. We performed a comprehensive literature search of Scopus, PubMed, and Web of Science databases and reviewed references within selected articles per PRISMA guidelines using the search terms “glioma” “glioblastoma,” “astrocytoma,” and “cerebellopontine angle.” Data from the relevant articles including demographics, clinical features, neuroimaging, management, follow- up, and overall survival were extracted and statistically analyzed.

Results. Overall, the search strategy revealed 286 articles that met our criteria. After implementing inclusion criteria we identified articles describing in total 53 CPA gliomas. Sixteen patients (30.2%) belonged to the WHO grade I group, 4 (7.5%) patients belonged to the WHO II group, one (1.9%) patient belonged to the WHO III grade group, and 32 (60.4%) of patients belonged to the WHO grade IV group. The mean age of patients with glioma at admission was 30.0±25.9 years. Twenty-four (45.3%) of patients belonged to the pediatric group, and 29 (54.7%) to the adult group, with a slight male (52.8%) predominance. The most common presenting symptom was gait disturbance, 20 (37.8%), followed by headache, nausea, and vomiting in 15 (28.3%) patients, and hearing loss in 14 (26.4%) patients. In our patient cohort mean OS was 12.9 months. Reported origins of tumors were from the cerebellum in 19

(41.3%) patients, from cranial nerve REZ in 14 (30.4%) patients, and pons in 13 (28.2%) patients. Subtotal resection (STR) was achieved in 27 (56.2%) patients, gross total resection (GTR)

in 16 (33.3%) patients, and biopsy only in 5 (10.4%) patients. Twenty-one patient (43.7%) received radiotherapy alone, 12 (25.0%) patients received chemotherapy alone, and complete adjuvant therapy received 12 (25.0%) patients. Cox proportional hazard model and Kaplan-Meier testing in substratum of malignant gliomas identified preoperative hydrocephalus ($p<0.05$), chemotherapy ($p<0.01$), and radiotherapy ($p<0.001$) as factors that influence OS in patients with CPA malignant gliomas.

Conclusions. Due to the rarity of the tumors, understanding the factors influencing survival and optimal management of CPA gliomas is challenging. This paper reviewed to the best of our knowledge reported cases of CPA gliomas and identified factors that influence OS in patients, in particular with malignant gliomas that represent challenging lesions in the CPA, with preoperative hydrocephalus as a predictor of poor OS, and surgical resection together with adjuvant treatment regardless of the extent of resection to be the predictor of a better outcome.

Keywords: cerebellopontine angle; glioma; glioblastoma; overall survival

128 Neurological and radiological predictors of road traffic accident induced diffuse axonal injures: a single centre 6 months outcome analysis

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Purpose: Diffuse axonal injury (DAI) is often a severe form of primary head injury, condition defined as multiple, scattered, small hemorrhagic, and/or non- hemorrhagic lesions, alongside brain swelling with impaired axoplasmic transport, axonal swelling, and disconnection after traumatic brain injury (TBI). DAI has a topological predilection for focal involvement of certain sites in the brain on which pathohistological as well as radiological classification which is based on 3 grades depending on corpus callosum and brainstem injury involvement. The aim of this study was to determine prognostic value and correlation of Glasgow coma scale (GCS) score upon admission and radiological DAI grade with 6 months outcome based od Glasgow outcome scale (GOS) score in patients who suffered DAI due to road traffic accident (RTA).

Material and Methods: This research was conducted as a retrospective study at the Clinic of Neurosurgery, University Clinical Center of Vojvodina. All RTA DAI patients which were treated at this department in the past three years were retrospectively included. After neurosurgeon and radiologist radiological scores validation, comparison between scale performances as well as their accuracy in predicting patients' 6-months outcome by using Glasgow outcome scale (GOS) was made. We used receiver operating characteristic curves to analyze the correlation between all scales and outcome. We calculated the area under the curve (AUC) to determine the power of both scales while paired samples T test for dependent means was used to determine correlation between the scales.

Results: A total of 30 patients were included in the final analysis. Mean age at presentation was 33.2 (±13.5) years, overall mortality was 26.7%, average GOS was 3.3 (±1.7) and mean Glasgow coma score (GCS) was 7.4 (±4.5). Mortality was higher among patients with lower scores. The AUCs indicated that all scoring systems had similarly high discriminative power in predicting outcome/ death (GCS, AUC = 0.88/0.68, DAI radiological grade, AUC =0.77/0.65). High correlation was found between GCS and DAI radiological grade ($t=6.46$,

$p<0.00001$). Additionally, low GCS and high radiological DAI grade were identified as strong predictors of unsatisfactory outcome or/and death (all $p<0.01$)..

Conclusion: This study shows both the devastating consequences that DAI can have and expresses also the need for further analysis of admission factors and radiological characteristics on a larger sample in predicting outcome in order to develop an adequate treatment algorithm and clinical guidelines for the best outcome.

Keywords: diffuse axonal injury; classification; glasgow coma scale; glasgow outcome scale

129 Gunshot head injury. Management and outcome. Retrospective single center analysis

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Objectives: Study a group of patients with head trauma from gunshot injury and identify factors that could predict outcome.

Background: Head trauma related to gunshot wounds are rare in European countries in times of peace, although it happens in consequence of suicidal attempts, assaults and accidents. It is usually associated with poor outcome and high mortality rate.

Methods: Retrospective analysis of patients who were victims of head injury by gunshot wounds between January 2010 and

December 2021 at the Department of Neurosurgery, Egas Moniz Hospital, in Lisbon. All cases of gunshot wounds were caused by handgun. We analyzed demographic features (gender, median age at diagnosis), GCS at admission, entry and exit bullet holes, intraventricular trajectory, midline shift, basal ganglia injury venous sinus injury and outcome (GOS).

Results: 9 patients with head trauma from gunshot wounds were identified. 1 female and 8 males, with ages between 22 and 82 years old, mean age 42. 7 patients underwent surgery, 1 patient underwent conservative treatment and another patient initially managed conservatively, later was taken to surgery for bullet extraction. All patients were admitted in the ICU. 4 patients died and 5 patients survived. Midline shift > 5 mm was observed in 3 patients, 5 patients had intraventricular trajectory; and basal ganglia injury and venous sinus injury was noted in 1 and 2 patients, respectively. At admission they were examined in GCS 4 (n=3), GCS > 4 < 9 (n=5), GCS > 9 (n=1). 3 patients with intraventricular trajectory have survived. Mortality was observed in all patients with GCS 4, venous sinus injury or basal ganglia injury. In the group of patients that survived, 1 had severe neurologic deficits (GOS 2), 2 had moderate neurologic deficits (GOS 4) and 2 became independent with minor deficits (GOS 5).

Conclusions: Head trauma from gunshot is a devastating injury, nevertheless some patients can survive and have a good outcome. In this analysis low GCS at admission, basal ganglia injury and venous sinus injury were associated with poor outcome. However, the intraventricular trajectory was not clearly associated with poor outcome.

Keywords: gunshot injury, head, management, outcome

130 Influence of age of patients with mild traumatic brain injury on disturbance of consciousness and CT findings on admission

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Introduction: Worldwide, more than 50 million people suffer from traumatic brain injury annually. The largest number of injured is in the group with mild traumatic brain injury (MTBI), about 80%. Also, there is growing number of elderly injured persons.

Goals: Goals of this research were: comparison of differences of MTBI injured persons of different ages in relation to the disturbance of the state of consciousness and CT finding at the time of admission to the hospital.

Material and methods: This retrospective study included 150 injured persons with MTBI who were hospitalized at Clinical Center of Vojvodina Neurosurgery Clinic in the period from 01.01.2020. until 01.07.2021. Injured persons were divided into three groups according to their age, aged 18-30, second group 31-65 and third 66 or over. Groups were compared in relation to the disturbance of the state of consciousness of injured (evaluated by Glasgow Coma Scale) and CT findings (evaluated by Rotterdam CT score). Gender, mechanism of injury and use of oral anticoagulant or antiplatelet therapy were also examined.

Results: Statistical analysis showed that average value of the Rotterdam CT score in the group of injured persons aged 18-30 was 1.6; average value of the score in the group of injured persons aged 31-65 was 1.64, while in the group of injured persons over 65 years of age it was 2.36. The difference between the average score values between the over 65s and the other two groups is highly statistically significant.

Conclusion: Results of this study indicate a statistically significant difference in the average value of the Rotterdam CT score between the group of injured persons with MTBI aged 66 or over compared to the groups of injured persons aged 18-30 and 31-65, meaning that older injured persons have more severe injuries (higher Rotterdam CT score) while in all examined groups disturbance of consciousness on admission, evaluated by GCS, was practically the same.

Keywords: mild brain injury, trauma, consciousness, CT

131 Clinical and radiological predictors of the outcome of conservative therapy of patients with tuberculous spondylodiscitis

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Introduction/Aim. Tuberculosis is still a disease with high incidence. Out of all the diseased, 3-5% have a spine TB. The disease in its classical form has a characteristic but unspecified clinical picture, while the radiological methods are more sensitive in diagnosis. In Serbia, like in the rest of the world, records show the problem of late recognition which is the most common cause of complications and sequelae. The aim of the work was getting to the most important elements of early diagnosis regarding the predictors of spine TB, by analyzing of clinical, laboratory, and radiological parameters.

Methods. The study included a group of 21 patients affected by the spine TB treated at the Military Medical Academy in the

period 2005-2017, age averaging at 57,6 years. Diagnosis was made based on the clinical picture, laboratory, microbiological or radiological characteristics. We analysed these characteristics in detail and compared between groups divided based on attributes, and different modality of outcomes. We created a scoring system for easier quantification of symptoms at reception and at the outcomes.

Results. The score of symptoms at reception coorelate with the number of affected vertebrae. Erythrocyte sedimentation rate offers a discriminative value of the assessment of the type of involvement in the vertebrae, as in the scope of existence of skip lesions. Value of CRP have a discriminative value in the assessment of outcomes. Leukocyte count is linked with the neurological deficit at reception and is helpful in the assessment of outcome. The duration of the disease 60 days before hospitalisation is also linked with the outcome.

Conclusion. Initial values of CRP, leukocyte count, and the duration of the disease can all be useful in the assessment of the final outcome. Erythrocyte sedimentation rate is a potential marker of paradiscal involvement.

Keywords: tuberculous spondylodiscitis, conservative therapy, outcome

132 Comparative analysis of clinical and radiological presentation, surgical approaches, and operative outcome of brainstem cavernous malformation

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Clinical message: Regardless of the recommendation of using the intra-operative Navigation that suggested on the cases reported in the literature, a detailed understanding of the normal anatomy with its normal variations and anatomy of the pathology is still the bottom line for refining surgical skills to achieve a superior surgery for the patient who only cares about the perfect result.

Object: The aim of this study was to enhance the planning and use of microsurgical resection techniques for intrinsic brainstem lesions by better defining anatomical safe entry zones.

Method: 23 patients with deep brainstem Cavernomas without exophytic presentation treated at the Institute of Neurosurgery, Clinical Center of Serbia in Belgrade between 1998 and 2016, using 4 surgical approaches, each entry zone were chosen depends on Image guidance supports anatomical and radiological knowledge, ensuring a perfect trajectory to the lesion. Step wise dissections were exposed the brainstem surface through each approach.

Result: Six safe entry zones have been used for approaching lesions in the brainstem, including the Perioculomotor zone, lateral mesencephalic sulcus to the midbrain, trans middle cerebellar peduncle to pons, olivary zone, and lateral medullary zone to the medulla. A discussion of the approaches, anatomy, and limitations of these entry zones is included.

Conclusion: Due to its specific localization brain stem, cavernous malformation today presents a major challenge for neurosurgery to improve patient outcome and reflected in the avoidance of potentially adverse effects of treatment.

The right approach enhances maneuverability to work around with more than one angle is only can be done by good knowledge and experience of all different approaches.

Keywords: Cavernous malformation; Brain-stem; Pre-temporal approach; Retro- sigmoid approach safe entry zones.

133 The effects of low doses of corticosteroid therapy on the outcome and reoccurrence rate in patients with surgically treated chronic subdural hematoma

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Introduction. Chronic subdural hematoma (CSDH) is a collection of "old" blood and liquid bellow the brains outermost covering (the dura). The collection is surrounded by the membrane, and a self-perpetuating inflammatory process leads to the growth of the fluid mass. It is a common neurological disease with a rapidly rising incidence due to increasing age and widespread use of anticoagulation drugs**.** Minimally invasive surgical procedure performed through the burr-hole craniostomy (BHC) is the current standard practice for symptomatic patients, with a low general complications rate, but with a recurrence rate reaching up to 30%**.** Recently, several medical managements, and endovascular options were evaluated as a sole treatment option or as an addition to the surgical treatment in order to improve outcomes. Dexamethasone (DXM) is most frequently used corticosteroid drug in therapy of CSDH as an alternative, non-operative or adjuvant treatment modality with the potential to block the inflammatory pathways in the formation of the CSDH and can specifically impede the formation of neo-membranes and neo-capillaries by its powerful inhibition of inflammatory mediators. It can shorten the recovery period after

surgical intervention and eventually resolve potential reoccurrence. However, recently published clinical trial concluded that the DXM as a sole treatment leads to the fewer favorable outcomes when compared to placebo, and is not adequate for the use as a sole treatment of CSDH.

Aim. To estimate the effectiveness of low-dose DXM therapy in preventing recurrence in patients with chronic subdural hematoma after surgical treatment.

Material and method. In the 5-year study period, from January 1st 2016 to December 31st 2020, 117 patients with CSDH received a surgery for CSDH at the Clinic for Neurosurgery in Military Medical Academy in Belgrade, Serbia, and iatrogenic cases (e.g., after insertion of VP shunt) were not considered. Twenty- six patients received a low-dose DXM treatment (two doses of 7 AM and 1 PM,

for 21 days, according to the scheme: 2x2mg for 7 days, 2x1mg for 7 days, and finally 2x0,5mg for 7 days) in addition to the usual surgical procedure, while the remaining surgically treated patients were only advised to take symptomatic treatment after surgery. The patients were followed with computerized tomography 7 days after DXM seize, and once again after 1-2 months. The complete follow up lasted for six-months.

Results. In the series of 26 cases, there were 17 male and 9 female patients. One patient died during six-month follow-up. Among other 25 patients relapse rate was below 2%. In our institutial experience, the reoccurrence rate was 7%, while previously published reported reoccurrence rates ranging from the 2 to as much as 34% of cases, depending on the surgical and augmentation methods, as well as the follow up period. No other complications were noted in the study group.

Conclusion. Dexamethasone in lower doses, is safe, and may be effective to lower the reoccurrence rate among patient who undergo minimally invasive surgical treatment for CSDH, without additional morbidity or mortality, and therefore, positively impact the treatment outcome.

Keywords: chronic subdural hematoma, corticosteroids, outcome

134 Epilepsy and arterio-venous brain malformations

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Given the complexity of the anatomical structure of AVMs, their localization and the functional importance of the surrounding brain, the current dilemma of neurosurgeons is the choice of optimal AVM treatment due to the impossibility of adequately assessing the risk of certain therapeutic methods in relation to the natural course of untreated brain AVMs. Brain AVMs initially presented with epileptic seizures cause particular confusion because clinical results have shown that in over 20% of cases, the epileptic seizure focus is not only at the location of the AVM, but is independent of it and it is located in the opposite hemisphere of the cerebrum. This kind of finding indicates that it is not only the complexity of brain AVM structure that is a factor in the choice of treatment methods. The congenital origin of brain AVM and the pathophysiological phenomenon of "blood theft" make it difficult to find a unique treatment protocol, which opens up the dilemma of whether a surgeon can fit an individual case into a whole.

Epilepsy as the initial symptom of brain AVM is in the majority of cases, the 93.3% presented with GM type, and in 73.3% of cases had a good therapeutic response to one of the antiepileptic drugs. In 26.7% of cases GM seizures were controlled by a combination of several antiepileptic drugs. In 26.7% of cases, epileptic seizures alternated with bleeding, with an immediate annual risk of 0.14%. Poor control of epilepsy is accompanied by a decrease in life and work capacity. The age of the patient at the time of diagnosis of AVM initially presented with epilepsy had no influence on the frequency and type of attacks as well as on the therapeutic response. The results of surgical treatment did not favour surgery as the method of choice for the treatment of epilepsy in brain AVMs.

Good medical control (drug therapy) of epilepsy supports the view that there is no need for urgent surgical treatment of brain AVMs, so we can generally conclude that brain AVMs are more benign lesions compared to a wide range of neurosurgical diseases, which requires a patient and strategically well-processed therapeutic approach.

Keywords: epilepsy, arterio-venous brain malformations, treatment

135 Neuroethics and controversies of contemporary neurosurgery

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Background. Modern neurosurgery is characterized both by technological advances and increasingly complex ethical dilemmas. Implementation of modern technology into diagnosis and treatment of nervous disorders may cause alienation between a neurosurgeon and his patient.

Methods. The study identified ethical issues that arise in use of various technologies for diagnosis and treatment of skull, brain and spinal cord lesions.

Results. Most frequent ethical dilemma was making a fetish of visual data (especially CT and MRI images) while ignoring

anamnesis, clinical status and patient's personality. It leads to degradation of clinical judgement, physician's dependence on technology and lack of his or her clinical skills (hyposkillia), and detrimental to doctor-patient relationship. The second dilemma is corruption or conflict of interests (which includes bribing patients in a public hospital, getting money from the industry for prescribing drugs, implantation devices, unnecessary surgical interventions etc.). The third dilemma is between sanctity of life and its quality, for example, chronic vegetative state or in minimal consciousness state ("life not worth living"). The fourth (and increasing) ethical dilemma is related to the so-called preventive neurosurgery in asymptomatic patients (e.g., clipping or coiling of unruptured aneurysms, stenting or surgery for stenotic carotid arteries, etc.). One has to find a balance between a risk of intervention and a risk of natural history.

Conclusions. Following measures to solve ethical dilemmas in modern neurosurgery are recommended: 1) to include education in ethics and analytical decision-making in neurosurgery training at all levels; 2) to increase general culture of neurosurgeons and allied specialists; 3) to continue basic research of neurosurgery pathology which would result into more humane methods of diagnosis and treatment; 4) to take care of a specialist (e.g. a neurosurgeon) by the society (including moral and material entitlement); 5) to evaluate all achievements of neurosurgery from humanitarian standpoint.

Keywords: ethics, modern technology, neurosurgery

136 Percutaneous Gasserian ganglion procedures with augmented reality headset: feasibility study on human cadaver

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Introduction. Trigeminal neuralgia is defined as sudden, usually unilateral, severe, short-term, shock-like, or recurrent stabbing pain attacks in the distribution of one or more branches of the trigeminal nerve, the fifth of the cranial nerves. Recent studies have stated that the lifetime prevalence of trigeminal neuralgia is approximately 0.3%. The percutaneous Gasserian ganglion procedures, rhizotomy and RF ablation are practical applications primarily performed under fluoroscopy. Augmented Reality (AR); is the visualization of two or three-dimensional virtual objects created in a computer environment in real-time, in a way that interacts with the real world directly or indirectly. Its use in the field of medicine is increasing. We designed an experiment in a cadaver to check the feasibility of the percutaneous Gasserian ganglion procedures with AR head-mounted display.

Materials and Methods. Cranial CT was performed by placing a marker in the neck region of a human cadaver. The cranium of the cadaver was three- dimensional modeled with the 3D Slicer, an open-source and free program. A line from the foramen ovale trajectory was applied to the cranium image created. The operation program was developed using the Vuforia Engine image target system inUnity. The program was run on an augmented reality headset Microsoft HoloLens 2, and Kirchner wire was sent by targeting the foramen ovale with AR guidance. (Figure 1)

Results. The programming on the computer took about 20 minutes, and the procedure took just 10 seconds. It was felt that the foramen ovale was passed in the first attempt. Cranial CT was performed for control, and it was observed that the K wire was passing through from the foramen ovale perfectly. (Figures 2 and 3)

Conclusion. AR guidance on percutaneous Gasserian ganglion procedures is very easy and a viable technique. It can be beneficial to learn and practice these techniques. Feasibility in humans should be studied by applying it to more human cadavers and with more than one user. AR technology can replace existing neuronavigation systems after software and hardware improvements.

Keywords: percutaneous Gasserian ganglion procedures, augmented reality, cadaver

137 Prognostic factors of descending necrotizing mediastinitis development in deep neck infections – a retrospective study

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Objectives. Descending necrotizing mediastinitis is the most serious complication of deep neck infections. The objective of this study was to find out main prognostic factors of descending necrotizing mediastinitis (DNM) development in deep space neck infections (DNI).

Methods. The study enrolled all medical data from patients who were admitted to Emergency Center of Vojvodina with the diagnosis of multispace DNI with DNM or without DNM either as the primary diagnosis or with discharged diagnosis after surgical treatment during 7 years period.

Results. After final analysis total of 141 charts were randomized for statistical analysis, 124 charts in DNI and 17 DNI and DNM groups. The main cause of infections in both groups was odontogenic. On multivariate regression analysis of collected data infection of retropharyngeal, pretracheal and carotid space, C-reactive protein, and procalcitonine values were statistically significant predictors for development of DNM.

Conclusion. Treatment and diagnosis of DNM requires multidisciplinary approach, with prompt clinical and radiological examinations including computer tomography of deep neck spaces, empirical broad spectrum antibiotic therapy and radical surgical approach and debridement. Miltispace neck infection and especially infection of retropharyngeal, carotid, and pretracheal spaces are the most sensitive predictors for development of DNM in deep space neck infections.

Clinical relevance. If the infection reaches from deep neck spaces to retropharyngeal, pretracheal and carotid space it is most likely that DNM will occur.

Keywords: Odontogenic infections, Deep space neck infection, Desceding necrotizing mediastinitis, Risk factor, Pharyngeal infection

138 Convolutional neural networking CNN based automated detection of meningiomas using Keras and Tensorflow on 2D MRI scans

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Objectives. Magnetic resonance imaging (MRI) is the method of choice to image meningiomas for detection and volumetric assessment, making MRI highly relevant for therapy planning and monitoring. A multiparametric deep-learning model convolutional neural networking using high level Keras with Tensorflow API on 2D MRI scans was used. Routine MRI data including images from diverse referring institutions to investigate machine learning performance in automated detection of meningiomas in comparison to manual was studied.

Methods. 60 of 128 consecutive preoperative MRI datasets [T1/T2-weighted, T1- weighted contrast-enhanced (T1CE), FLAIR of meningiomas that were treated surgically at our institution and graded histologically as tumor grade I (n = 43) or grade II (n = 17). The CNN based VGG-19 deep learning model was trained on a performance analysis of the proposed methodology and experiments were carried out using publicly available MRI images in cancer imaging archive dataset of 2289 slices from 212 subjects along with independent dataset (BRATS2015) of cases inclusive of 1149 of meningioma, 549 glioma and 591 of pituitary tumor cases. In the proposed model, contrast stretching technique and a deep neural network was employed for rich feature extract. The CNN used python based Keras and Tensorflow. Results were compared to manual detection by 5 radiologists in a consensus reading in FLAIR and T1CE respectively.

Methodology. It was a retrospective, experimental study.

Results. The CNN detected meningiomas in 56 of 60 cases. These learning features are combined with classifier models of CNN for training and validation based on high-quality brain tumor images collected from BRATS (Multimodal Brain Tumor Image Segmentation Benchmark). The proposed model has achieved 99.19% accuracy. Moreover, the proposed model obtained precision 99.22%, recall of 99.82%, and specificity of 99.47%, and 99.43%for meningioma. Further, automated detection correlated strongly with manual detection: average Dice coefficients were 0.79 ± 0.90 (range, 0.46-0.93)for grade I and 0.81 ± 0.06 for grade II meningiomas.

Conclusions. The CNN yielded accurate automated detection of meningioma tissue despite diverse scanner data and thereby may improve and facilitate therapy planning as well as monitoring of this highly frequent tumor entity.

Keywords: CNN, Artificial intelligence; Brain neoplasms; Machine learning; Magnetic resonance imaging; Meningioma

139 A case report on traumatic delayed epidural hematoma with atypical presentation

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Vertex epidural hematoma (EDH) is an uncommon type of EDH. The management of vertex EDH is a challenge for neurosurgeons, as there is no consensus on the proper treatment modality. Our patient had delayed clinical deterioration with the development of paraparesis and deep somnolent state. After an immediate head CT was performed, which showed massive delayed EDH at the vertex, the patient underwent an urgent operation. The postoperative course went satisfactorily with the complete withdrawal of all neurological deficits and control head CT scan showed complete evacuation of the hematoma. Vertex EDH represent an urgent neurosurgical pathology, which should not be diagnostically overlooked, and by need treated urgently in the operating room.

Keywords: epidural hematoma, superior sagittal sinus, trauma, dural tenting suture, epidural hemostasis

140 Military neurosurgery in imperial and soviet Russia

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Since 1798 military surgery was centered at Imperial Medico-surgical Academy in St. Petersburg (renamed Imperial Military Medical Academy in 1881, now the S.M.Kirov Military Medical Academy). Neurosurgery was viewed as an integral part of general surgery. However, Vladimir Bekhterev (1857-19270, a chair for nervous and mental diseases at the Academy, opened an operating theatre at the neurological clinic in 1897. He hoped that neurologists would eventually acquire surgical skills for treatment of neurological disorders similar to ophthalmologists and ENT specialists. Bekhterev's pupil Ludwig Pussep (Puusepp) (1875- 1942) became a privat-dozent (an associate professor) of surgical neurology in 1908 and in 1914 became a head of surgical neurology clinic the Institute for Psychoneurology. Next year it was transformed into the N.I. Pirogov First military lazarette for head injuries. Pussep authored a first Russian manual on surgical neurology in 1917.

Vladimir Shamov (1882-1962) is considered one of the founders of Soviet neurosurgery. He graduated from Imperial Military Medical Academy in 1908 and in 1931-1914 worked at the laboratory of experimental surgery headed by Harvey Cushing at Harvard University. In 1939 he was appointed ahead of First faculty surgery clinic of the S. M. Kirov Military Medical Academy. From 1947 to 1961, he was a director of the A. L. Polenov Leningrad neurosurgery Institute.

Another founder of Soviet neurosurgery was Nikolay Burdenko (1876-1946). In 1916 he organized a lazarette for peripheral nerve injuries in Zyrardow. He was a co-founder of Moscow neurosurgery institute (now the N. N. Burdenko National research center for neurosurgery) in 1932. Since 1937, he was a chief surgeon– consultant of Red Army. On August 1, 1941 he was appointed chief surgeon of Red Army. He advocated staged treatment of the wounded and establishment of specialized hospitals for head injuries during WWII.

During last decades the S. M. Kirov Military Medical Academy has been involved in specialized neurosurgical care in local military conflicts.

Keywords: military neurosurgery, imperial Russia, Soviet Russia

141 Expressed-depressed skull fracture: management and outcomes – case report

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A 22-year-old man was admitted to the Emergency Center of the University Clinical Center in Nis due to a severe head injury caused during a football match when he collided head-on with a teammate. Due to the impact of the tangential force on the epicranium, the frontal part of the skull was affected as well as the massif of the face, where you could locally see a bone defect on the frontal right.

The patient's state of consciousness on admission was variable, GCS 13, vital parameters stable. In the neurological condition, there was no pyramidal motor deficit. Diagnostic procedures included computed tomography (CT) of the brain with bone windows and 1-1.5 mm cross-sections and sagittal reconstruction significant for injury assessment. MSCT of the brain verifies a depressed multifragmentary fracture of the frontal bone parasagittally on the right involving the frontal sinus as well as a fracture of the roof and floor of the orbit on the right. Frontal right epidural hematoma 13mm thick and gas inclusions-pneumatocephalus. The patient was urgently prepared for surgery in the form of analyzes of biohumeral status (Glu 8.1 mmol / l, urea 7.1 mmol / l, Crea 109.5 mmol /, WBC 22.0 / L, RBC 5.21 / L, PLT 298 / L), screening of coagulation factors (prothrombin time 76%, INR = 1.2, aPTT 22.6). The injuries were surgically repaired, the epidural hematoma was evacuated, and the skull defect was reconstructed with prior plasticization of the dura to prevent CSF leakage in the frontal sinus. A titanium implant was used in the reconstruction of a multifragmentary fracture.

Keywords: expressed-depressed fracture, frontal-orbital region, epidural bleeding, multifragmentary fracture, defect reconstruction

142 Study of vascular-cerebral accidents (CVA) operated in Cameroon: case of the Yaoundé general hospital

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Neurotraumatology is by definition the description of trauma to the nervous system. Vasculo-cerebral accidents have developed in Cameroon in recent years. These strokes are mostly caused by

a schwannoma developing intradurally at the expense of a dorsal root.

This retrospective descriptive study of some cases of stroke in recent years in the Trauma Department of the Yaoundé General Hospital, has allowed us to analyse the realities of the diagnostic and therapeutic management of this pathology in Cameroon. Numerous problems were revealed through these cases, notably the lack of access to adequate diagnostic means and the insufficient number of neurologists in Cameroon. 90% of the cases of stroke recorded show that it always manifests itself in the form of a benign tumor that evolves very slowly and affects mainly young adults. However, it can be life-threatening in the case of a high cervical location, and above all, it can lead to potentially irreversible tetra or paraplegia. Early on, it is revealed by a radicular syndrome at the level of the lesion and late on by a true syndrome of slow medullary compression. Nuclear magnetic resonance imaging (MRI) of the spinal cord is the reference morphological examination. However, in the absence of MRI, myelography coupled with myeloscanner still plays a very important role in poor countries like ours. The main differential diagnosis is spinal meningiomas. Anatomopathological examination of the surgical specimen confirms the diagnosis. The radical treatment is univocal and surgical. The functional prognosis depends above all on the precocity of the treatment.

The multiplication of neurosurgery services throughout the country with specialized training and the popularization of advanced morphological diagnostic techniques would improve this situation. We reiterate the better quality of results of early surgery that would not be obtained without spinal cord MRI.

Keywords: Vascular-cerebral accidents, MRI, Cameroon, Neurotraumatology, Surgery

143 Simultaneous surgery of consequential bilateral foot drop after hip surgery – case report

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Introduction. Foot drop is rare, but serious complication of hip arthroplasty, occurring in up to 7,6%, according to the available literature. In majority of cases the exact cause of this complication is not identified. Risk factors include: revision and posttraumatic surgery, surgeon inexperience, multimorbidity. We present a case of patients who experienced consequential bilateral foot drop after separate hip arthroplasties.

Case report. A 56-years old male patient, with history of arterial hypertension and diabetes mellitus type II, was operated in 2016 and 2018, having total hip arthroplasty, which finally resulted in permanent bilateral foot drop. Considering clinical, radiological and EMNG findings, we decided to perform simultaneous surgery on both legs, planning external neurolysis and eventual nerve repair on the right, and two-tail tendon transfer on the left side, and surgery was done on March 4th 2019. Postoperative course went unremarkably and after sutures and plaster removal, patient went physical treatment for 3 months. Six months after surgery, MRC grade of grade of the right leg was M4/5, while he achieved M3/4 on the left. Pain was significantly resolved, and graded 3 for the right and 5 for the left leg, according to the VAS. Patient's general quality of life was improved significantly, reflecting his almost normal walk, and independency of the foot orthosis.

Conclusion. Persistent foot drop as a complication of total hip arthroplasty is rare, but has devastating impact on QoL and must be recognized in its early stage and patient should be referred to the specialized Centre, as soon as possible. Satisfactory recovery may be obtained for the chronic as well as for the recent nerve injury. However, this should not become a practice, but this case reflects the potential of nerve surgery.

Keywords: hip arthroplasty, complication, foot drop

144 Spontaneous subarachnoid hemorrhage: clinical presentation and outcome

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Spontaneous subarachnoid hemorrhage (SAH) represents the most common clinical picture of aneurysmal bleeding (about 75-80% of all SAH-s are of aneurysmal origin). Mortality is approx. 45%, and about 30% of patients have a serious permanent functional deficit. About 1/3 of patients have it late diagnosis, and this mainly refers to patients with "warning leak" and disturbance of the state of consciousness.

The observed group includes 137 middle-aged patients of both sexes (90 women and 47 men) aged 50.38±8.25 years, with clinically and neuroradiologically verified spontaneous subarachnoid hemorrhage and angiographically proven intracranial aneurysm. All patients were operated within 3 days of bleeding. Patients were clinically graded on admission according to the WFNS scale for spontaneous subarachnoid hemorrhages. The mean value of WFNS grade was 2.219±0.999, with Med=2 ($p<0.01$, $\chi 2=55.238$, DF=4). There were 123 (89,781%) aneurysms in the carotid arterial system and 14

(10,219%) aneurysms in the vertebral-basilar arterial system. In relation to the arterial system to which the aneurysm belongs, a statistically significant difference is observed in favor of aneurysms of the anterior carotid arterial system ($p<0.01$, $\chi2=82.054$, DF=1).

Treatment outcome was measured by the GOS (Glasgow Outcome Sore) scale. The mean treatment rating was 4.204±1.058 with a median of 4 ($p<0.01$, $\chi2=11.34$, DF=4). Timely recognition of spontaneous subarachnoid hemorrhage, as well as its diagnosis and treatment, is of great importance.

Keywords: spontaneous, subarachnoid hemorrhage, outcome

145 Transorbital brain injury without eyeball injury

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Introduction. Transorbital penetrating brain injuries are rare in clinical practice. However, when they happen, they usually have great consequences on patients. Trajectory path of projectile or solid elongated tool may lead to intracranial injuries with vision damage and permanent neurological deficit. These injuries are usually easy to recognize. We report a case where transorbital penetrating brain injury happened under unknown circumstances, followed by delayed diagnosis and uneventful recovery.

Case Report. A 33-year-old male was initially brought to a local hospital, confused, agitated and giving an impression of alcohol abuse. At the first examination only a laceration of the upper left eyelid was noticed. There were no reliable data about injury circumstances beside the information that it happened at some fishing site where he lost conscience suddenly and woke up with eyelid injury. There was no history of any past illnesses and he was not taking any medication at that time. After the observation he was discharged. He came back the day after somnolent having paralysis of the right side of the body. He was hypotensive, having amnesia and vomiting. The patient was emergently transferred to the Department of Neurosurgery at the Military Medical Academy. After the admission computed tomography was conducted. CT scan revealed parasagittal subdural hematoma on the left side 7mm thick with no midline shift. There was an intraventricular hemorrhage in the left lateral ventricle. Contrast scan excluded any vascular malformation. A bone defect of about 1 cm was noted on the roof of the left orbit with a dislocated fragment indicating traumatic lesion. It was followed by soft tissue hematoma and edema in the left eye region. There were no traumatic lesions of the skull bones. The patient's neurological status was unchanged. He was somnolent, disoriented and confused. No vital functions were compromised. Pupils were unequal with left pupil dilated and slower pupillary response. There were no signs of cranial nerves damage. He had paralyses of the right arm and leg with no sensory deficit. An ophthalmologist was consulted for the eye examination. No lesions of the eyeball were noticed. There was only laceration with hematoma on the left upper eyelid why it was difficult to open the left eye. Ophthalmoscopy was normal with intact macula and no vascular changes. The patient was administered mannitol, triple antibiotic systemic therapy and local antibiotics and corticosteroids for the eye treatment. There was no indication for surgical treatment. One week later intracranial bleeding showed regression with clinical improvement of the patient status with persisting right-side paresis. According to available information, clinical examination and radiology findings we concluded that patient had a transorbital penetrating brain injury without eyeball harming.

Conclusion. Every orbital trauma should be carefully examined, regardless the first impression of superficial injury. The first neurological examination might be normal, but further investigation and cooperation of ophthalmologist, neurosurgeon and maxillofacial surgeon should lead to correct and timely diagnosis.

Keywords: Trauma, Brain injury, Transorbital

146 Intracranial aneurysms: morphological characteristics

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Introduction: Rupture of intracranial aneurysm is followed by high mortality and morbidity rate. In light of that, understanding natural flow of intracranial aneurysms requires understanding the mechanism of aneurysm rupture and identification of anatomical characteristics as predictive factors of bleeding.

Materials: 137 patients of both genders, that were treated in the Neurosurgery Clinic of the University Clinical Center of Serbia for subarachnoid hemorrhage caused by aneurysm rupture, were included in the study. We made comparative analysis of anatomical characteristis of the brain blood vessels and intracranial aneurysms, using angiographic and intraoperative findings.

Results: The form of aneurysm in important morphometric parameter. Bisaccular, elongated or irregular (multilocular) shape aneurysms have high risk for rupture. The mean value of the diameter of ruptured aneurysm was 12.066±7.630 mm, and of unruptured aneurysm 8.5±6.741 mm ($p<0.01$). The mean value of neck width of ruptured aneurysm was 4.212±2.252 mm, and of unruptured aneurysm 3.556±1.928 mm ($p<0.05$). Aneurysm neck width and diameter of the bearing blood vessel at the separation point ratio (OR) of ruptured aneurysms was

1.58±0.61, and of unruptured aneurysms was 1.14±0.52 ($p<0.01$). Aneurysm height and aneurysm neck width ratio (AR) of ruptured aneurysms was 1.89 ± 0.59, and of unruptured aneurysms was 1,33 ± 0.17 ($p<0.05$). Inclination angle of ruptured aneurysms was 139.22 ± 21.53, and of unruptured aneurysms was 101.73 ± 21.26 ($p<0.01$).

Conclusion: Based on research results, predictive model for the rupture of aneurysm can be identified using morphometric characteristics of the intracranial aneurysm and its bearing blood vessel: irregular shape of aneurysm, AR > 1.6, OR> 1.5 and inclination angle >135º.

Keywords: Intracranial aneurysm, Morphology, Single center

147 Bibliometric analysis of pediatric spinal tumors

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Purpose. The objective of this study is to analyze the most cited articles about pediatric spinal tumors to gain an insight about the most researched areas in this field, how the research trends evolved in time, most active authors, the collaboration between the authors/countries/journals.

Methods. We used Web of Science Core Collection to collect all the publications, then CiteSpace 5.8.R 1 for the bibliometric analysis (co-citation analysis of the documents, co-authorship analysis, country productivity analysis and cited journal analysis) and creating the network and cluster maps of the analyses.

Results. The general h-index of the 2228 publications about pediatric spinal tumors was 88 and the average citations per publication was 21.43. There is a rapid increase of number of publications and number of citations the field. Louis DN (2016) on Acta Neuropathologica has the highest number of citations and the highest amount of links, making this article the most influential publication within the field (Figure 1). Earliest publications in literature about the pathological basis and patient management, however, recently publications about intramedullary spinal cord tumors, spinal cord ependymomas and ependymal tumors took over the literature. Among the authors published in pediatric spinal tumors, George I Jallo is the most active author within the field (Figure 2). USA was the pioneer country in the pediatric spinal tumor research (Figure 3) Journal of Neurosurgery is the most active journal in this field. “Children”, “management” and “tumor” are the most frequently used keywords in these articles, as the majority of the literature in pediatric spinal tumors was about clinical patient management. Keywords “outcome” and “classification” had their citation bursts recently which indicated a shift of the research area towards understanding the nature of the disease recently (Table 1).

Conclusion. In our study, we have tried to evaluate the research on pediatric spinal tumors, its past and current situation. The focus of the studies are shifting from the pathological basis of the spinal cord tumors and patient management to the molecular and genetic classification of the pediatric spinal tumors. Considering the increasing research and rapid development on the new therapies targeting molecularly-altered tumor cells, we expect to see the result of these research with implementation of new molecular-targeted therapies to patient care as the prognosis of the pediatric spinal tumor patients get better in near future.

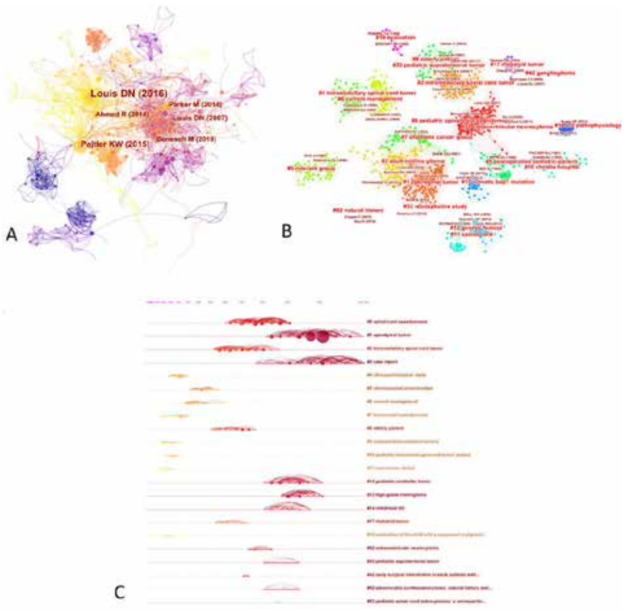

Figure 1: (A)Co-citation network map of references, showing the references cited in the literature from 2000 to 2021 on pediatric spine tumors. (B) Cluster map of references. The name of the cluster represents the topics of the references (C)Cluster map in the timeline showing the chronological order in which the references appear in each cluster

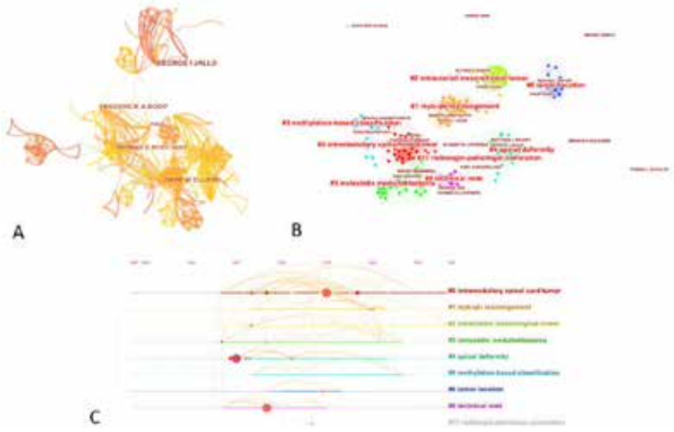

Figure 2: (A)Network map of the most active authors in the field of pediatric brain tumors. (B)Cluster map of authors. (C)The chronological timeline showing the first citation years of the authors within each cluster

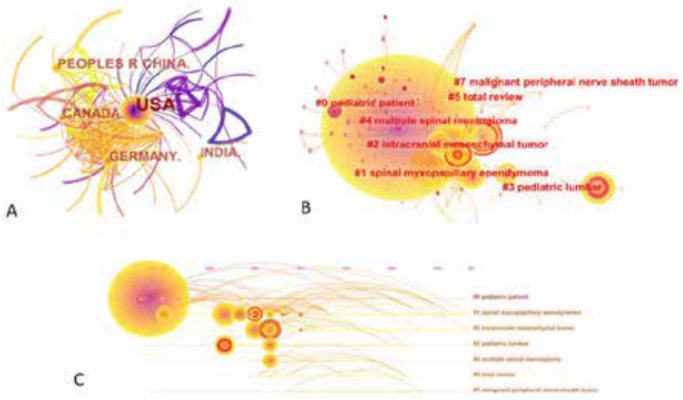

Figure 3: (A) Network map of the peak country productivity in the field of pediatric spinal research (B) Cluster map of the countries, the name of the clusters represent the research topic of the country productivity (C) The chronological order in which the country productivity appears in each cluster

Table 1: Top 25 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2000 - 2021
childhood	2000	7.71	2000	2003	
spinal cord compression	2000	4.54	2000	2005	
CT	2000	4.37	2000	2004	
chemotherapy	2000	6.13	2002	2004	
cauda equina	2000	4.8	2002	2009	
pediatric neurosurgery	2000	5.34	2004	2007	
ependymoma	2000	5.01	2004	2009	
magnetic resonance imaging	2000	4.26	2004	2009	
astrocytoma	2000	4.47	2005	2010	
pediatric patient	2000	4.27	2005	2010	
term follow up	2000	4.35	2006	2008	
intramedullary spinal cord tumor	2000	5.28	2007	2009	
infant	2000	4.17	2007	2009	
pediatric brain tumor	2000	3.96	2008	2010	
filum terminale	2000	4.03	2010	2014	
intramedullary tumor	2000	5.77	2013	2015	
clinical article	2000	4.99	2013	2018	
activation	2000	4.84	2013	2017	
laminoplasty	2000	3.95	2014	2017	
gene	2000	4.08	2015	2017	
outcome	2000	10.52	2016	2021	
epidemiology	2000	4.1	2016	2021	
pathway	2000	4.36	2017	2019	
classification	2000	11.14	2019	2021	
MRI	2000	4.3	2019	2021	

Keywords: Bibliometric analysis, Spinal tumors, Pediatric

148 Omentomyelopexy, treatment choice for pseudomenigeceles. Case report and review of the literature

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Introduction. Pseudomeningoceles are extradural accumulation of spinal fluid. In most cases, they appear as a complication of spinal operations. As the number of spinal surgeries increase worldwide, the importance of the complication is increasing.

The omentum, rich in blood and lymph vessels, possesses the potent ability of tissue regeneration. Omentomyelopexy is a operative procedure of harvesting autologous omentum as a flap and implating it on a dural opening. In our case we will represent omentomyelopexy as a treatment choice for pseudomeningocele.

Case report. A 37-year-old male was injured in a traffic accident, after falling down the cliff with his motor bike and initialy admited to our department and intensive care unit due to the hematothorax and an occult fracture of the thoracic spine. After initial chest tube placement, he remained in the intensive care unit where he started to develop lower limbs weakness, and magnetic resonance inmaging revealed pure ligamentous injury leading to the highly unstable spondylolisthesis (AO B3 Th12/L1). He underwent an urgent posterolateral fusion procedure with a favorable neurological recovery. Two years later a deterioration in form of a progressive weakness developed, and he was treated due to the arachnoiditis and intramedullary cyst. The treatment of choice was laminectomy, arachnolysis and cystectomy, however, a pseudomeningocele developed afterwards and the patient underwent multiple reoperations for the treatment of this complications in the following years, none of which turned to be effective. The „last resort“ option which was introduced to the patient was the omentomyelopexy, an extremelly complex procedure aimed at the local CSF absorption for the eventual cele obliteration and closure. This peculiar surgery was the last surgery the patient had to time, as his pseudomeningocele finally disappeared.

Conclusion. The omentum, The guardian of the belly, is proved to be abundant in angiogenic, raparative and healing properties. One will find many studies that observe effects in omental trasposition in acute and chronic spinal cord injure, but no publications dealing omentomyelopexy as a treatment for pseudomeningoceles. This case maybe will help to find a justification for further clinical trials of this procedure in patients who have a persistent pseudemeningoceles.

Keywords: omentomyelopexy; pseudomenigeceles

149 Brain hydatid cyst cases in neurosurgery ward (Aliabad University Hospital) Kabul, Afghanistan

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Introduction. Brain Hydatid Cyst is one of rare causes of Intracranial Space Occupying Lesion **(ICSOL),** Hydatid disease is caused by the infestation of the larvae of Echinococcosis. The definite hosts of Echinococcosis are various carnivores, the common being the dog. Humans get infected through the feco-oral route by ingestion of food contaminated by dog feces containing ova of the parasite or by direct contact with dogs. Brain involvement with Hydatid disease occurs in 1–2% of all Echinococcosis **granulose** infections.

Objective. Isolated cerebral Hydatid disease is a rare manifestation of it and discuss their mode of presentation, radiological features, operative procedure and outcome. The literature concerning isolated cerebral Hydatid disease is reviewed.

Method and material. Case series study, patient files.

Result. There were report 9 cases of successfully operated of Brain Hydatid Cyst from 2014 -2018. In this report, we analyze nine cases of isolated cerebral Hydatid cysts. In two cases, radiological features and surgical approaches were different. Patient chief complain was: Headache 77%, Vomiting 35%, Convulsion 45%, Vision problem 30%, Motor deficit 50%, Dysphasia19%, Sensory disturbances33%. Cyst localization: left side of Brain 63%, right side of Brain 37%. Sex: 8 female and 1 male.

Operation: by local Anesthesia. Craniotomy and Dowling-Orlando technique 7 cysts completely removed and 2 cases ruptured, and reported later. Anthelmintic medicine before and after operation continued by consultation of Internist.

Conclusion. Brain involvement with Hydatid disease occurs in 1–2% of all **Echinococcosis** *Granulose* infections. Isolated cerebral Hydatid disease is a rare manifestation of it. In this report, we analyze nine cases of isolated cerebral Hydatid cysts and discuss their mode of presentation, radiological features, operative procedure and outcome. In our two cases, radiological features and surgical approaches were different from one another. The literature concerning isolated cerebral Hydatid disease is reviewed.

Keywords: Dowling-Orlando technique, Echinococcosis, Brain Hydatid cyst

150 Endovascular treatment of traumatic intracranial aneurysms associated with traffic accidents

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Background: Traumatic intracranial pseudoaneurysms are rare complications of head and neck injuries following traffic accidents. They represent less than 1% of all intracranial aneurysms and most cases are associated with fracture of the skull. Rupture of these traumatic aneurysms is typically delayed from days to weeks following the initial trauma and occurs in up to 50% of cases. These aneurysms may be missed on initial investigation and may present as a delayed hemorrhage in a patient otherwise recovering well from a traumatic brain injury. Difficult diagnosis, delayed presentation and poor outcome contribute to overall prognosis of patients with these traumatic aneurysms.

Methods: We have retrospectively reviewed our database for cases with traumatic intracranial aneurysms developed after, and associated with, traffic accidents and treated with endovascular embolization in our Institution within the last ten years.

Results: We have found two cases with traumatic intracranial aneurysms associated with traffic accidents. In both cases, traumatic aneurysms were formed after skull base fractures of young adults following traffic accidents. Skull base fractures were diagnosed on initial CT imaging immediately after admission at the Emergency Department, whilst aneurysms were diagnosed on follow-up CT angiography imaging (CTA) during the hospitalization. There were not any new symptoms or neurological deficits that could be associated with the development of aneurysms in these patients, and the CTA was performed solely according to the protocol in practice in treating patients with skull base fractures.

Although aneurysms in both presented cases have wide neck, endovascular treatment with stent placement was not considered, as it is accompanied by dual antiplatelet therapy which needs to be avoided in patients with recent polytrauma, and complete aneurysm occlusion was attempted only with coils. On follow-up angiograms performed few months after the initial treatment, aneurysms have not been completely occluded, so stents had to be placed in both cases to protect,

this time, thicker packing of coils from migration in cerebral vessels. Stents were placed after a few months following the initial trauma and thus, without a significant risk of accompanied antiplatelet therapy side effects.

Conclusion: Suspicion for traumatic pseudoaneurysms should be made in all patients with severe head injuries following traffic accidents, especially if they present with delayed neurological deterioration. Since rarely being appropriate for conservative treatment, early and precise diagnosis with cerebral angiography and prompt treatment are essential for good prognosis. Due to its nature to be fragile and prone to rupture, endovascular embolization is a method of choice for treatment of this pseudoaneurysms.

Keywords: Endovascular treatment, Intracranial aneurism, Traffic accidents

151 Dural tenting sutures in patients with traumatic acute epidural hematoma: a case report

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Introduction: Epidural hematoma (EDH) is a life-threatening condition that occurs mostly after an injury. It is of paramount significance to make an adequate diagnosis as soon as possible and to evacuate EDH if necessary. Our aim was to show the importance of placing prophylactic dural tenting sutures for ensuring adequate hemostasis.

Case presentation: We present case of a 62-year-old male patient, who was diagnosed with an acute traumatic right parietal EDH and a right parietal cerebral hemorrhagic contusion (CHC). After an adequate diagnostic assessment, the patient underwent an urgent surgery, when the EDH and the CHC were evacuated.

The postoperative course was complicated by deterioration of the consciousness and worsening of the left hemiparesis; therefore, we performed a head CT scan, which showed the formation of the new EDH at the operating site. Moreover, we reoperated on the patient with the placement of multiple central dural tenting sutures, while the control head CT scan showed a complete evacuation of the EDH. Consequently, the patient made a good recovery at discharge, with a remaining discrete left hemiparesis. Follow-up examinations were performed after 3 and 6 months, while the patient reached full recovery.

Conclusions: By reducing the volume of the potential epidural space and ensuring the proper hemostasis of the vascular epidural structures, prophylactic central dural tenting sutures are crucial for maintaining an adequate hemostasis while operating on patients with EDH.

Keywords: Epidural hematoma, Dural tenting suture, Trauma

152 Transarterial approach for endovascular treatment of post-traumatic direct carotid cavernous fistulas

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Background: Carotid cavernous fistulas are abnormal arteriovenous connections between carotid artery and cavernous sinus. They are considered direct when there is a direct connection between the internal carotid artery and cavernous sinus, and these cases are generally traumatic and occur after blunt or penetrating injuries of the head. These are high-flow lesions and manifest with a visual loss, proptosis, chemosis, corneal exposure or even fatal epistaxis. They are usually accompanied with skull-base fracture and intracranial bleeding.

Thus, treatment of these lesions is always recommended and fundamental principle is to exclude the fistula from circulation preserving the carotid flow.

Methods: Trans arterial endovascular treatment of post-traumatic direct carotid cavernous fistulas was conducted on ten patients in our Institution between January 2006 and January 2016. They all have received periodic clinical and angiographic follow-up to evaluate the patency and stability of clinical results.

Results: All procedures were performed via transarterial, transfemoral, approach. Detachable coils were used for occlusion in all procedures, in one case together with neurovascular stent as a support, in one case with neurovascular flow-diverting stent for better occlusion, and in one case together with liquid embolization agent. In seven patients, carotid cavernous fistula was occluded completely, and symptoms related to them have been regressed after treatment and did not reoccur in the follow-up. In two cases fistula was formed between traumatic aneurysm in the cavernous segment of the internal carotid artery and cavernous sinus. There were no major complications following embolization procedures.

Conclusion: Spontaneous resolution of traumatic direct carotid cavernous fistulas is extremely rare and direct surgical repair with preservation of distal part of internal carotid artery is challenging due to the relative inaccessibility of this structure. This can be transposed using various endovascular treatment techniques and endovascular treatment represents an effective method for complete occlusion of these fistulas with favorable long-term outcomes.

Keywords: Transarterial approach, Carotid cavernous fistulas, Posttraumatic

153 Post-concussion syndrome disorders in amateur men athletes

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Background. Post-concussion syndrome is a situation that needs appropriate approach and management, especially in amateur athletes.

Aim. Aim of this study was to evaluate post-concussion syndrome disorders in amateur men athletes.

Methods. Evaluation of 10 amateur athletes, with post-concussion syndrome disorders, was performed: 2 basketball players (20%),2 football (soccer) players (20%) 2 volleyball players (20%),1 boxer athlete (10%),1 swimmer (10%) 1 long distance runner (10%), 1 short distance runner (10%)

Results. The most common disturbances were: headaches and dizziness in 5 patients-50%, fatigue in 1-10%, anxiety in 2-20%, insomnia in 1,10%, loss of memory in 1, 10% .

We suggest in all of them (10,100%), cognitive therapy and appropriate medication, under neurological and psychiatric surveillance. 8 of them- 80%-returned with safe results in the physical activity after 3 weeks period.

Conclusions. It seems that cognitive-behavioural therapy and medication could be helpful in these situations. Post concussion syndrome remains a post traumatic condition that needs accurate evaluation and approach.

Keywords: concussion, syndrome, athletes

154 Penetrating head injury caused by a screwdriver: literature review and case report

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Introduction. Penetrating head injuries (PHI) caused by sharp objects are associated with a high risk of potentially life-threatening complications and are estimated to account for approximately 0.4% of all head injuries. Areas with cranial openings and with a thinner bone, such as the orbital and temporal regions, are more susceptible to penetrating injuries from the sharp objects.

Since not many cases of penetrating skull injuries with a screwdriver have been described in the literature, the treatment of these patients is quite controversial and non-standardized. Therefore, the aim of this paper was to summarize and update the factors associated with potential complications, mortality, as well as the consideration of appropriate treatment modalities.

Case presentation. The authors present a three-year-old female patient who accidentally sustained a penetrating head injury with a screwdriver through the right orbit. A computed tomography (CT) scan of the head was performed, which demonstrated the presence of the metal end of a screwdriver in the anterior cranial fossa. The patient underwent an emergency surgery and the foreign body was evacuated with repair of dural and brain injury. The intervention was followed by a complete postoperative recovery without any gross neurological deficits. Follow-up examinations were performed up to three years after the injury, while the patient's condition remained unchanged.

Conclusions. In this paper, we considered the clinical presentation, diagnostic and therapeutic modalities, as well as potential complications accompanying penetrating head injuries caused by a screwdriver, with a literature review and a proposal of an algorithm for the treatment of such conditions.

Our patient's case supports immediate neurosurgical intervention and removal of a foreign object from the endocranium.

Keywords: Penetrating brain injury, Pediatric brain injury, Craniocerebral trauma, Craniotomy

155 Wallenberg syndrome: clinical case report

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Background: Wallenberg syndrome, also known as lateral medullary syndrome or the posterior inferior cerebellar artery syndrome, was described by Wallenberg in 1895. This neurological disorder is associated with a variety of symptoms that occur because of the damage to the lateral segment of the medulla posterior to the inferior olivary nucleus. It is the most typical posterior circulation ischemic stroke syndrome in clinical practice by its presentation. We report a rare case of acute transient Wallenberg's syndrome with dominant atypical gastrointestinal clinical presentation with vomiting, dysphagia and ataxia and discuss its mechanisms and clinical radiological correlation.

Case report: A 57-year-old man was admitted to Emergency Department of the University Clinical Center of Serbia for transient and acute Wallenberg's syndrome. The patient`s symptoms included ataxia (vitiligo), vomiting, dysphagia, left-sided hemiparesis, hemihypesthesia and Horner's syndrome, right palatal paresis, lower limb weakness, paresthesia on the left

side of the body and face, and right central facial palsy. The patient had a history of chronic arterial hypertension, two previous brain ischemic strokes (in 2005. and 2016.), and long-lasting type 2 diabetes mellitus, His current symptoms appeared mostly during physical activity. Symptoms occurred nearly every day and lasted from five to thirty minutes. Brain computerized tomography (CT) and CT angiography were performed and showed only chronical lacunar ischemic changes of the brain and the right vertebral artery hypoplasia in its V4 segment. Furthermore, brain magnetic resonance imaging (MRI) including diffusion weighted MRI imaging was performed and showed typical MRI changes for acute ischemia in the right half of the pons with the T2W and FLAIR sequence hyperintensities and diffusion restriction.

Conclusions: Hemodynamic instability due to the arterial vessels damage from chronic arterial hypertension and type 2 diabetes mellitus, combined with the right vertebral artery hypoplasia could lead to acute transient Wallenberg's syndrome in our patient. This case report could widen the knowledge on this complex syndrome and provide useful information and references to clinicians of different specialties (radiologists, neurologists, cardiologists, and gastroenterologists) so that diagnosis and treatment for patients with similar clinical manifestations could be promptly recognized.

Keywords: Wallenberg syndrome, Case report, Clinical

156 Inflammatory and oxidative stress makers in intracerebral hemorrhage: preliminary new insights from machine learning and virtual models of interaction

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In our previous work, we detailly evaluated the applicability of nineteen inflammatory and five oxidative stress (OS) mediators as candidates for prognostic biomarkers in the prediction of the edema volume [1], which develops 5 days after intracerebral hemorrhage (ICH) and can lead to severe deterioration. Since an intricate interplay, involving synergistic and antagonistic inter-relations was detected operating 3-days post-ICH being relevant for prognostication of the edema [1], in this study we focused on examination of the possible benefits from machine learning based on the previously detected biomarker profiles and interactions.

Several software packages were used for mathematical modeling with direct 3D visualization of the edema formation, as well as a number of shockwave flash applications with interactive 3D plots, which together were able to reveal preliminary new insights and patterns of interactions among the biomolecules. The main draw inferences from the virtual machine-learning interaction profiles were the perceptions of how the other non-significant model effects can influence the prognostic capacity of the significant predictors 3-days post-ICH in real time; moreover, possible direct and indirect effects of different variables on the model were simulated in a defined pathological state (IL-10 levels, absolute neutrophil count, absolute lymphocyte count, catalase activity, glucose levels) which were able to severely alter the previously proposed prognostic capacity of the significant predictors [1], thus giving a broader and more comprehensive view of the complex interaction and coaction among the inflammatory and OS mechanisms post-ICH.

The applications with interactive 3D plots, taking into consideration the whole multiplex synergy, coaction, and antagonism among the significant predictors and the other variables were able to confirm the proposed OS-CRP negative feedback loop, and on this basis, to make decisions and separate three distinct subgroups with the highest risk for the formation of large edema volumes. In conclusion, virtual models of interaction applied by machine learning can help in better understanding the interaction networks of biomolecules operating post- ICH, which drive the formation of the notorious brain edema.

Keywords: Stress makers, Intracerebral hemorrhage, Machine learning, Virtual models

157 Brain and cervical spine traumatic situations during amateur sea sports activity

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Objective. Aim of this study is to present cases of brain and cervical spine traumatic situations during amateur sports sea activity.

Design. 15 cases are presented for a time of 6-year period and 24 months follow up.

Setting. An accurate analysis of such cases in sports sea sports.

Participants. 14 male and 1 female, range of age 16-66, mean age 36,5 years.

Interventions. 15 hospitalization and treatment, 2 surgical interventions for brain trauma, 3 surgical interventions for spinal trauma,10 cases with conservative treatment.

Outcome measures. Good outcome in all 15 cases. **Main Results.** Pain Killer pharmacological treatment, Ct, Mri and x ray evaluation

in all of them.

Conclusions. Brain and cervical spine traumas are situations that needs accurate resolution and treatment

Keywords: Brain, Spine, Trauma, Sea sports

158 Outcome after traumatic brain injury in the elderly population

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Background. Patient age is, due to the aging process itself and associated diseases and conditions that accompany this physiological process, a factor that is often considered as a prognostic factor of the outcome of TBI. By multivariate analysis of all factors that may affect the outcome of the TBI, Murray et al. came to the conclusion that age is the most significant prognostic factor individually, followed by GCS score, motor response of the injured person and photoreactivity of pupils. Persons belonging to the group of the elderly population over 65 years of age most often have a large number of comorbidities in their medical history and accordingly take a large amount of different drugs. When it comes to TBI, the application of antiplatelet and antiaggregation therapy has a special impact. In the literature, we increasingly encounter the impact of the use of antiaggregation and antiplatelet therapy on the outcome of TBI treatment, although all authors fully agree that the benefit of using this therapy in the case of its true indications is undeniable.

Methods. The study included 142 people who suffered a head injury, which was verified by a head CT examination. Clinical and radiological parameters were observed, the course of treatment was analyzed, as well as the condition at discharge shown by GOS.

Results. The age of people who had TBI, in our research, shows that it is predominantly people who are over 65 years of age, that is, that there is a higher incidence of TBI among old people. For the group of elderly patients, it is characteristic that, in accordance with their comorbidities, they have a significantly higher number of those taking antiaggregant and anticoagulant therapy compared to those not taking it. The use of this therapy may also affect the severity of brain damage by affecting the enlargement of the lesion described in the initial computerized tomography finding. In the group of deceased patients, the percentage of patients who received this type of therapy was more than twice as high as those who did not. A statistically significant difference was obtained between these two groups in relation to the use of anticoagulant and anti-aggregate therapy, and this result indicates that the use of this type of therapy is directly related to the adverse outcome.

Conclusions. The clinical outcome of traumatic brain damage in the elderly population is associated with a number of factors present both during and after the injury itself and factors associated with premorbid functioning of the person. The use of anticoagulation and anti-aggregation therapy before the injury is distinguished as important, which is a common situation in the study population, because due to different comorbidities it uses a large number of medicines, from which drugs from these two groups are very common. For predicting outcomes based on the severity of the TBI, in addition to the assessment scales themselves, it is necessary to consider individual CT characteristics. Therefore, age should not be a limiting factor in the further management of patients with TBI.

Keywords: Traumatic brain injury, Elderly, Outcome

159 Management of penetrating brain injury caused by metallic foreign objects (nail, kitchen knife and blunt screw): four case reports and brief literature review

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Introduction. Whereas gunshot injury to the head is the most common cause of penetrating brain injury (PBI) in military conflict areas, metallic foreign body injuries account for the most common cause of PBI in urban and rural violence, although few reports have been reported in both pediatric and adult population in our local setting in the lake zone region of Mwanza, Tanzania.

Case reports. We reported four cases of penetrating brain injury, two in children (nail and screw) and two in adults (nail and kitchen knife). Our first case was a 1-year-old male presented after 24 hours with nail attached to a wooden handle in the left frontal region after falling while playing. Our second

case was a 14-year- old male with a clinging tubular screw penetrating the right frontal bone into the parenchyma 2 days after being hit by rangers. Our third case was a 72-old-male who was involved in a family conflict 2 days prior and was hit with a nail. The nail traversed the skull on the frontal parietal junction into the left-brain parenchyma on the left lateral ventricle wall and the tip is seen at the pre-pontine cistern. The fourth patient was 23- year-old male presented ten hours after sustaining stab knife injury into left orbital cavity. The knife was seen entry point at the left orbit and transecting the superior extraconal space of the left orbit, superior rectus muscle into the sella turcica, postero-superior wall of the left sphenoid sinus, and the distal tip impacted within the right aspect of the pons.

Three patients had no history of loss of consciousness on injury and preoperative neurological deficit and had a good recovery after surgery and no significant deficit on his neurologic function. The fourth patient who had history of loss of consciousness presented with mild aphasia and loss of vision left optic nerve transection by the stab knife through its supraorbital entry trajectory and eventfully had a fatal outcome 72 hours after surgery due to the severity of the primary neurovascular damage characterized by refractory global edema and large hemispherical ischemic changes/infarcts as seen on post operative contrast tomography (CT) brain scan.

Conclusions. PBI caused by metallic foreign objects is common in non- military conflict areas and can present with varying clinical manifestations and craniotomy for foreign body removal is the treatment of choice. Late referral is an observed challenge in our region. Early referral, urgent radiological imaging and timely surgery should provide uneventful postoperative prognosis with minimal neurologic deficits in these patients to avoid fatal outcomes.

Keywords: Penetrating brain injury, Metalic objects, Case reports

160 Elements of neuroendoscopic anatomy of the fourth ventricle-cadaveric studies

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Introduction. Neuroendoscopic anatomy of the fourth ventricle has been reported infrequently in the literature, most of the times based on laboratory experiences. Neuroendosopy offers a quite different outlook of the anatomy of the fourth ventricle and compared with the microsurgical descriptions it seems to provide a superior and detailed visualization of the superior part.

Aim. Regarding the upcoming neuroendoscopic techniques the fourth ventricle was examined.

Material and methods. In a series of 30 anatomically cadeveric specimens the fourth ventricle was investigated endoscopicaly. We are able to reach the fourth ventricle via the aqueductus cerebri and coming via the cerebromedullary cistern through the foramen of Magendie.

Results-Conclusions. Using principally rigid and sometimes flexible endoscopes the basic anatomic details seen under the neuroendocope and the topographical landmarks of the approaches were investigated presented and discussed. It seems that neuroendoscopy is a unique and very useful tool that it has a place in the armamentum of the modern neurosurgeon, its application will only broaden as we gain experience in using neuroendoscopic systems. Neurosurgery may have been slow to accept the use of modern neuroendocopic instruments in the management of neurological diseases but with advent of new scopes, illumination and instruments it is a fast-growing arena for minimally invasive neurosurgery.

Keywords: Neuroendoscopic, Anatomy, Cadaver study

161 Seemingly innocuous trauma on the neurosurgical table: a rare case of brain abscess

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Background. Intraorbital and transorbital injuries are included in the group of head injuries with low frequency. In particular, such injuries rarely end with infectious processes in the brain parenchyma.

Case presentation. A 57-year-old man reported to the neurosurgery department that he had suffered an injury to the conjunctiva of the upper eyelid a month earlier. The patient injured himself with a tree branch, which he removed on his own initiative. He was observed in the department of emergency medicine and ophthalmology, where a CT scan was performed, which showed a 20 mm hematoma in the orbit. After persistent weakness during eye abduction, an MRI was performed, which showed a compressive mass in the frontal lobe of the brain.

After neurosurgical observation, the patient was operated on, and inside the brain abscess, the rest of the tree branch that caused the trauma was found. The injury led to a perforation of the roof of the orbit, which caused an infectious process in the frontal lobe of the cerebrum.

Discussion. A brain abscess is a purulent collection caused by an inflammatory process in the brain parenchyma. It most often occurs as a result of trauma, but also due to other disseminating infectious processes. It is usually manifested by a non-specific triad: headache, fever and neurological deficit. Neurodeficiency signs appear in one fifth of patients. Anamnesis data, detailed

physical examination and timely radiological diagnostics are the gold standard in confirming the diagnosis of brain abscess.

Conclusion. Injuries can sometimes look harmless, but every injury should be observed to rule out complications. The main conclusion of this rare case report is that there is no such thing as a harmless injury, and that each should be investigated in detail during the anamnestic examination and physical examination, in order to determine a timely further diagnostic procedure.

Keywords: Intraoperative trauma, Brain abscess, Case report

162 Assessment of outcome in patients with severe traumatic brain injury with compressive hemathoma treated with decompressive craniectomy. A one centre retrospective study

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Introduction. Decompressive craniectomy is widely used to treat intracranial hypertension following traumatic brain injury (TBI). The patient with severe traumatic brain injury though with less prevalence in the main population represents a great challenge in management for every neurosurgical institution and the latter is followed with poorer prognosis, numerous perioperative and postoperative surgical complications and in certain cases followed by a severe disability.

Objectives. In this article we present a retrospective review of 25 cases of patients with severe traumatic brain injury treated with decompressive craniectomy for a period of one year.

Methods. This is a retrospective study in which 25 patients were included, 11 were women and 14 were man. They all presented on admission in comatose state with signs and symptoms of severe traumatic brain injury. Patients underwent CT scan and magnetic resonance imaging on admission. All patients underwent uni- or bilateral frontotemporoparietal decompressive craniectomy (Figures 1 and 2) with evacuation of an intra or extra axial haemathoma. Outcome was assessed at an interval of at least 6 months following injury using the Glasgow Outcome Scale (GOS) score.

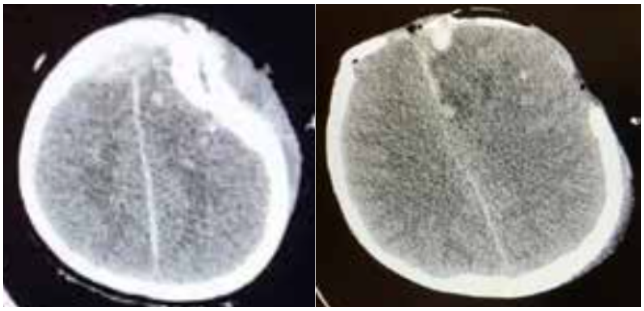

Figure 1. Bifrontotemporal decompressive craniectomy

Figure 2. Unilateral frontotemporal decompressive craniectomy

Results. A total of 25 patients underwent decompressive craniectomy for raised and refractory ICP. Three patients (12%) underwent bilateral and 22 (88%) unilateral frontotemporoparietal craniectomy. Out of all nine (36%) presented on admission with GCS score 4, six patients (24%) presented with GCS score 5 and ten patients (40%) with GCS score 8. At follow-up, 13 (52%) patients had a favorable outcome (good recovery or moderate disability), 7 (28%) remained severely disabled, and 5 (20%) died. Two patients were left in a vegetative state.

Conclusion. In adults with severe diffuse traumatic brain injury and refractory intracranial hypertension, early bifrontotemporoparietal decompressive craniectomy decreased intracranial pressure and the length of stay in the ICU but was associated with more unfavorable outcomes.

Keywords: Traumatic brain injury, Hemathoma, Decompressive craniectomy, Outcome

167 Optimization of some overlooked modifiable factors can prevent post operative complications in cranioplasty- an analytical research

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Background. Cranioplasty following decompressive craniectomy seems to be a routine surgical exercise, however, it is often coupled with a high rate of com- plications.

Methods. We did a 3 year study with both prospective and retrospective compo- nents conducted on 50 cases of autologous bone cranioplasty with bone preserved in bone bank where bone was not kept back during first surgery.

The epidemiological data of patients, interval between primary procedure (decompressive craniectomy), pre-cranioplasty Glasgow coma scale, time taken for cranioplasty and intraoperative complications were recorded. Following cranioplasty, complications like surgical site infection "SSI", hydrocephalus, hematoma, seizure, wound dehiscence, osteomyelitis, bone resorption, CSF hygroma etc. were noted and divided into immediate, early and late. Data were presented as frequency, percentage, mean±standard deviation (SD). Chi-square test was used for comparison of data. Quantitative variables with a group at different time were compared using paired t-test. A 'p' value less than 0.05 was considered to indicate statistically significant association.

Results. Immediate complications, within 24 hours post cranioplasty were seen in 4 patients (5.2%). Early complications (1-7 days post cranioplasty) were seen in 38.3 % patients. 50.7% were delayed complications occurred > 7 days post cranioplasty. Majority of these complications were conservatively managed. Two out of 3 patients who developed wound dehiscence progressed to become major complication of bone flap osteomyelitis and had to be reoperated for bone flap removal. Two patients who developed hydrocephalus required VP Shunt placement.

Table 1. Frequency and percentage of post-operative complications

	Frequency	Percentage
Subgaleal hematoma	16	32
Serous discharge	13	26
Hematoma (EDH, SDH)	7	14
Seizure	6	12
SSI	5	10
Wound dehiscence	3	6
Revision surgery	3	6
Osteomyelitis of bone flap	2	4
Hydrocephalus	2	4
Bone resorption	0	0
CSF Hygroma	0	0
Death	0	0

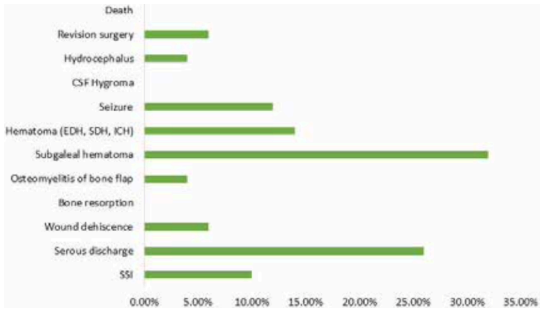

Figure 1. Percentage of post-operative complications

Table 2. Post-operative complications on the basis of timing

	Total	Immediate (within 24 hr)	Early (1-7 days)	Delayed (7-14 days)	14 days-1month	>1 month
SSI	5	0	0	1	2	2
Serous discharge	13	0	2	6	5	0
Wound dehiscence	3	0	0	1	1	1
Bone resorption	0	0	0	0	0	0
Osteomyelitis of bone flap	2	0	0	0	0	2
Subgaleal hematoma	16	3	13	0	0	0
Hematoma (EDH, SDH, ICH)	7	1	5	0	0	1
Seizure	6	1	2	0	0	3
CSF Hygroma	0	0	0	0	0	0
Hydrocephalus	2	0	0	0	1	1
Revision surgery	3	1	0	0	0	2
Death	0	0	0	0	0	0
Total	57	6	22	8	9	12

Conclusions. Age more than sixty years, female sex, smoking, pre-cranioplasty neurological status, patients with history of smoking and non-traumatic haemorrhage were significantly associated with the development of post-operative complications. Optimisation of patient-related factors – hypertension, diabetes, anaemia, may lead to better outcome especially in the elderly. Cranioplasty using autologous bone has a high rate of complications but most of the complications are minor and can be conservatively managed. Bone flap storage in bone banks is a good option, as literature suggest no difference in outcome when compared to bone storage in abdominal subcutaneous pocket. On the contrary, it saves intraoperative time, patient morbidity, decreases blood loss, and local abdominal wound complications.

From our study, no significance could be drawn to ideal time for cranioplasty but on analysis of various studies and reported complications, cranioplasty between 2-4 months would have better preserved tissue planes between duramater and subgalea; therefore, less operative time, less intraoperative blood loss, less chances of dural injury, subsidence of cerebral edema, and early patient rehabilitation. Intraoperative vancomycin instillation advocated for prevention of SSI, while extended cover of IV antibiotics in case of suture line discharge, dirty scalp condition and patient having undergone multiple procedures may have been contributory in decreasing rate of infection compared to other studies.

Limitations of study and Recommendations: Culture and sensitivity from bone flap prior to cranioplasty may be preventive for post cranioplasty infections and wound dehiscence. This practice can be evaluated in further studies. Small sample size warrants caution in interpreting results.

Keywords: Cranioplasty, Complications, Analytical research

168 Epidermoid cyst of the fourth ventricle: about a recurrent case

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Introduction: Epidermoid cysts are rare benign tumours that develop from ectodermal inclusions. Their location in the fourth ventricle (V4) is unusual.

Method: We report a case about a 38 years old man with no medical history. He was admitted to explore a static cerebellar syndrome. The patient was operated with the discovery of a whitish tumour with a pearly appearance reminiscent of an epidermoid cyst. The surgical removal was subtotal with respect to a portion of the capsule which was very adherent to the upper part of the floor of V4. The anatomopathology confirmed the hypothesis of an epidermoid cyst. Ten years after the first operation, the patient presented a recurrence. He was reoperated with subtotal removal of the lesion, respecting the portions adhering to the floor of V4.

Discussion: Formerly called cholesteatoma or pearl tumour of Cruveilhier. It is a benign tumour most often secondary to an ectopic inclusion of ectodermal elements at the time of neural tube closure between the 3rd and 5th week of gestation. The MRI appearance of epidermoid cysts is identical regardless of their location. The postoperative evolution is usually straightforward; however, chemical meningitis may occur and lead to communicating hydrocephalus. In the case of tumour residue, annual MRI monitoring is used to assess the potential evolution of the residue.

Conclusion: The epidermoid cyst of the 4th ventricle is a rare benign tumour with a generally favourable prognosis.

Keywords: Epidermoid cyst, Fourth ventricle, Recurrent case

169 Amoebic cerebral abscess: a case report and review of literature

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Introduction: Cerebral amoebic abscess is a rare infection but fatal. Since its identification in 1965, few cases have been observed world-wide.

Method: we report a case of a 56-year-old man who present a sign of intracerebral hypertension evolving for a year. He presents a Heaviness of the right hemi body for 1 month. The neurological exam objective a right hemiparesis without altered consciousness nor fever. The brain MRI shower a left parieto occipital lesion with peripheral enhancement. The patient was operated and a complete excision was done. The lesion was the lesion is abscessed largely adherent to the parenchyma with a thick shell. The culture of the abscess was negative. Histological examination and serology confirmed the diagnosis of cerebral amoeboma. We administrate an amoebicide with a good clinical evolution.

Discussion: CNS Amoebiasis is a rare entity. The main pathogen is Entamoeba histolytica. Cerebral involvement occurs via the haematogenous route, usually from the right lobe of the liver, resulting in single or multiple necrotic lesions. Identification of the amoeba requires specific techniques such as immunohistochemistry, PCR and serology, which allows a definite diagnosis. Treatment is both medical and surgical. The condition is manageable with good outcomes if recognized early.

Conclusion: Amoebiasis remains a threat in the intertropical zone. Cerebral involvement is rare and unrecognised. The treatment is medical and surgical. The evolution can be fatal in the absence of early diagnosis and adapted treatment.

Keywords: Amoebic cerebral abscess, Case report, Literature review

170 Ophthalmic history of recurrent meningothelial meningioma

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Introduction: Frontal meningioma is a histologically benign tumor, but it has the potential to affect the visual functional prognosis. The curative treatment is a challenge for a neurosurgeon.

Observation: We report the case of a patient aged 62 years. His history goes back 15 years with a progressive decrease of visual

acuity in the left eye. The ophthalmological examination had objectified in addition to the optic atrophy on the left, a papillary edema on the right, the whole defining a Foster Kennedy syndrome. This finding motivated a brain MRI which showed a large right frontal expansive process with radiological characteristics in favor of a meningioma. The patient underwent surgery to remove the meningioma (Simpson 3) and the anatomopathological examination confirmed a grade2 meningothelial meningioma. The evolution was marked by an initial stabilization of the patient's visual status before a new aggravation and installation of total blindness in the right eye 4 years after the first surgery. A new imaging study showed a recurrence of the meningioma in the same location. A re-intervention could not improve the prognosis of the right eye which evolved towards the progressive melting of the orbit, and the preservation of a visual acuity of 8/10 on the left side. The patient is currently presenting with a left exophthalmos (grade 2) without any decrease in visual acuity. A new MRI showed a recurrence of the meningioma in the left frontal. Given the importance of the exophthalmos and despite the difficulties of the re-intervention, a revision is planned to decrease the tumor volume.

Conclusion: Recovery from meningioma surgery depends on the degree of visual impairment and the extent of surgical resection. The treatment is neurosurgical, sometimes in association with radiotherapy, despite the slow spontaneous evolution.

Keywords: Ophthalmic history, Meningothelial meningioma, Recurrent

171 Cerebral blastomycosis mimicking a meningioma: a case report

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Introduction: Mycoses of the central nervous system are rare. They mainly concern immunocompromised people. The disease is sometimes isolated to the central nervous system but more often systemic or resulting from the extension of a locoregional focus. Generally accessible to effective treatment but fatal in the absence of adequate management. We report a case of cerebral blastomycosis.

Observation: The patient was a 57-year-old woman with no previous pathological history who was admitted with a progressive onset of ICP. The CT and MRI brain scans showed a left frontal lesion suggestive of a meningioma of the anterior floor of the skull base. The patient underwent surgery. Anatomopathological examination concluded to a meningeal blastomycosis.

Results: Blastomycosis is a fungal infection rarely seen in clinical practice. Blastomyces dermatitidis typically affects the skin and lungs. Central nervous system involvement is a rare but potentially fatal complication. No specific risk factors (apart from AIDS) have been identified. Dissemination is usually from a pulmonary focus. Neurological signs are often poor and specific and systemic signs (fever, inflammatory syndrome, etc.) are generally absent initially except in the presence of an extra-neurological focus. The cerebrospinal fluid usually shows pleocytosis and hyperproteinorachia, with cultures frequently returning negative. The best diagnosis is serological (ELISA). The course is almost fatal if left untreated. Treatment is based on amphotericin B + ketoconazole.

Conclusion: Solitary central nervous system involvement without pulmonary infection is a rare occurrence, rarely reported in the literature. Although imaging features may assist in the diagnosis of this entity. In the case of isolated CNS infection, the diagnosis is confirmed only by histopathology.

Keywords: Cerebral blastomycosis, Meningioma, Case report

172 Sellar melanocytoma mimicking a macroadenoma: a case report

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Primary Melanocytoma is a rare tumor. It is one of the melanocytic tumors of the central nervous system developed from leptomeningeal melanocytes derived from the neural crest. Melanocytomas represent 0.1% of brain tumors, they occur at any age with a peak in the fifth decade, with a discrete female predominance. Most melanocytomas develop in the extramedullary intradural compartment in the cervical and thoracic spine. Sellar melanocytomas represent a small subgroup of primary melanocytic tumors arising from leptomeningeal melanocyte. We report a case of melanocytoma of pituitary location in a 45-year-old patient who complained of an HTIC syndrome with decreased visual acuity. The brain MRI revealed a voluminous expansive sellar and supra sellar process, with a double cystic and fleshy component, with a necrotio-hemorrhagic remodeling suggestive of a voluminous macroadenoma. The anathomopathological diagnosis concluded to a melanocytoma. The originality of the reported case lies in the pituitary location of the melanocytoma, which may therefore be a differential diagnosis of pituitary adenoma. MRI is characteristic due to the paramagnetic properties of melanin: isodense or hyperintense signal in T1 and hypointense in T2, and homogeneous contrast.

Keywords: Sellar melanocytoma, Macroadenoma, Case report

173 Central nervous system aspergillosis in immunocompetent patients: a case report and review of literature

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Cerebral aspergillosis is a serious pathology that is difficult to diagnose outside the context of immunosuppression. We report a case about q 45-year-old patient who consulted for an HTIC syndrome in a febrile context. He was operated 2 weeks before an ENT operation for nasal polyp with simple postoperative course. The radiological examination revealed a left frontal collection with heterogeneous contours and air bubbles, which were enhanced after injection, all surrounded by edema and responsible for a mass effect on the left frontal horn and the midline. Mycological examination objectified mycelial filaments and the patient was treated by antifungals antibiotic.Cerebral aspergillosis is a serious pathology whose diagnosis must be evoked in front of an immunocompromised terrain but also in an immunocompetent subject. The notion of a pulmonary or ENT aspergillosis should make us think of this etiology.

Keywords: CNS, Aspergillosis, Case report

174 Outcome of laminectomy for cervical ossification of the posterior longitudinal ligament: case report and review of literature

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Ossification of the posterior longitudinal ligament, also known as posterior common vertebral ligament (PCLL), is a relatively rare condition, especially in the cervical region. It is characterized by an unusual ossification affecting the LVCP, which can lead to spinal cord compression causing neurological signs leading to severe cervical myelopathy. The therapeutic modalities are still under discussion between posterior decompression (Laminectomy) and anterior approach of the cervical spine (Corporectomy). We propose to present two observations of cervical PLO treated by laminectomy and through a review of the literature, we will try to study the advantages and disadvantages as well as the results of this therapeutic attitude. Cervical laminectomy in posterior longitudinal ligament ossification is a simple, rapid procedure with few immediate complications. These advantages are outweighed by the risk of natural progression of the PLO and kyphosis deformity. However, these disadvantages are slow to develop and do not necessarily lead to worsening or recurrence of the myelopathy. The results of cervical laminectomy in the treatment of PLO are therefore satisfactory overall, subject to appropriate patient selection.

Keywords: Cervical ossification, Laminectomy, Outcome

175 Intradural spinal epidermoid tumors: a care report and review of literature

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Intramedullary epidermoid tumors or cyst are rare and represent only 1% of spinal tumors and 2.3% of intramedullary tumors. They are benign dysembryoplastic lesions, most often congenital, related to the inclusion of ectodermal elements during embryogenesis. The authors report four new observations of epidermoid cyst of the cauda equina.

Keywords: Intradural spinal epidermoid tumors, Case report, Literature review

176 Vertebral metastases from intra cranial meningioma

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Metastasis of meningiomas has been described but remains exceptional; all histological grades of meningiomas can develop secondary lesions. Atypical and anaplastic meningiomas seem to metastasize more often. The possibility of metastatic meningioma should be considered in patients with a neoplasm associated with an intracranial meningioma. The prognosis of these metastases depends on the histological type. We report the observation of a patient with multiple spinal metastases of an anaplastic intracranial meningioma. The clinical and radiological features will be discussed, as well as the evolution and prognosis. Meningioma metastases are exceptional (0.1% of operated meningiomas). Atypical and anaplastic meningiomas seem to metastasize more often. The possibility of meningioma metastasis should be considered in patients with a neoplasm associated with an intracranial meningioma. The prognosis of these metastases depends on the histological type.

Keywords: Vertebral metastases, Intracranial meningioma, Case report

177 Primary glioblastoma in the spine: a case report

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Intramedullary glioblastoma is exceptional, unlike cerebral glioblastoma, which remains the most common glial tumour in adults. Complete surgical resection is not possible as the result of the infiltrative growth of these tumors. We report the case of a 20 years old man who present a walking disorder evolving for 2 months with heaviness of both lower limbs responsible for spinal claudication, episodes of constipation and urinary retention. On admission, the patient presents flaccid paraplegia tendon reflexes are absent, thermo-algesic anaesthesia suspended from D6 to D9 without deep sensitivity disorders. The medullary MRI objective an intramedullary expansive process from D7 to D11, with intense and heterogeneous contrast fixation. A complete macroscopic resection was done. An additional radiation therapy was performed. 10 months later, the patient is still paraplegic despite rehabilitation.

Discussion: Intramedullary glioblastoma (IMG) is very rare, representing 1.5% of spinal cord tumours and 5% of all glioblastomas. It occurs in almost 60% of cases in the cervical or cervicothoracic portion of the medulla. The radiological appearance is that of an intramedullary lesion, which may be confused with an astrocytoma or ependymoma, but the contrast enhancement points to a high-grade glial lesion. As far as treatment is concerned, it is still a matter of debate and there is currently no well-established protocol for the management of IMGs. The surgery is always proposed. The radiation therapy has a place in therapeutic protocols contrary to chemotherapy.

Conclusion: Primary glioblastoma in the spinal cord is a very rare entity and carries a very dismal prognosis. There is a short time from onset to the time of diagnosis and is followed by progressive neurological deterioration and death.

Keywords: Spinal, Primary glioblastoma, Case report

178 Unstable odontoid fractures: anterior retropharyngeal approach for alignment and customized VSP plate screw fixation and anterior transarticular atlantoaxial screws for associated atlantoaxial instability: a better option

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Background: Odontoid fractures with significant displacement are associated with atlantoaxial instability. The fracture and the instability need to be addressed. Anterior odontoid screw is insufficient if both problems coexist. In unsuitable fractures or unstable fractures, posterior atlantoaxial fixation (PAAF) is another option but does not address the fracture directly. Vertebral artery injury is a potential problem in addition to paravertebral venous plexus bleeding. Direct anterior extrapharyangeal surgery with fixation of the fracture with plate and screws in compression mode can enhance success in treatment of unstable odontoid fractures.

Material and methods: Since 2013 - 2021 we have treated 68, M/ F 45: 23, Age 18: 78 years patients of unstable Odontoid fractures. All patients underwent XRays, CT scan and MRI with MR angiography. Preoperative lateral X-ray of the neck in extension to check position of angle of mandible with respect to C2-3 disc was done in all cases. All patients were operated by, right sided anterior submandibular extrapharyangeal approach for fracture realignment followed by fixation in compression mode with customized variable screw placement (VSP) plate and screws with bilateral anterior transarticular screw fixation of atlantoaxial joints.

Follow up and Results: XRays and CT at discharge 3 months in 100% cases showed solid fusion across the fracture. Mild transient hypoglossal paresis was noted in 8 patients which resolved in 3 weeks. There was no need for blood transfusion or intraoperative navigation and operative time was between 2-3 hours. There was procedure related mortality.

Conclusion: Unstable Odontoid fractures need fixation. Displaced Odontoid fractures need realignment. Fixation in compression mode enhances and ensures fusion in 100% cases. Associated atlantoaxial instability can be treated from same exposure with anterior transarticular screws. The anterior extrapharyangeal approach is easy, safe, avoids the vertebral artery and preserves the posterior tension band.

Keywords: Odontoid fracture, VSP plate screws, Atlantoaxial screws

179 Covid-19 and histiocytosis

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Langerhans Cell Histiocytosis (LCH) shows a group of rare disorders presuppose specific cells that normally have significant roles as part of the immune system. Many LCs are created in specified parts of the body where they can form tumors or damage organs. Maximum cases of histiocytosis effect children between 1 and 15 years old, although people of all ages can increase LCH. The incidence peaks among children between 5 and 10 years old. However, the precise reason of histiocytosis is unclear and it affects roughly one to two out of 200,000 people each year. A rash on the head skin is the first sign of histiocytosis. LCH typically begins with a skin rash and can affect various organ systems including marrow, liver and lungs. It can also act on the lungs and the central nervous system (CNS). Most intracranial LCH occurrence are part of systematic disease and only 40% of intracranial LCH cases are isolated to the brain. The location of most intracranial LCH (5–50%of cases) involves the hypothalamic-pituitary axis (HPA). To be more specific, 23% of adult intracranial LCH cases infiltrate the posterior pituitary. Neurodegenerative conversion of the cerebellum and basal ganglia is uncommon but a complication in intracranial LCH also is known. The lesions seem to reflex an inflammatory process in the parenchyma and is associated with neuronal and axonal degeneration in atrophy in some cases. In other word, neurological complications are highly prevalent in COVID-19 patients such as dizziness, headaches, encephalitis and ischemic stroke. Yet, the alteration in the CNS induced by COVID-19 are still uncertain. Due to the rapid spread of COVID-19 in the world, the unknown effects of this virus on various parts of the body and the little information about the association of this virus with various disease, we report this case to know the possible link between histiocytosis and COVID-19.

Keywords: Covid-19, Histiocytosis, Literature review

180 Working with limited resources in armed confliect country for transportation & prehospital management of traumatic cervical spinal cord injuried pateitns, 89 cases

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Introduction. Traumatic cervical spinal injury (SCI) is one of the most devastating conditions with high rates of morbidity and mortality. First aid, transportation and on time management of such disorder play a vital role for favorable outcome and prognosis. The aim of this study to review the prehospital, immobilization, transportation and management of traumatic cervical spinal injury and its outcome.

Materials & Methods. The department of Neurosurgery of Jamhuryte Hospital, Kabul Afghanistan, carried out this one-year prospective case series from March 2017 to Mach 2018 to evaluate the pre-hospital management of SCI and its outcome.

Results. Eighty-nine cases were reported over period of one year. The SCI cases were more common among male (78.6%) compare to female gender. The main age group were 20 to 45 year of age which were affected (73.8%). The main causes of morbidity and mortality were high amongst those who were involved in motor vehicle accident (45.8%) fall from height (41.9%). Twenty percent (20%) of patients transported from the accident scene to hospital who has had cervical collar stabilization. An average patient's admission time to the emergency department of hospital was 16-72 hours past-accident, accounted for 22.9%. The most popular mode of transportation from the scene to the hospital was Private cars (59.2%). Associated injuries with SCI among these patients were long bone fractures (6.8%), traumatic brain injury (45.8%), and abdominal trauma (1.9%). Among cervical injury the sub-axial injury at the level of C3/C7 (76.7%) were the commonest. During admission, the complete and incomplete spinal cord injuries rates were 43.1% and 64.9% of patients, respectively. Surgical procedures for SCI management performed in (25%) of the patients. With favorable outcome, who had regained motor and sensory recovery with no post-operative complications.

Conclusion. In Afghanistan traumatic cervical spinal cord injury is still one of the most catastrophic conditions with high rates of morbidity and mortality safe and rapid transportation of the cervical spinal cord injured patients to the medical facilities for definitive care has been a fundamental concept to improve the treatment outcome and to reduce the complications as whole.

Keywords: Traumatic cervical spinal injury (SCI), Traumatic brain injury (TBI), MRI

181 Case report of a giant medial temporal cavernous malformation in a 16 years old male presented with atypical absence seizures

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Introduction: Giant cavernous malformations (GCMs) are very rare lesions very little has been reported about their clinical characteristics.

Material and methods: This case report shows a patient harboring right medial temporal cavernous malformation involving the parahypocampal gyrus. According to the MRI appearance the lesion was classified as Zabramski type I with diameter 4x3,6x4cm.

Results: We present a case of a 16-year-old patient with a history of atypical epileptic absence seizures. MRI of the brain with SWI, DWI, MRA have shown a vascular cavernous malformation at the level of the hyppocampal head and body, parahypocampal gyrus, with extension to the posterior aspect of the insular region. There were also MRI signs for present hemosiderin halo form previous sentinel microhemorrhages. The lesion is in direct proportion and located posterolateral to the M1 segment of the right MCA, the genu of the M1 is located posterolaterally in relation to the vascular malformation. The patient underwent for complete surgical excision of the lesion. A right frontotemporal craniotomy was performed, preparation and dissection of the posterior arm of the Sylvie fissure and the right ICA, ACA, MCA with M1 and M2, II-nd and III-d cranial nerves. After preparation of the posterior aspect of the right insular region a complete excision of the CM was made with resection of the haemosiderin halo, transylvian amygdalo-hyppocampectomy was performed together with preservation of the deep venous drainage of the medial temporal lobe. Postoperative course was uneventful without any new episodes of seizures. Control CT and CTA had shown normal postoperative findings, without signs of ischemic changes. At two months follow up the patient AED's are decreased on minimal dosage.

Conclusion: Currently the best way to treat symptomatic CM's is surgical excision of the lesion with excision of the hemosiderin halo and preservation of any venous angioma anomalies.

Keywords: Cavernous malformation, Pediatric, Case report

182 The long-term outcome of the traumatic cranial vault deffect- a biomechanical study

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Skull defects that require reconstruction are common in primary debridement of penetrating brain injuries. The cranioplasty restores normal intracranial pressure relationships within the skull and improves cerebrospinal fluid flow dynamics. The repaired cranial bone restores intracranial space and provides protection not only from the possible risk of accidental impact but also from the constant atmospheric pressure through the skull defect. Although cranioplasty is typically performed nearly 3 months after traumatic brain injury, recent reports indicate that early cranioplasty after 5 to 8 weeks may aid recovery. The unrepaired cranial vault defect results in the loss of the intracranial space separation and protection from either direct impact or the long term atmospheric pressure. The unrepaired cranial defect is a dynamic condition that undergoes changes driven by the aging process and brain atrophy along with the constant atmospheric pressure across the skin over the cranial defect. The cranial defect that was not covered by cranioplasty in the long term caused epicranial skin infolding due to the atmospheric external pressure through cranial defect on the one hand side and progressive atrophy of the brain tissue itself on the other hand side. Thus, the large cranial defect, lasting for decades allows for the anatomical changes resulted in the onset of the severe allodinic pain syndrome in the skin over the cranial defect. The long-term outcome of the unrepaired cranial defect - considering anatomical, mechanical, psychological aspects along with the underlying mechanism of the onset of the severe allodinic pain syndrome in the skin over the cranial defect is discussed.

Keywords: Cranial vault defect, Cranioplasty, Allodinic pain

183 Metaplastic, psamomatous, calcificated or ossified meningioma of the thoracic spine, what is the exact diagnosis? case report and a literature review

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Introduction. Spinal meningiomas account for about 10% of all meningiomas and are usually located in the intradural extramedullary space, most commonly in the thoracic region. Among them, psammomatous meningioma with osseous metaplasia is exceedingly uncommon, and only few cases are described so far. However, this diagnosis represents a consensus of the pathologist because WHO because classification of CNS tumors does not recognize this type of tumor as a subtype of meningioma.

Case report. We present a 66-year-old female patient with a 3-year history of chronic back pain located in thoracic region, with progressively worsening leg weakness and paresthesias. At admission she presented with severe paraparesis and painful numbness slightly above the level of the omphalos. Spine MRI examinations revealed an intradural extramedullary mass at the T7/T8 level sized 10x7x21mm that compressed spinal cord (Figure 1). According to the image characteristics, the probable preoperative diagnosis was meningioma. The tumor was meticulously excised en bloc, although it was very adherent to the adjacent arachnoid and dura with unusually rigid structure. Cauterization of dural attachment was also performed (Figure 2). Postoperative period was uneventful, and the patient had significant improvement of lower extremity strength during the first 7 days after surgery. Control spine CT showed no tumor remnant (Figure 3). She was followed regularly and 3 months after the operation, patients gait improved to almost normal ambulation with fully recovered sphincter control. The pathologist's consensus confirmed the diagnosis of psammomatous meningioma with osseous metaplasia, WHO grade I (Figure 4).

Conclusion. Spinal psammomatous meningioma with osseous metaplasia is extremely rare finding, however, since histology findings are characteristic it probably represents a special subtype of meningioma, because according to the current classifications it cannot be classified into other subtypes. We performed literature review and found 4 similar cases. Findings are discussed.

Keywords: Spinal meningioma; Psammomatous meningioma; Psammomatous meningioma with osseous metaplasia

184 A rare case of intramedullary pilocytic astrocytoma: a case report

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Pilocytic astrocytoma is the benign form of astrocytomas. It represents a classic tumor of the posterior fossa in children. Its intraspinal localization is much less well known. We report a case of intra-medullary pilocytic astrocytoma occurring in an 11-year-old girl presenting gait disorders with progressive weakness in legs for 2 months associated with gestational disorders of both upper limbs and vesico-sphincteric disorders. The neurologic examination revealed decreased muscle strength of lower extremities (spastic paraparesis) with peripheral brachial diplegia. Brain magnetic resonance imaging (MRI) and spine MRI were performed. The cranial MRI revealed no pathologic Changes. Spinal MRI revealed an intramedullary lesion ranging from the medullary bulbo junction to D4. After antiedema treatment with steroids, C1–T4 laminectomy and total resection of the lesion was performed. Pathologic specimen obtained at surgery was reported as WHO Grade I pilocytic astrocytoma.

Keywords: Pylocitic astrocytoma, Intramedullary, Case report

185 Cerebellar arteriovenous malformation revealed by an acute subdural hematoma of the posterior fossa: case report and review of literature

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Introduction: Most cases of arteriovenous malformation (AVM), which is defined as an abnormal tangle of blood vessels in the brain, are presenting with headache, Seizures, Stroke-like symptoms or intracerebral hemorrhage. An AVM can rupture and bleed into the brain, an event called an intracerebral hemorrhage (ICH), or it can bleed into the space between the brain and skull, a rare event called a subarachnoid hemorrhage (SAH). We report the case of an adult patient with a subdural hematoma of posterior fossa caused by a ruptured cerebellar AVM .

Case report: A 63-years-old female was admitted to the hospital with a sudden severe headache. Her past medical history was significant forhypertension, heart valve diseases and atrial fibrillation treated by Acenocoumarol. Results of a neurological examination were normal. An acenocumarol overdose has been confirmed. Emergency cranial CT revealed a cerebellar subdural hematoma. She presented an altered state of consciousness in few minutes. She subsequently underwent craniotomy for evacuation of subdural hematoma of the posterior fossa and an AVM was discovered intraoperatively.

Conclusion: The symptoms of AVMs vary, depending on their type and location. Cerebral AVM can present with not only intracebral hemorrhage or intraventricular bleeding but also with subdural hematoma. AVMs that bleed can lead to serious neurological problems and sometimes death.

Keywords: Cerebellar AVM, Acute SDH, Case report, Literature review

186 Paraganglioma of the cauda equina region: a case report

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Spinal paragangliomas are very rare neuroendocrine tumors often presenting with low back pain and radicular symptoms. Gross total resection is the mainstay of operative treatment. Here, we present a case of this rare tumor and its management, including a review of the pathology and literature related to this tumor. This is a case of a 64-year-old man with no significant medical history with a week history of bilateral sciatica and weakness in the lower extremities with no sphincter disorder. Physical examination revealed a paraplegia, worse in the right compared to the left with no sensory disturbances, patellar and ankle reflex were absent and a lumbar spine syndrome. Neuroimaging with an MRI of the lumbar spine demonstrated an intradural mass at the level of L2 and L3. Complete tumor excision was done. Histologic sections demonstrated a paraganglioma.

Keywords: Paraganglioma, Cauda equina, Case report

187 Surgical management of pituicytomas: a single-center case series

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Objective: Pituicytomas (PT) are an extremely rare benign sellar and/or suprasellar tumors. It is typically challenging to distinguish from other sellar and suprasellar lesions because of it slow frequency. Surgical treatment may be challenging, owing to the hyper vascularity of the tumor. Due to the rarity of this tumor, most of the literature exists as case reports and small case series. We are here reporting our experience with patients operated on in our department and using recent scientific updates to establish clinical and radiological features of PTs that may allow a suspicion diagnosis to allow an optimal therapeutic strategy.

Methods: This is a retrospective single-center study, reporting the clinical manifestations, radiological characteristics, histopathological features, treatment strategies and long-term outcomes of 4 patients who have been treated for a Pituicytoma at Kremlin-Bicetre University Hospital in Paris, France over the past 7 years.

Results: Four patients were operated. All cases were misdiagnosed before surgery. Endoscopic transphenoidal approach was performed as first surgery for all cases. During surgery, unusual important bleeding was noted but we could optain a good resection after one or two surgeries. Pathological diagnosis was confirmed in all cases. During the follow up no recurrences occurred.

Conclusions: We added four more cases to the literature in order to make practicians establish Piticytomas at suspicion diagnosis for sellar and/or suprasellar masses. Knowing the diagnosis, a preparation can be made preoperatively to avoid possible complications peroperatively.

Keywords: Pituicytoma, Sellar tumors, Benign

188 Primitive neuroectodermal tumors of the spine: a case report and review of the literature

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Introduction. Primitive neuroectodermal tumor (PNET) originates from primitive neuroepithelial cells and occurs in the central nervous system (CNS) and the surrounding muscles, bones, and organization. Primitive neuroectodermal tumors (PNET) are heterogeneous group of malignant neoplasms that occur mostly in childhood and early adulthood and they are divided into central and peripheral types. PNET is often located in the cerebral hemisphere. Primary pPNETs of the spine are extremely rare. In this study we present an illustrative case of a primary intradural PNET of the lumbar spine, demonstrating clinical, pathological, and imaging characteristics of PNET of the spine, followed by a comprehensive review of the literature.

Case report. A 33-year-old Tunisian man presented with a six months history of low back pain with radiation of the pain to the right lower limb and bilateral symmetric leg weakness. The patient had no medical history. Physical examination revealed hypoesthesia of the lower limbs, evidence of flaccid paraplegia, and hypoactive reflexes in lower extremities. There was no bowel or bladder dysfunction. MR imaging demonstrated the presence of a 60 × 32 × 21 mm intradural extramedullary mass at the right L1–L2 level. This mass had heterogeneous signal intensity, T1 isointense, T2 hyperintense and low post-contrast enhancement following gadolinium administration. No other cord lesion and no osseous abnormality of the spine were found. A complete resection of the mass was done after a laminectomy. Immunohistochemical analysis showed positivity for vimentin, CD99 and S-100 favoring the diagnosis of PNET. After courses of chemotherapy and radiotherapy, our patient has significant improvement of his weakness at 16 months follow-up.

Conclusion. Primary spinal PNET is very rare and occurs predominantly in children and adolescents. Lacking clinical and radiographic specificity, those tumors should be included in the differential diagnosis of intradural mass lesions. In order to confirm the diagnosis, histopathology and immunohistochemistry analysis are mandatory. Due to limited evidence regarding the therapeutic aspects of these tumors, no definite protocol can be formulated for their treatment, but resection, radiotherapy, and multipotent chemotherapy are the preferred treatment options for these patients. Clinical outcomes still need to be evaluated in prospective trials.

Keywords: Spine, Neuroectodermal tumor, PNET

189 Septic neurological manifestations of Osler-Weber-Rendu syndrome: report of 2 cases

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Introduction: Hereditary hemorrhagic telangiectasia or Osler-Weber-Rendu syndrome is a rare autosomal dominant vascular disorder characterized by epistaxis, mucocutaneous telangiectasias, and arteriovenous malformations affecting various organs and systems. We present two cases of Osler-Weber-Rendu syndrome with Pulmonary Arteriovenous Malformation and neurological manifestations.

Case report 1: This is a case of 38-years-old man with medical history of epistaxis, operated 10 years ago for brain abscess with no cause determined. He was admitted to our hospital for intracranial hypertension syndrome. Neurological examination revealed right sided hemiparesis. Physical examination revealed a fever (38.5°) and labial telangiectases. Neuroimaging showed an abscess in the left parieto-occipital region. Chest CT scan revealed a pulmonary arteriovenous malformation. A surgical excision of the brain abscess was done with good evolution after 45 days of antibiotic therapy. Later, the patient underwent a pulmonary angiogram with embolization of a large left lung arteriovenous malformation.

Case report 2: We report the case of a 29-years-old man with no significant medical history who presented with headache and fever. Results of a neurological examination were normal. Physical examination revealed a 38–38.9°C – mild fever. Neuroimaging showed a subdural empyema of the right temporo-parietal region. Chest CT scan revealed a pulmonary arteriovenous malformation of the left Anterior basal segment. Antibiotic therapy was done and the evolution was good. Embolization of the pulmonary malformation was done later.

Conclusion: Neurological manifestations of Osler-Weber-Rendu syndrome are rare but considered to be life-threatening. The pulmonary arteriovenous malformations must be considered as cause of brain abscess or subdural empyema and an embolization should be done.

Keywords: Abscess, Osler-Weber-Rendu syndrome, Pulmonary arteriovenous malformation

190 Solitary choroid plexus metastasis of clear cell renal carcinoma 11 years after nephrectomy: a case report

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Introduction. Brain metastasis which commonly arises in patients with lung cancer, breast cancer and melanoma are the most common intracranial tumors amongst adults. While brain metastasis of renal cell carcinoma are less common, intraventricular localization is particularly rare. There are few small series and mostly case reports which have noted intraventricular involvement of RCC metastasis.

Case presentation. 51-year-old patient, followed for a kidney tumor operated for nephrectomy 11 years ago (2010), has been progressively presenting for 4 months with speech, memory and concentration disorders, with installation for 2 months heaviness of his right half-body without signs of HTIC or comitiality. On clinical examination, we find memory disturbances, aphasia with a lack of words and dysarthria, without motor deficit. A brain MRI was done showing a left frontal intraventricular tumor with ipsilateral ventricular dilation. The Body CT scan does not show a suspicious lesion. He was operated (April 2021) for complete excision of this lesion. He underwent 3 radiosurgery sessions 1 month later. At 6 months of follow-up, he described a clear clinical improvement, essentially of his frontal syndrome.

Conclusion. BM secondary to RCC tend to be located in the ventricular system, adherent to the choroid plexus. The focus of the differential diagnosis can be narrowed considerably by knowing the patient's age and the exact location of the tumor within the ventricles. Early detection of brain metastases, and a therapeutic strategy including surgery and radiosurgery can offer patients an extended survival.

Keywords: Choroid plexus, Metastasis, Clear cell renal carcinoma

191 Surgical treatment of dysembryoplastic neuroepithelial tumor: about 5 cases

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Introduction. Dysembryoplastic neuroepithelial tumor (DNET) is a slowly growing intracranial tumor characterized by cortical location and multinodular architecture. DNET mostly involves the supratentorial region and frequently presents seizure in younger patients. The surgical treatment of these tumors is rare. We report 5 cases of dysembryoplastic neuroepithelial tumor surgically treated.

Methods and Results. It is a retrospective study of 5 cases of dysembryoplastic neuroepithelial tumor, conducted in our Neurosurgical Department. It's about 2 men and 3 women with an average age 21.4 years. All patients have a clinical history of Drug-Resistant Epilepsy with a duration of evolution ranging from 5 years to 19 years. We report 2 cases of focal seizures and 3 cases of generalized seizures. The right lobe is the most affected (3 cases). The lesions are localized in the frontal lobe in 3 cases and in the temporal lobe in 2 cases. All the cases were operated with a complete excision. The postoperative evolution was favorable in 4 cases with no more epileptic seizure; one recurrence has been registered and was operated with good evolution.

Conclusion. The DNET is a Benign mixed glioneuronal neoplasm of children and young adults, characteristically associated with intractable partial seizures. The surgical treatment may be a good alternative for the patients with drug-resistant epilepsy.

Keywords: Dysembryoplastic, Neuroepithelial tumor, Epilepsy

192 Tuberous sclerosis complex revealed by a giant cell astrocytoma: a case report

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Introduction. Tuberous sclerosis complex (TSC), also known as Bourneville disease, is an autosomal-dominant, neurocutaneous, multisystem disorder, classically characterized by mental retardation, epilepsy and skin lesions. There is,

however, considerable heterogeneity in the neurologic manifestations. It is characterized by the development of benign tumors affecting different body systems affecting the brain, skin, retina, and viscera. We report the case of a young adult patient with TSC revealed by a giant cell astrocytoma.

Case Report. We report the case of a 25-years-old man with no significant medical history, neither any phakomatosis in the family health history. He was admitted to our hospital with a two month history of idiopathic intracranial hypertension (pseudotumor cerebri). Physical examination revealed many hypomelanic macules on the back and on the abdomen. Results of a neurological examination were normal. A papilledema grade 3 bilateral is found on fundoscopy. MRI showed a cerebral ventricle neoplasm, hydrocephalus and multiple intracranial calcifications. The patient was operated with complete excision of a youth and hemorrhagic brain ventricle tumor. Histopathologic examination confirmed a subependymal giant cell astrocytoma.

Conclusion. TSC can occur as sporadic cases, due to new spontaneous mutations in TSC1 or TSC2, and may appear both in early childhood and in elderly subjects. In any case of subependymal giant cell astrocytoma the TSC should be identified, the presence of two major features or one major and two minor features was considered sufficient for a definitive diagnosis. There is no cure for TSC, although treatment is available for a number of the symptoms. The prognosis of TSC depends on the severity or multiplicity of organ involvement.

Keywords: Tuberous sclerosis complex, Giant cell, Astrocytoma

193 Aspiration thrombectomy using distal access catheter in the management of procedural thromboembolic complication related to brain aneurysm treatment

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Background: Despite growing evidence over the last two years of the efficacy and safety of direct thrombus aspiration using a large bore distal access catheter as a type of mechanical thrombectomy procedure in acute stroke large-vessel occlusion patients, the experience and evidence of this technique for managing thromboembolic complications in endovascular aneurysm treatment is still limited and little literature is available regarding this topic. We present a case of a thromboembolic occlusion of the left middle cerebral artery during the preprocedural angiograms of a large and fusiform left internal carotid artery aneurysm, successfully treated by direct thrombus aspiration using a Sofia5F distal access catheter (MicroVentionEurope, Saint-Germain-en-Laye, France).

Case report: A 54-year-old woman was admitted to our hospital for elective endovascular aneurysm treatment. The patient was prepared for intervention with dual antiplatelet therapy since the placement of flow-diverting stent was intended. During the intervention, on working-projection preprocedural angiograms, a thromboembolic occlusion of the M1 and M2 segment of the left middle cerebral artery was noticed. This complication was successfully managed navigating already placed distal access catheter intended for support during the opening of the flow-diverting stent, therefore the thrombus was manually aspirated for two minutes and Thrombolysis in Cerebral Infarction scale 3 flow was restored.

Conclusion: This case should encourage the use of Sofia5F distal access catheter already placed for aneurysm treatment to perform zero-delay direct thrombus aspiration as a rescue approach for thromboembolic complications during endovascular aneurysm treatments.

Keywords: Aspiration thrombectomy, Thromboembolism, Brain aneurysm

194 Surgical treatment of spinal metastasis, single center experience

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Introduction: Spinal column is the most frequent location of bone metastases. Due to progress in cancer treatment and imaging, life expectance of these patients is longer and as consequence there is constant rise in frequency of spinal metastases. 10% of patients who suffering from cancer have spinal metastases and 10-20% of them have also spinal cord compression. Treatment strategy depends mainly from patient clinical condition and primary tumor characteristics. Main goal of treatment is improving patient`s quality of life, preventing neurological deficit and pain relief. In the most cases these patients require a multidisciplinary approach.

Methods: In University Clinical Center of Kragujevac 107 patients were surgically treated due to spinal metastases during last three years period. Decision for surgery was made in every case based on patient`s clinical condition and expected survival according to Tokuhashi classification and OSRI score. Preoperative spinal instability was estimated by use of Spine

Instability Neoplastic Score (SINS) and Tomita classification. Treatment modalities included percutaneous vertebroplasty or spinal decompression with fusion.

Results: Of the total number 37 of operated patients had spinal metastasis in thoracic segment, 49 in lumbar, 5 in cervical and 16 patients had multifocal spinal lesions. Vertebroplasty was treatment option for 61 patients and 39 patients were treated with decompression and spinal fusion. Combined technique was used in 7 cases. Clinical outcome was estimated according to pain scores (VAS) and quality of life scores, which were recorded before and after surgery. Survival for each patient was also recorded.

Conclusion: Surgery for spinal metastases is nowadays part of standard treatment protocol for carefully selected patients. Surgical treatment contributes to significantly better pain control, improved quality of life and length of survival. There is also need for development of more sensitive scores which will provide additional help in decision making for surgery.

Keywords: Spinal metastases, Quality of life, Multidisciplinary treatment

195 Vestibular schwannoma mistaken for a meningioma of the cerebellar tent: a case report

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Introduction: Intraparenchymatous schwannomas are benign tumors usually developed at the expense of cranial nerves. They are usually located in the cerebellopontine angle. Vestibular nerve is most frequently affected followed by trigeminal nerve. Schwannomas developed without any relation to cranial nerves are seldom.

Observation: We report the case of a 40-years-old female, with no medical history, who complained from intermittent occipital headaches and visual blur evolving over 2 years. Physical examination found a discrete peripheral right facial palsy, hypoesthesia of the right hemiface, and bilateral papillary edema at the fundus. The rest of the somatic examination did not show any signs evoking type 1 neurofibromatosis (NF1). ENT examination was normal. Brain imaging showed a lesion that was strongly suggestive of a meningioma of the tent. The patient underwent surgery and complete resection was performed. Pathological examination concluded to a schwannoma.

Discussion: Schwannomas mostly arise from the vestibular portion of the vestibulo-cochlear nerve, less frequently from other nerves except of the optic nerves. Intracerebral schwannomas unrelated to any cranial nerve or to a neurofibromatosis are exceptional. Only few cases of intracerebellar schwannomas were reported in the literature. Mechanisms underlying the development of intraparenchymal schwannomas remain a mystery; however, several theories were proposed. Despite of their rarity, intracerebellar schwannomas should be considered as differential diagnosis when imaging techniques show a well-circumscribed nodule in the cerebellar hemisphere.

Conclusions: Intraparenchymal schwannomas are very rare. Out of the context of NF1 or schwannomatosis, it is very difficult to guess its nature on imaging hence the importance of anatomopathological examination. It is important to recognize this entity in order to have recourse to the adequate surgical approach.

Keywords: vestibular, schwannoma, meningioma

196 Hydrocephalus revealing a gliosarcoma in a child: a case report

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Introduction: Gliosarcoma is a primary mixed tumor of the central nervous system characterized by biphasic proliferation involving a glial contingent type glioblastoma and a sarcomatous contingent. It is mostly seen in adult males and rarely in children. These tumors are well-known for their poor prognosis. Treatment is based on surgical resection along with radiotherapy and in some rare cases chemotherapy.

Observation: We report the case of a 5-month-old baby, with previous normal psychomotor development, who presented after the rapid onset of a right frontal swelling and an intracranial hypertension syndrome. MRI showed the presence of a voluminous expansive right frontal process for which the patient underwent surgery with a subtotal excision. Post-operative follow-up was uneventful. Pathological examination concluded to a gliosarcoma. An MRI done 1 year after the surgery objectified, in addition to a parasagittal tumor residue, the presence of an external hydrocephalus. The patient was derived through a subdural-peritoneal shunt. 5 months after the second surgery the patient presented neither clinical nor radiological signs of tumor recurrence.

Discussion: Congenital forms of gliosarcomas are very rare. They are usually supratentorial rather affecting the temporal region. Clinical presentation is variable and not specific depending on the location of the tumor. Typically, it is an intracranial hypertension syndrome along with motor deficit and seizures. Imaging techniques may show the same aspect of

glioblastomas leading to a wrong diagnosis. Often it is a superficial, well-circumscribed, hyperdense mass with peripheral enhancement in an irregular crown, surrounding a central hypodensity corresponding to areas of necrosis and peritumoral edema. Complete resection is not always achievable and adjuvant treatment might be needed.

Conclusion: Gliosarcoma is a rare malign tumor with poor prognosis. Even though imagery can be evocative, confirmation should be both anatomopathological and immunohistochemical. Treatment is based on surgery along with radiotherapy.

Keywords: hydrocephalus, gliosarcoma, pediatric tumor