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SAŽETCI
ABSTRACTS

SUPPLEMENT

12th - 15th October 2023

Petrčane, Croatia

9th Congress of the Croatian Neurosurgical Society

and Joint Meeting with the Czech Neurosurgical Society

and Collaborative Meeting with German Society of Neurosurgery

and Croatian-Japanese Pre-congress Symposium on Normal Pressure Hydrocephalus

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Supplement Editors:
Miroslav Vukić, Sergej Marasanov

Coordinating Editor:
Mario Habek

9th Congress of the Croatian Neurosurgical Society and Joint Meeting with the Czech Neurosurgical Society and Collaborative Meeting with German Society of Neurosurgery and Croatian-Japanese Pre-congress Symposium on Normal Pressure Hydrocephalus

12th - 15th October 2023

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- Czech Neurosurgical Society
- University of Zagreb, School of Medicine

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TOPICS

1. Neurooncology
2. Skull Base Surgery
3. Vascular Neurosurgery
4. Spinal Neurosurgery
5. Pediatric Neurosurgery
6. Trauma Neurosurgery and Critical Care
7. Functional Neurosurgery
8. Epilepsy surgery
9. Stereotactic Neurosurgery and Radiosurgery
10. Free topics
11. Nurses topics

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The Editor-in-Chief of Neurologia Croatica, as advised by the Editorial Board, had accepted publishing the abstracts of the 9th Congress of the Croatian Neurosurgical Society and Joint Meeting with the Czech Neurosurgical Society and Collaborative Meeting with German Society of Neurosurgery and Croatian-Japanese Pre-congress Symposium on Normal Pressure Hydrocephalus as a journal supplement.

The editors of this Supplement have reviewed and approved the submitted abstracts. The authors of abstracts are responsible for their own contributions.

The Supplement Coordinating Editor is responsible for the overall quality of the Supplement.

Mario Habek
Editor-in-Chief

Contents

INTRODUCTION

Dear colleagues, dear friends,

On behalf of the Managing Board of the Croatian Neurosurgical Society as well as of the Organizing

Committee, I have the honor and pleasure of welcoming you to the 9th Congress of the Croatian Neurosurgical Society and Joint Meeting with the Czech Neurosurgical Society and Collaborative Meeting with German Society of Neurosurgery and a very special pre-congress Symposium on Normal Pressure Hydrocephalus in collaboration with the Japan Neurosurgical Society and Medical School of the University of Zagreb. This exceptional gathering will take place in Petrcane near Zadar on the Croatian Adriatic coast, from the 12th to the 15th October 2023.

From its inception almost a quarter of a century ago, the Congress of the Croatian Neurosurgical Society has outgrown its' initial scope of a national neurosurgical specialists' meeting to grow to a regional melting pot of exchange of knowledge, experience and up-to-date management strategies in the different fields of the noble art of neurosurgery. We will once again bring together prominent Croatian and European neurosurgeons, as well as distinguished guests and speakers from all over the world to provide the attendants a spectacular environment for professional formation and social interaction.

The 9th Congress promises to be the most attended yet, since its integrative part is a Joint Meeting with the Czech Neurosurgical Society as well as a special Collaborative Meeting with members of the German Society of Neurosurgery. Also, we proudly co-organize a spectacular Pre-Congress Symposium with eminent guests from the Japan Neurosurgical Society.

We invite you to take an active part in the scientific program of this remarkable Congress and share your valuable experiences with colleagues.

With very best regards to all,

Professor **Miroslav Vukić**, MD, PhD
President of the Organizing Committee
President of the Croatian Neurosurgical Society

WELCOME LETTER

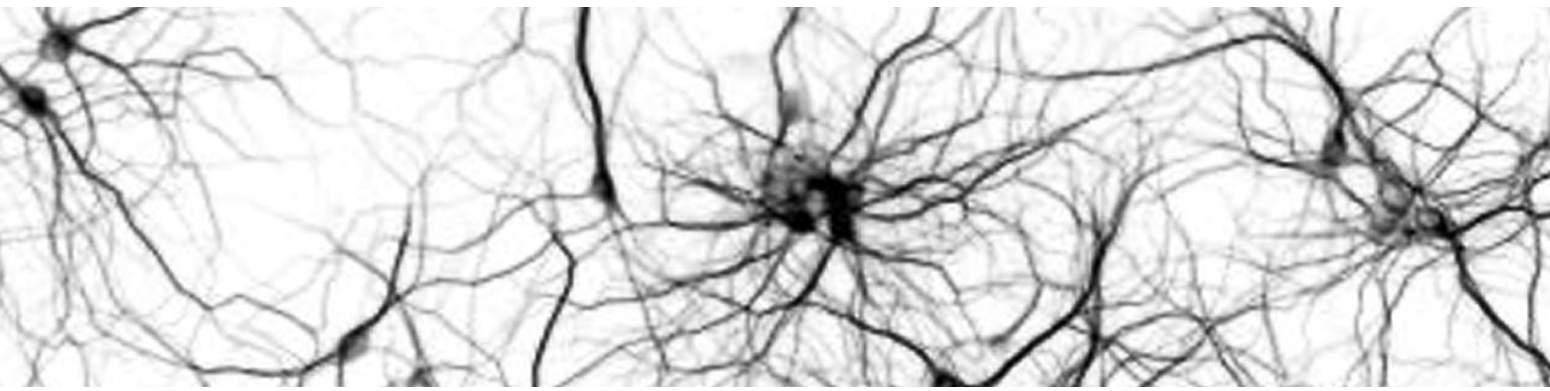
Dear friends, dear colleagues,

it is a great honor to welcome you on the 9th Congress of the Croatian Neurosurgical Society and Joint Meting with the Czech Neurosurgical Society and Collaborative Meeting of the German Society of Neurosurgery. The idea of meeting three companies is a new creative format. We hope for closer mutual contacts and more detailed knowledge of sophisticated projects and goals in our countries in a more intimate environment. It is actually the first close official contact between Czech and Croatian societies. This connection has its own logic, our countries have shared interests since the Middle Ages, in the time of the monarchy and also in times of national revival. The joint meeting is further strengthened and crowned by the participation of advanced German and Japanese societies.

We look forward to this meeting, new friendships and insighs to improve the care of our patients.

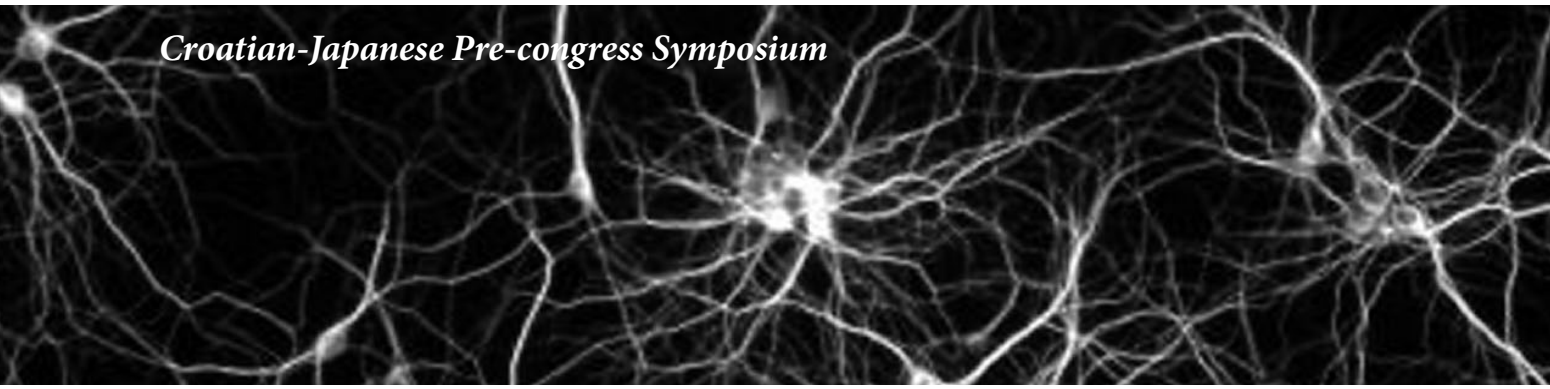
We invite you to contribute to scientific program of this event.

Professor **Martin Sameš**, MD, PhD
President of the Czech Neurosurgical Society,
Czech Medical Association



PRE-CONGRESS SYMPOSIUM ON NORMAL PRESSURE HYDROCEPHALUS (PAHOPHYSIOLOGY OF CSF AND NPH DEVELOPMENT)

ABSTRACTS OF ORAL PRESENATATIONS



Croatian-Japanese Pre-congress Symposium

DISTRIBUTION OF DIFFERENT MOLECULES BETWEEN INTERSTITIAL AND CEREBROSPINAL FLUID - DOES CEREBROSPINAL FLUID CIRCULATE?

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Aim: The cerebrospinal fluid (CSF) movement and its influence on substance distribution along CSF system and between CSF and insterstitial fluid have been analyzed and discussed in light of the new hypothesis of CSF physiology. According to new hypothesis, CSF movement is not a unidirectional circulation, but a permanent rhythmic systolic-diastolic CSF volume pulsation.

Methods: Distribution of various substances (radioactive water, organic acids, inulin etc.) has been investigated in CSF and interstitial space after their application into different CSF compartments in freely moving large animals (dogs and cats).

Results: Our results suggest that substance distribution along the CSF system is observed in all directions (in the direction of imagined circulation from brain ventricles to subarachnoid space, as well as in the opposite direction), and depends on the substance resident time, whereby longer resident time means longer distribution path. Furthermore, distribution into the cortical subarachnoid space is significant in the vicinity of the interhemispheric space, and very poor along the temporal and parietal subarachnoid space. Quick disappearance of organic anions from central CSF compartments, and very low concentrations of the tested substances in "peripheral" CSF compartments were observed in control condition. When active transport was blocked with probenecid, substance concentrations in CNS tissue and in „peripheral" CSF compartments were significantly increased compared to control group.

Conclusion: Obtained results suggest that CSF movement (systolic-diastolic CSF volume pulsation) represents the main force of substance distribution along the CSF system, and from CSF via peri- and paravascular routes into the central nervous system (CNS) parenchyma interstitial space. It seems that brain metabolites are predominantly removed from the interstitium and the CSF by means of active transport at the capillary level (it has the most important role in CNS homeostasis), and not, as it is generally believed, by unidirectional circulation into dural sinuses of the brain convexity.

Croatian-Japanese Pre-congress Symposium

THE ANALYSIS OF CEREBROSPINAL FLUID FLOW DYNAMICS IN MOUSE FETUSES - CEREBROSPINAL FLUID MAY FLOW OUT FROM THE BRAIN THROUGH THE FRONTAL SKULL BASE AND CHOROID PLEXUS

Akai Takuya[1], Toshihisa Hatta[2], Hiromi Sakata-Haga[2], Seiji Yamamoto[3], Shusuke Yamamoto[1], Satoshi Kuroda[1]

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Key words: cerebrospinal fluid; outflow; channel; gate, mouse; fetus, fluorescein; gold particle.

Aim: Cerebrospinal fluid (CSF) has been believed to be produced in choroid plexus, and drain into sagittal sinus through arachnoid granules in one-way. This theory can explain most pathological conditions. Recently, new CSF drainage tracts were proposed such as brain capillaries, meningeal and nasal lymphatic systems. In this study, we investigated the extracranial outflow of particles in CSF. This analysis will contribute for the prevention of hydrocephalus, cerebral degenerative diseases and brain aging.

Materials and Methods: Mouse fetuses at a gestational age of 13 days were used. Either fluorescent proves with differing molecular weights (MW) or gold particles with different size or cadaverine were injected into the lateral ventricle. The fluorescent probes movements were monitored in live. Gold particles deposition was studied under stereomicroscope or electron microscope (EM). Cadaverine deposition, indicates its movements tract, were observed under fluorescent microscope.

Results: 1) Fluorescent study: With an injection of low and high molecular weight (LMW, HMW) probes conjugate, both probes dispersed into the brain, but only the LMW probe dispersed into the whole body. The gate size to go out from brain is suspected as less than 1400. 2) Gold particle study: The gold particles accumulated at the frontal skull base. EM study revealed gold particles deposition between the ventricular ependymal cells. And only small size particle (2 nm) was found in liver. 3) Cadaverine study: Its deposition was observed on the frontal skull base, choroid plexus, ependyma and peri-vascular space.

Conclusion: The particles in CSF may drain to extracranial space via frontal skull base and choroid plexus through ependyma and peri-vascular space. This particles outflow is regulated by its MW and size.

Croatian-Japanese Pre-congress Symposium

NEURORADIOLOGICAL INSIGHTS INTO THE PATHOPHYSIOLOGY OF HYDROCEPHALUS

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Aim: Development of advanced radiological techniques make possible to depict central nervous system in details, with excellent contrast between CSF and surrounding structures (bones and parenchyma).

Methods: It is feasible to perform precise segmentation of all CSF spaces and to quantify their volumes both in intracranial and spinal part. Aside from volumetric analysis advanced MR techniques (T2 space and phase-contrast sequences) are capable to depict and even quantify movement of CSF, especially in regions where these movements are pronounced as foramen of Monro, mesencephalic aqueduct and cranio-cervical junction.

Results: Radiological diagnostic procedures often show findings which are not in concordance with classical CSF hypothesis based on active secretion manly by choroidal plexuses, unidirectional CSF circulation and reabsorption in dural sinuses. Our clinical cases showed that choroidal plexuses are not necessary for CSF production and that blockage of mesencephalic aqueduct will not always induce hypertensive hydrocephalus as proposed by classical concept. Furthermore, application of contrast in spinal CSF space will almost always show distribution opposite to one proposed by classical concept.

Conclusion: These radiological findings point out that classical hypothesis of CSF physiology is not able to explain numerous clinical cases which emphasize necessity for new approaches to this issues.

Croatian-Japanese Pre-congress Symposium

CHANGES OF WATER TURNOVER IN BRAIN TISSUE AND CSF SPACES IN PATIENTS WITH IDIOPATHIC NPH: DYNAMIC PET STUDY USING [15O]H2O

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[4]*Department of Behavioral Neurology and Neuropsychiatry, Osaka University United Graduate School of Child Development, Osaka, Japan*

Introduction: In order to clarify differences of water molecule turnover in brain and CSF of idiopathic NPH (iNPH) from normal condition, dynamic PET was performed using radio labeled H2O.

Methods: Normal volunteers (n=10) and patients

with definite iNPH (n=5) were included. Dynamic PET data were obtained for 15 minutes after intravenous [15O]H2O (500MBq). Voxels of interest were set in internal carotid artery (ICA), superior sagittal sinus (SSS), cortical gray matter (GM), white matter (WM), basal ganglia (BG), cerebellar cortex (CC), lateral ventricle (LV), Sylvian fissure (FS), and prepontine cistern (PPC). Time and relative radio activity (RAA) curves of each VOI were analyzed.

Results: In the control group, the peak radio activities of GM, WM, BG and CC were at 26.8, 67.3, 26.3 and 40.3 seconds after the peak in ICA, respectively. Activities in whole brain structures decreased gradually. On the contrary, activities of LV, FS and PPC increased gradually until the end of measurement. In the iNPH group, RRA of BG was significantly lower than controls. RRA curves of GM and WM were decreasing and also getting closer, each other in late phase. This means diffusion of water molecules in brain resulting in equal distribution in time. Compared with the controls, it took significantly longer until the equal distribution in brain in iNPH. RRA of LV, FS and PPC in iNPH tended to be lower compared to controls. After L-P shunt, these delays tended to be normalized.

Conclusion: Water turnover in brain and CSF is reduced or delayed in iNPH compared to normal, which is normalized after shunt surgery.

Croatian-Japanese Pre-congress Symposium

EFFECTS OF EXPERIMENTAL IMPAIRMENT OF CSF MOVEMENT ON HYDROCEPHALUS DEVELOPMENT

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Aim: We have tested a new hypothesis about CSF dynamics, according to which CSF pressure does not depend on CSF secretion, unidirectional circulation and absorption, but it is a consequence of biophysical characteristics of cranial and spinal space, according to the law of fluid mechanics.

Methods: CSF pressure and volume changes, observed in different „body" positions of the new CSF system model, which consists of the cranial part with unchangeable volume, and the spinal part with a volume that can be changed, were compared with the observations obtained from anaesthetized cats and rabbits in control conditions, as well as after producing cervical stenosis and aqueduct of Sylvius blockade.

Results: In an upright position, in control animals an appearance of subatmospheric pressure inside the cranium occures, which is in accordance with the law of fluid mechanics, and in opposition with the generally accepted hypothesis about CSF dynamics. This implies that a much better brain perfusion exists in an upright body position than it was previously believed (an important evolutionary adjustment). A performed analysis of hydrostatic pressure gradients inside the craniospinal CSF space in all of the tested body positions indicates that CSF circulation in an unidirectional manner from the ventricles into the cortical and spinal subarachnoidal space is impossible. In the case of impaired craniospinal communication (cervical stenosis, aqueductal blockade), the pressure inside the ventricles becomes more positive.

Conclusion: The observed results are in accordance with the new „Bulat-Klarica-Orešković" hypothesis of CSF physiology, according to which CSF pressure and volume are regulated by osmotic and hydrostatic forces at the brain and spinal cord capillary level.

Croatian-Japanese Pre-congress Symposium

CEREBROSPINAL FLUID DYNAMICS-MRI TIME-SPATIAL SPINE LABELING METHOD

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Key words: CSF dynamics; MRI; Time-SLIP; normal pressure hydrocephalus.

Aim: To observe normal cerebrospinal fluid dynamics and its changes in pathophysiological conditions using spatial-temporal labeling inversion pulses (Time-SLIP) technique.

Methods: Both 1.5T and 3T MRI scanners (Canon Medical Systems Corp., Japan) were used in Time-SLIP CSF dynamics imaging. MR radiofrequency pulses convert specific volumes of CSF into endogenous tracers. CSF dynamics can then be observed. A gate-free and fast image acquisition technique like Time-SLIP is necessary to visualize natural CSF motion, whose behavior varies with cardiac pulsation and respiration. CSF dynamics observation over a 1-5 sec. with this method. Time-SLIP was applied to CSF where the region of interest.

Results: In the normal brain, active exchanges of CSF between the lateral and third ventricles (through the foramen Monro) were observed. Cerebrospinal fluid turbulent flows were observed in the third and fourth ventricles but not in the body of the lateral ventricle. Large pulsatile CSF movement was seen in the pre-pontine cistern. Rapid pulsatile CSF motion was observed in the Sylvian fissure. However, no CSF movement was detected in the subarachnoid space over the convexity of the brain. No unidirectional CSF net flow was detected. In the patient with hydrocephalus, exchanging flow through the foramen Monro disappeared, and an exaggerated CSF pulsatile flow through the aqueduct was observed. Dominant CSF pulsation in the pre-pontine cistern was impaired in the patient with hydrocephalus secondary to subarachnoid hemorrhage. In idiopathic normal pressure hydrocephalus, there is no blockage of CSF pulsation in entire CSF spaces.

Conclusion: The MRI Time-SLIP technique visualized CSF dynamics in normal and pathophysiological conditions. Cerebrospinal fluid dynamics observed by Time-SLIP technique in the normal physiological brain was very much different from the classical bulk CSF circulation theory described in neurosurgical textbooks.

Croatian-Japanese Pre-congress Symposium

NEW PROGNOSTIC FACTOR FOR THE TREATMENT OF NORMAL PRESSURE HYDROCEPHALUS

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2Croatian Institute for Brain Research, School of Medicine University of Zagreb, Zagreb, Croatia

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Aim: The diagnosis and management of idiopathic normal-pressure hydrocephalus (iNPH) remains unclear. Despite the current guidelines for INPH treatment and use of various prognostic tests, preoperative assessment is often left to the free judgment and clinical experience of the physician. Despite

the fact that some prognostic tests, suggested by the iNPH guidelines, should be associated with high sensitivity and high predictive value, there is often no positive clinical response to surgical treatment. Therefore, there is a need to search for additional prognostic tests that would improve results of surgical treatment.

Methods: In our study 19 patients with clinical and neuroradiological signs of iNPH were selected according to guidelines, for preoperative assessment and possible further surgical treatment. MR volumetry of the intracranial and spinal CSF was performed. Patients were tested using prolonged external lumbar drainage in excess of 10 mL per hour during thee days. Clinical response to lumbar drainage was followed by a walking score and a mini-mental test.

Results: Twelve out of 19 patients had a positive clinical response to prolonged external lumbar drainage and they underwent shunting procedure. The results shows that in patients who respond positively to drainage, there is a significantly higher volume of CSF in the spinal space (120.5 ± 14.9 ml) compared to (103.1 ± 27.4 ml).

Conclusion: This study shows for the first time that the volume of spinal CSF could have a predictive value in the preoperative assessment of patients with idiopathic normal-pressure hydrocephalus. Additional prospective randomized clinical trials are needed to confirm our results.

Croatian-Japanese Pre-congress Symposium

CSF BIOMARKERS APPLICATION IN THE TREATMENT OF IDIOPATHIC NORMAL PRESSURE HYDROCEPHALUS

Madoka Nakajima

Department of Neurosurgery, Juntendo University Faculty of Medicine, Tokyo, Japan

Aim: Cerebrospinal fluid (CSF) is not merely a buffer that protects the brain from trauma, but is also responsible for the transport of bioactive molecules and excretion of waste products produced by brain activity. Idiopathic normal pressure hydrocephalus (iNPH) is a condition based on impaired CSF excretion, with disproportionate stagnation in the brain, particularly in the subarachnoid space, which can be corrected by shunt therapy to facilitate drainage.

Methods: Investigating the composition of cerebrospinal fluid, which regulates the environment within the brain in this disease, will provide insight into the pathophysiology of the disease, its differential diagnosis, severity assessment and prognosis of treatment.

Results: Currently, there is no disease-specific CSF biomarker for iNPH because the complex pathogenesis of the disease is not yet understood. However, leucine-rich α2-glycoprotein (LRG), which indicates the presence of a chronic inflammatory response, and protein tyrosine phosphatase receptor type Q (PTPRQ), which reflects the function of choroid plexus epithelium and ventricular ependymal cells, have been identified as specific in iNPH by comprehensive proteome analysis. Particularly PTPRQ has been identified as the protein that specifically fluctuates and is increased in iNPH. To differentiate neurodegenerative diseases and understand comorbidities, Amyloid β42 (Aβ42), phosphorylated tau (pTau), and total tau (tTau), which reflect Alzheimer's disease, the largest comorbidity, have been widely reported to predict shunt treatment outcomes for patients diagnosed with iNPH on both clinical picture and imaging. Other factors that may be predictive of shunt treatment outcome in patients with iNPH include the Neurofilament light chain (NFL) as a protein derived from neurons that correlates with cognitive function.

Conclusion: These biomarkers can now be measured also in plasma, and potential combinations of biomarkers will provide patients with prognostic information prior to treatment.

Croatian-Japanese Pre-congress Symposium

DIAGNOSIS AND TREATMENT STRATEGY OF IDIOPATHIC NORMAL PRESSURE HYDROCEPHALUS

Masakazu Miyajima, Madoka Nakajima

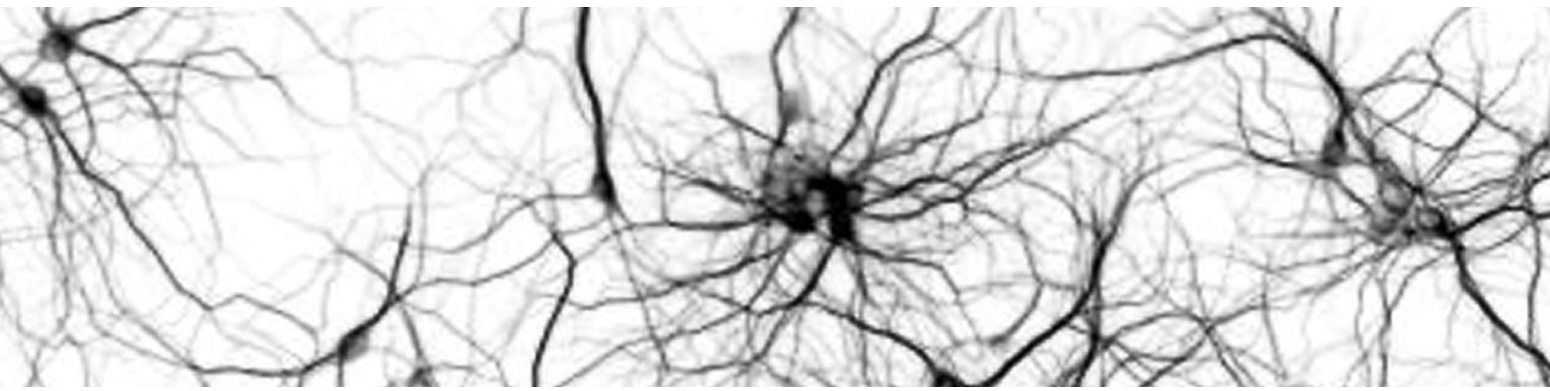
Department of Neurosurgery, Juntendo University Faculty of Medicine, Tokyo, Japan

Aim:: Idiopathic normal pressure hydrocephalus (iNPH) is becoming increasingly important with the aging of society as a disease that can affect the daily activities of the elderly. In recent years, evidence for the diagnostic criteria and treatment of iNPH has increased, and the third edition of the iNPH treatment guidelines was published in Japan in 2020.

Methods: With the promotion of multicenter studies in Japan, the diagnosis of iNPH is centered on the neuroimaging findings of DESH (Disproportionately enlarged subarachnoid space hydrocephalus), inclusion of the characteristic symptoms gait disturbance, overactive bladder, and cognitive impairment, as well as anatomical changes of the brain, such as narrowed sulci in the high and middle part of the arcuate region.

Results: Magnetic resonance imaging has been used to evaluate brain changes in iNPH through new imaging method, and research is underway to elucidate the pathophysiology of iNPH in combination with biological information obtained from cerebrospinal fluid (CSF) biomarkers. On the other hand, the precise prognosis of shunt treatment for non-DESH patients and patients with comorbid neurodegenerative diseases will become an important issue in the future to determine the indication for surgery.

Conclusion: As a person ages, the body's ability to maintain its internal environment deteriorates. CSF circulation may play an important role in neuronal cell homeostasis, and CSF shunt therapy plays a role in maintaining brain environment homeostasis in patients with iNPH.

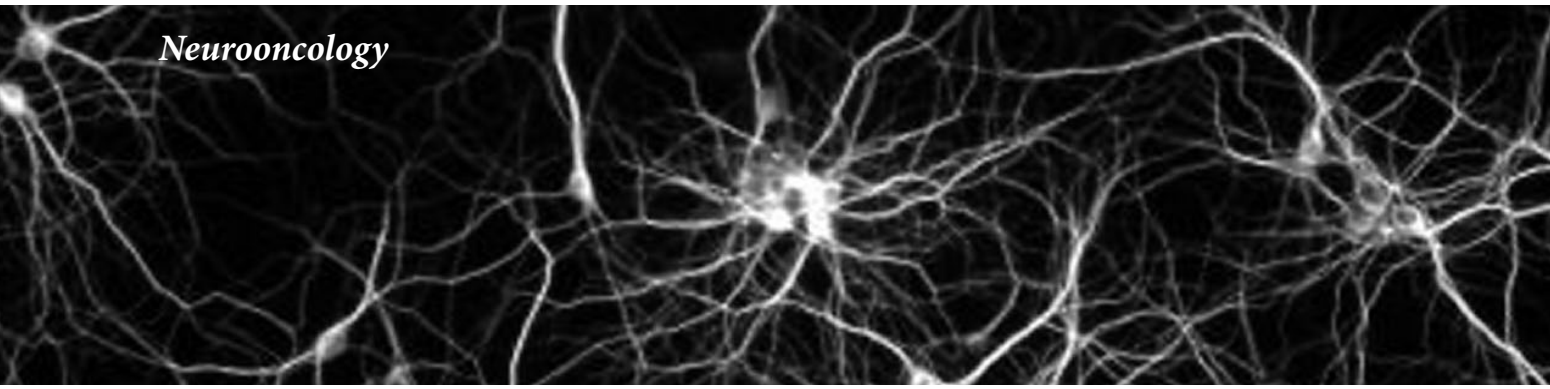


9TH CONGRESS OF THE CROATIAN NEUROSURGICAL SOCIETY

AND JOINT MEETING WITH THE CZECH NEUROSURGICAL SOCIETY

AND COLLABORATIVE MEETING WITH GERMAN SOCIETY OF NEUROSURGERY

ABSTRACTS OF ORAL PRESENATATIONS



Neurooncology

PEDIATRIC ANAPLASTIC PLEOMORPHIC XANTHOASTROCYTOMA

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Key words: anaplastic; pediatric; pleomorphic; xanthoastrocytoma.

Pleomorphic xanthoastrocytoma (PXA) is an uncommon malignancy of predominantly children and young adults. Its anaplastic variant (aPXA) is extremely rare and has a dismal prognosis due to aggressive biology and lack of optimal treatment. An 8-year-old boy was admitted to an outside hospital due to nausea and vomiting and altered mental status. Radiological workup showed a supratentorial mass lesion of the frontal lobe. He deteriorated neurologically, was intubated and sedated and transferred to our Department to undergo surgery. The lesion was removed gross totally and histology was consistent with the diagnosis of aPXA. Dysphasia and right-sided hemiparesis were noted postoperatively, yet improved over the course of hospital stay. The patient was discharged on 12th postoperative day and subsequently underwent photon and proton therapy, followed by adjuvant chemotherapy and then targeted therapy. His disease was under control for sixteen months, after which it had recurred and he underwent another surgery. Two further recurrences were operated at 26 and 33 months since the first surgery. At three years since the first admission, his neurological deficit is minimal, yet systemic sequelae of the oncological treatment are extensive.

Neurooncology

GLYCATED HEMOGLOBIN IN PATIENTS WITH INTRACRANIAL MENINGIOMAS

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Key words: meningioma; glycated hemoglobin; glucose.

Meningiomas are among the most common primary tumors of the central nervous system. Previous research into the meningioma histological appearance, genetic markers, epigenetic landscape and transcriptome has revealed that benign meningiomas have a significant difference in their glucose metabolism compared to aggressive lesions. However, a significant correlation between the systemic glucose metabolism and the metabolism of the tumor hasn't yet been found. Based on our preliminary research, we hypothesized that chronic levels of glycemia (aproximated with glycated hemoglobin (HbA1c)) is different in patients with aggressive and benign meningiomas. We analyzed 71 patients with de novo intracranial meningiomas, operated on in three large European hospitals, two in Croatia and one in Spain. Our results show that patients with WHO grade 1 meningiomas have significantly lower HbA1c values compared to patients with grade 2 lesions (U = 641.5, p < .05). We also found a significant number of patients having unrecognized and untreated hyperglycemia, harboring all the risks that such a condition entails. This finding is especially important considering the current routine and wide-spread use of corticosteroids as anti-edematous treatment. Further research in this area could not only lead to better understanding of meningiomas themselves, but could also have immediate clinical application.

Neurooncology

INSULAR GLIOMA TREATMENT - SINGLE CENTER EXPERIENCE

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Key words: insular glioma; glioma; awake craniotomy; low grade glioma.

Background: Insular gliomas are a unique entity with specific presentation and clinical behavior. One-fourth of low-grade and one-tenth of high grade gliomas are found in this region. Due to close proximity to various eloquent structures, operative treatment of tumors in this area presents a challenge. Multiple surgical strategies are employed (awake surgery, monitoring of evoked potentials etc.) in order to maximize the patients' onco-functional balance.

Methods: A retrospective analysis of medical records was performed for all patients who underwent surgical resection of glioma involving the insular region, during the period between 2015 and 2023.

Results: 58 patients (37 M, mean age 44.5, age range 10-81) were treated for insular glioma between 2015 and 2023. The average number of surgical procedures per patient was 1.5 (range 1-5), the total number of procedures was 85. Histopathology was as follows: ganglioglioma (1), astrocytoma grade 2 (23), oligodendroglioma grade 2 (7), astrocytoma grade 3 (5), oligodendroglioma grade 3 (2), glioblastoma (20). The mean patient age was 39.2 (grade 2 tumors), 53.8 (grade 3 tumors), 50.5 (glioblastoma). 16 patients underwent awake surgery, for a total of 20 procedures - 2 awake procedures were performed for grade 3 tumors, 1 for GBM and the rest (17) were performed for grade 2 tumors.

Conclusion: Insular gliomas present a challenge for surgical treatment, and multiple adjuncts are available to improve patient outcomes, prolong survival and reduce morbidity. Surgical experience is crucial to maximize the potential benefit of surgrery, and therefore these tumors should be treated in highly experienced centers exclusively.

Neurooncology

INTRAVENTRICULAR TRIGONAL MENINGIOMAS - INSTITUTIONAL EXPERIENCE

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Key words: intraventricular meningiomas; trigonum; surgical approach.

Objective: Ventricular meningiomas are extremely rare entity and represent 1-2% of all meningiomas. Authors present their experience with trigonal meningiomas.

Material and Methods: Ten patients were operated on in the period 2004-2022 in our institution. Nine women and one man. Average age was 46.7 year (28-71). MRI:Average volume of tumour was 29 ml (2.5-63). Oedema was present in 5 patients. Hydrocephalus was present in three patients. Midline shift was recorded in 5 patients – 7 - 12 mm.

Clinical findings: incidental in 2 patients, nauzea, vomiting in 5 patients, coma in two patients, homonymous hemianopsia in 6 patients (in two comatous impossible to examine) and finally hemiparesis in 5 patients. Transtemporal approach was used in the begining period and in one case where optic radiation was destroyed before surgery. In all other patients parietal (parietooccipital) approach has been used.

Results: Emergent surgery in comatous patients was used in two cases. EVD was first choice, followed by tumour exstirpation in 24 hours. One of these patients had recurrent intravetricular hematoma with evacution which resulted in long-term severe disability. All other patiens had good outcome. No new homonymous hemianopsia (HH) has been recorded, and initial HH improved in 5 patients with exception of one patient where optic radiation was destroyed before surgery. Surgery was radical in 8 patient, in one case small residuum was iradiated using Leksell gama knife (no growth in 10 years) and in one case extremely small suspicious residuum is followed by PET MRI.

Conclusion: Surgery of trigonal meningiomas is very efffective with good long term results. Acute surgery is sometimes in large tumours with brain shift, oedema and hydrocephalus necessary.

Neurooncology

ADVANCED BRAIN MAPPING TECHNIQUES FOR TREATMENT OF LOWER GRADE GLIOMAS IN ELOQUENT REGIONS USING "ASLEEP AWAKE ASLEEP" MODALITY: SINGLE-INSTITUTION EXPERIENCE

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Key words: brain mapping; low grade glioma; awake craniotomy.

Aim of the study: Lower grade gliomas in eloquent regions present a specific surgical challenge due to the proximity of various cortical and subcortical language, speech and motor areas. We describe our series of 51 patients in which brain mapping techniques during awake procedures using "asleep, awake, asleep" modality were performed for resection of lower grade gliomas in eloquent brain areas.

Methods: A total of 51 "asleep, awake, asleep" surgical procedures using specific brain mapping techniques for lower grade gliomas were performed at our institution from July 2015 to August 2023. We present a retrospective review of 51 patients with gliomas located in regions concerning language. Standard preoperative radiological workup included 3T MRI, fMRI, tumor volumetry and DTI, cognitive, language and neurological testing was performed establishing baseline values for postoperative comparison.

Results: Our series included 51 patients, 24 females and 27 males, the median age was 35 (range: 21-57).

All of the lesions were located in the left hemisphere. The most common location was frontal operculum and insula followed by temporal region and temporo-parietal fiber intersection area. Fifteen patients underwent repeat surgery, and 36 patients had a single procedure. Subtotal resection, with respect to the boundaries obtained during intraoperative testing, was achieved in 21% of patients, gross-total resection in 60% of patients, and supratotal resection in 19% of cases. Average length of hospital stay was 7.7 days (range: 6-10). The most common histopathological finding was IDH mutant grade 2 diffuse astrocytoma, followed by grade 2 oligodendroglioma and grade 3 diffuse astrocytoma. 22% of patients revealed tumor progression during follow-up period, verified after repeated surgery. Early postoperative cognitive and language testing showed a discrete decline from the baseline values in the immediate postoperative period in 33% of patients, which recovered later in the follow up period. Most of the patients with stable tumors showed language improvement.

Conclusion: Our experience shows that awake craniotomy is the method of choice for safe resection of lower grade gliomas situated in language regions, enabling feasible margin of tumour resection, preservation of important cortical structures and subcortical fiber bundles due to the hodotopical reorganisation of the brain.

Neurooncology

RESECTION CAVITY OF BRAIN METASTASIS - WHAT FOLLOWS?

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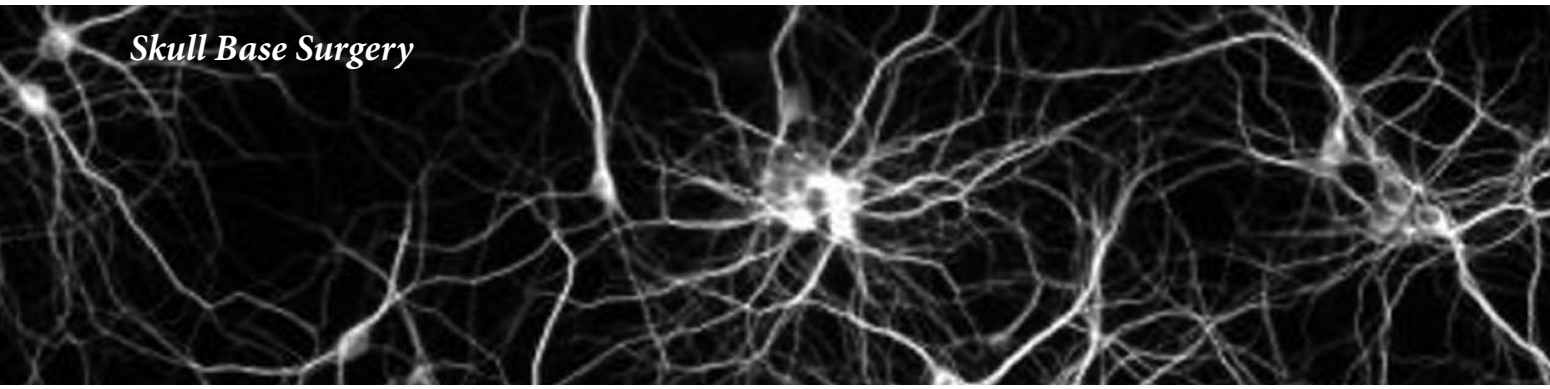
Key words: brain metastasis; resection cavity; radiotherapy; stereotactic radiosurgery.

We are increasingly facing with brain metastases that require active treatment. Surgery is indicated for solitary large metastases, hemorrhage, symptomatic mass effect, or indications for a tissue diagnosis which is more common as we have more targeted therapy in the armamentarium. For the last 25 years there is strong Level I evidence that adjuvant brain radiotherapy significantly improve local control (LC) of disease. Across all of the series, the median LC of the tumor bed resection cavity was 80.5% (range, 60.5%-91%). After surgery, the standard of care had been adjuvant whole brain radiotherapy (WBRT) based on the historic randomized trials, but recently this has been challenged with the application of stereotactic radiosurgery (SRS) and fractionated stereotactic radiotherapy (SRT) to the surgical bed. Level I data demonstrate that postoperative single-fraction SRS is associated with better LC than observation after surgical resection of brain metastases. Early adopters began treating surgical cavities with a single-fraction SRS using doses 12-14 Gy. However, given the suboptimal LC associated with larger resection cavities, emerging data also suggest that fractionated SRT regimens may have improved LC over single-fraction SRS. Several retrospective studies suggest superior LC ranging from 84% to 93% after fractionated regimens. This concept of fractionated SRT is the subject of an ongoing phase III Saturnus trial. Another important issue is timing of SRS. It s extremely important to perform SRS of resection cavity within 2-3 weeks after surgery what is different comparing historical practice of performing WBRT within 3 months. After time period of several weeks tumor cavity shrinkage is occuring resulting in uncertain target delineation what is leading to poor LC. If SRS is doing after 8 weeks results of LC are the same as radiotherapy was completely omitted. Some of critical questions remain unanswered. For example, is there a benefit of postoperative radiation therapy in patients with brain metastases from melanoma who undergo complete resection and receive dual-agent immunotherapy and is it neccessary after resection of EGFR mutated metastasis from NSCL. In rare cases where WBRT is indicated advanced techniques shuold be encouraged such as hippocampal-avoiding WBRT with aim to preserve neurocogntiive function.



Skull Base Surgery

PETROCLIVAL MENINGIOMA SURGICAL STRATEGIES

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Key words: approach; meningioma; morbidity; petroclival; surgery.

Background: Petroclival meningomas (PCM) arise from the upper two thirds of the clivus but their dural attachment is centered on the petroclival junction. They pose significant surgical challenges and are coupled with a high mortality and morbidity burden. Treatment strategies include microsurgical resection and radiosurgery.

Aim: To review treatment strategies for PCM and present cases treated at our Institution over a five-year period. Focus is set at reporting and comparing neurological and other morbidity across surgical approaches.

Methods: A systematic review of the literature and a single-center archival database review to retrieve PCM cases data including: i) patient-level data (sociodemographic); ii) clinical dana (presentation, duration of symptoms, functional status pre- and postoperatively, follow-up); iii) PCM data (size, location); and iv) treatment-related data (approach, duration, blood loss, complications, outcome).

Results: Fifteen cases were identified and data compared to the previously published data identified by the literature review. Among the neurological morbidity, cranial nerve deficits are the most common, in up to a third of patients, and nVII is the most common individual damaged nerve.

Comparably high is the incidence of hemiparesis/hemiplegia. Among non-neurologic morbidity, cebrospinal fluid (CSF) leakage is the most common, in approximately 15% of cases. The outcomes differ between surgical approaches. Existing treatment strategies are discussed regarding their advantages and limitations. Emerging treatment modalities are outlined.

Conclusion: Our results show PCM treatment outcomes comparable to other neurosurgical centers. Surgery remains the gold standard of care for PCM, despite its challenges. Novel complementary diagnostic and treatment modalities might offer aid in reducing surgery-related mortality and morbidity. The observed differences in outcomes across surgical approaches might be better explained as a function of tumor location/extension, rather than surgical approach, as the latter is contingent upon the former.

Skull Base Surgery

EXTENDED SUBTEMPORAL APPROACH

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Key words: approach; indications; morbidity; subtemporal.

The infratentorial extension of the subtemporal approach was historically introduced to reach the preganglionic trigeminal nerve pathology. Over the years the approach has evolved to encompass a wide range of pathology of the incisural space and clival region. The aim is to review the pathology (indications and contraindications) of the region accessible via the approach, primarily meningiomas (petroclival, tentorial, petrous, and other), trigeminal schwannoma, and vascular lesions (brainstem cavernoma, basilar artery aneurysms). Next, relevant anatomical structures (bony and dural landmarks, vascular and neural structures) and their relations are described. Finally, surgical pitfalls related to the approach are discussed. The review converges upon a single-center experience at the Department of Neurosurgery, Clinical Hospital Center Zagreb. Individual cases are discussed, including surgical outcomes. Regardless of its infrequent use, owing to the relative paucity of the pathology, the extended subtemporal approach is an important tool in the neurosurgeons` armamentarium and should, as such, be kept in mind and further developed to harness the benefits of the ever evolving technological advances.

Skull Base Surgery

ENDOSCOPIC ENDONASAL CRANIOPHARYNGIOMA SURGERY

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Key words: craniopharyngioma; endonasal; endoscopic; sellar region; surgery.

Introduction: Craniopharyngioma are rare benign tumors of the suprasellar region. Their incidence is bimodal – in other words, they appear either in pediatric or late adult age. Due to mass effect and destruction of local neural structures, they cause visual deficits, hormonal disturbances, and cognitive impairment. Treatment is surgical, aimed at complete removal, and the traditional approach is transcranial. Residual disease is treated by radiosugery. Endoscopic surgery is being used ever more extensively, throughout a wide spectrum of neurosurgical indications, which include surgical treatment of craniopharyngioma via the endonasal transsphenoidal extended approach. The approach uses a natural corridor, enables a wide and encompassing exposure of the suprasellar region and enables treatment results superior to the traditional transcranial alternatives.

Aim: First, to discuss indications, relevant anatomy, advantages and limitations of the extended endonasal approach in treating pathology of the sellar, suprasellar and parasellar region, and second, to report our experience via a case series of adult crani-

opharyngioma patients treated at the Department of Neurosurgery, Clinical Hospital Center Zagreb.

Methods: Literature review to identify published reports on craniopharyngioma case series operated on using the endonasal endoscopic approach. Institutional review of cases treated using the endonasal endoscopic as well as the traditional approach at the Clinical Hospital Center Zagreb and comparison of outcomes between the two.

Results: Several case series were identified by the literature review, and the results support efficacy of the endonasal endoscopic approach in the treatment of craniopharyngioma, albeit with a complication rate somewhat higher than the traditional transcranial approach. In the observed period, there were 25 adult craniopharyngioma cases operated on at the Department, of which three using an endonasal endoscopic approach. The latter had a higher tumor removal rate, comparable outcomes in the sense of visual and hormonal function, yet also a higher rate of cerebrospinal fluid leakage and wound disruption.

Conclusion: The endoscopic endonasal technique is and efficient alternative to the traditional transcranial approach in the surgical treatment of craniopharyngioma.

Skull Base Surgery

REVIEW OF A CLINICAL CASE SERIES OF 116 VASCULARIZED FLAPS USED FOR CLOSURE OF SKULL BASE DEFECTS AND ROLE OF THE LEARNING CURVE

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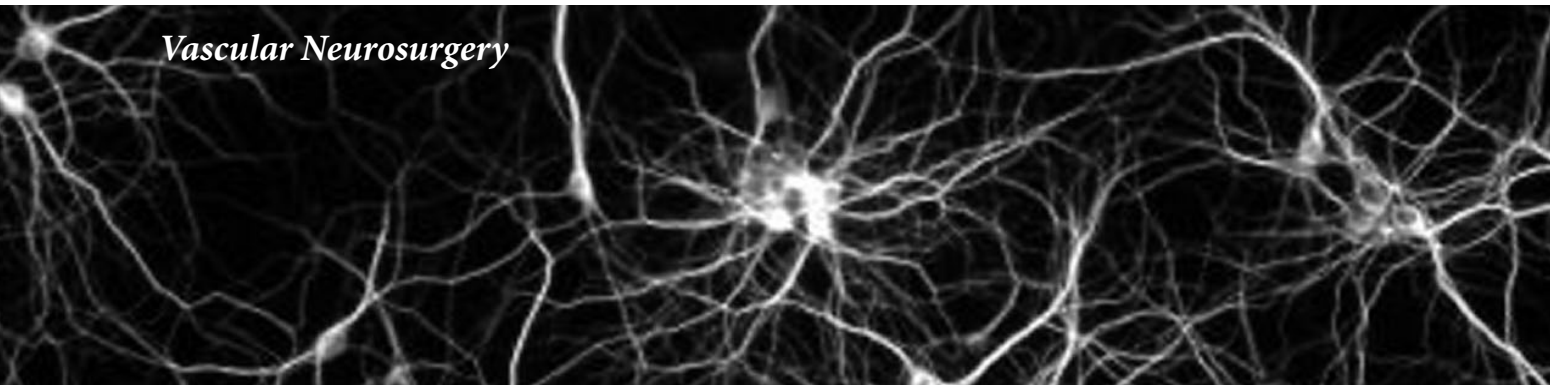
Key words: Skull base surgery; Cerebrospinal fluid leak; Learning curve; Endoscope.

Aim of the study: The purpose of this study was to describe the effectiveness of vascularized flaps for the reconstruction of skull base defects.

Methods: A retrospective review of medical records was performed for 116 patients who underwent endoscopic skull base surgery for intradural pathology with intraoperative high-flow CSF leakage between the years 2008 and 2022. The incidence of CSF leak was assessed concerning flap type, diagnosis, and approach. To assess the learning curve effect, patients were divided into early cohort (2008 - 2015) and late cohort (2016 - 2022) groups.

Results: The mean age of our patients was 52 years, with a higher distribution of women (65 vs. 51). The mean follow-up was 64 months. The most common diagnoses were meningiomas (35.3%), craniopharyngiomas (17.2%), and spontaneous or posttraumatic CSF leak (15.5%). The nasoseptal flap was used in 110 cases and a pericranial flap in 6 cases. Overall postoperative CSF leakage was 12% (14/116) in this series. There were no significant risk factors for postoperative CSF leakage among the demographic data. CSF leak was found only in nasoseptal flaps (13%) and most often in anterior fossa meningiomas (26.7%), Rathke pouch cysts (20%), and craniopharyngiomas (15%). When dividing the results by timetable, the patients who underwent skull base reconstruction in the early cohort experienced more postoperative CSF leakage than in the late cohort.

Conclusion: Multilayer reconstruction with a vascularized flap is considered the best option for skull base reconstruction. CSF leakage can happen especially in anterior fossa tumors with a higher prevalence rate. The learning curve affects the incidence of CSF leakage. Training on easily cases and knowledge of technical details could reduce the learning curve.



Vascular Neurosurgery

SURGICAL TREATMENT OF AVM-s AND THE CURRENT ROLE OF EMBOLISATION

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Key words: transcallosal approach; ventricular tumors; fornix; deep venous system.

Introduction: Transcallosal approach belongs to basic neurosurgiocal approaches and is being used mainly for the processes of the III rd and lateral ventricles. These might be either extraaxial ventricular tumors or for example intraaxial thalamic gliomas. The approach has its peculiarities and risks – injury of pericallosal arteries, deep venous system or fornices.

Material: During 2005 to 2022 we used this approach in 43 patients with histologically diverse lesions. The most frequent were thalamic pilocytic astrocytomas (12 patients) and 7 craniopharyngeomas. There were 6 colloid cysts, 3 metastases, 3 glioblastomas, 2 subependymomas, 2 germ cell tumors and one ependymoma, schwannoma, cavernoma, plexus papilloma, ganglioglioma, diffuse low grade glioma, anaplastic pleomorphic xanthoastrocytoma and subependymal giant cell astrocytoma.

Results: Tumor was totally removed in 20 cases, 14-times the resection was subtotal (more than 90%) and in 8 patients there was only partial resection (less than 90%). 28 patients had a good treatment results, in 7 cases there was a transient neurological deficit (2 cases of mild hemiparesis and 3 cases of a transient memory deficit) and 5 cases of permanent neurological deficit (severe hemiparesis). One patient after a partial resection of a metastasis died due to a hemocefalus.

Conclusion: Transcallosal approach should belong to a basic armamentarium of a neurosurgeon dealing with ventricular tumors. There are situations where the use of transcallosal approach seems to be a really the best option. It is necessary, however, to take into consideration the risks of this approach, mainly the damage to deep venous system and the fornices.

Vascular Neurosurgery

OUTCOME OF PATIENTS WITH RUPTURED MCA ANEURYSM AND ASSOCIATED INTRACEREBRAL HEMATOMA

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Key words: aneurysm; hematoma; outcome.

Aim of the study: To evaluate the results of operated patients with MCA aneurysm rupture and associated intracerebral hematoma.

Methods: Patients operated on between 2006 and 2022 were evaluated. Monitored parametres: Clinical grade on admition, Size and lokalization of hematoma, Brain swelling, Decompressive craniectomy, Treatment, Hydrocephalus, Age, Gender.

Results and Conclusion: Urgent ICH removal with clipping of aneurysm is the best available treatment (time effective). Vasospasms and significant brain edema impede chances for favorable outcome. Patients with ICH located in the left hemisphere seem to have worse outcome than those on the right. Outcome of patients with SAH and ICH admitted to the hospital remains unfavorable in majority of patients (72 %).

Vascular Neurosurgery

TREATMENT RESULTS OF ANEURYSMAL SUBARACHNOID HAEMMORHAGE IN THE ELDERLY

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Key words: subarachnoid hemorrhage; clipping; endovascular treatment; seniors.

Introduction: The aim of our study is to present the treatment outcomes of patients with aneurysmal SAH 3 months after the event who were treated with clipping or coiling at University Hospital Brno between 2009 and 2019.

Material and methods: The study was based on a retrospective analysis of a database of patients with cerebral aneurysms who were treated at University Hospital Brno between 2009 and 2019, a period of 11 years. 499 patients were included in the study. Of these patients, 345(69%) were treated with surgical clipping and 154(31%) were treated with endovascular coiling. Patients were divided into 4 groups: according to age into 0-64years and 65+years group, and according to modality of treatment of aneurysm by clipping or coiling. We evaluated the relationship between the current age of the patient and the treatment outcome in 3 months after the SAH attack, assessed by modified Rankin scale (mRS), where the successful treatment outcome was mRS 0-2 (independent patient), and the influence of initial HH on the treatment outcome based on age and modality.

Results: Of the 499 patients, 345(69%) were treated with clipping (MS) and 154(31%) with coiling (EV),

and the average age of MS and EV treated patients was not significantly different (p=0.2216). In both surgically and endovascularly treated patients in all age categories; we did not observe a significant difference in Hunt-Hess score (p=0.1664, Chi-squared test) or in graphical severity of SAH according to Fisher score (p=0.5041, Chi-squared test). Favourable treatment outcome (mRS 0-2) in 3 months after attack was 49 (52.88%) in 65+ years group after MS and 23(60.61%) in 65+ after EV. And unfavourable treatment outcome (mRS 3-6) in 3 months was 43(47.12%) in MS treated and 15(39.39%) in EV treated patients, which was statistically significant (p=0.0002, Chi-squared test). Favourable treatment outcome (mRS 0-2) at 3 months of attack with good clinical status on admission (HH1-2) was seen in 136(55%) patients in 0-64years group after MS and 28(33%) in 65+ after MS. And unfavourable treatment outcome (mRS 3-6) after 3 months with initial poor clinical condition (HH 3-5) had 50 (20%) patients treated with MS in 0-64 years group and 39(44%) treated with MS in 65+ group which is statistically significant (p=0.0001, Chi-square test).

Conclusion: Elderly (65+years) after SAH are at higher risk of unfavourable neurological status 3 months after attack compared to younger patients, especially if they are in severe clinical condition on admission. However, a significant proportion of these patients remain in good clinical condition after treatment of the aneurysm, so the method of treatment and extent of treatment needs to be assessed individually. In elderly patients treated endovascularly, we observed a better treatment outcome at 3 months compared with patients treated by open microsurgery.

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Vascular Neurosurgery

ARTERIOVENOUS MALFORMATIONS - CURRENT TREATMENT STRATEGIES

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Key words: arteriovenous malformations; vascular neurosurgery; intracranial hemorrhage.

Introduction: Arteriovenous malformations (AVMs) are a complex pathology that can cause serious morbidity and mortality. Annual haemorhage rates are up to 2,2% which grows to 50% in a 30-year period.

There are few treatment options for brain AVMs: conservative (observation) or various treatment techniques, such as microsurgical techniques, endovascular embolization and stereotactic radiotherapy used alone, or in combination. Each treatment modality is associated with certain treatment-associated morbidity and mortality. A treatment plan is devised to offer the lowest risk, yet highest chance of obliterating the lesion.

The goal of AVM treatment is typically the prevention of new or recurrent hemorrhage. However, seizure control or stabilization of progressive neurological deficits are occasionally treatment goals as well. Interventional treatment of ruptured brain AVMs is generally advisable, due to a higher subsequent hemorrhage risk.

A recent report with 1235 surgically treated AVMs showed very low morbidity and almost 0 mortality with very high cure rates, and better results than other treatment modalities. Outcome predictors in surgery are diffuseness, deep perforator supply, patient age and experience of the treating surgeon.

Apart from neurosurgery, radiosurgery plays a more important role in deep, inaccessible lesions, or those having an intimate association with eloquent cortex. Radiosurgery was previously limited to a certain

volume. Today, there are new treatment options in which irradiation is applied in smaller doses, or different parts of AVM are separately irradiated.

A recent review of the literature regarding the use of endovascular embolisation for AVM treatment confirmed previous observations of increased complication rates and procedure-related mortality. Given existing reports, modern use of endovascular embolisation remains an adjunct to microsurgery, with the main goals of decreasing intraoperative blood loss in large AVMs and securing associated aneurysms or deep arterial feeders.

Microsurgery is considered the gold standard of AVM treatment, given its favourable cure rates, safety profiles and immediacy, especially for low grade AVMs. The key to achieving good outcomes is appropriate patient selection in high-volume, multidisciplinary centres.

Conclusion: The best treatment for SM 1&2 is surgery. For higher grades consensus should be made by an experienced team in combined treatment modalities.

Vascular Neurosurgery

USE OF EXTRACRANIAL-INTRACRANIAL BYPASS IN NEUROSURGERY

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Key words: EC-IC bypass.

Aim of the study: Extracranial-intracranial bypass (EC-IC bypass) is the only surgical technique that is used to increase/maintain cerebral blood flow in patients with moyamoya disease, occlusive cerebrovascular disease, or compromised flow in the treatment of large aneurysms and tumors. Bypass remain the only technique that could help in treating such complex lesions preventing pending ischemic lesion.

Methods: We have retrospectively reviewed our database and identified patients with moyamoya disease, occlusive cerebrovascular disease and those with complex aneurysms and tumors which were treated surgically using EC-IC bypass from January 2013 to June 2023. Good preoperative patient preparation, meticulous technique, and postoperative antiplatelet therapy are prerequisites for bypass patency. Through typical cases of patients with occlusive cerebrovascular disease, complex aneurysms or tumors, and moyamoya disease the bypass techniques will be presented, and the results discussed.

Results: In the mentioned period, a total of 23 EC-IC bypasses were performed, and in most patients (82,6%) STA (single or double barrel) was the donor vessel. In 4 patients radial artery graft was used for EC-IC bypass formation. Intraoperatively, the patency of the bypass was confirmed using ICG angiography and doppler. Modified Rankin scale score for all operated patients was 3 or less, and there was no deterioration in neurological status, while some showed clinical improvement. In all patients, except one, patency of the anastomosis was confirmed postoperatively using invasive angiography (DSA).

Conclusion: Despite endovascular techniques for treatment of pending ischemic lesions in patients with cerebrovascular disease and brain aneurysms, bypass technique is the only surgical treatment option that gives additional blood supply or blood flow redirection, and that is why it is necessary to learn EC-IC bypass techniques.

Vascular Neurosurgery

COMPLEX ANEURYSMS - DIFFICULT TREATMENT OPTIONS

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Key words: complex aneurysms.

Aim of the study: Most intracranial aneurysms can be treated either with endovascular coiling or microsurgical clipping. There is a subset of aneurysms with wide neck, intraluminal thrombosis, large in size, with dolichoectatic / fusiform appearance, or aneurysms in difficult location that cannot be treated with simple techniques, but they need to be treated with thrombectomy, resection, aspiration, reconstruction, bypass formation or combination of surgical and endovascular techniques.

Methods: Such complex aneurysms remain difficult or impossible to treat endovascularly. Obtaining proximal and distal control, sharp dissection, temporary occlusion, preservation of perforators, circumferential dissection, distal circulation preservation or augmentation with bypass are surgical nuances needed in their treatment.

Results: Complex aneurysms represent 5% of all intracranial aneurysms. Large aneurysms should be treated because their rupture risk extents to 50%. Rupture of such complex aneurysms complicate their treatment even more because of thrombogenicity, and other coagulation disturbance related to SAH. For large aneurysms mortality rate in unruptured cases is 60% in two years, and those who survive suffer from marked neurological deficit. On the other hand, calcified neck, intraluminal thrombus, and stiffness complicate their treatment. Furthermore, manipulation with such aneurysm is similar to treatment of large tumors, but with additional difficulty because distal circulation must be preserved. On the other hand, thromboembolic events are common presentation.

Conclusion: The use of microneurosurgical techniques in the treatment of complex intracranial aneurysms continue to be crucial for successful outcome. Combined microsurgical and endovascular techniques are used on a case-by-case basis for the best possible outcome. The preservation of knowledge and technical nuances is crucial for treatment of such lesions in the future.

Vascular Neurosurgery

ACUTE SURGERY FOR ISCHAEMIC STROKE-INDICATIONS AND RESULTS

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Key words: acute endarterectomy; embolectomy; bypass; ischemic stroke.

Objective: Role of acute carotid endarterectomy (ACEA) is not so clear from EBM point of view in comparison with elective procedure. Authors present their experience with this theme. Indication for emergent embolectomy or acute bypass in LVO is extremely rare.

Material and Methods: Sixty nine patients were operated on in the period 2002-2022 in our institutions. Fourteen women and 55 man. Average age was 63.6 year (38-81).

Diagnosis was made in the beginning using angiography but in last years uniformally by CTA. Internal carotid occlusion was present in 61 patients and narrow ICA stenosis in 8 patients. Clinical findings: Stroke in evolution 51, CVA 14 and TIA in 4 patients. Preoperative modified Rankin score: 0-0, 1-3 pts, 2-4 pts, 3-16 pts, 4-28 pts, 5-18 pts. Two cases of acute bypass and embolectomy are included.

Results: ICA recanalization has been reached in 55 patients, in 10 patients (chronic occlusion) stumpectomy was performed. One patient underwent acute EC-IC bypass after ACEA failure with good result. Another patient underwent direct M1 embolectomy (no access for interventional radiologist) again with good result. Two patient after stumpectomy underwent elective EC-IC low flow bypass.

Postoperative modified Rankin score: 0-15 pts, 1-7 pts, 2-11 pts, 3-19 pts, 4-5 pts, 5-5 pts, 6-7 pts. mRS 0-2 (good result) reached 33 patients (48%).

Improvement (mRS change 1 point or more) 45 patients, stabile state 14 pts, deterioration 3 pts and death in 7 pts. Results of embolectomy and bypass are mRS 2 and 34.

Conclusion: Prognosis for the patients with carotid occlusion followed by major stroke.is bad. ACEA (sometimes in combination with other procedures) brings good result for large group of patients. Indications for embolectomy or acute bypass are rare, but proper selection can result in satisfactory results.

Vascular Neurosurgery

RESULTS OF MICROSURGICAL MANAGEMENT OF ANTERIOR COMMUNICATING ARTERY ANEURYSMS

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Key words: anterior communicating aneurysm; clipping; vasospasm.

Aim if the study is a retrospective analysis of microrsurgical management of anterior communication artery (ACOM) aneurysms. Compare our technique and results with literature outcomes of endovascular and microsurgical management.

Methods: We evaluated retrospectively ruptured and unruptured cases operated on our department between 2006 -2016. Outcomes have been evaluated according to GCS and mRS scale. Microdialysis has been used for monitoring vasospasms for patients HH4-5 and for indication of angioplasty.

Results: We evaluated 39 unruptured patient, morbidity has been 0%, mortality 2,5% (systematic hypertension in ICU resulting in infratentorial hemorrhage and death). Patients had a stable mRS throughout follow-up 8 weeks -mRS 0-2: 38 pts (97,5%). Ruptured cases represents cohort 96 patients. Presentation 30% HH1, 24% HH2, 25% HH3, 11% HH4, 10% HH5 and 6% F1, 9% F2, 38% F3, 47% F4. Vasospasm developed in 28 cases on the 1st-18th day of hospitalisation, average length of vasospasms was 6 days. 13 cases were managed with intensification of 3H therapy, 5 cases were managed with i.a. nimodipin, 10 cases were managed with intraarterial aplication of milrinon and microdialysis monitoring. Morbidity mortality of ruptured cases have been 23,9%.

Conclusions: Our results are comparable with published results of microsurgical and endovascular management. Algorithm for vasospasm treatment is presented, microdialysis is promising tool for predicting delayed ischemia.

Vascular Neurosurgery

LARGE ANTERIOR CHOROIDAL ARTERY ANEURYSMS

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Key words: anterior choroidal artery aneurysm; clipping, flow diverter; suction decompression technique.

Introduction: Anterior choroidal artery (AChoA) aneurysms belong to less frequent cerebrovascular lesions and therefore there are still only a few reports describing neurosurgical management. The aim of this video presentation is 1) to emphasize the complexity of surgical clipping of aneurysms in anatomically complicated area of AchoA when important perforators arise in close proximity or directly from the aneurysm. 2) to analyze indications and outcomes of both surgical and endovascular treatment (flow-diversion) in review of recent literature.

Material and Results: Authors present two videos of incidental large AChoA aneurysms using clipping with suction decompression technique. The patient

had an uneventful postoperative course. The postoperative CT angiography did not show any sign of complication or sac residue.

Conclusion: Surgical clipping, supported with combination of monitoring methods (TCD, ICG, MEP) is a safe method and a better alternative to endovascular treatment when choroidal artery arising from the neck of aneurysm. Occlusion rate of AChoA after flow-diversion treatment is 3,5% - 7% (2,3,4).

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Vascular Neurosurgery

THE ROLE OF THE EC-IC BYPASS IN THE MICROSURGICAL TREATMENT OF COMPLEX BRAIN ANEURYSM

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Key words: aneurysm; EC-IC bypass; vascular neurosurgery.

Complex brain aneurysm remains still the neurosurgical challenge. The treatment is usually a combination of various microsurgical techniques - clipping, wrapping, trapping, aneurysmorhaphy and EC-IC bypass. Insurance or protective bypass is crucial for next steps of surgery and protection of brain tissue. We present the cohort of patients who were treated at our neurosurgical department between 2012 and 2022. Overall, 13 patients were included, 6 women and 7 men. The locations of aneurysm were internal carotid artery in 8 cases, middle cerebral artery in 4 cases, posterior inferior cerebellar artery in 1 case. In 10 cases aneurysms were incidentally detected, in 3 cases it was associated with subarachnoid hemorrhage, 5 of aneurysms were gigantic and in 2 cases was blister type. The treatment was specific for each aneurysm including EC-IC bypass in every patient in this study. The aim is presentation of unique EC-IC bypass usage as a part in the treatment of complex brain aneurysm.

Vascular Neurosurgery

EMERGENT MICROSURGICAL EMBOLECTOMY AND EC-IC BYPASS IN STANDARD ACUTE ISCHAEMIC STROKE TREATMENT FAILURE

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Key words: acute ischaemic stroke; ec-ic bypass; mechanical tromectomy; microsurgical intervention.

Background: Despite all the gains that have been achieved with endovascular mechanical thrombectomy revascularization and intravenous thrombolysis logistics since 2015, there is still a subgroup of patients with salvageable brain tissue for whom persistent emergent large vessel occlusion portends a catastrophic outcome.

Objective: To test the safety and efficacy of emergent microsurgical intervention in patients with acute ischemic stroke and symptomatic middle cerebral artery occlusion after failure of mechanical thrombectomy.

Methods: A prospective two-center cohort study was conducted. Patients with acute ischemic stroke and middle cerebral artery occlusion for whom recanalization failed at center 1 were randomly allocated to the microsurgical intervention group (MSIG) or control group 1 (CG1). All similar patients at center 2 were included in the control group 2 (CG2) with no surgical intervention. Microsurgical embolectomy and/or extracranial–intracranial bypass was performed in all MSIG patients at center 1.

Results: A total of 47 patients were enrolled in the study: 22 at center 1 (12 allocated to the MSIG and 10 to the CG1) and 25 patients at center 2 (CG2). MSIG group patients showed a better clinical outcome on day 90 after the stroke, where a modified Rankin Scale score of 0–2 was reached in 7 (58.3%) of 12 patients compared with 1/10 (10.0%) patients in the CG1 and 3/12 (12.0%) in the CG2.

Conclusion: This study demonstrated the potential for existing microsurgical techniques to provide good outcomes in 58% of microsurgically treated patients as a third-tier option.

Vascular Neurosurgery

URGENT ONE-STAGE TREATMENT OF RUPTURED BRAIN ARTERIO-VENOUS MALFORMATION

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Key words: brain arteriovenous malformation; stroke; intracerebral hemorrhage.

Brain arteriovenous malformation-related intracerebral haemorrhage (bAVM-ICH) has a better prognosis than spontaneous ICH. The best predictive prognostic value in a bAVM-ICH patient in acute setting has been reported to be the AVICH Score. There are conflicting opinions on the timing of the treatment. Traditionally larger and deeper located bAVM are usually postponed 2-6 weeks after urgent decompressive surgery (two-stage treatment). However, there are reports of comparable results of one-stage resection versus delayed two-stage resection. The aim of this retrospective analysis of urgently operated bAVM-ICH patients in a single center is to evaluate the surgical outcomes.

Methods: All adult patients urgently operated on with ICH and supratentorial AVM proven on DSA were included in this retrospective single-center analysis between 2013 and 2020. Every surgery was performed within 24 hours of the onset of ICH symptoms. Premorbid mRS (modified Rankin Scale), baseline demographics, comorbidities and preoperative NIHSS (National Institutes of Health Stroke Scale) were assessed. AVM and hematoma were classified according to Lawton's and AVICH classification. The emergency procedure was performed by one of the two surgeons. Outcome was assessed using the mRS and NIHSS in 1 and 3 months after discharge.

Results: In the above mentioned period we performed surgery on 10 patients, 3 women and 7 men. Initial average NIHSS was 18.1 (8 - 33), after 30 days NIHSS was 8.6 (3 - 19). In three months follow-up mRS was 2.8 (1-4).

Conclusion: Urgent one-stage removal of ICH and excision of AVM were performed with satisfactory outcome in ten patients.

Vascular Neurosurgery

EMERGENCY CAROTID ENDARTERECTOMY AFTER TIA OR NON-DISABLING STROKE IS SAFE

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Key words: stroke; carotid endarterectomy; TIA; myocardial infarction; cranial nerve lesion.

Background: Stroke is associated with a 46% risk of recurrence in the first 14 days following the event. Carotid endarterectomy (CEA) is an effective form of stroke prevention and is recommended to be performed within 2 weeks following stroke. On the other hand, emergency CEA (performer within 48 hours after stroke) is controversial due to high risk of complications. The goal of our study was to compare the results in patients who underwent CEA within 48 hours or more than 48 hours after stroke.

Methods: We performed retrospective analysis of our prospectively collected database of patients operated for carotid stenosis between 2006 and 2020. We analyzed the occurrence of major adverse events, such as stroke, acute myocardial infarction or death after surgery. Further, minor adverse events, such as cranial nerve lesion, hematoma or hyperperfusion syndrome were analyzed. CEA performed within 48 hours after stroke was defined as emergency CEA.

Results: Since 2006 till 2020 we performed emergency CEA in 277 patients comprising 196 males and 81 females. The mean age was 66 years. The surgery was performed in awake patients under local anesthesia. Stroke, myocardial infarction or death occurred in 11 (4.0%) of the 277 patients operated within 2 days after stroke. In patients operated within 24 hours after stroke, the risk of these adverse events was even lower, being 2.9% (4 out of 139). Concerning minor adverse events, hematomas were present in 16 patients (5.8%), cranial nerve paresis in 5 patients (1.8%), and vocal cord paralysis in 4 patients (1.4%). The cerebal hyperperfusion syndrome occurred in 2 patients (0.7%) operated on the day of surgery.

Conclusion: We conclude that emergency carotid endarterectomy is safe after TIA or non-disabling stroke.

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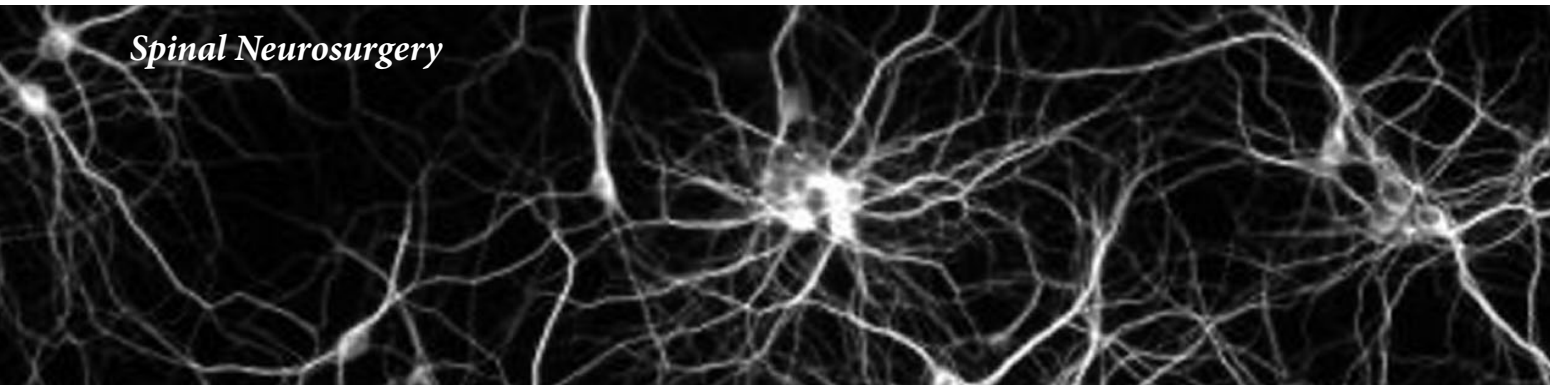

Spinal Neurosurgery

INFLUENCE OF THE CERVICAL ARTHROPLASTY ON THE RANGE OF MOTION OF THE CERVICAL SPINE

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Key words: cervical arthroplasty; range of motion.

Background: Cervical arthroplasty came into use as a modern method of treatment of cervical spine diseases at the beginning of this century. The objective of this study was to define the influence of cervical arthroplasty on the range of motion of the cervical spine.

Methods: Static and dynamic cervical radiographs of patients who had cervical arthroplasty due to monosegmental cervical disc herniation were compared to the cervical radiographs of the same patients before the surgery, and with the radiographs of the control group (healthy volunteers). The group of patients who underwent cervical arthroplasty consisted of 25 patients who were operated at the Department of Neurosurgery, University Hospital Centre Zagreb. The control group consisted of 25 healthy volunteers. The range of motion of the cervical spine was calculated after the computer analysis of the static and dynamic cervical radiographs.

Results: Our results showed that the range of motion of the cervical spine of the operated group increased from 55 degrees before surgery, to 63 degrees, 24 months after surgery. Also, the range of motion of the functional spinal unit increased from 11 degrees before surgery, to 14 degrees, 24 months after surgery. Range of motion of the cervical spine of the control group was 66 degrees. Statistical analysis showed that 24 months after surgery there was no statistically significant difference between the range of motion of the cervical spine of the operated group and the range of motion of the cervical spine of the control group.

Conclusions: The results of this study indicated that both the range of motion of the cervical spine and the range of motion of the operated functional spinal unit were increased after the cervical arthroplasty was conducted. They also showed that 24 months after surgery there was no statistically significant difference between the average value of the range of motion of the cervical spine in the operated group and in the control group.

Spinal Neurosurgery

TRANSFORAMINAL ENDOSCOPIC DISCECTOMY FOR SOFT AND CALCIFIED THORACIC DISC HERNIATION

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Key words: endoscopic surgery; thoracic spine; soft and calcified disc herniations.

Aim of the study: To describe benefit and clinical outcome of transforaminal endoscopic discectomy using reamers for foraminotomy for treatment of soft and calcified thoracic disc herniations.

Methods: A series of 26 patients with single or double level thoracic disc herniation underwent transforaminal discectomy using reamers for foraminotomy. All patients were operated in local anesthesia with conscious sedation. Demographic and radiographic data, intraoperative complications, and clinical outcomes were reviewed.

Results: Twenty-six patients were enrolled with an average age of 55 years (range, 28 to 71 years). Follow-up was at 6, 12 and 24 months. The length of hospital stay was one day. The average preoperative verbal numeric pain scale score was 9, which later decreased to 3 at final follow-up. Decrease of more than 50% in Oswestry Disability Index scores was achieved in 25 out of 26 patients in all 3 review points. All patients with myelopathy and/or sphincter dysfunction had significant improvement of their symptoms. One patient had transient hemiparesis and needed early revision.

Conclusion: Transforaminal selective endoscopic discectomy using reamers for additional foraminotomy provides excellent exposure and allows consistent decompression of thoracic soft and calcified disc herniations. This study demonstrated that this minimally invasive transforaminal endoscopic technique can be safely performed for soft or calcified thoracic disc herniations.

Spinal Neurosurgery

TRANSFORAMINAL ENDOSCOPIC DISCECTOMY FOR UP-MIGRATING L5/S1 DISC HERNIATIONS

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Key words: transforaminal endoscopic discectomy; L5/S1 level; local anesthesia.

Aim of the study: To describe technical details, including preoperative planning, and feasibility of transforaminal endoscopic selective discectomy for up-migrating disc herniations at L5/S1 level.

Methods: We present successful application of transforaminal endoscopic technique for up-migrating herniations at L5/S1 disc level. Patients underwent surgery in local anesthesia with conscious sedation and were discharged home the same day.

Results: Postoperative MRI scans and clinical outcome measurements show adequate decompression and significant pain reduction after transforaminal endoscopic discectomy for up-migrating disc herniations at L5/S1 level.

Conclusion: With transforaminal selective endoscopic discectomy, performed in local anesthesia with conscious sedation, almost all up-migrating disc herniations at L5/S1 level can be successfully removed and adequate decompression can be achieved after thorough preoperative planning. The approach is safe if the patient is operated in local anesthesia. The height of the iliac crest does not matter while using this minimally invasive surgical technique.

Spinal Neurosurgery

SCREENING FOR DEGENERATIVE CERVICAL MYELOPATHY (SCREEN-DCM): PREMILIMINARY RESULTS OF AN ONGOING PROSPECTIVE MULTICENTER STUDY

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Key words: cervical stenosis; screening; spine; tandem stenosis.

Aim of the study: Screen patients with lumbar pathology for Degenerative Cervical Myelopathy (DCM), and develop an effective strategy to uncover DCM. DCM is the commonest cause of spinal cord impairment, but remains under-diagnosed. Given that Lumbar degenerative disease (LDD) is one of the most common problems encountered in neurosurgical practice, and with a high prevalence of tandem stenosis, the present study sought to screen this population to uncover undiagnosed DCM.

Methods: A survey of 13 neurosurgeons was used to develop and modify screening criteria, and screening was performed primarily for patients with LDD. Points were attributed based upon the presence of signs/symptoms (e.g. Hoffman sign) and for comorbidities associated with DCM (e.g. Rheumatoid arthritis). Patients with >=3 points underwent MRI examination to confirm DCM. An exploratory multivariate analysis of the effectiveness and efficiency of this proposed screening test will be evaluated after positively screening 50 patients for DCM.

Results: Out of 140 patients screened, 43 screened positive (>=3 points) and 36 had a subsequent cervical MRI. Of the 36 patients, 11 (30.6%) were diagnosed with DCM, and 4 of these (36.4%, 4/11) were eventually operated. The average number of points for patients screening positive with a diagnosis of myelopathy was 5.36 vs 4.12. All patients with myelopathy were considered as mildly myelopathic. Nine out of the 11 positive patients (81.8%) had T2WI hyperintensity signal changes on MRI. An additional 9 out of the 36 (25.0%) patients presented with cervical canal stenosis without clear evidence of spinal cord compression or sufferance.

Conclusion: Screening in patients with LDD appears resulted in a diagnosis of DCM in over 30% of patients having an indication for an MRI. Additionally, screening identified an 25% of individuals with cervical stenosis but without clear myelopathy. These are preliminary results and further analysis from this multicenter study are expected later this year.

Spinal Neurosurgery

ENDOSCOPIC SURGERY FOR LUMBAR DISC HERNIATION - LONG TERM RESULTS

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Key words: lumbar disc herniation; endoscopy.

Lumbar disc herniation is one of the most often indications for spine surgery. Open discectomy is considered as the golden standard for the lumbar disc herniation surgery, however the endoscopic technique has evolved in the last decade as an alternative method of treatment. According to existing experiences, the endoscopic technique has a similar effect on outcome as standard surgery and additionally, endoscopic technique has several advantages during surgery as well as in post-operative period. The main advantage of endoscopic technique is in shortening of physiotherapy in post-operative period. Department of Neurosurgery in The University Hospital Brno is the first department conducting endoscopic lumbar herniectomy in the Czech Republic. In this article, we would like to present our first experiences with this technique, which has been used in our department from 2017.

Between 2017-2020 endoscopic technique was used in our department for treatment of 92 patients (20 - 70 years old) with lumbar disc herniation at the L4/5 or L5/S1 levels. Evaluated parameters were as follows: pain intensity in terms of dorsalgia and radiculopathy using Visual analogue score (VAS), limitations of common activities using Oswestry disability index (ODI). These parameters were evaluated before surgery and in the periods of 6 weeks and 6 months and 2 years after the surgery.

There was statistically significant difference in VAS score before surgery and 6 weeks as well as 6 months and 2 years after surgery in case of both dorsalgia and radiculopathy. Proportionally similar results were found in male and female subgroups, in which significant improvement was found both 6 weeks and 6 months after surgery. ODI values were significantly higher before surgery, compared to values at 6 weeks, 6 months and 2 years after the surgery. In male subgroup, there was not significant difference between ODI before surgery and 6 weeks after surgery, while there was a significant difference between ODI before surgery and 6 months and 2 years after surgery. In female subgroup, the ODI values before surgery were significantly higher than values at both 6 weeks, 6 months and 2 years after surgery. Recurrent herniation has occurred in 7 case, which has been successfully solved by reoperation using microscopic technique.

In evaluating group, there was a significant improvement after surgery, which may be considered as normalization of clinical status. All the evaluated parameters were significantly improved or normalized, i.e. dorsalgia, radiculopathy, limitations of common activities due pain. Our first experiences with the application of endoscopic technique for lumbar disc herniation surgery are maximally positive and based on these experiences as well as on references from other departments and literature, we plan to use this method in the future.

Spinal Neurosurgery

MOBILE ROBOTIC IMAGING AND NAVIGATION IN SPINE SURGERY

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Key words: navigation; mobile robotic imaging; spine surgery.

The use of navigation has become a proven tool in spine surgery.

Improved accuracy with the use of navigation has been demonstrated and its use has proven to be a safe alternative to fluoroscopic guided procedures. The use of navigation enables the limitation of radiation exposure to the patient and surgeon during common spine procedures, which over the course of a surgeon's lifetime may offer significant health benefits. Furthermore, the integration of mobile robotic imaging with navigation increases precision, speed and safety of spine procedures. It allows the surgeon to utilise 3D images, which are easily acquired while the patient is positioned on the operating table, for planing and navigating the procedure as well as for post-op control imaging. This way, the margin of error is reduced to a minimum which leads to better treatments of patients and a more cost efficient system at the long run.

We want to show our experience at starting using mobile robotic imaging and navigation in spine surgery for transpedicular screw placement in regards to doing the same procedure for many years with fluoroscopic imaging.

Spinal Neurosurgery

RESULTS OF SURGICAL TREATMENT OF DEGENERAL CERVICAL MYELOPATHY

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Keywords: degenerative cervical myelopathy; mJOA score.

Cervical myelopathy is a relatively common and serious diagnosis, especially in relation to degenerative disorders of the cervical spine (DCM). Frequently, patients have a pronounced neurological deficit, which cannot be satisfactorily corrected even with acute surgery. The aim of this study is a retrospective analysis of 207 patients with DCM who were treated at Neurosurgical Department České Budějovice in Czech republic between 2016 and 2022. We have reviewed basic demographic data, initial clinical presentation and final outcome (assesed by mJOA score) and the type of surgery. Also, we have assesed the role of perioperative electrophysiological monitoring. Our results have shown that the anterior approach has the best overall outcome (mJOA 14,7), regardless of single or multiple level surgery. However, the main difference between the initial and final mJOA score was in posterior approach (Δ mJOA 3,1). As well, we have confirmed the important role of intraoperative neuromonitoring (mJOA 14,3).

Spinal Neurosurgery

INTRAOPERATIVE ULTRASOUND IMAGING IN SPINAL SURGERY

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Key words: spinal surgery; sonography; navigation.

Background: The precise localization of spinal pathological lesion and control of resection or decompression may decrease probability of complications due to unnecessary spinal structures' exposure and reduce need of revision surgery due to insufficient extent of procedure. Modern ultrasound devices and small high-frequency probes enabled the use of intraoperative ultrasound imaging (iOUS) in the setting of the spinal surgery. After surgical approach through hemi/laminectomy iOUS offers possibility to localise the target lesion, to adjust the approach or reassess spinal level and to plan the durotomy or myelotomy.

Material and methods: Operative records, histological findings, MRI and intraoperative ultrasound images of 163 patients operated for spinal tumors and other lesions, were retrospectively evaluated. The ultrasound characteristics of tumors and the contribution to the intraoperative navigation were assessed.

Results: In all cases, all spinal pathological lesions were displayed as clearly bordered lesions. The differentiation from spinal cord and nerve roots were reliable. In 22,7% of all surgeries iOUS contributed to approach size correction. Intradural tumors were the most frequent type of lesion (25% of all intradural tumors) requiring approach modification. In 1 case (1,5%) iOUS showed only indirect signs of the tumor's presence and the level of approach was corrected. The most frequent localisation of approach corrections was in the upper and middle thoracic spine. In other cases, the presence of tumor was verified and the extent of durotomy and/or myelotomy planed. The iOUS control of adequate decompression was performed for extradural metastatic tumors, abscesses, degenerative and haematomas.

Conclusion: Although X-ray navigation is a standard navigation tool for spinal tumor surgery, the iOUS may contribute to the tumor's localisation and optimal surgical exposure, especially for intradural tumors in thoracic spine region. Objective control of decompression may be useful for extradural compression by metastatic tumors, hematomas, degenerative changes of infections.

Spinal Neurosurgery

„MINI OPEN“ PLIF IN SURGICAL TREATMEN OF DISC HERNIATION

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Key words: "mini open"; PLIF; disc herniation.

Aim of the study: To show whether lumbar disc herniation with „far lateral“ or foraminal extrusion and/or segmental instability can be a good case for spinal fusion or not, by comparing the outcome of posterior lumbar interbody fusion (PLIF) using unilateraly minimally invasive technique and discectomy alone.

Methods: Conventional lumbar fusion is associated with significant muscle stripping and retraction that can adversely affect both short- and long-term patient outcomes. In contrast, minimally invasive lumbar fusion is performed via a local muscle splitting at the area of facetectomy and entry point of pedicle screws insertion has significantly diminished the amount of iatrogenic soft-tissue injury. This approach has also shown the potential to reduce the amount of intraoperative blood loss, the intensity of postoperative pain, and the duration of hospital stays.

We describe the surgical technique of minimally invasive access for PLIF, show the clinical outcome in the perioperative period with this approach

Results: „Mini open“ PLIF provides improved treatment outcomes with respect of low back pain and radicular pain, and enhance postoperative recovery.

Conclusion: The use of mini-open technique for pedicle screw instrumentation with spinal fusion procedure provides excellent clinical results and may be an operation of choice for lumbar spinal fusion in selected patients.

Spinal Neurosurgery

PREVENTION OF EPIDURAL FIBROSIS AFTER LUMBAR DISC SURGERY - TECHNICAL NOTE

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Key words: microdiscectomy; epidural fibrosis.

Background: Failed back surgery syndrome has multifactorial causes. Epidural fibrosis is one of the major causes of FBSS and the incidence ranges from 10% to 75%. MRI with gadolinium is considered the gold standard modality for consistently diagnosing enhancing scar tissue. Many authors have found no relationship between the severity of epidural fibrosis and pain following surgery.

Epidural fibrosis is attributed to 3 main factors: the destruction of epidural fat, the formation of epidural hematoma and the migration of fibroblasts from the perivertebral muscles into the laminectomy defect.

Therefore, any available materials that can eliminate the abovementioned risk factors, but not impair tissue healing are welcome.

Methods: Preservation of the natural barrier is the safest and most effective way to reduce the extent of peridural fibrosis. The prevention or inhibition of the invasion of fibroblasts from the muscle layer is an important factor in reducing the extent of scar formation.

Results: Minimal invasion to the spinal canal is considered as the primary measure to reduce the epidural fibrosis. There is no absolute effective technique that is currently available to reduce EF after lumbar disc surgery. The concept of ligament sparing is not new and many collegues published their techniques.

Conclusion: We believe that preservation of the ligamentum flavum not only reduces scar formation but also helps the surgeon to locate the anatomical plane at reoperation.

We don't have experience with the use of other mentioned materials, primarily due to price, but we are trying to reduce formation of epidural fibrosis and improve surgical outcome with meticulous technique and autologous materials.

Spinal Neurosurgery

MINIMAL ACCESS POSTERIOR INTERBODY FUSION SURGERY

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Key words: minimal access surgery; spinal fusion; posterior interbody fusion.

Aim: The development of minimal access techniques in surgery offer the potential for less invasive surgery with reduced morbidity but whether the surgical goals of fusion or deformity reduction could be achieved remains in question. The presentation includes 2 studies evaluating short and long term outcomes in the application of minimal access posterior interbody fusion (MAPLIF) surgery in patients with spondylolisthesis.

Methods: Forty-seven consecutive patients who underwent posterior interbody fusion surgery for radicular pain and spondylolisthesis were evaluated. Twenty-three underwent open (OPLIF) surgery and 24 MAPLIF. Patients were evaluated clinically and radiologically. The patients were then re-evaluated 5 years later. Four patents had died and one declined to participate leaving 42 for analysis.

Results: The 2 cohorts were evenly matched with respect to age, sex, financial status, back pain, leg pain,disability scores and degree of slip. The loss of disc height was greater in the OPLIF group and the general health better in the MAPLIF group as assessed by SF36. Patients undergoing MAPLFI were able to mobilise quicker and were discharged earlier than open patients but there was no difference in the duration of surgery or the blood loss. Both groups experienced substantial improvement in leg and back pain. Both groups experienced a substantial improvement in their disability scores. Disc height and alignment was restored similarly in both groups. These benefits were sustained at 5 year follow-up.

Conclusion: Posterior lumbar interbody fusion is an effective treatment for leg and back pain associated with spondylolisthesis and the improvement is sustained in the medium/long term. Improvement in pain is associated with an improvement in physical and social function and this improvement is sustained. MAPLIF is as effective as OPLIF in improving radicular pain, back pain and function in patients with spondylolisthesis.

Spinal Neurosurgery

MOBILE APP-ASSISTED POSTOPERATIVE REHABILITATION AFTER LUMBAR DISC SURGERY

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Key words: lumbar disc surgery; postoperative rehabilitation; mobile app; patient engagement; pain management; functional recovery.

Lumbar disc surgery is a common procedure undertaken to alleviate chronic low-back pain and improve patients' quality of life. However, the success of these surgeries is significantly influenced by the effectiveness of postoperative rehabilitation. This study presents an innovative approach utilizing a mobile app to enhance the effectiveness of postoperative rehabilitation following lumbar disc surgery.

Objective: The aim of this study is to investigate the feasibility and potential benefits a mobile app integration into the postoperative rehabilitation for patients who have undergone lumbar disc surgery. The app is designed to provide exercise routines, track progress in real-time, offer educational resources, and improve patient engagement and outcomes.

Methodology: A pilot study was conducted involving a cohort of patients who recently underwent lumbar disc surgery. In this study app MySpine, available on App Store and Google Play, was used. The application was developed by the former patient in collaboration with employees of the Department of Neurosurgery, General Hospital Varaždin. The application was offered for free to all patient who underwent lumbar disc surgery and participants were divided into two groups: a control group that refused to use the app receiving standard postoperative rehabilitation instructions and an experimental group utilizing a specially developed mobile app. The app offered guided exercises, progress tracking, and educational content regarding recovery. Data on age, gender, adherence, pain levels, functional improvements, and patient satisfaction were collected and analyzed.

Results: Preliminary findings suggest that the integration of a mobile app in postoperative rehabilitation has the potential to improve patient engagement and outcomes. Participants using the app reported better pain management, increased confidence in movement, and improved functional capacity. The app's educational resources were also well-received, empowering patients to actively participate in their recovery.

Conclusion: Integrating a mobile app into the postoperative rehabilitation of lumbar disc surgery patients has the potential to improve adherence, reduce pain, and enhance overall recovery outcomes.

Spinal Neurosurgery

INVASIVE VERTEBRAL HAEMANGIOMA

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Key words: vertebral neoplasams; spinal embolization; invasive vertebral haemangioma.

Aim of the study: Invasive haemangiomas are rare and it is estimated that only 1% become symptomatic through the adult hood. The most feared and the most notorious are ones causing neurological deficit due to spinal cord compression. In such a setting decompression surgery is potentially unfeasible due to life threating blood lose. To overcome that kind of an obstacle embolization is the only option. Described methods of embolization are: vascular embolization, percutaneous cement embolization (vertebroplasty), open vertebroplasty and percutaneous and open embolization with haemostatic material. In the setting of a threating spinal cords compression radiation therapy is also feasible and well described, and in some cases embolization is also advocated. Even today there is no clear consensus how to treat this kind of benign vertebral neoplasms. Herein we would like to discus and present our experience in treating invasive vertebral haemangiomas.

Methods: We have revived the medical records and image database of 7 patients that were diagnosed with invasive haemangiomas in the time from 2017 to 2023.

Results: Four of them were female and one was male, age distribution was from 24 to 74 years of age. All patients were brought to our attention due to neurological deterioration due to medullar or spinal root compression. In 6 patients MR images showed clear spinal cord compression and sign of myelopathy in the thoracic region. One patient hat L4 nerve root compression and severe radiculopathy. Six patients were surgically decompressed after intraoperative vertebroplasty, and one patient had prior embolization with particles. In the 3 month follow up 2 patients showed signs of tumour growth and they were threated additionally with radiosurgery. Latter controls revealed good tumour growth control. One patient was treated with radio therapy and vertebroplasty, but the tumour growth was not sustained and, in that case, surgery was deemed unfeasible.

Conclusion: Invasive haemangiomas that are causing neurological deterioration are thought to threat vertebral neoplasms. Threating patients with invasive haemangiomas demands multimodality treatment that would suit the each patient for the best.

Spinal Neurosurgery

DEGENERATIVE SPINE SURGERY AND SAGITTAL PROFILE

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Key words: lumbar sagittal profile; degenerative spine surgery; spinal stenosis surgery.

Aim of the study: Hereby I would like to describe our experience with surgical treatment of degenerative spine conditions with special consideration on the sagittal profile reconstruction of the lumbar spine.

Methods: In time period from 2020 till 2023 we have surgically treated 30 cases of degenerative lumbar spine conditions that had significant spinal stenosis or/and sagittal malalignment or clear deformity. Out of 30 cases 9 were revision cases, where decompression and in situ fusion was performed. All patients had PI-LL mismatch greater that 20° and 10 had SVA displaced more than 10 cm. Outcome was measured using the Oswestry Disability index.

Results: All the patients' major complaint was walking disability, 50 m or less of walking distance. All the patients had no motor deficit although neurological symptoms were in good correlation with EMNG and MRI findings. Nine previously operated patients had no residual spinal canal stenosis but pure deformity, SVA displacement more than 5 cm and PI-LL mismatch more than 20°. In the other group 14 patients had deformity and spinal canal stenosis (SVA displacement more than 5 cm and PI-LL mismatch more than 20°), 7 patients had pure deformity without stenosis. Surgical strategy was created based on the MR, MSCT and SLOT radiography findings. For the stiff deformity corrective osteotomies were performed, in cases where anterior retroperitoneal approaches (ALIF, OLIF, LLIF) are feasible providing distraction and sagittal alignment recreation. In cases where decompression and deformity is addressed cantilever TLIF was performed. All the patients had significant improvement in ODI after surgery.

Conclusion: Our results show that sagittal profile of the lumbar spine plays an important role in surgical treatment of the lumbar spine. We have also noticed that such surgical procedures require more time spent in OR and they are more technically demanding for the hole surgical team. Such surgical procedures are probably not best suited for all of the patients but for the selected ones. Our results are clearly concordant with previously published data.

Spinal Neurosurgery

EXTREME LATERAL INTERBODY FUSION AND BILATERAL PERCUTANEOUS PEDICLE SCREW FIXATION PERFORMED ALL IN LATERAL POSITION

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Key words: degenerative disc disease; fusion; percutaneous; lateral interbody; minimally invasive.

Objective: Evaluation of the feasibility, technical difficulty and clinical results in performing combined lumbar XLIF and bilateral percutaneous pedicle screw fixation done all in lateral position

Background: Lumbar XLIF and bilateral percutaneous pedicle fixation is a valuable minimally invasive approach for achieving an useful and solid lumbar circumferential fusion in selected cases. Currently, a change in the position of the patient on the operating table from lateral to prone is used. Theoretically, being able to perform both approaches in the same position, would significantly reduce surgical time.

Materials and Methods: Fifteen consecutive patients were submitted to a circumferential fusion done in the same, lateral, position. There were 9 female and 6 male patients, mean age 52 years. Low back pain due to degenerative disc disease were the prevalent symptom and pathology, respectively. Follow-up was recorded for operation time and walk out of bed timing and compared to the group of patients operated previously in whom the change in position was used. Clinical outcome was evaluated with VAS and ODI scores.

Results: Seven patients performed a two-level circumferential fusion, fife at L3-L5 levels and two at L1-L3 levels while 8 patients performed the procedure on a single level (six on L4-L5 and two on L3-L4). Mean surgical time was 79 (±14) minutes (29 for XLIF and 50 for pedicle fixation) for one level and 114 (±21) minutes (54 for XLIF and 60 for pedicle fixation) for more than one level surgery. Average time lap between the XLIF part and pedicle screw part of the procedure was 6 (±2) minutes. As compared to the usual approach with the change in position, approximately 20 minutes were saved. There was no significant difference in walk out of bed timing as well as no difference was found for clinical outcome scores (VAS and ODI). No differences in screw positioning were found on post-op X-rays between the two groups as well as no additional complications were noted in this group of patients as compared to the patients operated previously with the change in position.

Conclusions: Lumbar circumferential fusion with XLIF and bilateral percutaneous pedicle screw fixation performed in lateral position seems a useful modification of the standard procedure done in two different positions. The main advantage is time saving. Technical challenge in performing the procedure in lateral position is slightly more demanding due to different patient orientation however, the learning curve is short and after a few cases the timing of the approaches between prone and lateral position equals. No differences in clinical and radiological outcomes and complication rates were noted.

Spinal Neurosurgery

LUMBAR LORDOSIS CORRECTION WITH INTERBODY HYPERLORDOTIC CAGES: INITIAL EXPERIENCE, LEARNING CURVE, TECHNICAL ASPECTS AND COMPLICATION INCIDENCE

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Key words: anterior interbody; fusion; degenerative spine; deformity.

Introduction: Analyzes of the initial experience on learning curve, technical differences and peri or early post-operative complications using lumbar hyper-lordotic anterior and lateral interbody cages for the correction of lumbar lordosis as compared to the usage of regular lordotic cages.

Material and Methods: Initial twenty-one consecutive patients treated with 13 hyper-lordotic anterior lumbar interbody fusion (ALIF) cages and 8 hyper-lordotic extreme lateral interbody fusion (XLIF) cages. Mean age 64 years. Mean lumbar hypo lordosis 23 degrees.

Results: No significant procedure-related technical differences were found between the hyper-lordotic and non-hyper-lordotic ALIF cages. Slightly significant procedure-related technical differences were found between hyper-lordotic and non-hyper-lordotic XLIF cages. The complication type and occurrence were comparable.

Conclusion: Sagittal balance correction of the lumbar lordosis using hyper-lordotic ALIF and XLIF cages is a relatively safe surgical procedure with a short learning curve for those surgeons already familiar with anterior and lateral, retroperitoneal, procedures.

Spinal Neurosurgery

LUMBAR, TWO-LEVEL, CORPECTOMY FOR DEFORMITY CORRECTION IN A CASE OF POST-SURGICAL OSTEOMYELITIS AND INSTRUMENTATION FAILURE

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Key words: spine surgery complications; infection; corpectomy.

Female, 41 years of age. Operated seven times starting with L4-S1 TLIF fusion for unspecific low back pain. Subsequent surgeries including a PSO at L3 level with instrumentation extension from pelvis till Th7. After the second-last surgery Escherichia Coli infection destroyed the L4 and L5 vertebral bodies. Reoperation and six months of antibiotics healed the infection. Final X ray images showed a complete destruction of L4 and L5 vertebral bodies and failure of the rods (Th12-L1 level). Pelvic parameters: PI 60,

PT 32, LL 34, TK 37, SVA 60. Patient presented with severe low back pain (VAS 9/10) and generalized weakness of the lower limbs with feet drop. Was able to walk for short distance with bilateral crutches.

Three-stage revision surgery: first stage comprised posterior approach for replacement/implantation of pedicle screws from pelvis to Th5. In L4 and L5 the screws were not placed due to complete destruction of vertebral bodies. Second stage included an anterior approach with the exposure of the vertebral column from L3 to S1. Upon removal of the remnants of the L4 and L5 a Harms cage was positioned from the lower endplate of L3 to the sacrum. The cage was filled with autologous bone and fixed in place with a screw proximally in L3 and distally in the sacrum. Third stage comprised posterior re-opening, multiple SPOs and positioning of rods in compression until an adequate lordotic curve was thought to be obtained. No major intra or post-op complications were encountered. On twelve months follow-up the patient reported a 70% reduction of low back pain (VAS 3/10). Was able to walk with one-side crutch for 500 meters and climb a series of 20 stairs. The X ray images showed decent alignment with some subsidence of the cage at the L3 level.

Spinal Neurosurgery

DIRECT LESION AND REPAIR OF ILIAC VEIN DURING EXTREME LATERAL INTERBODY FUSION SURGERY

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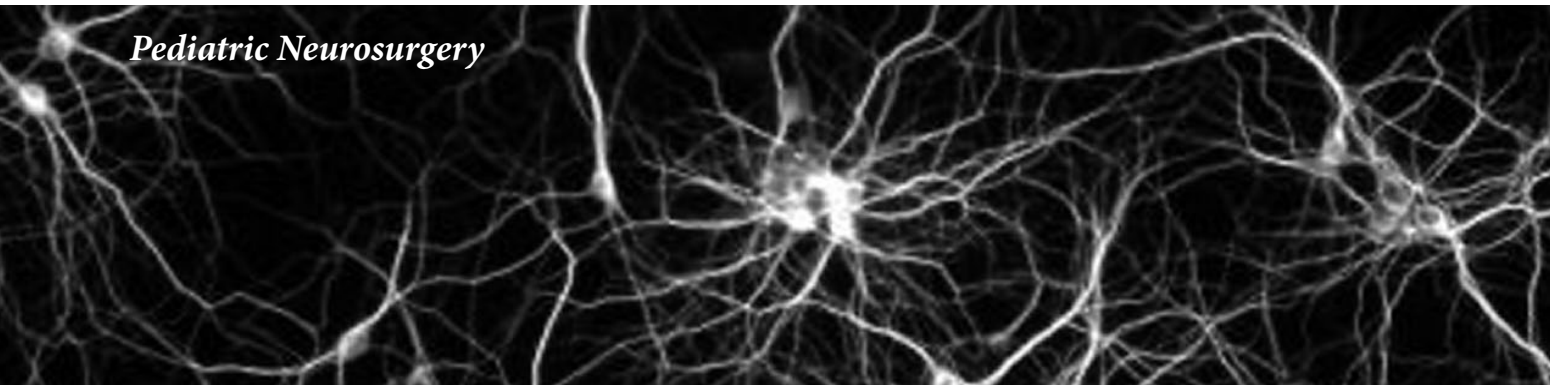
Key words: lateral interbody fusion; complication; vascular lesion.

Purpose: Description of a case of direct intraoperative lesion and repair of a major vascular injury of common iliac vein during an extreme lateral interbody fusion L4-L5 procedure

Methods: Sixty-nine years old female operated for L4-L5 spondillysthesis suffered a major vascular injury of a vein. The high cava bifurcation and inadequate pre-operative analysis of the radiological documentation brought to the lesion. The lesion was successfully repaired and the patient didn't suffer post-operative sequel.



Pediatric Neurosurgery

THE INFLUENCE OF TRANEXAMIC ACID ON THE DEGREE OF BLEEDING IN PEDIATRIC PATIENTS UNDERGOING CRANIOSYNOSTOSIS SURGERY

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Key words: tranexamic acid; bleeding; craniosynostosis; pediatric patients.

Aim of the study: Craniosynostoses are developmental disorders that are related to the premature fusion of the bones of the neurocranium. Surgical treatment is often opted for. One of the main problems in treating pediatric patients is blood loss during surgery and the risk of hypovolemic shock. We aimed to evaluate the impact tranexamic acid (TXA) has on the degree of bleeding during surgery in these patients.

Methods: We included 100 pediatric patients who underwent surgical treatment of craniosynostosis at our Department. Surgical procedures were performed in a supination position with the head being fixed in a special headset at the level of the maxilla. The procedure encompassed suturing and bone remodeling. Additionally, fronto-orbital advancement was performed if deemed necessary. Following surgery, patients were treated in a pediatric intensive care unit (PICU). As a standard of care, complete blood count was collected before the surgical procedure, immediately after the procedure, and before the discharge from the PICU. These findings (including hemoglobin – Hb and red blood cell count – RBCC), together with data on blood transfusions (BT) and TXA administration, were collected from the patients' medical history.

Results: Patients' age span was 3-62 months. 73 of the patients were male. Most common presentation (in 58 patients) was the simple craniosiostosis - scaphocephalus. Suturing and bone remodelling of the neurocranium was most frequently performed (in 61%), while additional fronto-orbital advancement was needed in 39% of cases. 27 patients received TXA during the procedure and 66 of patients needed an intraoperative BT. Our results showed a significant decrease in Hb and RBCC values when comparing the preoperative values with the first control values at the time of entry into PICU (Hb0'=118,98±10,57, Hb1'=103,11±13,96 g/L, P<0,001, ΔHb=-15,84 g/L). Comparison between patients that receieved TXA and those who did not receive it found no difference in the tested parameters of bleeding. Furthermore, TXA administration showed no reduction in intraoperative BTs.

Conclusion: Although there are numerous studies of the effect of TXA on the reduction of surgical bleeding, its clinical effect remains dubious. Our study showed no significant impact of TXAon bleeding in pediatric patients undergoing surgery for craniosyostosis.

Pediatric Neurosurgery

CHALLENGES IN PEDIATRIC INTRACRANIAL ANEURYSMS TREATMENT

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Key words: aneurysms; pediatric intracranial aneurysms; pediatric subarachnoid hemorrhage; pediatric vascular anomalies.

Background: Pediatric intracranial aneurysms are rare and are often giant, fusiform and dissecting, compared to adult intracranial aneurysms. The occurrence and formation of pediatric aneurysms is often associated with connective tissue disorders, head injury or infection, which further increases the complexity and difficulty of treatment.

Methods: A retrospective review of medical records was performed for the period between January 2012 and December 2022 - pediastric intracranial aneurysm cases were further analyzed. Aneurysm type, location, presentation, previous and current treatments were analyzed. All patients have long term follow up and surgical and radiological outcome were reviewed.

Results: From 2012 to 2022, among 1252 aneurysms surgically treated at our Department, only 13 cases were pediatric patients which confirms the very low incidence of pediatric aneurysms. As in previous studies, the rupture rate in pediatric aneurysm cases is very high and present 53,8% of our cases. All but one aneurysm were found in the anterior circulation. Two patients had giant aneurysms, five had fusiform aneurysms that require trapping or proximal vessel occlusion, and two aneurysms were resected and bypassed. The rest was clipped. Complete occlusion was confirmed in all patients using CTA, MRA or DSA. During follow up in two patients (15.3%), an additional aneurysm was discovered. Only patients who presented with SAH ended up with neurological deficit on follow up, and the majority had distal MCA fusiform aneurysms that were treated with proximal vessel occlusion.

Conclusion: Surgical management of pediatric aneurysms differs from adult cases due to the difference in aneurysm presentation, size, shape, and location and often requires a large experience with multiple aneurysm treatment strategies. Due to persistence of complete clip occlusion, or need for aneurysm resection, and need for long term follow up, surgical treatment has a clear advantage over endovascular treatment. Congenital etiology of many pediatric aneurysms leads to patients requiring long term radiological follow-up, in order to disclose new aneurysm formation, or regrowth of previously treated aneurysms.

Trauma Neurosurgery and Critical Care

SEVERE TRAUMATIC BRAIN INJURY (STBI) - NEUROREHABILITATION IN THE INTENSIVE CARE

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Key words: sTBI; early neurorehabilitation; outcome.

Aim of the study: The number of patients surviving sTBI is increasing. Based on the progress in urgent and intensive care, patients with severe, previously fatal brain damage survive, but often with serious functional deficits. Early neurorehabilitation is one of the most important factors for the restitution of impaired brain function. Integration of rehabilitation in the intensive care makes it possible to start therapy directly, without any interruption.

The aim of the prospective study was to show the implementation of early rehabilitation program for patients after sTBI in intensive care and to evaluate the outcome after 12 and 24 months.

Methods: 51 survivors (age 33. 8, range 16-64 years, m: f = 4:1) of severe brain injury (GCS </= eight for at least 24 hours) underwent an interdisciplinary early rehabilitation program. Duration of rehabilitation program was at mean 18,4 (4-78) days adapted to the individual capability for 3-4 hours/ day. The follow-up examination took place 12 and 24 months after the sTBI.

Results: Data revealed a high level of independence in activities of daily living (mean Barthel Index after one year 92.7 points, after two years 93.7 points). After one and two years, 74.5% and 80.4% of the patients were completely independent on need of care. Nevertheless, more than half of the patients show sensorimotor, cognitive, behavioural, speech and visual deficites. Return to work rates improves between one and two years after trauma, as evidenced by the rate of patients being back to full time work at one year (n= 14, 28%) and two years (n=20, 40%) post-sTBI; although, none of these changes reached statistical significance.

Conclusion: The successful implementation of early rehabilitation programs for patients after sTBI in intensive care is possible. Focussed on outcome, the data revealed a high level of independence in activities of daily living. Return to work rates were not satisfying, but improving between one and two years after trauma.

Trauma Neurosurgery and Critical Care

TRANSFORMING PATTERNS OF TRAUMATIC BRAIN INJURY MANAGEMENT INFLUENCED BY THE COVID-19 DISEASE PANDEMIC

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Key words: traumatic brain injury; COVID-19 pandemic; management patterns.

Aim of the study: The outbreak and worldwide dissemination of the highly infectious COVID-19 respiratory disease have intensely altered the practice of emergency neurosurgery in Croatia, particularly for traumatic brain injury (TBI) patients, transforming its management patterns. Herein, we provide an institutional analysis of the influence of the COVID-19 disease pandemic on the treatment of TBI.

Methods: By implementing national public-health recommendations, we designed a specific protocol for COVID-19-positive, and COVID-19-suspected emergency TBI patients, adequately adjusting neurosurgical capability and capacity, and minimizing the risk of the disease transmission among patients and medical personnel. We examined hospital-admitted TBI patients for eight months (January to August 2020). The observed time was divided into 3 intervals: pre-lockdown, lockdown, and post-lockdown periods. Some independent variables like gender, age, and severity of injury at admission and discharge, were analyzed using the methods of descriptive statistics. The Mann-Whitney U test was used to compare the ratio between surgical and non-surgical TBI patients, the cause, multiplicity, type, and severity of injury, and the treatment between the pre-lockdown and lockdown periods, as well as between lockdown and post-lockdown periods. Chi-squared test or Fisher's exact test was used for the comparison between groups in pre-lockdown, lockdown, and post-lockdown periods.

Results: The number of surgical TBI patients, the mean age of admitted patients, as well as the frequency of isolated injuries and chronic subdural hematoma, were significantly decreased during the lockdown and post-lockdown periods.

Conclusion: The COVID-19 disease pandemic extensively influenced the patterns of TBIs, diminishing patients' overall number and age. Isolated TBI and chronic subdural hematoma were less frequently seen in these patients, forcing neurosurgical service to quickly readjust its management to the emerging new condition.

Trauma Neurosurgery and Critical Care

THE EFFECT OF HYPEROSMOLAR MANNITOL SOLUTION ON THE DYNAMICS OF CEREBROSPINAL FLUID IN PIGS

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Key words: mannitol; intracranial pressure; cerebrospinal fluid; pig.

Aim: The mechanism of action of hyperosmolar solution in lowering of elevated intracranial cerebrospinal fluid (CSF) pressure is still unclear. We hypothesized that intravenous (i.v.) administration of mannitol solution will cause a decrease in CSF pressure by decreasing the volume of CSF, rather than the volume of brain parenchyma and/or blood volume, as it is generally believed.

Methods: To test our hypothesis, we created a new model in swine (n=6) where intracranial hypertension was induced by inflation of the balloon of Foley's catheter (3 ml) introduced parietally epidurally. CSF pressure was recorded in lateral ventricle (LV) and lumbar subarachnoid space (LSS). The effect of 10% mannitol solution (i.v. over 15 min) on reduction of CSF pressures was monitored for 60 minutes before and after cranio-spinal obstruction (tightening of the epidurally placed surgical thread at the C2 level).

Results: In the period before the increase of CSF pressure, typical effects of mannitol administration on both vital parameters (changes in heart rate and mean arterial pressure) and biochemical parameters (decrease of haematocrit and electrolyte concentration) were noticed. Intracranial pressure increased from 12.3 ± 2.7 mmHg to 47.8 ± 21.1 mmHg after balloon inflation. Administration of mannitol solution led to a significant decrease in CSF pressure in LV and LSS approaching the values of the control phase. However, when mannitol was administered after creation of craniospinal obstruction, we observed a separation of the CSF pressures in the two compartments. CSF pressure in LV increased (32.0 ± 4.1 mm Hg), while in LSS it continuously decreased over time (8.6 ± 2.4 mm Hg).

Conclusion: Obtained results support our hypothesis according to which an increase in serum osmolarity caused by i.v. administration of mannitol solution leads to osmotic extraction of water from the interstitial and cerebrospinal fluid, and subsequently to a decrease in the volume of CSF, predominantly in the spinal compartment. This finding fits into the new hypothesis of CSF physiology, according to which the volume of CSF (production and removal of CSF and interstitial fluid) is regulated by the interaction of osmotic and hydrostatic forces throughout the entire capillary net of the CNS.

Trauma Neurosurgery and Critical Care

THREE-DIMENSIONAL CUSTOM-MADE POROUS POLYETHYLENE CRANIOPLASTY IN PATIENTS AT HIGH RISK FOR SURGICAL SITE INFECTION - MONO-INSTITUTIONAL STUDY

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Key words: cranioplasty; porous polyethylen; surgical site infection; high-risk patients.

Objectives: The aim of our study was to verify the assumed low incidence of surgical site infection (SSI) after porous polyethylene cranioplasty in patients at high risk for SSI.

Background: Cranioplasty is accompanied by a high incidence of complications. A common complication is SSI with an incidence of 1.4 - 24.4%. The optimal material for cranioplasty in terms of the incidence of infection remains unclear. Porous polyethylene is a modern material associated with a low risk of infection, but has not yet been included in any meta-analyses.

Methods: We prospectively evaluated a group of 21 patients over the period 2014 – 2022, who underwent secondary three-dimensional (3D) custom-made cranioplasty from porous polyethylene. Patients at high risk for SSI were defined through risk factors: previous infection with the need for removal of an autologous bone flap or implant, bone flap resorption, repeated revision surgeries, open frontal sinus.

The incidence of SSI and exposure of the implant were assessed. The objectives were evaluated using physical examination and computed tomography.

Results: Twenty-one operations were performed on 21 patients. In 16 cases, cranioplasty was performed after decompressive craniectomy and in five cases after craniotomy of limited size. Seven patients had one risk factor and 14 patients had a combination of two risk factors. The mean follow-up was 48 months (12-96).

Neither infection nor implant exposure was detected in any patient in our group.

Conclusion: We have confirmed the minimal risk of infection or implant exposure after 3D custom-made cranioplasty with porous polyethylene, even in patients at high-risk for SSI. Further clinical studies with better evidence could confirm our conclusions.

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Trauma Neurosurgery and Critical Care

MIDDLE MENINGEAL ARTERY (MMA) EMBOLIZATION FOR CHRONIC SUBDURAL HEMATOMAS: RATIONALE AND DESIGN FOR THE STOP RECURRENCE OF MMA BLEEDING (STORMM) RANDOMIZED-CONTROL TRIAL

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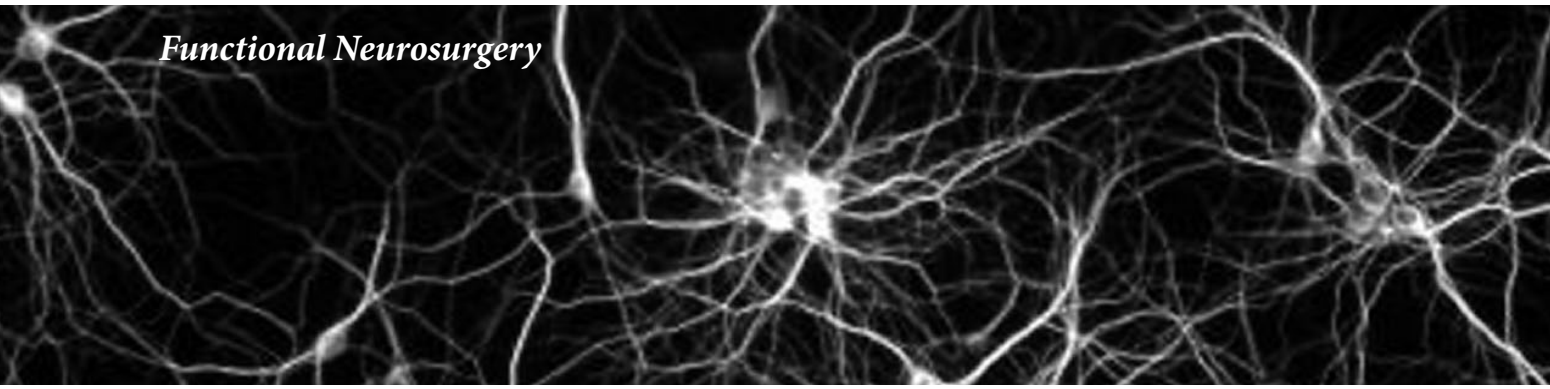
Key words: neurotrauma; prospective; nonsurgical treatment; neuro-intervention; embolization.

Aim of the study: Chronic Subdural Hematomas (cSDH) are common and can result in neurological impairment and reduced consciousness. Surgery is typically performed once neurological symptoms develop. Recent studies suggest that arteries nourished by the middle meningeal artery (MMA) may be responsible for hematoma progression and that MMA embolization is clinically useful. There is less evidence, that embolization of MMA can be a treatment option for individuals without surgical treatment. We propose a multicenter study to investigate both of these potentials: (1) Assessment of efficacy of MMA-embolization after surgery to reduce recurrence and improve outcomes, (2) Assessment of embolization-alone efficacy when surgery is contraindicated or refused.

Methods: cSDH patients with surgical indication will be randomized at a rate of 2 MMA embolization to 1 conventional management at multiple centers within Europe. The primary outcome measure will be recurrence rate. Based on recurrence rates of cSDH estimated at 20% and recurrence with MMA embolization at 4%, alpha=0.05, and power of 80%, we estimate a minimum enrollment of 153. Other major outcomes include radiological parameters (volume, maximal coronal and sagittal hematoma size, unilateral/bilateral presence), at 6-weeks and 6-months follow-up. Clinical outcome assessment will include Glasgow Outcome Scale-Extended (GOS-E), modified Rankin scale (mRS), Markwalder grade, mortality, complication rates (TDN grade) and readmission up to 6-months follow-up. Excluded patients receiving embolization without surgery will additionally be assessed for regression, stability and progression of hematoma size.

Ethics and dissemination: While it has been shown that the MMA embolization can reduce recurrence, this has not yet been demonstrated with high-level evidence. However, low risks exist with neuro-interventional procedures, therefore, there is equipoise for randomizing patients to evaluate the potential benefits and to determine if these clearly outweigh the risks and costs of MMA embolization. Peer-review publication and presentation of the results at international meetings will be planned.



Functional Neurosurgery

VERBAL MEMORY IN PATIENTS WITH GLIOMAS AFTER AWAKE CRANIOTOMY IN REGARD TO ONCOLOGY TREATMENT

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Key words: neuropsychological assessment; verbal memory; awake craniotomy; gliomas; neurooncology.

Gliomas are mainly brain malignant tumors. Three main types include astrocytomas, oligodendrogliomas and ependymomas and each of them are divided as low, mid or high-grade tumors. The treatment includes surgery and combination of radiation therapy and chemotherapy. For optimal oncological outcome, maximal or gross total resection of gliomas is vital in addition to preserving cognitive functions. Awake craniotomy to date has been shown as golden standard procedure in obtaining maximum tumor resection in eloquent areas while minimizing severe neurological and cognitive postoperative deficits. Besides optimal neuro-oncological outcomes, preservation of language and other cognitive functions are crucial due to their role in daily living functioning. Preoperative and postoperative neuropsychological assessment often showed deficits in other cognitive functions such as memory, visuoperceptual functions, learning, reasoning, executive functions (planning, mental flexibility) and changes in emotional functioning rather than just language. Furthermore, cognitive impairment is not always associated with specific tumor location due to functional connectivity of the whole brain. Many patients underwent oncology treatment complain of cognitive decline which often includes impairment in memory, naming, attention, processing speed etc.

Gliomas in eloquent areas are treated with awake craniotomy at the Department of Neurosurgery, Medical School University of Zagreb. Every patient underwent preoperative and postoperative neuropsychological assessment with a mean time of 3 month follow up. As a standard neuropsychological battery, tests of verbal learning and memory were applied. In this study, eighteen (out of 30) patients, with low and mid-grade gliomas who underwent awake surgery were included. Eight of them underwent radiotherapy or/and chemotherapy after surgery. The aims of this study were to assess was there decline in verbal memory postoperatively regarding preoperative results and whether there was significant effect of oncological treatment (radio/chemotherapy) on verbal memory. The preliminary results showed no significant decline in short-term and long-term verbal memory postoperatively. Moreover, the group of patients that underwent postoperative oncological treatments showed no significant difference in both short-term and long-term verbal memory compared to those without the treatment. The study showed important role of neuropsychological assessment in awake craniotomy emphasizing the need for neuropsychological testing for other cognitive functions rather than language only.

Functional Neurosurgery

MIRCOVASCULAR DECOMPRESSION FOR TRIGEMINAL NEURALGIA: TECHNIQUE, RESULTS, INFLUENCE OF DIFFERENT FACTORS ON LONG-TERM OUTCOME

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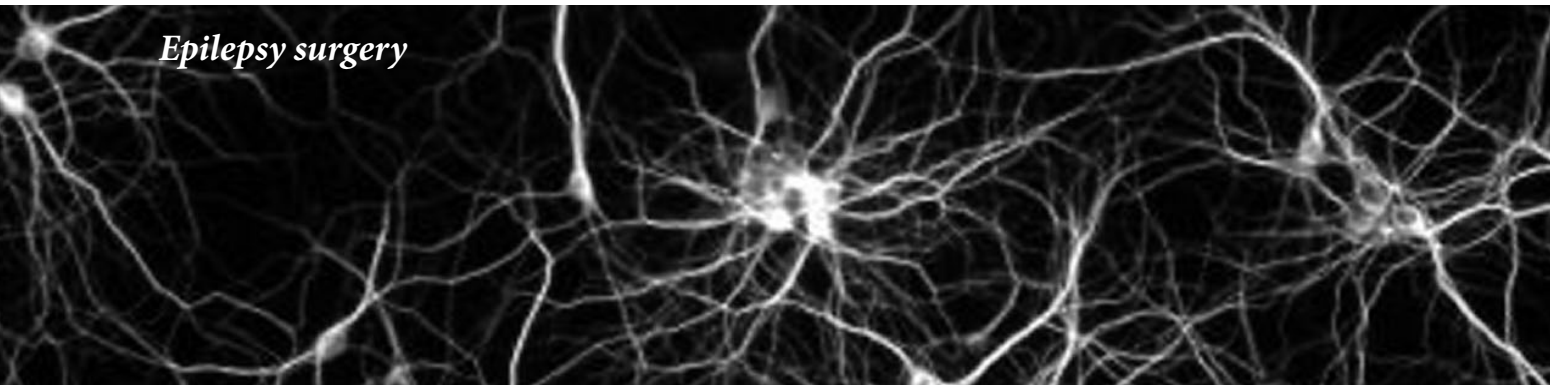
Key words: trigeminal neuralgia; microvascular decompression; outcome.

Background: Trigeminal neuralgia (TN) is characterized by attacks of shock-like shooting facial pain lasting up to two minutes. The most common cause of TN is neurovascular conflict, when the trigeminal nerve is compressed by a vessel. The most effective treatment method is microvascular decompression of trigeminal nerve by isolating the nerve from the vessel.

Methods: We have retrospectively analyzed long-term treatment results in 70 patients with trigeminal neuralgia that have undergone microvascular decompression during 2012-2023. We have analyzed neuralgia type, pain duration, trigeminal nerve branches involved, age and sex (according to medical data and patient interview), compression factor and compression severity (according to operation protocol and intraoperatively recorded videos) and correlated the data with long-term outcome. Compression severity was evaluated via intraoperative video retrospectively according to the classification proposed by M.Sindou et al., as well as classification introduced by the authors of this paper, which includes compression severity, as well as arachnoid adhesions. Long-term patient outcome was evaluated by Barrow Neurological Institute (BNI) scale.

Results: Patients were grouped into 3 similar sized groups in terms of pain duration: 10 years. Most favorable outcome is witnessed in the <3 years of pain group (15 out of 19 patients are BNI I). Arterial compression was diagnosed in 40 patients, venous in 12 and combined in 16. BNI I status has been achieved in 31 patients with arterial compression, 5 patients with venous compression and 12 patients in combined group. Intraoperative videos of 59 patients were evaluated to define the severity of compression. Grade I compression was seen in 33 cases (21 patients BNI I), Grade II in 11 cases (8 are BNI I), Grade III in 13 cases (12 are BNI I).

Conclusion: Neuralgia type, as well as compression factor and severity influence long-term outcome in patients that have undergone microvascular decompression. A more meticulous patient selection can contribute to a higher success rate of microvascular decompression.



Epilepsy surgery

TREATMENT OF PHARMACORESISTANT EPILEPSY VIA SELECTIVE AMYGDALOHIPPOCAMPECTOMY FOR MESIAL TEMPORAL SCLEROSIS: SINGLE- CENTER EXPERIENCE

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Key words: epilepsy; pharmacoresistant epilepsy; epilepsy surgery; selective amygdalohippocampectomy.

Background: Around one-third of epilepsy patients are resistant to treatment, despite multiple antiepileptic drugs (AEDs) used. One of the most common causes of structural, pharmacoresistant epilepsy is mesial temporal sclerosis. Surgical resection of the mesial temporal structures (amygdala, hippocampus, parahippocampal gyrus) leads to Engel class 1 outcomes in 59-93% of patients at year 1 of follow-up, and up to 53% of patients at year 5, according to the literature. Herein, we present a single-institution experience of selective amygdalohippocampectomy (SAH) for treatment of epilepsy associated with mesial temporal sclerosis.

Methods: Patients with pharmacoresistant epilepsy due to mesial temporal sclerosis, confirmed on MRI and associated with typical mesiotemporal semiology and video-EEG patterns, were treated at our center. Several patients required invasive monitoring preoperatively (stereoelectroencephalography) in order to determine the lateralization of the epileptogenic zone. All patients were treated via a transsylvian approach.

Results: 97 patients (52 M, mean age 37.3, range 13-65) were treated, the mean disease duration was 22 years (range 2-61). Engel seizure freedom outcomes at year 1 were: 1 - 86.6% (1A - 72.2%); 2 - 11.3%; 3 - 1.1%; one patient died one month postoperatively. ILAE outcomes at year 1 were: 1 - 74.2%; 2 - 2.1%; 3 - 13.4%; 4 - 12.4%; 5 - 5.2%. 5-year follow-up is available for 66/97 patients. Engel outcomes at 5 years were: 1 - 84.8% (1A - 77.3%); 2 - 9.1%; 3 - 6.1%; There were no severe postoperative neurological deficits. Visual field data is available for 30 patients - 2 patients suffered from new- onset contralateral superior quadrantanopia. Two patients had postoperative meningitis and recovered after antimicrobial treatment.

Conclusion: Selective amygdalohippocampectomy is a rewarding procedure in patients with pharmacoresistant epilepsy due to hippocampal sclerosis. The beneficial effect of resection is sustained over a longer follow-up period.

Epilepsy surgery

SURGICAL TREATMENT OF ADULT PATIENTS WITH INTRACTABLE EPILEPSY AND HISTOPATHOLOGICALLY DIAGNOSED FOCAL CORTICAL DYSPLASIA

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Key words: focal cortical dysplasia; epilepsy; surgery; malformations of cortical development.

Aim: Malformations of cortical development are a heterogenous group of disorders characterized by the disruption of cerebral cortex formation caused by different genetic or epigenetic mechanisms with either generalized or focal distribution. Focal cortical dysplasia, as a subgroup of previously defined disorders, presents with a various degree of abnormal cortical lamination and neuronal enlargement with dysplastic features. Focal cortical dysplasia has been well recognized as a cause of pharmacoresistant epilepsy in childhood, however there is a limited analysis of patient characteristics and surgical outcomes in the adult population.

Methods: A consecutive series of adult patients who underwent surgical resection for focal cortical dysplasia in the Department of Neurosurgery, University Hospital Centre Zagreb is presented. Patients' data was retrospectively analyzed using medical records. Investigated features were: demographic characteristic, clinical presentation, histopathological type of focal cortical dysplasia (ILAE classification) and different outcome measures.

Results: There were 17 patients included in the study with slight female predominance (52.9%). Patients' seizure characteristics were classified as auras, simple or complex partial seizures with or without secondary generalized tonic-clonic seizures. Most of the patients had no significant neurological deficit (82.4%). There was an equal distribution between temporal and extratemporal lesions, while 3 patients had multilobar localization. The mean age of surgery was 29.8 (ranging from 19 to 41). According to ILAE classification most of the lesions were classified as type III with dual pathology. The rest of the sample was classified into type I or type II. According to Engel's classification most of the patients had favorable outcome with good seizure control.

Conclusion: Adequate patient selection for focal cortical dysplasia surgical resection in adult population can lead to a satisfactory treatment outcome, however further studies are necessary in this specific group of patients.

Epilepsy surgery

RESECTIVE EPILEPSY SURGERY AFTER STEREOELECTROENCEPHALOGRAPHY (SEEG) IN PRESURGICAL ASSESSMENT OF PHARMACORESISTANT REFRACTORY MRI-NEGATIVE EPILEPSY

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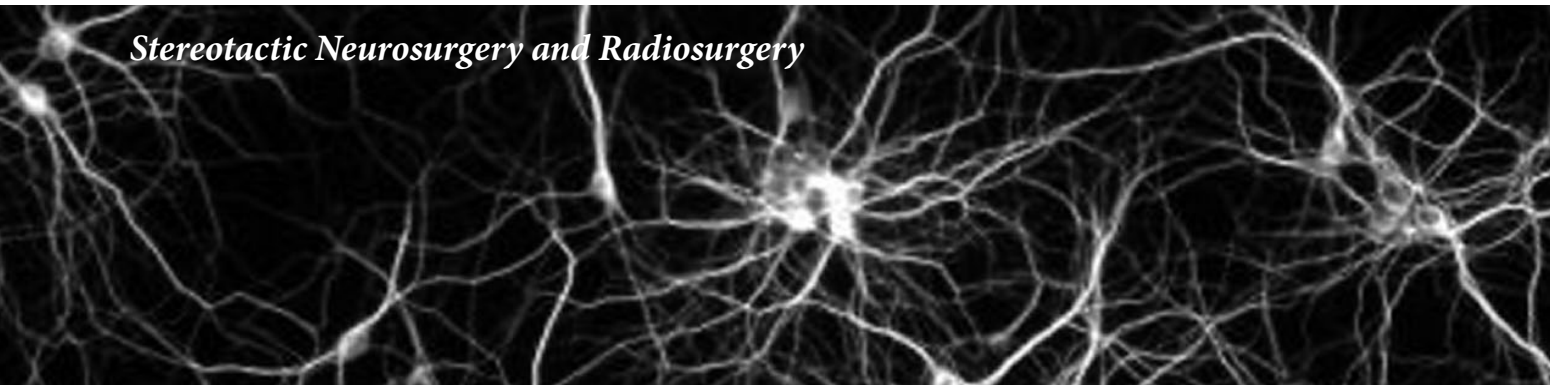
Key words: MRI-negative epilepsy; SEEG-guided; phamacoresistant focal epilepsy.

Aim of the study: MRI-negative focal epilepsy is one of the most challenging cases in surgical epilepsy treatment. Resection neurosurgical treatment procedures of pharmacoresistant epilepsy is widely used today in neurosurgical expert centers. Advances in non-invasive preoperative diagnostic methods have increased the number of patients in whom the epileptogenic zone hypothesis can be defined with high certainty. Despite the above, there is still a significant number of patients in whom it is necessary to use one of the methods of invasive monitoring as a complementary method in determining precise epileptogenic zone and epileptogenic onset zone.

Methods: We report a preliminary results of successfully treated 5 MRI negative patients after SEEG epilepsy evaluation. The epilepsy center in the department of neurology of the University Hospital Center Zagreb, in cooperation with the department of neurosurgery, has been systematically treating patients with epilepsy for 15 years. In the last few years, stereoelectroencephalography (SEEG) is the most commonly used invasive monitoring modality, especially in MRI-negative epilepsies or in cases where the possible epileptogenic zone is near the eloquent cortex. In this study, consecutive surgical patients with focal MRI-negative epilepsy were recruited.

Results: All patients underwent routine preoperative evaluation according to the dedicated protocol of our epilepsy center to determine the treatment strategy. History of epilepsy, seizure frequency, interictal and ictal EEG data, PET data, MRI data, neuropathological findings, and surgical outcomes were evaluated. Four of five treated patients are Engel 1 epilepsy surgical outcome score and one is Engel 2, after resection.

Conclusion: SEEG is a safe and efficient methodology for invasive definition of the epileptogenic zone in the most challenging MRI negative epilepsy patients.



Stereotactic Neurosurgery and Radiosurgery

STAGED GAMMA KNIFE RADIOSURGERY FOR LARGE BRAIN METASTASES

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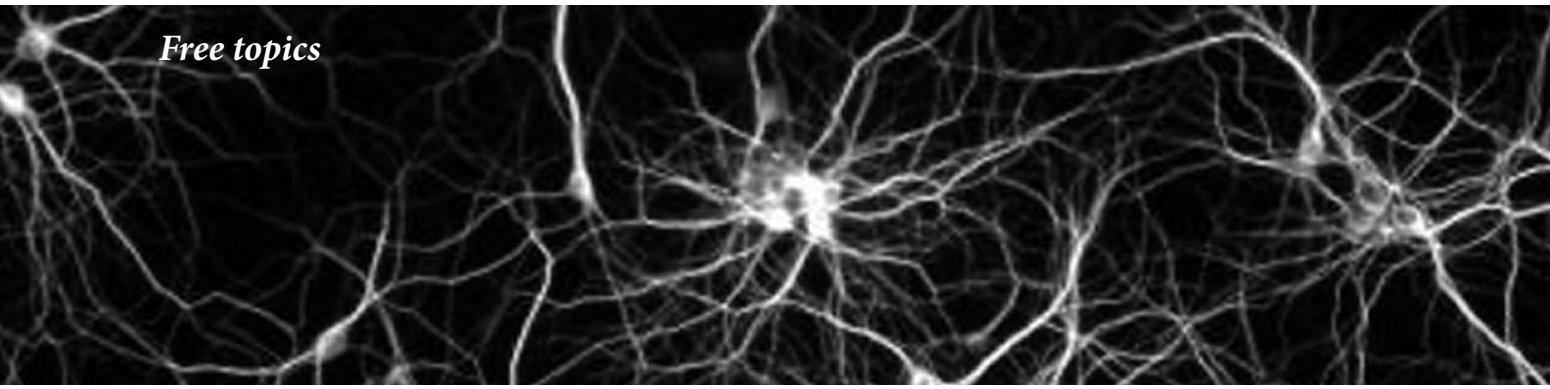
Key words: Gamma Knife; radiosurgery; metastasis; hypofractionation.

Aims: Large brain metastases in patients who are poor surgical candidates pose significant therapeutic challenge for neurosurgeons and radiation oncologists, since treatment options are very limited. For these patients, hypofractionated radiosurgery offers a viable treatment option, achieving good local tumor control while minimizing toxicity and risk of neurological injury. We report our series of patients treated for large brain metastases with Gamma Knife hypofractionated adaptive radiosurgery (HARS).

Methods: During a period of four years we treated 22 patients with 25 large metastasis over 2.5 cm in diameter. 92% of metastases were over 10 cc in volume. Median age of patients was 60 years. A cumulative dose of 30 Gy to tumor margin divided into three fractions of 10 Gy with 14 day intervals was delivered. We investigated tumor volume and perifocal edema change during treatment and follow-up. Primary tumor histology, local and distant failure, and adverse events were recorded.

Results: Median follow-up was 6 months (range, 1-45). Primary histology included lung in 22 (50%), breast in 4 (18%), gynecological in 3 (14%), colorectal in 2 (9%) and melanoma in 1 patient (5%). Tumor volumes showed reduction during treatment and at last follow-up in 88% of patients. Perifocal edema volumes showed three distinct patterns of change after treatment. No severe radiation adverse events were recorded in the follow-up period.

Conclusion: Three stage Gamma Knife HARS for large brain metastases offers an effective means of tumor and edema control, with a good safety profile. It is a viable treatment option for a selected group of patients considered not suitable for surgical resection or single fraction radiosurgery.



Free topics

RE-DO SURGERY IN PERIPHERAL NERVE SURGERY

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Key words: peripheral nerve; surgical complications; revision surgery.

Aim of the study: To present our experience with re-do surgery in peripheral nerve surgery and review the literature.

Methods: Selected illustrative cases are presented and the literature is reviewed on the subject of revision surgery following peripheral nerve surgery.

Results: Re-do surgery in peripheral nerve surgery is rarely needed if performed by an experienced nerve surgeon. Although some cases such as the malignant peripheral nerve sheet tumor (MPNST) recur very often (up to 86.3% of cases), the revision surgery mostly includes cases with persistent pain and/or weakness following improperly performed surgical decompression or postoperative fibrosis. The other conditions requiring a revision may include painful neuroma at the site of primary nerve suture or transection (up to 30% of cases), recurrent intraneural ganglion cyst (up to 15% of cases), benign nerve tumors due to incomplete resection (up to 5.3% cases) or associated with neurofibromatosis (up to 8.3% cases), and re-restoration of motor function due to failure of the previously performed procedure.

Conclusion: In order to achieve satisfying postoperative results, a comprehensive evaluation of the patients is necessary. The physical examination, electrodiagnostic and imaging studies help to locate the nerve lesion and choose the most effective surgical strategy.

Free topics

VR INNOVATION POSSIBILITIES IN CLINICAL PRACTICE (NEUROREHABILITATION, TRAINING OF NEUROSURGERY OPERATIONS) + VR WORKSHOP

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Key words: virtual reality; neurorehabilitation; simulation of neurosurgical operations.

Objective of the study: Creation of exercise and learning modules in VR to supplement neurorehabilitation and neurosurgery

Methods: Creation of exercise rehabilitation modules for selected neurological diseases (Parkinson's disease, CMP and injuries) and simulation of neurosurgical operations. Testing in a multidisciplinary team (neurologist, physiotherapist, speech therapist, neurosurgeon, psychologist, IT specialist).

Results: According to ongoing clinical evaluations within the project, the processed modules prove to be a useful part of complex rehabilitation for the above-mentioned diseases thanks to improved motivation patients and gamification of therapy. Operative simulation can speed up the learning curve as confirmed by foreign studies

Conclusion: Rehabilitation and simulation of operations with the use of VR according to the first results is offered as a supplement to the comprehensive rehabilitation of the mentioned diseases and the training of operatives. The research is supported by national TAČR and Lerco projects.

Free topics

SHUNT OPERATIONS IN TREATMENT OF IDIOPATHIC INTRACRANIAL HYPERTENSION

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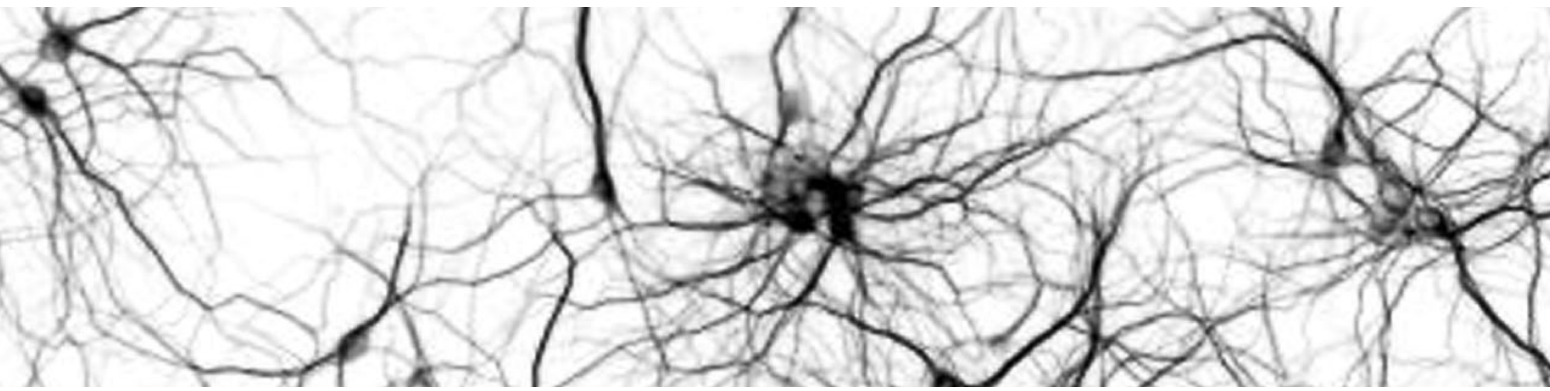
Key words: Idiopathic intracranial hypertension; shunt procedure; lumbar puncture; stereotactic ventricular catheter placement.

Idiopathic intracranial hypertension is a rare nosologic unit that affects primarily obese women of child-bearing age. The pathological hallmark of disease is increased intracranial pressure that does not result from any obvious cause. The exact pathophysiologic mechanism of the process is still unknown. Clinical findings include, among other, headaches, oedema of optic nerves with imminent reduction of vision, which may become irreversible if not treated. The investigation methods include MRI and MR venography of the brain, then fundoscopy and perimetry and last but not least lumbar puncture with measurement of opening pressure. Therapeutic options include medical treatment and surgical or endovascular procedures. Shunting procedures represent effective surgical vision preserving therapy. Presentation summarizes results of our department since year 2006 till present.

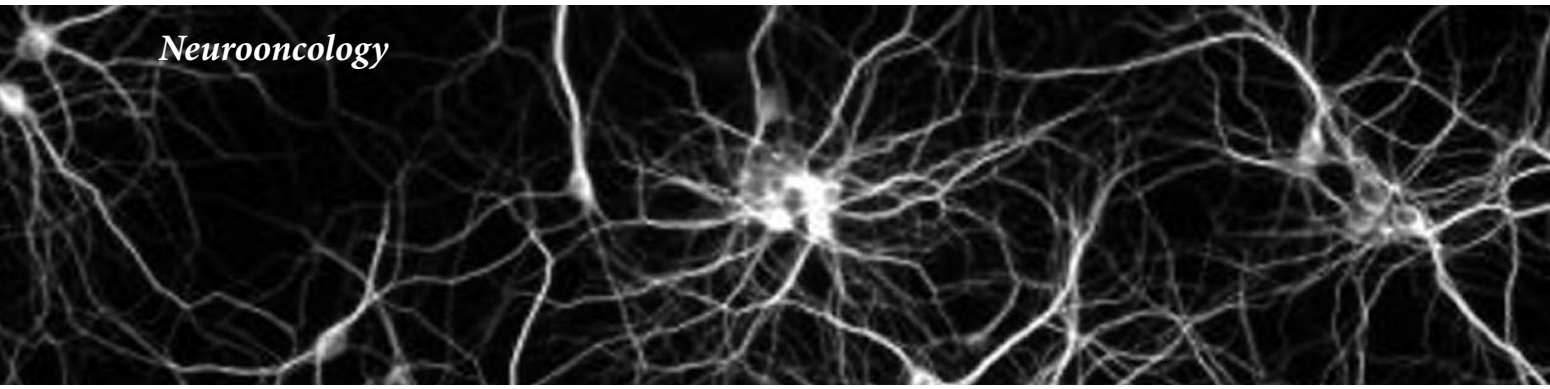


9TH CONGRESS OF THE CROATIAN NEUROSURGICAL SOCIETY

AND JOINT MEETING WITH THE CZECH NEUROSURGICAL SOCIETY

AND COLLABORATIVE MEETING WITH GERMAN SOCIETY OF NEUROSURGERY

ABSTRACTS OF POSTER PRESENATATIONS



Neurooncology

CHATGPT IN GLIOMA ADJUVANT THERAPY DECISION MAKING: READY TO ASSUME THE ROLE OF A DOCTOR IN THE TUMOR BOARD?

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Key words: artificial intelligence; data management; deep learning; information management.

Aim of the study: To evaluate ChatGPT's performance in brain glioma adjuvant therapy decision-making.

Methods: We randomly selected 10 patients with brain gliomas discussed at our institution's central nervous system tumour board (CNS TB). Patients' clinical status, surgical outcome, textual imaging information and immuno-pathology results were provided to ChatGPT V.3.5 and seven CNS tumour experts. The chatbot was asked to give the adjuvant treatment choice, and the regimen while considering the patient's functional status. The experts rated the artificial intelligence-based recommendations from 0 (complete disagreement) to 10 (complete agreement). An intraclass correlation coefficient agreement (ICC) was used to measure the inter-rater agreement.

Results: Eight patients (80%) met the criteria for glioblastoma and two (20%) were low-grade gliomas. The experts rated the quality of ChatGPT

recommendations as poor for diagnosis (median 3, IQR 1-7.8, ICC 0.9, 95% CI 0.7 to 1.0), good for treatment recommendation (7, IQR 6-8, ICC 0.8, 95% CI 0.4 to 0.9), good for therapy regimen (7, IQR 4-8, ICC 0.8, 95% CI 0.5 to 0.9), moderate for functional status consideration (6, IQR 1-7, ICC 0.7, 95% CI 0.3 to 0.9) and moderate for overall agreement with the recommendations (5, IQR 3-7, ICC 0.7, 95% CI 0.3 to 0.9). No differences were observed between the glioblastomas and low-grade glioma ratings.

Conclusion: ChatGPT performed poorly in classifying glioma types but was good for adjuvant treatment recommendations as evaluated by CNS TB experts. Even though ChatGPT lacks the precision to replace expert opinion, it may serve as a promising supplemental tool within a human-in-the-loop approach.

Neurooncology

PRIMARY OSTEOLYTIC SYNOVIAL SARCOMA WITH INVASION OF SUPERIOR SAGITTAL SINUS – CASE REPORT AND LITERATURE REVIEW

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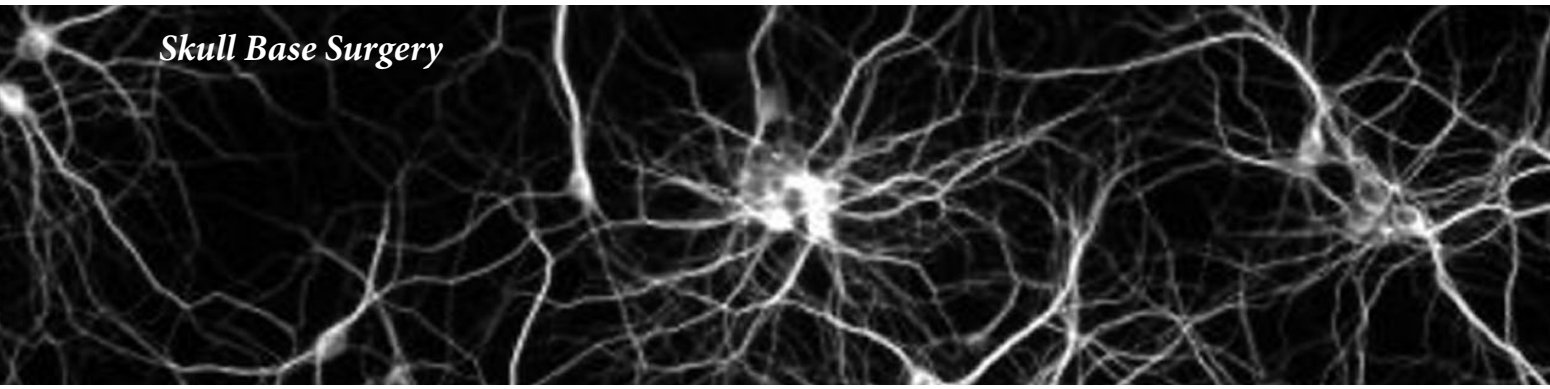
Case report: 69 - year old man was admitted to our hospital complaining of coordination difficulties. Patient had mild left hemiparesis. MRI scan showed neoplasm located in the right parietal region which eroded parietal bone and extendend from subcutaneous tissue to the dural surface with infiltration of superior sagital sinus. Central part of the tumor was necrotic and tumor rim enhanced vividly with gadolinum contrast. Based on radiomorphologic characteristics of the neoplasm and patient's enlarged prostate, metastatic prostate cancer was our primary differential diagnosis. Intracranial part of the neoplasm was reached through parieto – occipital craniotomy. Tumor mass was adherent to the superior sagital sinus near its inflow into sinus confluence. Reconstruction of the sagital sinus in its posterior third was considered too risky so we opted for maximal tumor reduction. Histopathological finding showed highly proliferative tissue composed of polymorphic spindle and epiteloid shaped cells. Proliferative activity based on Ki-67 antibodies was 40%. Tumor cells were TLE1, panCK, CK5/6, EMA, vimentin and WT2 positive. S100, desmin, HMB45 and STAT6 markers were negative. Based on microscopic apperance and immunohistochemical markers synovial sarcoma was diagnosed. Two months after intial surgical treatment patient developed paraparesis. MRI scan showed signs of disease progression. Necrotic tumor mass with inhomogenous ring enhancement and perilesional edema was shown in left parietooccipital region. Additional intraosseous mass within occipital bone was verified. Systemic oncological treatment was indicated.

Discussion: Synovial sarcoma is highly-malignant type of mesenchymal cancer, with incompletely defined cells of origin. Usually, it arises paraarticulary. However, various anatomical locations have been reported as primary site of synovial sarcoma appearance. Primary intracranial synovial sarcoma is extremely rare type of malignancy. To the best of our knowledge this is the first report of primary meningeal based synovial sarcoma which had osteolytic effect on the overlying bone. Our report of dural based synovial sarcoma further supports proposition that multipotent mesenchymal cells are cancer – initiating cells for synovial sarcoma. Additionally, disease progression within only two months of intial treatment clearly shows aggressive nature of dural based sarcomas.



Skull Base Surgery

ANTERIOR CLINOIDECTOMY – VOLUMETRIC ANALYSIS OF RESECTION EXTENT

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Key words: anterior clinoidectomy; meningeom; skull base.

Introduction: The anterior clinoid process (ACP) is the medial part of the small wing of the sphenoid bone. The anatomical location of ACP is important due to its relation to the optic nerve, internal carotid artery and parasellar nerve structures. Anterior clinoidectomy is a microsurgical procedure removing a part or all of the ACP. This is a key microsurgical step in the successful and safe therapy of paraclinoid aneurysms or parasellar tumours that enables exposure and safe mobilisation of the optic nerve and internal carotid artery in the clinoid and ophthalmic segments.

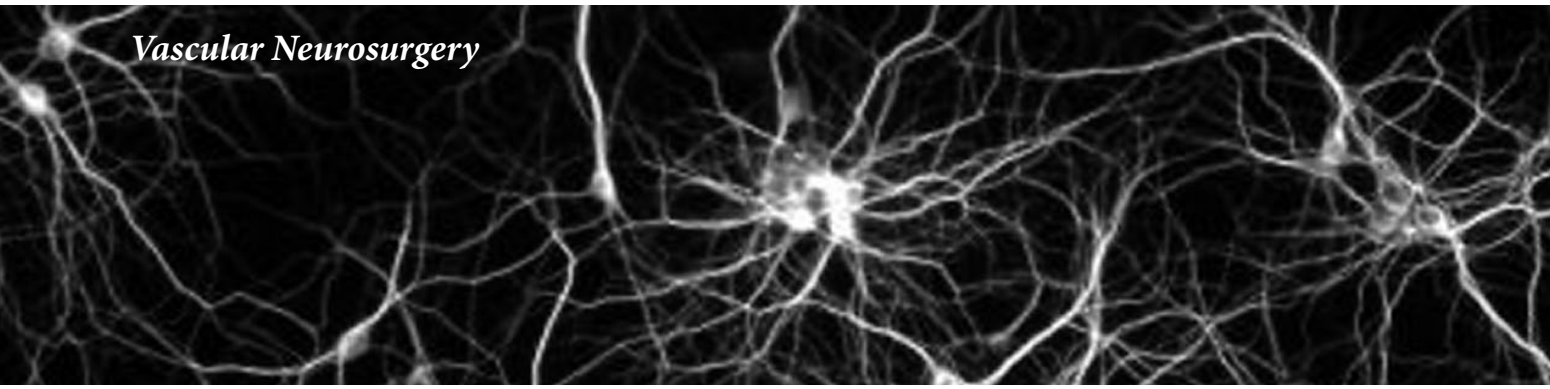
The aim of the study was to perform a volumetric analysis of the extent of anterior clinoidectomy and to correlate the results with the technical approach (extra- or intradural), resection extent (complete or partial), pathology, complication rate and extent of tumour resection.

Methods: The retrospective study included 31 patients, 12 men and 19 women, who underwent anterior clinoidectomy in the 2010-2020 period. All patients underwent preoperative and postoperative CT scan of the skull base. This examination was used for the volumetric analysis. The ratio of APC volume to the volume of postoperative APC residuum obtained by computerised volumetry was utilised as an objective measure of resection extent.

Results: The extent of resection of the clinoid process showed no statistically significant effect on the following postoperative complications: vision deterioration, occurrence of oculoparesis or hemiparesis. The incidence of epilepsy, cerebrospinal fluid leak, vascular injury, vascular occlusion and perioperative mortality after surgery was not recorded. The extent of clinoid process resection had a statistically significant effect on the incidence of exophthalmos after surgery (p=0.011).

Conclusion: Anterior clinoidectomy is a complicated neurosurgical procedure with a potential risk of serious complications. The presented study confirms that the resection extent only affected the incidence of postoperative exophthalmos.

Supported by the Ministry of Health, Czech Republic – conceptual development of research organisation (FNOl, 00098892).



Vascular Neurosurgery

PREDICTORS AND OUTCOME OF HYDROCEPHALUS FOLLOWING ANEURYSMAL SUBARACHNOID HEMORRHAGE

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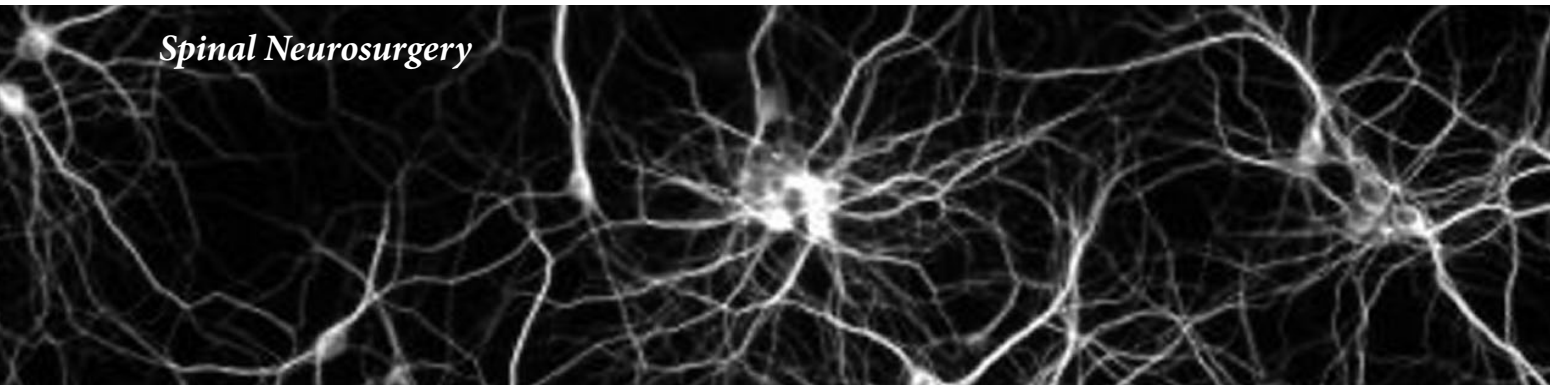
Key words: hydrocephalus; subarachnoid hemorrhage; predictor; outcome.

Aim of the study: Hydrocephalus is frequently encountered complication following aneurysmal subarachnoid hemorrhage (aSAH). Three stages of hyprocephalus have been recognized: acute (48-72h after the hemorrhage), subacute (3-14 days) and chronic (more than 14 days). The aim of our study was to identify predictors and outcome of patients presenting with hydrocephalus after aSAH.

Methods: Hospital - based retrospective study was conducted among patients, who presented with aSAH during 2017 - 2022. The following data were statistically analyzed - age, sex, location of the ruptured aneurysm, Hunt - Hess and Fisher scale, procedure (coiling or clipping), in-hospital medical complications, symptomatic vasospasm occurrence, ventricular and/or lumbar drainage, VP shunt implantation, time to shunt, CSF parameters (protein, erythrocyte count) and CRP before shunt implantation, complications after shunt implantation, premorbid mRS, hospital discharge mRS, mRS after 6 months.

Results: Overall 128 patients were included in our study (43 male), with mean age of 57 years. We did not find correlation between age, location of the aneurysm and the need for drainage. 47% men needed drainage, 21% developed shunt dependeng hydrocephalus (SHDC). Whereas 37% women required drainage and 13% presented with SHDC. 49% patients required drainage after coiling, compared to 37% after clipping, but there was no difference in SHDC occurrence (16% for both methods). We proved correlation between both Hunt-Hess and Fisher grade and the need for drainage as well as SDHC, also there were more complications correlating with higher Fisher grade. Patients with symptomatic vasospasm were more likely to obtain drainage and VP shunt, than patients without vasospasm. There was no correlation between CFS parameters, CRP, time to shunt and complications or worse outcome. There was only one complication after VP shunt implantation. Patients after VP shunt improved in mRS after 6 moths by at least 1 point.

Conclusion: We have been able to identify several predictors of both acute and chronic hydrocephalus following aSAH, complications following VP shunt implantation and outcome of these patients.



Spinal Neurosurgery

COMBINED ENDOVASCULAR REPAIR OF AORTA AND REMOVAL OF PENETRATING PEDICLE SCREW AFTER POSTERIOR INSTRUMENTATION – CASE REPORT AND LITERATURE REVIEW

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Key words: pedical screw; endovascular repair; aortic injury.

Stabilization of spine using transpedicular screws is most commonly used instrumentaion technique among spinal surgeons. „Free hand“ technique is considered relativly safe and can be performed under X-ray control. Vascular injuries with misplaced screws are rare but potentially fatal complication. Injury of thoracoabdominal aorta by malpositioned screw demand multidisciplinary approach. Injury of vessel wall might demand screw removal and vessel wall repair. Here we present a case of 72-year old female patient who underwent long segment fixation of thoracolumbar spine. During follow up, CT scan and afterwards aortography showed lesion of posterior aortic wall by malpositioned screw without signs of bleeding. After meticulous preparation combined endovascular repair with stent-graft and removal of penetrating screw were performed. Endovascular treatment was performed simoultaneously with screw removal. During screw removal patient was in lateral decubital position. Patient was dismissed on 8. postoperative day. Control CT aortography 6 months after showed no leak or other changes in aorta. We found combined endovascular vessel repair with simultaneous screw removal safe and sufficient for this kind of aortic injury. Althought lateral decubital postion bears limitations, gives enough space for operator. Performing intraoperative aortography provides good insight in stent position and eventual bleeding after screw removal.

Spinal Neurosurgery

ERAS PROTOCOL IN SPINAL SURGERY, EVALUATION AFTER 1 YEAR

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Key words: spinal surgery; ERAS protocol; complications.

Introduction: Surgical procedure = stress response (catabolism, immunosuppression, free radical production and hypercoagulable states), increased complication rates, prolonged recovery and increased postoperative morbidity. ERAS (Enhanced Recovery After Surgery) clinical protocols reduce the stress response associated with surgery and thus reduce postoperative complication rates. Spinal surgery - an invasive intervention requiring specific postoperative rehabilitation and complicated pain management using opioids - the essential benefits of ERAS protocols represent a natural evolution of this surgical field.

Objectives: At the suggestion of clinicians and in concert with hospital leadership, a comprehensive clinical protocol was implemented with the goal of standardizing care, reducing complications, decreasing length of hospital stay, and reducing costs. Last but not least, the creation of a proprietary database - statistical processing. Preparation creation of an ERAS protocol for other neurosurgical patients.

Methods: In the first preparatory phase, an analysis of cases (90 hospitalised cases during the period January-March 2021. Then, based on the data, the design and preparation of the implementation of the clinical protocol during 2021. In the second phase, the actual implementation during 2022 and the evaluation of the project and measurement of changes in 2023.

Results: Between February 1 and December 31, 2022, a total of 207 patients were included in the clinical protocol. 08-I03 - Spine surgery with instrumentation 32.5%, 08-I04 - Spine surgery without instrumentation 67.5%. Evaluation of the implementation of the clinical protocol - cases in the analysis, the evaluation period was 02-12/2022, total 203 patients. Comparison group 01-12/2019, total 385 patients. Reduction in mean postoperative length of hospital stay by 1.4 days (3.7 vs. 5.1 days). After implementation of the clinical protocol, 78% of patients were discharged between postoperative days 1 and 4, compared to 60% in 2019. The majority of patients with no ICU stay or 1 day (68% vs. 60%). Cost reduction by half (50.3%) for laboratory tests (650 vs. 1309 CZK). Cost reduction by 41.3% for antibiotics (305 vs. 179 CZK). Minimal reduction in blood loss (635 ml vs. 662 ml), but 63.1% reduction in the administration of blood derivatives.

Conclusion: After the implementation of the protocol, the care of patients after spinal surheries was standardized, the length of hospitalization was reduced, the use of hemostatic agents was standardized. The implementation of measures to reduce the frequency of SSIs cannot yet be evaluated.

Spinal Neurosurgery

INTRADURAL SACRAL MENINGIOMA - A RARE CASE OF BENIGN SPINAL NEOPLASM

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Key words: intradural tumors; benign meningiomas; sacrum.

Spinal menigiomas are tumors originating from arachnoid cap cells, located in the dural root sleeve and are most commonly situated in the intradural extramedullary compartment, respecting the pial layer of the spinal cord.

Spinal meningiomas are rare and account for about 1.2% of all meningiomas, and 25% of all spinal cord tumors.

The majority od the spinal meningiomas are located in the thoracic spine, however meningiomas involving the sacral region are exceptionally rare.

In this paper we present a rare case of primary benign meningioma which is restricted to the sacral region, with no sign of recurrence after a long follow-up period.

A 60 years old man initially presented with a one year history of left-sided shiatica and occasional disturbances in urination and defecation.

Conservative management with analgesics and physiotherapy did not lead to significant improvement.

CT scans and MR imaging reveald an intradural, partially calcified tumor within the levels of S1 and S2 segments.

Total surgical resection of the tumor with repair of the dura was performed.

In the postoperative period the disturbance of the spinchter control still persist, therefore the patient was provided with a permanent urinary catheter.

Three months after the operation the patient suffered of an ishaemic stroke with consequent left-sided hemiparesis, and a year and a half after the operation a colonostomy was performed.

Three years after the operation patient can control the urinary spinchter, and he is now without urinary catheter.

In a 6 years follow-up there was no sign of recurrence.

Spinal Neurosurgery

SCHWANNOMA OF MIDDLE CERVICAL SPINE - A CASE REPORT

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Key words: cervical spine; schwannoma; surgical treatment; micro-neurosurgery.

Schwannomas, also known as neurilemmomas, are benign peripheral nerve sheath tumors.

They originate from any nerve covered with Schwann cell sheath.

Schwannomas constitute 25-45% of tumors of the head and neck. They are benign tumors that are usually asymptomatic.

Treatment of choice for this tumor is aggressive and toral resection. Recurrence of this tumors are rare.

Preoperative diagnosis is difficult and relying on clinical suspicion and confirmed by surgical pathology.

A 62 years old woman was admitted to the hospital with a clinical picture of neck pain on the left side, difficulty turning the neck to the left, and discrete weakness of the left hand (4/5).

The patient first noticed her symptoms 9 months ago and has been worsening slowly.

MRI of cervical spine showed an extradural mass on segment C4-C5, dimensions 20x14 mm, extending in neural foramina with compression od the spinal cord to the right.

The standard middle posterior approach was performed with laminectomy of C4 and C5. In micro-neurosurgical technique capsule od the tumor were opened and tumor removed completely. Dural incision were made to explore intradural compartment - no intradural tumor was found.

Histopathological examination reveald typical features of Schwannoma.

Postoperatively the patient had a very good recovery and no motor deficit.

A control MRI was performed 1,3 and 5 years after the operation, without evident recurrence of the tumor.

Trauma Neurosurgery and Critical Care

SURGICAL TREATMENT OF INTRADISCAL FRACTURE C2-C3 AND C3-C4 INTERVERTEBRAL SPACE WITH SPINAL MEDULLA CONTUSION IN A 36-YEAR-OLD MAN

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Key words: trauma; spinal cord commpression; ACDF; laminectomy.

We present the case of a 36-year-old young man who fell from a height of 4 meters while performing agrarian tree-trimming work and suffered blunt trauma to the head and neck. The mechanism of the trauma is hyperextension, during which a fracture of the disc tissue and a contusion of the medulla occur. After the initial neuroradiological treatment (CT according to the polytrauma protocol) and additional neurowork. treatment (MR C spine) with preoperative preparation in the Intensive Care Unit, ACDF C2/3 and C3/4 and decompressive laminectomy C3 and C4 were performed.

Postoperatively, the patient was monitored in the ICU and post-ICU with physical rehabilitation with a good response to medulla decompression in terms of improving limb mobility. After the completion of the neurosurgical treatment, the patient was referred for inpatient balneotherapy treatment.

Trauma Neurosurgery and Critical Care

MORTALITY IN PROFESSIONAL AND AMATEUR BOXING - A CALL TO ACTION IS DEMANDED TO UNDERSTAND AND PREVENT THIS PHENOMENON

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Key words: boxing; traumatic brain injury; cerebral hemorrhage; acute subdural hematoma; dementia pugilistica; mortality.

Despite many rules have been put in place to avoid catastrophic consequences, boxing-related injuries and sudden death are still occurring. However, the numbers available in the literature regarding mortality and long-term consequences represent only the tip of the iceberg. In fact, the real extent of this phenomenon, the pathophysiology, as well as how to prevent the chronic consequences of repeated TBI remain poorly understood. Combat sport-related TBI are divided into acute and chronic forms. Acute ones occur in a single fight and can even be the consequence of a single blow. These include concussions, mild (GCS 15-13), moderate (GCS 12-9), and severe TBIs (GCS<9). In boxing, acute subdural hematomas are the most common form of intracranial hemorrhage, as well as the most common life-threatening injury. Clinical consequences can be abrupt with loss of consciousness, focal neurological deficits, or even death on the ring or soon after. Chronic injuries are typically caused by repeated TBI over a longer period. They can manifest clinically as post-concussion syndrome, second impact syndrome, and chronic traumatic encephalopathy. According to analyses on the Velazquez fatalities collection, the largest existing database on boxing-related fatalities, since 1880 the death rate is approximately 10 athletes per year. However, a considerable number of fatalities go undetected in non-official bouts and long-term sequelae are barely trackable. A concerted effort to raise awareness and shed light on combat sport related neuro-trauma is clearly required and as neurosurgeons, it is our role to take on this challenge. A call to action to address this knowledge gap, decrease and prevent this phenomenon is advocated.

Trauma Neurosurgery and Critical Care

SEVERE TRAUMATIC BRAIN INJURY (STBI) - NEUROREHABILITATION IN THE INTENSIVE CARE

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Key words: sTBI; early neurorehabilitation; outcome.

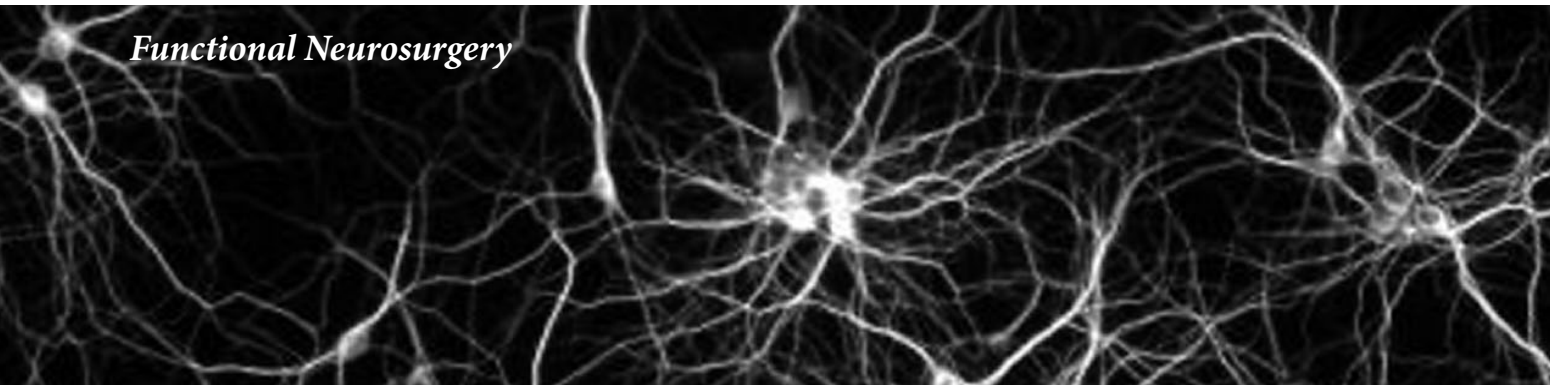
Aim of the study: The number of patients surviving sTBI is increasing. Based on the progress in urgent intensive care, patients with severe, previously fatal brain damage survive, but often with serious functional deficits. Early neurorehabilitation is one of the most important factors for the restitution of impaired brain function. Integration of rehabilitation in the intensive care makes it possible to start therapy directly, without any interruption.

The aim of the prospective study was to show the implementation of early rehabilitation program for patients after sTBI in intensive care and to evaluate the outcome after 12 and 24 months.

Methods: 51 survivors (age 33. 8, range 16-64 years, m: f = 4:1) of severe brain injury (GCS </= eight for at least 24 hours) underwent an interdisciplinary early rehabilitation program. Duration of rehabilitation program was at mean 18,4 (4-78) days adapted to the individual capability for 3-4 hours/ day. The follow-up examination took place 12 and 24 months after the sTBI.

Results: Data revealed a high level of independence in activities of daily living (mean Barthel Index after one year 92.7 points, after two years 93.7 points). After one and two years, 74.5% and 80.4% of the patients were completely independent of need for care. Nevertheless, more than half of the patients had sensorimotor, behavioural, speech, visual and/ or auditory disturbances. Return to work rates improved between one and two years after trauma, as evidenced by the rate of patients being back to full time work at one year (n= 14, 28%) and two years (n=20, 40%) post-sTBI; although, none of these changes reached statistical significance.

Conclusion: In summary, the successful implementation of early rehabilitation programs for patients after traumatic brain injury in acute care is possible. Focussed on outcome, the data revealed a high level of independence in activities of daily living. Return to work rates were not satisfying, but improving between one and two years after trauma.



Functional Neurosurgery

SURGICAL TREATMENT OVERVIEW IN DYSTONIA AND CURRENT FINDINGS IN NEUROPHYSIOLOGIC RESEARCH IN FOCAL LARYNGEAL DYSTONIA

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Key words: Deep Brain Stimulation; DBS; larygeal dystonia; Dystonia; Cortical Silent Period.

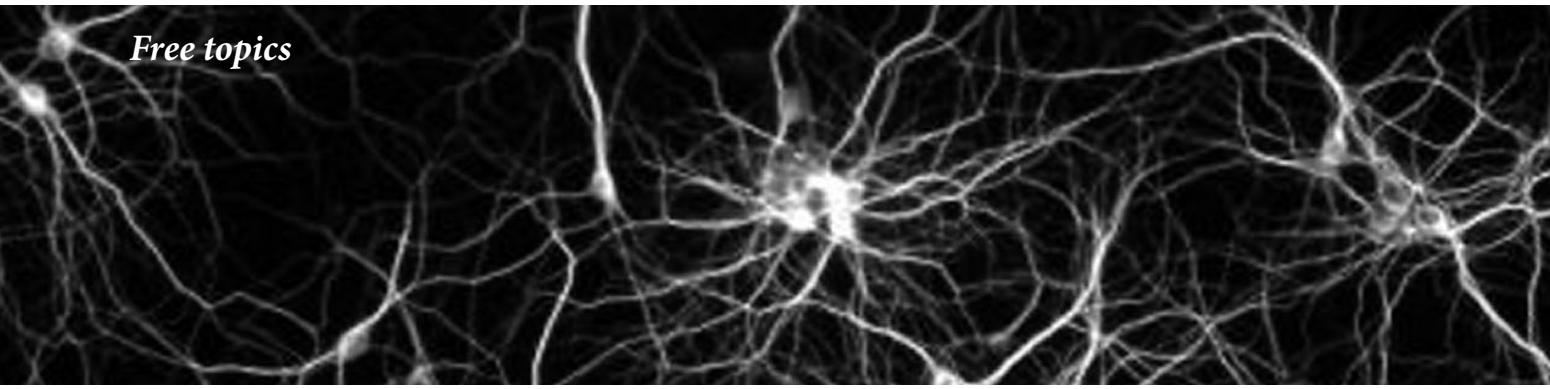
Aim of the study: This overview explores surgical interventions for dystonia treatment and presents current neurophysiological findings regarding focal laryngeal dystonia (LD).

Methods: A comprehensive overview of PubMed and the Web of Science was conducted, focusing on neurosurgical Deep Brain Stimulation (DBS) for generalized, segmental, and focal dystonia, as well as otolaryngologic (ENT) treatments for LD. Neurophysiological findings, particularly the cortical silent period (cSP), were discussed as indicative of intracortical inhibitory processes mediated by GABA B receptors.

Results: The overview emphasizes DBS, for dystonia treatment and reports recent developments in DBS and ENT procedures for LD. We identified 22 systematic reports from the past five years, demonstrating that targeting the globus pallidus internus (GPi) or subthalamic nucleus (STN) enhances motor function and reduces disability in generalized or segmental dystonia patients. Notably, patients' quality of life improves at one year and is sustained at three years post-treatment. Additionally, LD-related five case reports involving 12 patients showed significant improvements in cepstral peak prominence (dB), a measure of acoustic analysis quantifying voice fundamentals and harmonics. DBS applied to the Ventrointermedial nuclei (Vim) resulted in a significant reduction in tremor rate (Hz) in voice-related muscles for LD patients. Unilateral and bilateral stimulation of Vim or GPi led to improvements in LD rehabilitation parameters, including the Unified Spasmodic Dysphonia Rating

Scale (USDRS) and Voice-Related Quality of Life (VRQOL). Novel ENT procedures, such as Endoscopic laser thyroarytenoid myoneurectomy or type II thyroplasty, improved voice parameters, subsequently enhancing USDRS and VRQOL scores. Current findings indicated shorter cSP in laryngeal muscles in adductor focal LD compared to control groups (p<0.001) and shorter cSP in cervical muscles of segmental cervical dystonia (p<0.001), with diverse cSP changes in generalized dystonia depending on the type.

Conclusion: The overview concludes that DBS of GPi or STN enhances motor function in generalized and segmental dystonia, improving dysphonia symptoms in selected LD DBS cases. Emerging therapies like type II thyroplasty and endoscopic laser thyroarytenoid myoneurectomy show promise in LD treatment. Additionally, cSP measurements may serve as a valuable neurophysiological marker for understanding and assessing LD diagnostically and therapeutically.



Free topics

EPIDURAL ANALGESIA AFTER SPINAL FUSION SURGERY OUR EXPERIENCE

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Key words: epidural analgesia; spinal fusion surgery; pain.

We present three cases of continuous epidural analgesia after major spine surgery. Our aim is to show the safety and effectiveness of continuous epidural analgesia and rationalize use of multimodal intravenous analgesics. All three cases discuss patients undergoing posterior spinal fusion surgery with decompression of upper lumbar spine. Due to length and anticipated pain intensity a joint anesthetic and surgical decision was to use continuous epidural analgesia postoperatively. Epidural catheter was placed intraoperatively under direct vision and the bolus of lidocaine 2% as a test dose applied after patient regain full consciousness to test the position of the catheter. In patients with no neurological deficit infusion of diluted local anesthetic (bupivacaine 0.2%) with opioid was continued for 48 hours postoperatively. During that period the intravenous analgesic requirement was recorded.

In conclusion patients undergoing spinal fusion surgery may experience severe postoperative pain therefore efficient and safe analgesia is mandatory. The goal is to improve pain control in patients undergoing major spine surgery.

Free topics

CSF TRIPLET TESTING IN PATIENTS WITH IDIOPATHIC NORMAL PRESSURE HYDROCEPHALUS

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Key words: idiopathic normal pressure hydrocephalus; Alzheimer's disease; CSF triple test.

Aim of the study: Dementias are one of the most frequently considered diseases within the differential diagnosis of idiopathic normal pressure hydrocephalus (iNPH). The most frequently occurring Alzheimer's dementia (AD) is then the first dementia considered in the differential diagnosis.

Aim of the study was to compare the differences in test values in patients with iNPH and AD.

Methods: CSF samples were obtained from patients, in which supplementary tests were performed (lumbar infusion test and external lumbar drainage) for iNPH and/or underwent short surgery. Determination of β-amyloid 1-42, of both total and phosphorylated tau protein was performed on the company's device Roche Cobas® 8000 with e 801 module, which uses electrochemiluminescence non-competitive determination using reagents.

Results: A total of 41 CSF samples were taken from 30 patients with iNPH. The average age of the patients was 68.9 years, median 71.5 years. The youngest patient was 51.0 years old and the oldest 78.6 years old. Eleven patients underwent testing only and shunt surgery was not indicated for them. In 19 patients, shunt surgery was indicated, Overall, in the group of these patients β-amyloid was decreased and tTau levels and pTau proteins were decreased too. Statistically significant differences between individual subgroups were not demonstrated.

Conclusion: Using the CSF triplet testing is helpful in the differential diagnosis of iNPH and AD or to determine the coincidence of these two diseases. Biomarker monitoring can evaluate over time the effect of surgery on a biochemical level, better understand these processes and also confirm possible development of AD over time.

Free topics

SURGICAL TREATMENT OF CSF-VENOUS FISTULA IN SPOTANEOUS INTRACRANIAL HYPOTENSION – 2 CASES

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Key words: spontaneous intracranial hypotension; csf-venous fistula; surgery.

Introduction: Spontaneous intracranial hypotension (SIH) is a condition that results from leakage of cerebrospinal fluid (CSF) into the extradural space. It results from dural tears, a meningeal diverticulum, or CSF-venous fistulas. The most common and typical symptom of SIH is orthostatic headache that is worse in the upright position.

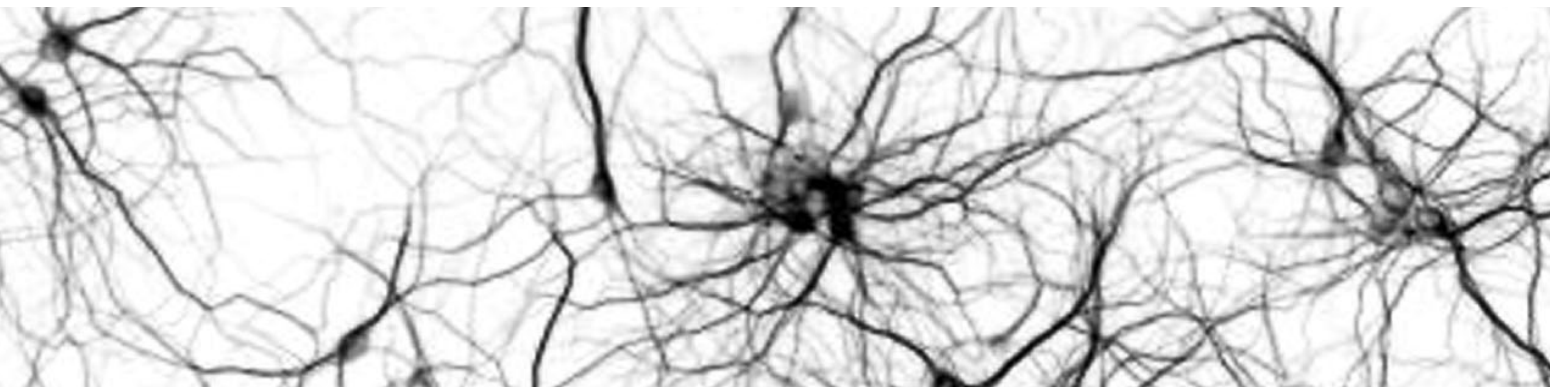
The estimated incidence of SIH is 5 per 100,000, although this is likely to be an underestimation due to its varied clinical presentationand investigative methodology. SIH is more prevalent in women with a female to male ratio 2:1. Mean age at presentation is between 40-50 years of age.

We present two cases of patients with SIH resulting from CSF-venous fistulas.

Cases: The first patient was 61-year-old woman and the second one 62-year-old woman. They suffered from orthostatic headaches that were worse in the upright position. Over time, the headaches worsened and the intervals of possible verticalization became shorter. Neurological examination was normal. The patients underwent MR of the brain with the finding of bilateral hygromas and enhancing of meningeal sheaths, confirming the suspicion of SIH. MRI of the spine was without any pathological findings in both women.

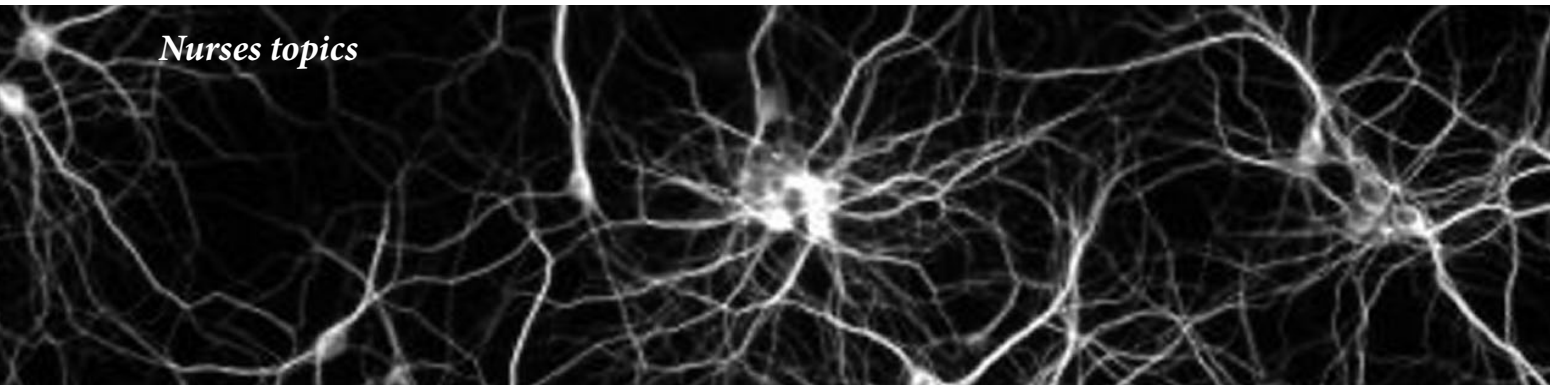
The patients were admitted for a CT spectral myelography, which diagnosed a CSF-venous fistula in the area of the T8 root on the right in the first patient and the area of the L2 root on the left side in the second patients. CSF-venous fistula were coagulated and dissected. The patients reported improving of their status immediately after the operation.

Conclusion: These case reports show that surgical treatment can be beneficial in the treatment of patients with SIH. An important and necessary condition is to detect CSF-venous fistula using special imaging methods and also to think about this alternative in patients with SIH without epidural fluid collection.



SATELITTE SYMPOSIUM FOR NEUROSURGICAL NURSES

ABSTRACTS OF ORAL PRESENATATIONS



Nurses topics

AWAKE CRANIOTOMY

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Key words: operation; brain; awake, craniotomy; monitoring; multidisciplinary team; cooperation.

AWAKE is a type of surgery performed on the brain. Part of this neurosurgery intervention is provided while the patient is fully conscious and alert. By using direct cortical stimulation, and with a specific form of intraoperative monitoring, it is possible to do resectioning of pathological lesions while not affecting physiological tissue. This process allows for the monitoring of the patient's speech, verbal and non-verbal semantics, and emotional and executive functions during the procedure. The presentation deals with the indications, complications, practical realizations and nursing care before and after the operation, including the education of patients. The main focus is on the multidisciplinary team and our cooperation.

Nurses topics

COMPREHENSIVE CARE FOR A PATIENT WITH SPONTANEOUS AND POST-TRAUMATIC CEREBROSPINAL FLUID

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Key words: liquorrhoea; diagnostics; treatment; complication.

Leakage of cerebrospinal fluid, CSF, is a potentially life-threatening condition. Traumatic liquorrhoea, as a complication of head injuries, can occur in a small percentage of sufferers, in whom it manifests itself immediately, or it can manifest itself with a longer interval within weeks, months or years. Non-traumatic spontaneous cerebrospinal fluid then occurs with increased pressure of cerebrospinal fluid in brain tumors in the area of the base of the skull, or as a result of congenital anomalies and osteomyelitis.

As part of the diagnosis of cerebrospinal fluid, a laboratory method of examining secretions for the presence of beta-trace protein, or isotopic cisternography, is used. From the imaging methods when detecting a fistula, CT and MR of the brain, or their combination. An examination by an otorhinolaryngologist using an endoscope can be an unforgettable part.

Depending on the cause of the cerebrospinal fluid, we choose either conservative therapy or an operative solution. Both for patients treated conservatively and for patients after surgery, hospitalized at the Neurosurgery Clinic of the University Hospital in Ostrava, we provide specific diagnostics, treatment and nursing care, based on an effort to recover as quickly as possible and minimize complications, which include, for example: pneumocephalus, cerebrospinal fluid hypotension or meningitis. These complications can directly threaten the patient's life.

Nurses topics

BRAIN DEATH

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Key words: brain; death; transplantation; ethics.

In modern times, the problem of how to define the death of a person has arisen. Death is a phenomenon that occurs since ancient times, it is a part of the apartment in this world. Despite the fact that death is a part of life and is a natural process, not everyone perceives it that way. The difference in the perception of dying and death can be found in different religions and ways of life. Brain death, also commonly referred to as death by neurological criteria, was after death and beyond the legal definition of death. Its determination involves many considerations and details. The presentation deals with the description of philosophy and its clinical determination and special considerations from the point of view of medical ethics.

Nurses topics

THE USE OF HBOT IN NEUROSURGICAL PATIENTS WITH BRAIN DAMAGE

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Key words: HBOT; neurosurgery; oxygen.

HBOT is method of treatment where hemoglobin is fully saturated with oxygen and, subsequently, oxygen is physically dissolved in the blood plasma. However, HBOT does not simply mean the administration of a greater amount of oxygen compared to administration at normal atmospheric pressure, as is often misunderstood. HBOT has many unique effects that cannot be replaced by any other method,

including a signaling effect on DNA (transcription) with an influence on many cellular processes (hormones, enzymes, receptor regulation)

Hyperbaric oxygen can reach the so-called sleeping cells in the brain and nervous tissue and gradually wake up their metabolism. The effect of this therapy is that it stimulates cells, promotes new tissue growth, expels harmful oxygen radicals, reduces inflammation, stimulates latent neurons, and improves blood flow in the brain and muscles and glucose metabolism. It also helps to speed up the flushing of lactate and toxins from the tissues.

In this review, we will show and discuss our modest experience with this treatment method, which was use at our clinic in neurosurgery (paients with brain damage).

Nurses topics

NEUROSURGICAL TEHNOLOGICAL DEVELOPMENTS IN SKB MOSTAR

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Key words: neurosurgery; technology; developmen;, Kinevo; microscope; loop x; neuromonitoring.

In the last couple of years, as technology develops in all fields, we also note progress in medicine. The development of technology in medicine greatly helps the medical staff to do their work for patients as precisely, easily and efficiently as possible. At SKB Mostar, we have the pleasure of working with modern technology, of which I would like to single out:

- Kinevo 900 microscope
- Brainlab Curve navigation
- Ultrasound bk5000
- Neuromonitoring

1. On the microscope, we have the option of audio and video recordings. In addition, we have the functions of recording angiography in brain blood vessel operations, and blue and yellow light, which in combination with contrast provides coloring of tumor formation in the brain.
2. Navigation is a combination of physics, mathematics and computer science. Using navigation, we determine the exact localization of the tumor formation. In addition to localization, it gives us information about how much tumor mass we have removed, and helps us not to damage some centers during the operation. I would single out adaptive hybrid surgery as one of the special possibilities of navigation.
3. Ultrasound bk 5000 has 3 neurosurgical probes that show us the actual (current) condition of the operative field. With the help of ultrasound, we can do a biopsy of the process on the brain, which enables a faster intervention and faster recovery.
4. Neuromonitoring serves us to monitor the evoked potentials, with which we monitor the motor and sensory during the operation.
5. Brainlab loop X is an intraoperative CT device that enables 2D and 3D image display. We use it in spine surgery.

This technology enabled us to perform complex procedures, as well as faster and more precise procedures. The future brings us new challenges, but with development and good education, we will try to overcome them successfully.

Nurses topics

SUMMARY CARE OF PATIENTS WITH TRACHEOTOMY

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Introduction and research objectives: Tracheotomy is surgical procedure used to make an opening tracheostoma on the anterior wall of the trachea. According to the technique of performance, we distinguish classical tracheotomy, conicotomy and percutaneous dilatation tracheotomy.

Discussion: The choice of the tracheotomy technique depends on the indication and the patient's condition. Tracheostoma may be temporary or permanent. Temporary tracheostoma is closed spontaneously after the termination of its indication, while it is permanently done in patients with total laryngectomy. Tracheotomy is a very safe operation nowadays, but there are many post-operative complications that can occur in tracheotomised patients. Complications are divided into early post-operative and late post-operative depending on the time they occur. The role of the nurse/technician in the post-operative period is to provide proper care for tracheotomised patients, monitor vital functions and observe the appearance and condition of the patient. The nurse/medical technician carries out tracheostasis curing and wrapping, aspires the airway, regularly cleaning and changing the internal cannula cartridge, wetting the airway, caring the oral cavity and feeding the patient. Monitoring vital parameters and looking at the patient's appearance, nurses/technicians recognise early symptoms of post-operative complications. With these procedures, the nurse/technician prevents complications, early recognizes the occurrence of complications and provides optimal conditions for the patient's recovery.

Conclusion: In addition to postoperative care, the nurse/medical technician participates in the education of the patient about selfsufficiency, as a member of a multidisciplinary team participates in education on the use of speech aids, such as voice canals, voice apparatus and voice prosthesis. Keywords: tracheostomy care, tracheotomy, complications, cannulas

Nurses topics

CERVICAL SPINE INJURIES IN THE GENERAL HOSPITAL ZADAR FROM 2019 TO 2021

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Key words: risk factors; injury mechanism; cervical spine injury; frequency.

Introduction and research objectives: Spinal cord injury is a serious challenge that requires prevention and education to reduce its consequences. This study analyzed factors that influence the incidence of these injuries and compared differences between participant groups. It also examined the prevalence of conservative and surgical approaches to spinal cord injury.

Materials and methods: The study included patients with cervical spine injuries admitted to Zadar General Hospital between 2019 and 2021. Data were

collected from the patients' medical records and statistical analysis was performed. Ethical aspects of the research regarding confidentiality and protection of patient data were observed.

Results: Patient characteristics were analyzed in the study of cervical spine injuries. Men were more likely to be injured in the 60-79 age group. Falls from height, falls on the ground, and traffic accidents were the most common mechanisms of injury. The majority of patients were treated conservatively. There is no difference in the frequency of injuries according to mechanism and age, but there is a correlation between gender and age of patients.

Conclusion: The frequency of cervical spine injuries does not differ between traffic accidents and falls from height. Men have a higher frequency of injury than women. There is no difference in the frequency of injuries according to age. The majority of patients were treated conservatively. There is a correlation between gender and age of patients in relation to cervical spine injuries.

Nurses topics

NEUROSURGICAL TREATMENT OF EPILEPSY

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About 1% of the world's population (about 65 million people) suffers from epilepsy. That is why it is considered the most common neurological disease. Today, it is accepted that epilepsy is referred to in the plural, due to the variety of seizures at different ages, in the prognosis and the different impact of the disease on the patient's life. A minimum of 2 seizures is required for diagnosis. During an attack, muscle spasms, sensory disturbances, disturbances of smell, vision or hearing may occur. The diagnosis is made on the basis of a physical examination, examination by a neurologist, EEG and blood tests. The symptoms depend on the type of seizure the patient has, so we distinguish: Petit Mal seizures, Grand Mal seizures, single focal and generalized seizures. Epilepsy treatment is most often medical, which includes anticonvulsant therapy. There are also epilepsies in which drug therapy is not sufficient and a different method of treatment must be included, which is the surgical treatment of epilepsy. In the Clinical Hospital Dubrava, several operations are performed in the neurosurgery operating room, namely: amygdalohippocampectomy, vagus nerve stimulation, SEEG and deep brain stimulation as treatment options for epilepsies in which drug therapy does not give the expected result. The role of operating nurses/technicians is multiple and complex because they are part of a multidisciplinary team that is necessary for successful surgical treatment of patients. Table, preparation of necessary instruments and devices, instrumentation and safe transport. The Department of Neurosurgery of the Clinical Hospital Dubrava is a reference center for stereotaxic and functional neurosurgery, and is there for committed to providing surgical care for people suffering from epilepsy. With this goal, new operative techniques are being developed using the RONNA robot, which is unique in this part of Europe due to the need for greater accuracy in stimulating certain core in the brain, hence better results for epilepsy patients. Technological progress is no longer a distant future but our present, and the challenges of getting to know technologies motivate operating nurses/technicians to keep up with new knowledge and approaches in operating processes within brain structures. RONNA is a unique example of the cooperation of technological progress for the benefit of the patient. Operating nurses/technicians of the neurosurgery room of the Dubrava Clinical Hospital are witnesses and participants of advanced operating techniques performed by robotically navigated systems.

Nurses topics

MINIMALLY INVASIVE SPINAL FUSION

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Vertebral column also called spine or backbone is our body 's central support structure. It keeps us upright ,connects different parts of our body and allows movements in different directions. It consists of 33-34 vertebrae separated by intervertebral discs and connected by ligaments which altogether allow it's flexibility. Spine also protects spinal cord which runs through the spinal canal. Like any other organ in human body,it is prone to various diseases, degenerations and traumas which can cause instability. One of the treatment options is spinal fusion of the affected vertebras to prevent their movement. Open spinal fusion have been used for decades and performed through a long incision on the back resulting in a large damage of muscle and sorounding tissue. The progress of technology led to a discovery of new methods in spinal surgery and one of them is Minimally invasive spinal fusion. Minimally invasive spinal fusion is a procedure in which screws and rods are inserted through tiny tubes through small incisions. Thanks to approach through small incisions, damage of muscles and sorounding tissue is reduced resulting in fewer bleeding and shorter postoperative recovery. The keys to a successful operation are competent surgeon and scrub nurse who has to know operative technique basics and be familiar with the instruments that are used for the procedure.

Nurses topics

INTRATHECAL BACLOFEN THERAPY (ITB) - OUR EXPERIENCE

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Key words: intrathecal baclofen therapy; patient; medical nurse.

Spasticity as an uncontrolled muscle reaction is a common symptom after brain and / or spinal cord injury; it reduces the ability to carry out daily activities - selfcare and contributes to poorer quality of life. Intrathecal Baclofen Therapy (ITB) is a contemporary approach to spasticity therapy, regardless of the cause.

This study presents the indications for ITB, testing and patient selection, patient preparation for surgery, surgical procedure of pump implantation, importance of further monitoring of patients with pump refilling procedure.

Informed and cooperative family, an educated patient with realistic and clearly defined goals of treatment, and the teamwork of all health professionals involved in his / her care will secure good results.

Nurses topics

NEUROPHYSIOLOGICAL IOM OF EVOKED POTENTIALS IN NEUROCHIRURGY

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Key words: evoked potentials; IOM; changes; anaesthesia; team.

In our clinic, we have been using intraoperative monitoring for 30 years with the aim of preventing additional neurological deficits. Evoked potentials (EP's) are recorded changes in the electrical activity of parts of the nervous system in response to external stimulants.

The basic tests we use are: somatosensory evoked potentials (SEP), brainstem auditory evoked potentials (BAEP), motor evoked potentials (MEP) with the whole range of modalities.

The purpose of the IOM is to timely warn the neurosurgeon who, depending on the possibility, changes the operative technique.

In addition to specific EP change caused by the neurosurgeon, there are also non-specific ones, such as the "noise" of the environment, anaesthesia, etc. All anaesthetics change the EP depending on the preoperative condition of the EP. IOM requires a stable anaesthesia regime.

Therefore, the teamwork of everyone present in the operating room is very important.

Nurses topics

GAMMA KNIFE RADIOSURGERY IN CONTEMPORARY NEUROSURGICAL PRACTICE FROM A NURSING PERSPECTIVE

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Key words: Gamma Knife; radiosurgery; treatment.

Since its introduction into clinical practice more than half a century ago, Gamma Knife radiosurgery has gradually become one of the cornerstones of modern neurosurgical care. It has revolutionized the treatment for many neurological disorders and, where available, significantly improves the standard of care of neurosurgical patients. Performing radiosurgical treatment with the Gamma Knife requires a team effort, and besides the role of the neurosurgeon, medical physicist and radiation technologist, the role of a specially trained registered nurse is pivotal for the successful functioning of the Gamma Knife Unit.

Gamma Knife radiosurgery is available in the Department of neurosurgery of the University Hos-

pital Centre Zagreb since the installation of the first Unit in 2004, with over 7000 procedures being done so far. The installation of the new Icon model in 2019 broadened the range of indications and improved the workflow. The role of the nurse is present in every step of the treatment protocol – from scheduling the first appointment, delivering crucial information to the patient, pre-treatment preparation, assistance in the treatment workflow itself, and postradiosurgical care and follow-up.

The aim of this brief presentation is to give an overview of the variety of contemporary indications for radiosurgery, present the caseload of our Gamma Knife Centre and specifically address the role of the attending nurse in everyday radiosurgical practice.

Nurses topics

MEDICAL CARE OF PATIENTS WITH GLIOBLASTOMA

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Glioblastoma is one of the most aggressive forms of brain tissue tumors, and it is caused by mutations of some types of stem cells in the brain (glia cells, astrocytes and oligodendrocytes). It accounts for about 15% of all brain tumors, and has a very low survival rate. About 20% of patients survive a year, and less than 5% survive within 5 years of diagnosis. The most commonly used forms of treatment are surgical removal, radiation treatment and chemotherapy. Due to the difficult availability of this type of tumor, the limited knowledge of the medical profession about glioblastomas and the unclear etiology of the tumor, in more severe cases supportive and palliative therapy plays an important role, with a special emphasis on nursing

The nurse in neurosurgical care for patients with glioblastoma represents an irreplaceable member of the multidisciplinary approach to the treatment of this aggressive form of tumor. Through her role, the nurse integrates and coordinates various aspects of care, providing not only technical medical services, but also emotional support, education and communication between the patient and the medical team. Direct clinical care provided by a nurse encompasses a number of elements, including medication administration, monitoring of vital signs, early postoperative care, and timely recognition and management of potential complications. The role of the nurse does not end only with the technical aspects of care. The nurse also provides emotional support to patients and their families, it helps them cope with the stress and anxiety that often accompanies glioblastoma diagnosis and treatment. Through this multivalent role, the nurse significantly contributes to optimizing treatment outcomes and improving the quality of life of patients with glioblastoma.

Nurses topics

POSTOPERATIVE COMPLICATIONS OF BRAIN TUMOR REMOVAL

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Brain tumors are divided into benign and malignant. Regardless of the type, head surgery carries certain risks. Symptoms and dangers depend on the size of the tumor and its location in the brain. The consequences of tumor surgery are expressed in functional and aesthetic terms. Complications occur more often after open excision of a brain tumor (craniotomy). Postoperative complications include the following; loss of functions depending on the area of the brain that was operated on, infection of wounds and penetration of pathogens into brain tissue, increased intracranial pressure, brain edema, epileptic seizures and hypoxia. During surgical intervention, possible consequences such as dysfunction of some parts of the brain manifested by a decrease in visual acuity or its complete loss, changes in motor functions (partial or complete paralysis), disorders of the vestibular apparatus, partial or complete amnesia (short-term, long-term), influence on the urination process , the appearance of symptoms of mental disorders and speech disorders. The consequences of the operation depend on a large number of factors; the age of the patient, the presence of accompanying diseases, lifestyle, and also depend on the type and location of the operated area. Every doctor should talk to the patient and his family about the consequences expected after surgery, and the nurse should carry out preoperative and postoperative interventions, and educate the patient and provide support to him and his family. After surgery, most patients have disturbances lasting several weeks, but some of them last longer than six months or remain permanently. Complications after surgery to remove a brain tumor can lead to a significant deterioration in the patient's health. However, with correct and qualified action, the probability of consequences is small.

Nurses topics

BEHAVIORAL CHANGES IN PATIENTS WITH BRAIN TUMORS

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Modern neurosurgical procedure is gaining prominence as part of the overall evolution of medicine; precisely because of its complexity, it necessitates a high level of specific knowledge and abilities in the field of health care. Neurosurgical illness is frequently a chronic disease that causes lifelong disability or progresses over time. The patient's change in behavior in reaction to the diagnosis of a brain tumor heavily influences the assessment of the patient's status and the implementation of healthcare interventions. Injuries and diseases of the nervous system frequently have long-term consequences not only on the body's neurological physiological system, but also on cognitive and affective functions, personality, and individual characteristics that give the patient a sense of individuality. Anxiety, frustration, anger, hostility, fear, regression, denial, guilt, depression, stigma, and powerlessness are common emotional and behavioral responses in hospitalized brain tumor patients. The profound

impact of a brain tumor diagnosis ripples far beyond the individual, reaching out to envelop the family, who shoulder the weight of ensuring the most fundamental needs of the affected patient are met. The nurse's heartfelt goals involve an ongoing commitment to understanding and evaluating the patient's psychological well-being, ensuring timely and relevant information sharing, and cultivating a strong bond with both the patient and their family. Delivering top-notch healthcare, practicing patience, and fostering a positive attitude within patients are all instrumental steps that lead to success through effective coping mechanisms. These efforts, driven by compassion and optimism, hold the power to make a genuine difference in the journey of healing and adaptation.

Nurses topics

HIGH INTRACRANIAL PRESSURE

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Increased intracranial pressure (ICP) is a pathologic state common to a variety of serious neurologic conditions, all of which are characterized by the addition of volume to the intracranial vault. Intracranial pressure (ICP) monitoring is now viewed as integral to the clinical care of many life-threatening brain insults, such as severe traumatic brain injury, subarachnoid hemorrhage, and malignant stroke. It serves to warn of expanding intracranial mass lesions, to prevent or treat herniation events as well as pressure elevation, which impedes nutrient delivery to the brain. It facilitates the calculation of cerebral perfusion pressure (CPP) and the estimation of cerebrovascular antiregulatory status. ICP is typically assessed invasively but a number of emerging; non-invasive technologies with inherently lower risk are showing promise. Management of intracranial hypertension secondary to traumatic brain injury is crucial to optimizing outcomes. Use of pharmacological and/or surgical management is often needed to prevent secondary brain injury and its immediate and long-term effects.

Nurses topics

CRANIAL NERVE SCHWANNOMA

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Key words: evoked potentials; nursing; Schwannoma; surgery.

Schwannoma are benign tumors arising from glial cells which envelop and support the nerve cells. The most common cranial nerve tumor is the vestibular Schwannoma. These tumors can be treated surgically or via stereotactic radiotherapy, with the former being among the more challenging procedures for the wider neurosurgical team. Surgical removal of a vestibular Schwannoma confers a high risk of neurological damage. However, due to its anatomical location, vestibular Schwannoma often causes neurological deficits even preoperatively. To minimize the risk of neurological damage, in par-

ticular cranial nerve damage, evoked potentials of the nerves affected by the tumor are monitored during Schwannoma surgery. In our presentation we aim to review the state-of-the-art of the technology, strategies, and methods employed in neurosurgical treatment of Schwannoma. We focus on preoperative workup and scope of activities pertaining to a scrub nurse who is a part of a multidisciplinary Schwannoma team.

Nurses topics

CENTRAL NERVOUS SYSTEM NEOPLASMS IN THE PEDIATRIC AGE

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Key words: brain neoplasm; pediatric; nursing; surgery

Following leukemia, brain tumors are the second most frequent pediatric neoplasm. As opposed to adults, pediatric brain tumors are more common in the infratentorial compartment, comprising 50-70% of all pediatric brain tumors. Infratentorial tumors quickly lead to an increase in intracranial pressure with cerebrospinal fluid flow obstruction and compression on vital centers. At times, although not as a general rule, there is need for a preoperative hydrocephalus relief, by either a ventriculoperitoneal shunt, external ventricular drainage or endoscopic third ventriculostomy. The aim of our presentation is to review the procedure of endoscopic third ventriculostomy, tumor biopsy, and Ommaya reservoir placement – a device used for intrathecal chemotherapeutic agent delivery. For complex surgical procedures such as these, scrub nurses need to have the appropriate training for endoscopic techniques. Among the more challenging aspects within the field is performing multiple procedures on a single patient.

Nurses topics

TECHNOLOGICAL PROGRESS IN NEUROSURGERY AND ITS IMPACT ON INTRAOPERATIVE CARE

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Key words: intraoperitive nursing care; education; new technologies.

Intraoperative nursing care for the patient is carried out from the moment the patient is admitted to the operating room until the transfer of the patient after the operation to the recovery room. The methods and procedures that are today in daily use for the implementation of intraoperative nursing care are extremely complex and require scrub nurses to have, in addition to the knowledge of special clinical skills, the knowledge and operation of highly sophisticated computerized devices used in neurosurgery.

Namely, neurosurgical treatment and its results are increasingly based on high technology and the philosophy of "minimally invasive neurosurgery". It

made it possible to carry out the surgical treatments in a much faster and safer way for the patients. The main task and the activity of the nurse is to take care of the patient's safety in the operating room environment, so that the surgical procedure can take place safely and without complications. This security has certainly been improved by the integrated operating room, which is characterized by numerous functionalities, from the most technologically advanced devices to the system for storing documentation related to the data of the patients who have been operated on, such as image and video materials of the operation itself, while respecting high standards of the data protection. This video storage system of all off the neurosurgical operations was improved by the "N care" system. It enabled the storage and secure availability of video material to all who are authorized to use it for educational purposes.

The complexity of nursing work in the intraoperative care, the responsibility related to aseptic conditions during surgical procedures, as a prevention of possible infection, requires formal training for these nurses. We still don't have such education for now. The University of Applied Health Sciences together with the professionals in the field created all the prerequisites for starting a one-year education for this important segment of nursing activity.

Accelerated technological changes and progress in the medicine demands from the instrument nurses the need for lifelong learning as the only way to keep up with the changes.

Nurses topics

CERVICAL KYPHOSIS CORRECTION VIA A COMBINED APPROACH

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Key words: cervical kyphosis; combined approach; ependymoma; instrumentation.

We report the case of a patient with a C1-C7 ependymoma presenting with quadriparesis. She underwent surgical treatment at which a gross total removal was achieved. Following postoperative rehabilitation, the quadriparesis resolved almost entirely. Gradually, over time, a cervical kyphosis developed, which led to a deterioration in neurological status. A reoperation was scheduled aimed at correcting the deformity. The procedure was carried out in two steps. First, the cervical medulla was decompressed via CIII-CVII corpectomies and the anterior column was reconstructed using an autologous fibula graft. The second procedure was a CI-ThI instrumentation and was supplemented by the use of intraoperative evoked potentials. Both procedures and postoperative course were uneventful and the patient was discharged to a rehabilitation clinic.

Nurses topics

NURSING CARE FOR PATIENTS WITH INTRACRANIAL BYPASS - CASE REPORT

Antonio Medved, Šimun Tot, Ivana Garić, Maja Prović, Nina Cvjetičanin, Gordana Pavlek, Anđelka Kriste, Vesna Bratić, Mario Bespaljko

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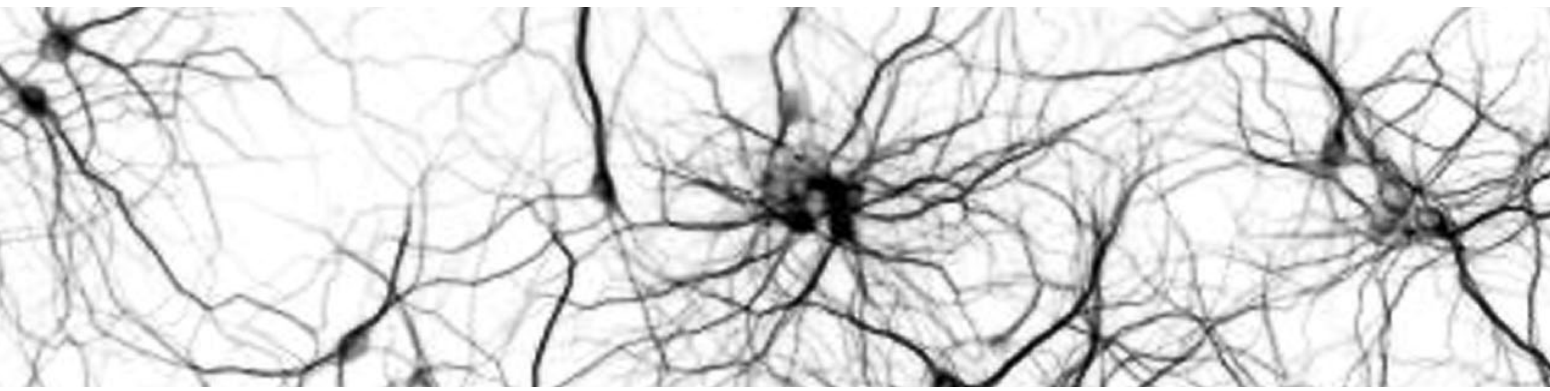
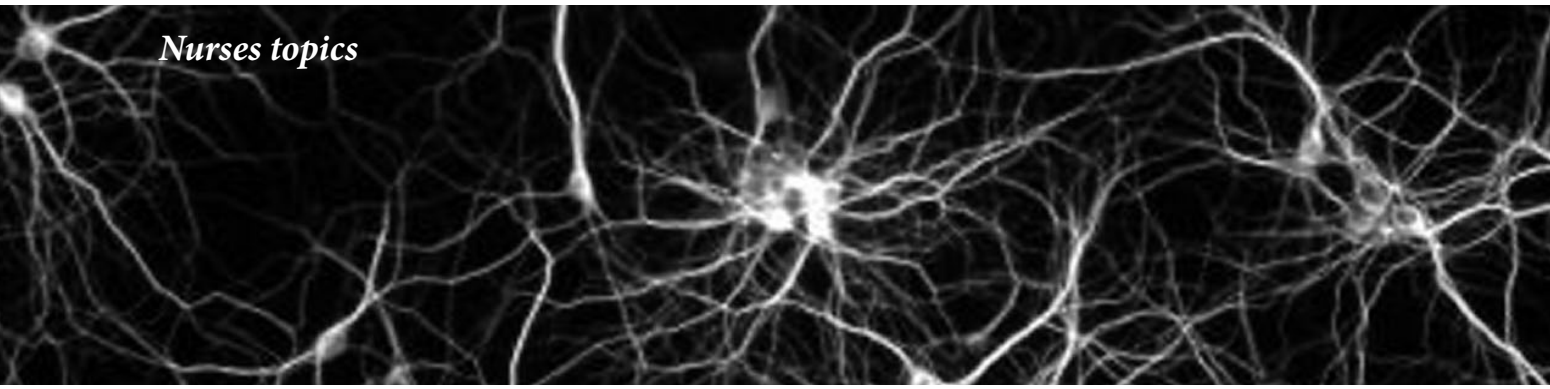
Key words: aneurysm; bypass; nursing care.

Along with cardiovascular diseases, cerebrovascular diseases are the leading cause of morbidity and mortality in the modern world. Brain aneurysms develop as a result of thinning and degeneration of the artery walls. A brain aneurysm is best treated by surgical or endovascular removal. However, there are complex aneurysms that cannot be excluded from the circulation by standard means. In these cases, in order to prevent their rupture or the loss of function of a part of the brain, it is necessary to remove the entire cerebral blood vessel together with the aneurysm and replace the circulation by creating a bypass, i.e. by bringing blood to a certain part of the brain from another source. The role of the nurse in preparing the patient for surgery is extremely important, and the purpose of perioperative care is to provide the patient with the best possible physical, psychological, social and spiritual readiness for surgery. The aim of this paper is to show the significance and specifics of nursing care in the preoperative, intraoperative and postoperative care of a neurosurgical patient with a placed intracranial bypass Key words: aneurysm, bypass, nursing care.



SATELITTE SYMPOSIUM FOR NEUROSURGICAL NURSES

ABSTRACTS OF POSTER PRESENATATIONS



Nurses topics

HYDROCEPHALUS

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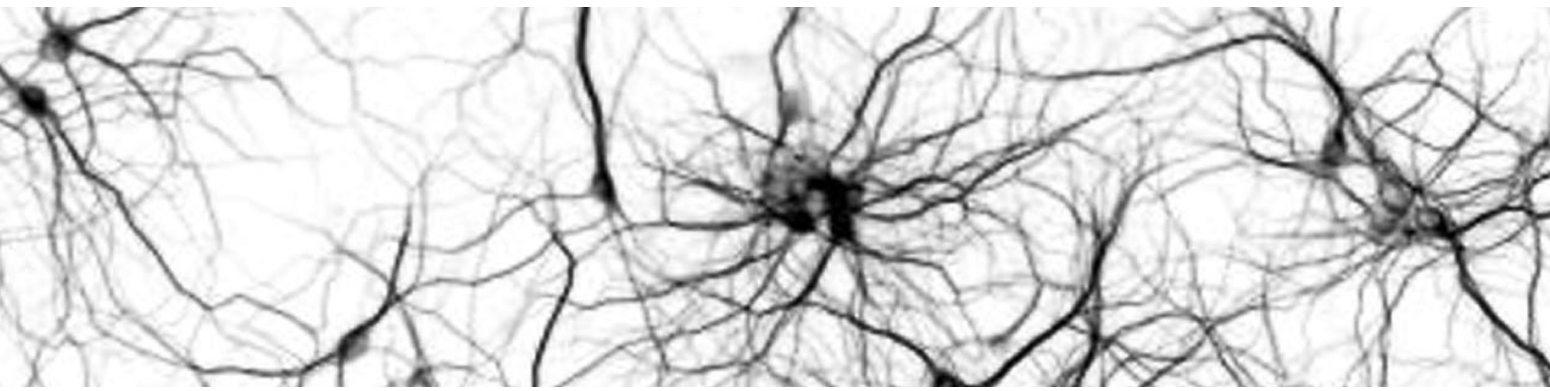
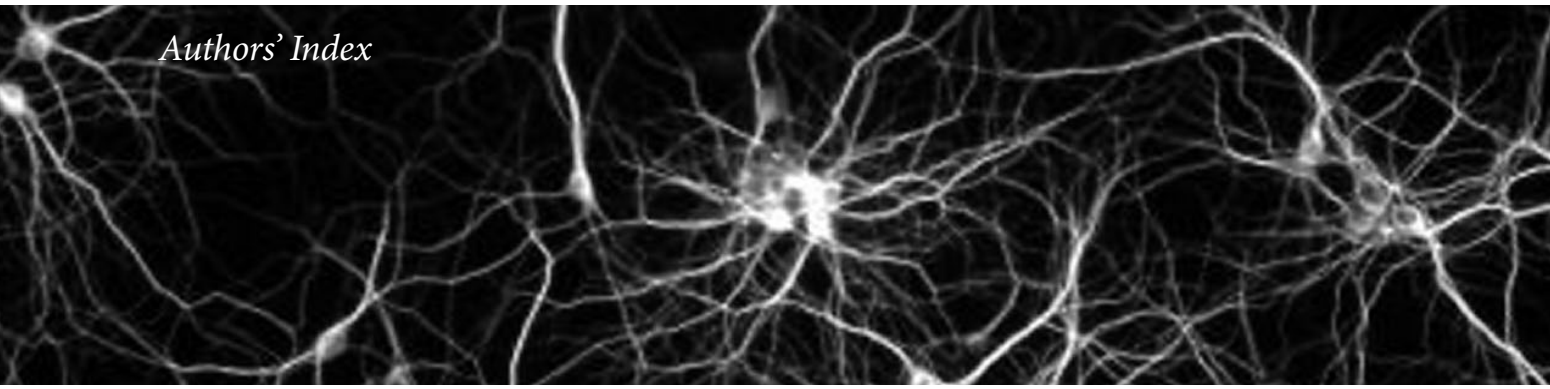
Key words: hydrocephalus; Pudenz drainage; patient; scrub nurse; operating room.

Hydrocephalus refers to the progressive dilation of the brain's ventricular system. Manifestations include an enlarged head and brain atrophy. The treatment is surgical, specifically drainage procedures. Drainage operations are applied in cases of elevated intracranial pressure and hydrocephalus. The most commonly used method is ventriculoperitoneal drainage, according to the Pudenz technique.

Patient preparation is crucial, as is the readiness of the operating room's scrub nurse for ventriculoperitoneal drainage following the Pudenz technique. The scrub nurse is an integral part of the neurosurgical team, needing to be familiar with the surgical procedure's sequence and prearrange instruments. The success of instrument handling depends on thorough preparation. Therefore, the scrub nurse must possess in-depth knowledge of not only the tools and instruments they handle but also the course of the planned surgical procedure, all of its stages, and the anatomical structures traversed during the operation to be ready for any possible complications that may arise.



Authors' Index



Authors' Index

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**9th Congress of the Croatian Neurosurgical Society
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and Croatian-Japanese Pre-congress Symposium
on Normal Pressure Hydrocephalus**

12th - 15th October 2023, Petrčani, Croatia

possible.

Notes

Notes