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CHALLENGING RECONSTRUCTIVE NEUROSURGERY – 2009 DECLARATION BEIJING OF INTERNATIONAL ASSOCIATION OF NEURORESOTRATOLOGY (IANR)

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OBJECTIVES

Reconstructive neurosurgery plays an ever more important part in multidisciplinary neurorehabilitation of impaired higher cortical functioning. Up to now medical treatment failed to replace damaged central nervous system (CNS) plasticity. This is especially true for severe traumatic brain injuries (TBI), stroke, and a number of degenerative and infectious lesions, when cortical and subcortical structures are disturbed and the connecting fibres of the CNS network are disrupted that provide the miraculous functional communication which has been called the social system by the great neuroscientist A. Luria.

METHODS

Intensive experimental studies on neuroregeneration, neurorepair, neuroplasticity, neurotrophicity, neuromodulation, neurorehabilitation aim at neuroprotection and neural repair to enable the damaged cells to survive functionally, to regain or to substitute disturbed motor and or mental-cognitive and neurobehavioral functioning.

RESULTS

The human brain is the one we least know how to repair. Its injuries have terrible consequences. Now a days due to a better insight and understanding of the underlying physiological and pathological mechanism of brain and neuron damage as demonstrated in various animal experiments new strategies appear on the horizon.

The Beijing Declaration of International Association of Neurorestoratology (IANR) that was adopted by the 2nd IANR Annual Conference General Assembly, Beijing, China, April 26, 2009, was proposed by a number of international researcher and clinicians where I took part too. These instructions should serve as a code for future research and clinical application of Neurorestoratology and will be explained by the author on behalf of presidium of the international association to the audience.

DISCUSSION

Without ethical controls and external scientific audit of the clinical results that were achieved a number of doctors and so called institutions for neural repair offer worldwide human somatic cell therapies and gen therapies for central nervous system diseases and other surgical interventions for neuromodulation in the internet where the evidence has not yet been demonstrated regarding

effectiveness and efficiency. This is especially true for severe spinal cord injury and TBI.

CONCLUSION

The mission of the International Society for Neurorestoratology is to bring together all the different strands of investigation which aim to repair the brain, nerves and spinal cord, to control the quality of research and clinical application, and to provide the platform for collegial discussions and exchange while respecting the world's multicultural ethics and statements of religious beliefs. Neurorestoratology aims to encourage persistence and cooperation in these many tentative and fragile beginnings of experimental and clinical research, as one has to confess that all attempts are still experimental at present time.

MENTAL RECOVERY AND SOCIAL REINTEGRATION FOLLOWING SEVERE BRAIN DAMAGE. THE NEUROSURGEONS IMPACT ON EARLY NEUROSURGICAL REHABILITATION OUTCOME

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OBJECTIVES

The number of patients with permanent brain damage is growing as the results of the increased survival rate from such common conditions as severe head injury. Incomplete recovery of brain functions has far-reaching consequences because it often produces some degree of mental disability; this calls for a different degree of adjustment than does the need to cope with most physical disabilities. "Brain damage has become synonymous with loss of skills, while the rehabilitation of brain-damaged individuals has become known as a method to restructure lives within a social context" quotes the great Danish neurophysiologist A-L. Christensen,1986.

METHOD

Neurorehabilitation has been established in Germany as in other European and non European countries over the last two decades. Early neurological and neurosurgical rehabilitation (ENR) play a major role within the ongoing chain of holistic rehabilitation that aims at the patient's reintegration into social life after brain damage. Neurorehabilitation is a multidisciplinary challenge.

RESULTS

Our multidisciplinary aim of ENR is to avoid or to minimize long lasting disability (WHO) by focussing on brain plasticity and brain protection after acute and secondary insults to higher cortical functioning. In following the outcome of our patients after early neurosurgical rehabilitation at the academic Clemenshospital special needs for an adequate neuropsychological long-term treatment became obvious to reach the final target of individuals social reintegration as to be demonstrated by selected typical case reports.

DISCUSSION

In following the pioneering work of C.F. Goldstein in the beginning and A.R. Luria's epoch-making neuropsychological social concept of the working brain in the fifties and sixties we were able to introduce major parts for restoration of the brain's complex impaired functioning after brain trauma according to Luria's Legacy in the early nineties of the last century(see Anne-Lise Christensen et al,eds, Oxford publishers 2009). ENR needs a team approach. Neuropsychology

has a leader role in diagnostics and face to face restoration of impaired higher cortical functions. Music therapy became another important adjunct. However, practically mental-cognitive and neurobehavioral impairments are not jet taken into consideration as they should be. But, as described by A. R. LURIA (1902 - 1977), activity of the central nervous system has to be considered as a social organ with a coordinated and adaptable cooperation between various segments of the nervous system, and as a result of which constant results are always yielded under varying conditions.

Take home message: Next of kin have to become partners of the therapeutic team to understand and to translate the rehabilitative interventions into the patients to help humanizing the victim's human skills within the cultural- social context.

Mood disorders (coping with grief and loss) are common consequences following TBI. Mental-cognitive deficits need early consideration and carefully assessment during ENR as the might frustrate a holistic approach in neuropsychological early and long-term rehabilitation. Psychotherapy might be indicated in some cases. Development of theoretically driven clinical research should be open for different kinds of psychotherapeutic interventions regarding cognitive, behavioural, psychodynamic and mindfulness approaches.

CELL THERAPY IN SPINAL CORD INJURY

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Spinal cord injury is a major medical problem worldwide. Spinal cord injuries can lead to paraplegia or quadriplegia and have devastating consequences for victims and families.

During the spinal cord injury there is a complete or an incomplete section; therefore there is a disrupted spinal cord or some types of contusion, compression, penetration or laceration of the spinal cord appear. Spinal cord injury culminates in glial scarring, a multifactorial process that involves reactive astrocytes, microglia and macrophages, fibroblasts and Schwann cells.

After spinal cord injury there has two types of lesions : complete disruption spinal cord or different types of scars.

The scar of the spinal cord can be:

- a complete and impenetrable glial scar on the site of spinal cord injury,
- an incomplete scar and a post-traumatic syringomyelia or a post-traumatic cysts on the site of spinal cord injury,
- a filiform connective scar of the two segments of damaged spinal cord.

The glial scar, which is rich in growth inhibitors, including chondroitin sulfate proteoglycan (CSPG), is a major impediment to axonal regeneration following injury.

The inability to repair spinal cord damage is attributed to several factors :

- the presence of inhibitory substances in the tissue that surrounds the lesion,
- changes inside adult nerve fibres that make them unable to respond well to growth-inducing signals that are effective in embryonic fibres,
- the formation of cysts into the injury site and growing fibres cannot cross,
- the lack of nerve growth factors in the injury site,
- the formation of scar tissue at the injury site with additional inhibitory substances.

Therefore any treatment must solve the above difficult problems.

An efficient treatment in spinal cord lesions must combine more main approaches:

- minimising the initial damage and protecting surviving neurons - neuroprotection,
- removing barriers : after the injury the scar tissue gradually fills the damaged area and it is an impenetrable barrier and it does not allow regenerating nerve fibres to pass through.
- blocking factors which inhibit neural regeneration,
- modulation of inflammatory response following spinal cord injury,
- preventing inhibition of regrowth,
- tissue engineering : biocompatible materials can form a bridge across the damaged region,
- stimulating and guiding – neurotrophic factors,
- replacing damaged cells – stem cells therapy,
- correctly reconnect the damaged neural circuits inside and outside the spinal cord

There are no fully restorative treatments for spinal cord injury, but various rehabilitative therapies have been tested in animal models to improve functional outcomes after spinal cord injury. The stem cells based therapies are tryed to repair or replace tissues or cells damaged by injuries or diseases and to treat serious chronic diseases, such as spinal cord injuries.

Three therapeutic concepts are currently being envisaged:

1.Transplantation of differentiated cells derived from stem cells. The source for the specific differentiated cell types could be embryonic or somatic stem cells including the patient's own stem cells.

2. Direct administration of stem cells directly to the patient; the stem cells will differentiate into the desired cell type.

3. Stimulation of endogenous stem cells, induced by stimulating an individual's own population of stem cells by administrating growth factors.

Stem cells are feasible candidates for cell therapy of spinal cord injury. Bone marrow cells are the subject of extensive interest because of their stem cell like characteristics and pluripotency.

There are more data supporting beneficial effects of bone marrow cells in SCI :

1. bone marrow contains multipotent adult progenitor cells that produce a variety of cell types, including neuroectodermal, mesodermal and endodermal cell types.

2. bone marrow cell transplants improve function recovery and differentiate into astrocytes, oligodendroglia and neural presursors in animal experiments.

3. bone marrow cell transplants facilitate remyelination of the spinal cord, appear to be neuroprotective and also promote regeneration in injured animal spinal cords. (7, 8, 9, 10)

Substances that limit secondary injury processes and promote repair and regeneration of the injured spinal cord such as monosialotetrahexosylganglioside (GM-1), 4-aminopyridine (4-AP), [a potassium-channel blocking agent], brain derived neurotrophic factor (BDNF) and glial-derived neurotrophic factor (GDNF), also inhibitors of Nogo (neurite outgrowth inhibitor) and MAG (myelin-associated glycoprotein), have been studied.

Also transplanted tissues and cells, such as blood macrophages, bone marrow transplant with GM-CSF, olfactory ensheathing cells, fetal tissues, stem or progenitor cells, appear to produce neurological improvements.

In pathological conditions eg.spinal cord injury, the neurotrophins promote survival and rescue nerve cells from death and promote neurite extension, neuronal survival and differentiation. In spinal cord injury, the neurotrophins are capable to enhance axonal regeneration and reduce paraplegia. Bunge in 2008 showed that the most efficacious strategy for the acute complete transection of spinal cord was a combination

of implantation of Schwann cells, plus neuroprotective agents and growth factors administered in various ways, olfactory ensheathing cell (OEC) implantation and chondroitinase administration. Ratan and Noble in 2009 concluded that combinations of interventions were needed to surmount the multiple barriers to recovery in spinal cord injury recovery, Knoller et al (2005) and Park et al (2005) in small studies noted sensory improvements to SCI patients who underwent autologous bone marrow cell transplantation (BMT) in conjunction with granulocyte macrophage-colony stimulating factor (GM-CSF).

We present a preliminary study of the autologous bone marrow tissue implant into the lesioned spinal cord at seven complete SCI patients and the promising results, but much follow-up work is needed to document long-term benefits.

MICROSURGICAL RESULTS IN TREATMENT OF SMALL AVM WITH A REVIEW OF ALTERNATIVE TREATMENT MODALITIES (RADIOSURGERY AND EMBOLIZATION)

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This paper addresses the question of treatment results for cerebral AVM with special regard for smaller sized AVMs which could theoretically be treated by the three modalities radiosurgery, embolization, or microsurgery. The presentation reviews the own microsurgical series (n=255) and puts own results into perspective with other microsurgical series. It then focuses on own results for small AVMs (n=130) and the literature.

Then embolization series are reviewed. Key results are that total obliteration is usually described in the range between 5 and 15% with only 2 exceptional series describing obliteration rates over 40%. Side effects are bleeding rates between 4 and 13%, associated morbidities between 4 and 17%, and mortality rates between 1 and 12%, usually around 2-3%. Even more recent results for onyx describe total obliteration rates of only 16-20% with re-bleeding rates between 4 and 6%, new deficit rates between 5 and 24%, and mortality rates again around 2-3%.

In the next section many radiosurgical series are summarized: Obliteration rates vary between 55 and 79%, in some series for special subgroups around 87-92%. It has to be noted that the follow-up time has slowly crept up from two years to four or five years for maximum results. Due to this long time re-bleeding rates of 4% to 12% are described. Mortality rates vary between 0.6 and 13% but usually are around 2-3%. Delayed problems after long term follow-up include cyst formation which starts to develop after five years but may develop as late as from the 11th year. It should be noted that the combination of various treatment modalities implies that the risk of each treatment modality is added on top of the other. Palliative treatment was not found to be very effective instead leading to higher re-bleeding rates, mortalities, and major deficits. In a number of analyses the cost effectiveness and economic side of radiosurgery use was analyzed and usually microsurgery was found to be more economical and more effective.

Finally the question of when and how to intervene and which treatment modality to use under which circumstances will be summarized. The conclusions are that all three treatment modalities are needed. For small AVMs microsurgery has the highest exclusion rate with less mortality and a comparable rate of complications of all three modalities. There is a place for radiosurgery but only in small AVMs if an experienced vascular neurosurgeon does not want to operate.

The use of embolization as a routine presurgical adjunct can not be encouraged at the present time for Spetzler-Martin Grade I-III. The main application of embolization is transformation of a high risk larger AVM into a lower risk operable one.

MULTIMODAL TREATMENT (MICROSURGICAL APPROACH, EMBOLIZATION, GAMMA KNIFE SURGERY) IN INTRACRANIAL ARTERIOVENOUS MALFORMATION EXPERIENCE OF 194 CASES

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Keywords: arteriovenous malformation (AVM), intracerebral hemorrhage, seizures, CTscan, MR, MRA, DSA, Spetzler-Martin Grading System, microsurgery, GKS, embolization, outcome, GOS

INTRODUCTION

AVM represents 1/10 of cerebral aneurysms in USA, which count 1/100.000/year cases. The overall annual risk of hemorrhage is 2-4%. Important risk factors for AVM hemorrhage are: history of a prior bleed; deep location; deep venous drainage; increasing patient age; diffuse AVM morphology; one draining vein.

MATERIAL AND METHOD

Authors present 194 consecutive cases of AVMs: 80 operated, 94 treated with gamma-knife surgery (GKS) and 20 cases treated by embolisation, in the 1st Neurosurgical Department of the "Bagdasar-Arseni" Hospital, Bucahrest, in the period of time between 2000-2008 (9 years). The including criteria were: AVMs, admission, investigation, treatment, follow-up, complex multidisciplinary management in the I-st Neurosurgical Clinic. All this cases receive at first intention: microsurgical approach, GKS or embolization. There are a cohort of cases 32, in which the authors done a multiple therapeutical option (eg. embolization or surgery followed by GKS, or embolization followed by surgery). The excluded criteria were: AVMs treated in other services, Galen vein malformations and AVM grade VI.

These represent 194/6258 cases of mass lesions (3.1%) admitted in this period of time. There were 88 females (45.4%) and 106 males (54.6%) aged between 0 - 55 years with mean age of 21.9 years. The most affected group was 11-20 years: 68 cases (35%). All the cases followed the same protocol for clinical and neuroimagistic diagnosis (CTscan, MR, MRA, DSA). Three methods of treatment were performed in these 194 cases: microsurgical approach, GKS, embolization and 32 cases combined procedures.

The localization of AVMs was: superficial supratentorial 142 cases (73.1%), deep supratentorial 28 cases (14.4%), brainstem 1 case (0.5%) and cerebellum 23 cases (11.8%). The clinical onset by hemorrhage was present in 161 cases (83%), seizures in 29 cases (15.1%), headache/progressive non-hemorrhagic neurological deficit 19 cases (9.8%). The clinical features was dominated by headache in 166 cases (85.7%), followed by motor deficit in 62 cases (32.1%), seizures 64 cases (33%), neck stiffness 45 cases (23.2 %) and vomiting in 28 cases (14.4 %). The distribution in basis of the Spetzler-Martin Grading System (1986) was: grade I 48 cases (24.7%), grade II 59 cases (30.5%), grade III 50 cases (25.7%), grade IV 29 cases (14.9%) and grade V 8 cases (4.1%). The multimodal treatment was adapted in connection with AVMs, sizes and location, patient condition and age.

RESULTS

The postoperative complications were: recurrent hemorrhage 9/80 cases (11.2%) and obstructive hydrocephalus in 11/80 cases (13.7%) in which the V-P shunt was inserted. Important complications after the GK therapy were related in this series: 2 cerebral ischemic stroke, 1 intranidal AVM haemorhage, 1 malignant brain swelling, 1 focal neurological deficit. Other usual complication: diffusse headache, seizures, dizziness. In the cohort of AVMs embolization (20 cases) the important complications were: intraparenchimal haematoma (1 case), new neurological deficit (3 cases), cranial nerves paresis transitor or permanent (6 cases).

The neurological evaluation at 6 months for the whole series showed: focal neurological deficit 42/194 cases (21.4%), seizures 50/194 cases (25,8%), cognitive deficits 47/194 cases (24.1%), mental disturbances 29/194 cases (15.1 %), visual disturbances 31/194 cases (16%) and obstructive hydrocephalus 23/194 cases (11.6%).

The global outcome assessment by GOS at 6 months for 194 AVMs cases: good recovery 81 cases (41,8%), moderate disability 92 cases (47.4%), severe disability 16 cases (8,2%), persistent vegetative state 2 case (1%) and death 3 cases (1.5%).

CONCLUSIONS

Generally intracerebral hemorrhage is the initial symptom in AVMs. For many years the microsurgery represent the best treatment in gr. II–III AVMs. Actually, the GKS open a new minimal invasive therapeutic perspective (grade I-III). The large AVMs (grade IV–V) and AVMs in functional areas requires a multimodal treatment: stadial embolization, microsurgical excision and GKS, if it is necessary.

NEUROIMAGING AND MICROSURGICAL MANAGEMENT OF BRAINSTEM CAVERNOMAS

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OBJECTIVE

Brainstem cavernomas are benign vascular malformations; however, they can cause severe neurological deficits when bleeding. Removal of these lesions has been related with a high surgical morbidity, and there is no general consent on the surgical management of these lesions. It was the goal of this study to review the surgical results of a recent series of brainstem cavernomas. Intraoperative navigation made use of MR based brainstem tractography, whereas intraoperative electrophysiological mapping of the brainstem was done to optimize resection.

METHODS

A total of 25 consecutive patients with cavernomas in the brainstem were included in this study. All treated patients suffered at least one hemorrhage before they underwent surgical treatment. Presenting symptoms included facial palsy, diplopia, dizziness, headaches and gait disturbance. Pre-operative neuroradiological examinations included MRI with diffusion tensor imaging (DTI) to visualize brainstem tracts.

RESULTS

Less invasive approaches including the retrosigmoid and the medial suboccipital approach were used. Brainstem mapping was used to determine a safe point of entry. Microsurgical resection of the cavernomas was performed under continuous intra-operative monitoring. A total tumor removal was achieved in 23 cases and new cranial nerve deficits were observed in only two patients after surgery.

CONCLUSION

Our results show that by using a refined microsurgical technique combined with minimally invasive approaches, neurophysiological monitoring and brainstem mapping, a total resection of brainstem cavernomas can be achieved with a very low surgical morbidity.

MEDULLOBLASTOMA IN CHILDREN (21 YEARS OF EXPERIENCE)

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Keywords: medulloblastoma, surgery, radiotherapy, chemotherapy, outcome

BACKGROUND

Medulloblastoma (MBL) represent 30%-40% of posterior fossa tumors in children. The mechanism of tumorigenesis is unknown. For MBL, 5-year progression free, and overall survival is 60 and 59%. Authors present a series of 196 consecutive operated cases which represent 21 years retrospective study of MBLs in the Pediatric Neurosurgery Department 1st Neurosurgery Clinic of the Bagdasar-Arseni Hospital, Bucharest, for 21 years (1988-2008). Authors present the classification of these tumors in basis of the Chang system score (1969), the localization, neuroimaging, clinical features, multimodal treatment, follow-up, outcome and Q.o.L. Although the appearance of CT findings in MBL are highly characteristic, but MR is the preferred for imaging diagnosis, for posterior fossa and supra/subtentorial and spinal dissemination.

MATERIAL & METHOD

In the 1st Department of Neurosurgery, in the period of time between 1988-2008 (21 years), 196 consecutive operated cases of MBL. The most affected age was 4-9 years – 102 cases (52%). There were 114 boys (58%) and 82 girls (42%). The preponderant localization was median, vermis and 4th ventricle in 141 cases (71,9%), paramedian in 49 cases (25%) and cerebellopontine angle in 6 cases (3,1%).

At admission, the classification by Chang et al. staging (1969): T1 64 cases (32.6%); T2 61 cases (31.1%); T3a 39 cases (19.9%); T3b 22 cases (11.2%); T4 10 cases (5.1%); M0 128 cases (65.3); M1 30 cases (15.3%); M2 8 cases (4.1%); M3 24 cases (12.2%) and M4 6 cases (3.1%).

All the cases were investigated by CT-scan and MR. Obstructive hydrocephalus was observed in 141 cases (71,9%) and the performed treatment: preoperative EVD 42 cases (21,4%), neuroendoscopy 28 cases (14,3%) and VP shunt 71 cases (36,2%).

All the cases were submitted to the surgical intervention. The total resection was performed in 92 cases (46.9%), near-total resection in 34 cases (17.3%), subtotal resection in 70 cases (35,7%).

According to the international classification the patients was with: "low risk": age > 3yo, M0 stage, or residual tumor <1.5cmc, and "high risk": age < 3yo, M1-M3 stage and residual tumor >1.5cmc. In our data – 29 operated cases 0-3 years old (14,8%).

All the operated cases received multimodal postoperative therapy (radiotherapy, chemotherapy). The standard protocol of radiotherapy was completely to cover the whole cerebro-spinal axis (35-40 Gy + 14-15 Gy boost to tumor bed). Total contraindication of radiotherapy: 0-3 years old. Concerning of chemotherapy, the protocol (8 drugs in 1 day) is: vincristine, carmustine, procarbazine, hydroxyurea, cisplatin, cytarabine, prednisone, cyclophosphamide realized by Oncological Institute of Bucharest. The chemotherapy treatment was done in 4-6 cure. There is

no standardized chemotherapy regim; CCNU and vincristine are primary used.

The GOS at 6 months was: good recovery 97 cases (49,5%), moderate disability 65 cases (33.1%), severe disability 25 cases (12.8%), persistent vegetative state 3 cases (1.5%), death6 cases (3.1 %).

The median period of follow-up was 12.2 years (12 months-18 years). Lost cases 32 cases (16.3%) and monitoring cases 164 cases (83.7%). Local recurrences 25 cases (12.8%), spinal dissemination 74 cases (37.8 %) and supratentorial metastasis 31 cases (15.8 %).

CONCLUSIONS

MBL are classified in the PNET group. The neuroimagistic investigation is based especially on cerebral and spinal MR, the main findings for diagnosis. The goal of surgery is the total surgical removal and the pathological diagnosis. In some cases, the neuroendoscopy can be useful for preoperative hydrocephalus. In all the cases postoperative radiotherapy and chemotherapy must be performed. The follow-up is based on MR control to detect recurrences or dissemination. The final prognosis of medulloblastoma remain severe.

EPILEPSY AND MALFORMATIONS OF CORTICAL DEVELOPMENT

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Malformations of cortical development (MCD) correspond to a broad spectrum of cerebral lesions resulting from cortical development abnormalities during embryogenesis. They are characterized by cytoarchitectural abnormalities caused by abnormalities of neuronal migration and cortical laminar organization, and are frequently associated with a severe, early-onset, partial epilepsy, and with variable neurological and cognitive deficits. Diagnosis of MCD greatly improved with contemporary imaging, and MCD is an increasing identified cause of medically refractory epilepsy. Current classifications based on a combination of clinical, imaging, genetic and pathological data allow analysis of homogeneous patient series and optimal therapeutic strategies. MCD include Taylor type focal cortical dysplasias (TTFCD), other focal cortical dysplasias, hemimegalencephaly, Bourneville's disease, tumors associated with cortical dysplasias (dysembrypolastic neuroepithelial tumors and gangliogliomas), heterotopias and polymicrogyria. Successful surgical treatment can be proposed to patients with focal lesions such as TTFCD or tumors associated with cortical dysplasias, while favourable outcome can also be obtained in some diffuse cases such tuberous sclerosis, periventricular heterotopias and polymicrogyrias.

Suggestive neuroimaging features may be lacking in 30% to 40% of patients with FCD, rendering their identification difficult and leading to confusion with cryptogenic partial epilepsy. In these patients, as well as in those with a FCD localized in functional areas, invasive seizure monitoring, especially SEEG, has been proved to be helpful to identify typical patterns and to plan surgical resections. SEEG has also been useful in determining the organization of epileptogenic zone in each MCD type, and remains necessary in cases of image-negative FCD and diffuse MCD.

Adequate surgical resection strategy in TTFCD may lead to an excellent seizure outcome, with 90% to 95% of seizure-free patients. In our experience, TTFCD represents the most favourable cause of surgically remediable focal epilepsy, even when located in functional areas.

Further refinements in neuroimaging modalities should improve detection and delineation of focal MCD, while new surgical techniques, such as multiple stereotactic thermocoagulations, that are under evaluation, could extend surgical armamentarium in deeply or functionally located FCD.

LUMBAR CANAL STENOSIS IN A SERIES OF 110 SURGICAL CASES

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In our department we admitted 136 cases for lumbar canal stenosis, in a period of 4 years, during 08.01.2005-07.31.2009, and we selected 110 cases for surgery. The main surgery for these cases was laminectomy with adjacent yellow ligaments resection, superior subjacent laminae resection, and internal part of articular processes resection, with recess reconstruction. This basic surgery was performed in one level 67 cases, 2 levels, 24 cases, and 3 or more levels, 19 cases. Herniated disk resections were associated procedures in 45 cases. Sometimes, unilateral procedures or foraminotomies were used in multiple level surgeries or in cases with recess/foraminal stenosis alone.

The diagnosis was based mainly on MRI sometimes on CT images or combined CT/MRI studies. We used eFilm program for complex image processing and measurements. All the time the images were correlated with symptoms in order to focus surgery on medullar claudication alone, or medullar claudication associated with sciatica. Some patients couldn't be operated due to general condition, with associated diseases characteristic to the age group, and others were planned for partial decompression, addressed to main symptoms. Following this attitude we had no life-threatening postoperative complications.

We present pre- and postoperative images together with our algorithm in deciding the type of surgery according to a specific clinical and imagistic condition.

Compared to our previous series the number and complexity of cases raised progressively, due to this protocol and increased confidence of this category of patients in a successful surgery.

SELECTED COMBINATION OF NEUROTROPHINS POTENTIATE NEUROPROTECTION AND FUNCTIONAL RECOVERY FOLLOWING SPINAL CORD INJURY IN THE RAT

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Previous works from our laboratory showed that topical application of BDNF and IGF-1 when given alone separately is able to attenuate BSCB breakdown, edema formation and cell injury in a rat model of SCI. However, these beneficial effects of neurotrophins are limited to short periods ranging from 5 min to 30 min after SCI. Thus, it would be interesting to find-out whether a combination of neurotrophins will enhance or neutralize the neuroprotective efficacy of the growth factors in trauma models. In this investigation, the potential efficacy of BDNF in combination with GDNF, NT-3 or NGF in was examined in this investigation. The BDNF was applied over the traumatized spinal cord alone or in combination with other neurotrophins and motor dysfunction, blood-spinal cord barrier (BSCB) breakdown, edema formation and cell injury was examined in our rat model. The spinal cord injury (SCI) was performed by making a unilateral incision into the right dorsal horn of the T10-11 segment. The rats were allowed to survive 5 h after trauma [5]. Topical application of BDNF, GDNF or NGF 30 min after (but not 60 or 90 min) SCI in high concentration (0.5 μg and 1 μg) significantly improved the motor functions and reduced the BSCB breakdown, edema formation and cell injury at 5h. However, combined application of

BDNF and GDNF (but not with NT-3 or NGF) at 60 min or 90 min after SCI induced a significant reduction in motor dysfunction and spinal cord pathology. These observations suggest that a good combination of neurotrophins may have added therapeutic value for the treatment of SCI.

PRIMARY TUMORS OF THE CERVICAL SPINE

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OBJECTIVES

Often impinging on vascular and neural structures, cervical tumors are surgically challenging lesions. Since cervical primary tumors are rare, many issues regarding the best surgical strategy remain unanswered yet.

This study is a retrospective review of 66 surgeries performed on 35 patients, ranging in age 7 to 70 years, to clarify the surgical options for primary tumors of the cervical spine and to elucidate which factors influence outcome.

METHODS

Pre- and postoperative degree of pain and neurological status were quantified using four point and five-point scales, respectively. Radiological investigations were used to detect recurrence and evaluate the stability and/or fusion.

Data collected on patient characteristics, age, gender, symptoms, histopathology of the tumor, type of the surgery, adjuvant therapies, and complications, and results.. Follow-up ranged from 3 months to 10 years 6 months to 15 years (mean 59.9 months).

RESULTS

Posterior (26), anterolateral (24), retropharyngeal (9), combined (4), lateral (2), and transmandibular approaches (1) were used. Chordomas (n=8) and 17 different types of tumors were encountered. One patient died three weeks post-operatively and 5 died of their disease at follow up. 20 patients had no evidence of disease and 7 patients had recurrent tumors. According to Weinstein-Boriani-Biagini classification, tumor extension into both anterior and posterior columns of a vertebra was correlated with a poor outcome. Incomplete resections resulted in tumor recurrence which warranted subsequent surgeries (up to 9), especially in chordoma cases.

CONCLUSIONS

Complete tumor resection is the oncologically best surgical strategy and should be attempted whenever possible. However, this may not be feasible in every case because of complexity of the cervical spine. In these cases, acceptable mortality-morbidity rates and symptom-free years could be achieved by subtotal resections, even for malignant tumors.

SURGERY FOR KYPHOSIS

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GOAL

Kyphosis as a sagittal spine deformity causes pain and significant disability. The etiology may be ankylosing spondylitis, Scheurmann's disease, Pott's disease, osteoporotic compression fractures. This paper aims to analyse the technique used to correct severe kyphosis by a posterior only surgery.

MATERIALS AND METHODS

Between 1998 and 2008 a total of 44 patients with kyphosis were surgically treated. The reason of kyphosis was ankylosing spondylitis (17 cases), Scheurmann's disease (3 cases), congenital spinal anomalies (12 cases), Pott's disease (5 cases), posttraumatic kyphosis (7 cases).

21 cases with thoracic and lumbar kyphosis were operated with a posterior only approach using wedge osteotomy technique. 3 cases with cervicothoracic kyphosis were operated with an osteotomy in at C7-T1 level, since that level has no problem with vertebral artery. Reduction was achieved with traction and head deflexion.

RESULTS AND DISCUSSION

Significant reduction could be achieved in 37 cases. Neurological deficits did not worsen in patients with preoperative deficits. Hardware failures, loss of correction, CSF leakage and infection were most frequent complications. There were no neurological complications.

Anterior surgery is indicated in thoracic kyphosis more than 70º degrees, and kyphosis with neurologic deficits. A posterior wedge osteotomy is indicated for long curvature thoracic kyphosis, short curvature thoracic kyphosis between 30-70º and lumbar kyphosis more than 20º.

CONCLUSIONS

Kyphosis can easily and effectively be reduced by a posterior only approach in many types of kyphosis. Since they have no nerological deficits, the patients with ankylosisng sponylitis are most suitable for this surgery. In lumbar kyphosis one level wedge osteotomy (especially at L1 or L2 levels) or egg-shell procedure is appropriate. In thoracic kyphosis multilevel wedge osteotomies should be preferred. In cervicothoracic kyphosis an osteotomy at C7-T1 level should be the procedure of choice.

LUMBAR STENOSIS: LAMINECTOMY VERSUS MINIMAL INVASIVE LAMINOTOMY. A PROSPECTIVE ANALYSIS OF 104 PATIENTS

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With increased life expectancy more patients are seen with symptomatic spinal canal stenosis. In the last decade surgery changed to less invasive procedures. However, outcome of more or less invasive decompressions have to prove their advantages to be accepted. To compare laminectomy and minimal invasive laminotomy with bilateral decompression in cross over technique both methods were prospectively analyzed.

METHODS

Between 2005 and 2007 104 patients with mono-level lumbar stenosis were analyzed. Ninety-six patients (48 in each group) could be evaluated up to August 2008. We compared clinical outcome at discharge and 1 year later, blood loss, necessity of drainage, rebleeding, length of surgery, and postop. pain.

Results: Patients of both groups improves substantially after surgery. Blood loss, need of wound drainage (6 versus 42), length of hospital stay (7,4 versus 8,7 days), and back pain (VAS 1 vs 2,15) were significantly less in laminotomies, painless walking distance improved in the early follow-up. At the one year follow-up no difference was seen regarding back pain and claudicatio. Postoperative instability was seen in one case of each group.

CONCLUSIONS

Minimal invasive laminotomy has early advantages due to less invasiveness. However, long term results are very similar demonstrating that decompression is received sufficiently in both groups. Patient benefit from both procedures but in the short term run laminotomy improves by far the patients' comfort.

CHILDHOOD POSTERIOR FOSSA TUMORS

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Compared to adults, much higher percentage of tumors arises at the infratentorial area in children. Medulloblastomas, ependymomas and astrocytomas together in this location comprise almost half of all brain tumors and 90% of the infratentorial tumors in children. They represent far ends of the spectrum in terms of malignancy and natural course, while sharing the common feature variable that the amount of resection being the only significant variable for a favourable prognosis. One exception is diffuse brainstem gliomas are almost exclusively pediatric tumors that make almost 10% of all posterior fossa tumors. They represent one of the very few childhood tumors that surgery has not been to show any role in treatment. They have distinctive radiological appearance in MRI enough to initiate adjuvant therapy without biopsy. A very important detail is to differentiate focal pontine astrocytoma from diffuse form, which comprises 10% of brainstem tumors. Focal pontine astrocytoma is a typically surgical disease, which total resection provides cure. Miscellaneous tumors like hemangioblastomas, gangliogliomas and cavernomas are intra-axial pathologies occasionally found in children as well as extra-axial schwannomas, meningiomas and chordomas. They are cared accordingly as in adults with respect to age related physiological distinctiveness of children.

MRI findings are of great value not only in planning the most appropriate approach, but estimating the pathology and disease state. Utilization of operative microscope and microsurgical techniques prove classical large bone and dural openings unnecessary which save time, minimize blood loss and wound related complications. Postoperative early MRI within 24 hours is essential for future therapy planning and survival assessment.

This presentation will focus on the surgical approach to the various childhood tumors at the posterior fossa based on the experience on more than 600 tumors of different histopathological origin and location. The variety of histological types of tumors has predilections for different compartments of the infratentorial space which makes it more practical to discuss their surgery according to localization rather than the pathology. Special attention will given to specific approaches to common locations and key points unique to childen will be emphasized.