Scientific Meeting of the Belgian Society of Neurosurgery
LEUVEN, PROVINCIEHUIS
Saturday March 18, 2006

Abstracts Book
Intraoperative MRI: Clinical experience and new developments using a low-field mobile system with local shielding

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Keywords: Intraoperative MRI, Neuronavigation, Brain tumors

Introduction: The acquisition of intraoperative magnetic resonance images (iMRI) allows to reevaluate anatomical relationships during resection of brain lesions. We report our clinical experience and developments using a low-field mobile system with local and mobile radiofrequency shielding in a regular operating room.

Methods: Between October 2002 and January 2006, 178 neurosurgical procedures were performed using this system (originally the 0.12 Tesla PoleStar N10, and since January 2004, the 0.15 Tesla PoleStar N20, ODIN-Medtronic/SNT). Since June 2004, we prospectively integrated iMRI images within preoperative planning (Stealth, Medtronic/SNT) whenever available, to evaluate and correct for brain shift during surgery.

Results: 178 procedures were performed using the system. There were 87 craniotomies (49%), 1 stereotactic biopsy, and 90 transphenoidal procedures (51%). A few patients were scheduled for operation with iMRI, but the system could not be used because of limitation with respect of lesion location and/or patient's anatomy. Among the 87 craniotomies, there were 50 primary CNS tumors (57%), 6 craniopharyngiomas, 8 meningiomas, 8 epilepsy surgeries, 4 metastases, and 11 other lesions (schwannomas, teratoma, cavernoma; chordoma, ...). In this setting, the entire regular neurosurgical equipment could be used; only anesthesia monitoring was MR-compatible, because of wires with permanent connection to the patient. Integration of iMRI within the planning performed before surgery, including using PET data, allowed to adapt the surgical planning and procedure in selected cases. Image quality and interpretation, influence on surgery, and limitations of the system will be illustrated and discussed.

Conclusions: iMRI is a new step in the development of neuronavigation. PoleStar low-field system represents a specific design of iMRI. The possibility to use the system with a portable shielding in a standard room represents one more step towards the acceptance of iMRI in the neurosurgical community, especially when integrated in navigation systems.

(Supported by the F.N.R.S., and Tractebel, Belgium)
Direct subcortical stimulation by the use of a monopolar current of an ultrasound aspiration device


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Keywords: Stimulation, Monopolar, Ultrasound, Aspiration device

Introduction: The value of intra-operative direct cortical stimulation is well-documented, whereas subcortical stimulation has been stressed in the last years. Once the cortical mapping performed and the resection of the tumour is initiated, frequent control with subcortical stimulation is needed when dissecting in the vicinity of long tracts in the white matter. In practice, the standard procedure with the bipolar coagulation forceps in one hand and the CUSA[TM] in the other has to be interrupted to permit stimulation with a device, e.g. the bipolar probe of the Ojemann[TM] stimulator. Ideally there should be no interruption in the procedure. Moreover, the current should be applied exactly where the resection will be performed.

Method: Since a monopolar coagulation current is available on some devices of Ultrasonic Aspiration systems it seems obvious to use this probe for stimulation. When coupling the connection to an adapted Monopolar Stimulation Device a current can be applied (e.g. 50 Hz, 1 ms, 1-10 mA). If a motor response is provoked or if speech arrest occurs in object naming in awake patient, i.e. when the probe reaches a distance of some mm from functional white matter tract, the CUSA[TM]-resection is stopped. Simultaneous US-resection and subcortical stimulation are available. There are neither contraindications nor risks to the use of the CUSA[TM] for subcortical stimulation, except the classical side effect of electrical stimulation, c.q. seizure. Up to date we have successfully performed this type of procedure with ongoing corticosubcortical stimulation in more than 50 patients.

Conclusion: The advantages of the CUSA[TM]-subcortical stimulation are obvious: the duration of the procedure is shortened, the stimulation can be applied at any time necessary, particularly in the suspected neighbourhood of long fibre tracts, without changing the tools. The system is accurate, reliable and almost costless if that type of Ultrasonic Aspirator is available.


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Keywords: PET Methionine, Low-Grade Gliomas

Object: To evaluate the contribution of Positron Emission Tomography (PET) images into the image-guided resection of ill-defined low grade gliomas (LGG) in adults.

Methods: PET images using [11C]methionine (Met) were combined to magnetic resonance (MR) images in the navigation planning of 63 navigation procedures for LGG (39F/24M) in which tumor boundaries could not be accurately identified on T2-weighted or fluid-attenuated inversion-recovery (FLAIR) MR sequences for navigational-based resection. Level and distribution of Met uptake were analyzed to define tumor contours allowing to build a PET volume, projected on MR images for navigational-based resection (Pirotte et al., J Neurosurg 104: 238-253, 2006). Maximal tumor resection was accomplished in each case, for removing the entire abnormal metabolic area. Early post-operative MR and PET assessed the quality of tumor resection. Pre- and post-operative analysis of MR and PET images evaluated whether integrating Met-PET data in the navigation planning contributed to improve the tumor volume definition and the tumor resection.

Metabolic information on tumor heterogeneity or extent were useful for planning the surgery. In 80% of the procedures, Met-PET contributed to define a final target volume different from that obtained with MR alone (p=0.002). PET volume did not match MR volume and improved tumor volume definition in 88%. Met-PET helped to focus volumetric resection to hypermetabolic foci (20%) or to extend tumor resection (60%). Tissue samples taken on operative margins left in place showed no residual tumor in all patients in which a total resection of the increased Met uptake was achieved (52% of the procedures).

Conclusions: Met-PET-guidance helped to assess tumor extent and to plan tumor resection better than with MR-guidance alone. PET-guidance helped to increase the amount of tumor removed and to target resection to tumor portions presenting the highest evolving potential. Benefit for the patient's survival and outcome is under study.
Management of patients with brain metastasis in a large consecutive series at the University Hospital Leuven

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Keywords: Brain metastasis

Introduction: Cerebral metastases are the most common brain tumors for already decades. Since actual cancer treatments are capable of prolonging the patient's life, the number of cerebral metastases presented to the neurosurgeon and radiotherapist still continue to increase. The rate of cerebral tumor control, achieved with surgery and/or radiation therapies, and its impact on overall survival are, however, not clear. We conducted a retrospective analysis in order to assess the cerebral and systemic tumor control and whether the overall survival is primarily determined by the cerebral metastases or by primary tumor progression.

Materials and methods: A consecutive series of 220 patients with brain metastasis, presented to the neurosurgical department and, if indicated, treated between January 1996 and July 2005 was reviewed. Demographic findings, pathology and location of the primary tumor, systemic treatment of the tumor, localisation, presenting symptoms and treatment regimens of the brain metastases were abstracted from the patient's charts.

Results: There were 143 men and 77 woman. The mean age was 59 years. There were 101 tumors of the lung, 30 of the breast, 16 of the colon, 15 of the kidney, 13 of the skin and 7 of the oesophagus. In 24 patients the primary tumor was unknown. 14 patients had other malignancies. The mean time between the diagnosis of the primary tumor and the cerebral metastasis was 40 months. Fifty-three percent of patients presented with a focal neurological deficit, 25% with intracranial pressure, 16% with epilepsy and 6% of patients were asymptomatic. The cerebellum was the most affected part of the brain, followed by the parietal and frontal lobes. Twenty-three percent of patients were admitted with bihemispheric metastases. 79 patients underwent surgery and pancranial radiotherapy, 13 were only operated on and 5 received radiosurgery. Radiotherapy alone was performed in 100 patients, 10 patients had a therapy, other than surgery or radiation therapy, and 13 patients were not treated. Systemic tumor progression, rather than local cerebral tumor progression, seemed to be responsible for the actual overall survival.

Conclusion: Although an important referral and treatment bias can be assumed in our consecutive series, our results indicate that a pro-active management of brain metastases, aimed to induce local cerebral tumor control is justified both in terms of overall survival and as a part of the global cancer therapy. Treatment modalities like surgery/radiosurgery with or without radiotherapy result in a fair cerebral tumor control, which is an important element in maintaining the quality of life in these patients, in which overall survival primarily seems to be dependent on the systemic tumor control. Whether or not pancranial radiotherapy adds a substantial advantage to only local therapies, in terms of local tumor control and overall survival still is an ongoing debate, currently being addressed in a randomised EORTC trial.
Two step surgery for large intracranial tumors

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Keywords: Two step surgery

Introduction: Many large intracranial tumors are considered to be inoperable at the first look because of their size and their location in the neighbourhood of major neurovascular structures. In these selected cases it is important not to remove these pathologies in an one step surgery, but to plan a two step surgery in order to prevent or to minimalize permanent morbidities of the cranial nerves and vascular structures. Pre-operative decision making is therefore evenmore important than the surgery itself, not to only to save life of the patient but to make this life also more comfortable.

Methods: Out of our series, we present some clinical cases with different histopathologies:
- Giant meningioma of the skullbase right side with large intracranial portion and presenting only with headache, no other symptoms in a 26 year old lady.
- Large epidermoid involving the optochiasmatic cisterns and widely expanded to the infratantorial area and foramen magnum only with a small hearing loss in a young 31 year old male
- Giant pituitary tumor with huge suprachiasmatic expansion in a 46 old female presenting with only small visual deficit at left eye and hormone disturbancies.
- Giant low grade chondrosarcoma of clivus in a 49 year old male presenting with persistent headache, hemiparesis and gait ataxia

Conclusion: We present 4 cases to illustrate that two step surgery is an excellent option and a strategy in surgical removal of large intracranial tumors in order to prevent severe morbidities to the neurovascular structures, especially in large pathologies located at the base of the skull.
PET-related metabolic response of glial tumors after Gamma Knife radiosurgery

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Keywords: Glioma, PET-scan, Radiosurgery, Gamma Knife

Objective: To evaluate the metabolic response of cerebral gliomas after Gamma Knife radiosurgery (GKR).

Material & Methods: Between December 1999 and December 2004, 55 patients were treated by GKR in our center for a cerebral glioma using a combination of MR and PET guidance. One or multiple PET-scan were performed in the clinical follow-up for 38 patients, including 16 patients with a low-grade glioma (LGG) and 22 patients with a high-grade glioma (HGG). The PET radiotracer was FDG for 13 patients (including 10 patients with HGG) and methionine for 25 patients (including 13 patients with LGG). We analyzed the relation between modifications in the uptake of PET radiotracer after radiosurgery, histology and the volumetric and dosimetric parameters of the GKR procedure.

Results: One to 10 serial PET-scan were acquired during the follow-up of those patients, ranging from 3 months to 5 years (mean: 14 months). The PET-related metabolic activity of the tumor reduced significantly for 21 patients (55%), remained stable for 6 patients (16%) and increased for 11 patients (29%). Significant changes of tumor metabolism after GKR were more frequent with the use of methionine than FDG (64 vs 38%, respectively). For some patients, we have registered an initial reduction of tumor metabolism after radiosurgery, followed by an increase in metabolism. No statistically significant relation was found between histology, volumetric and dosimetric parameters of the radiosurgical procedure and the metabolic response of the tumor. For all patients, failure of tumor control occured by an increase in glioma metabolism assessed by PET prior to apparition of signs of tumor growth on MRI.

Conclusion: PET-scan can help in the follow-up of patients with LGG and HGG after GKR. The metabolic response seems not to be related to any volumetric or dosimetric parameters of the GKR procedure.
Direct Relationship between the Duration of Temozolomide Treatment and the Duration of the Survival of Immunocompromised Mice Orthotopically Grafted Into Their Brains with the 1p19q Non-Deleted U373 Human Glioblastoma

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**Keywords:** Glioblastoma, Temozolomide, Apoptosis, Autophagy

Object: Malignant gliomas, and especially glioblastomas (GBMs), are associated with a dismal prognosis because they diffusely infiltrate the brain parenchyma and because migrating malignant glioma cells are resistant to apoptosis, thus to pro-apoptotic cytotoxic drugs. The pro-autophagic drug temozolomide (TMZ) is able to kill apoptosis-resistant malignant glioma cells. TMZ contributes higher therapeutic benefits in GBM patients when it is administered during radiotherapy than at the moment of the tumor relapse. We therefore investigated at the experimental level whether the duration of TMZ treatment directly impacts on the survival of immunocompromised mice bearing human U373 GBMs into their brains.

Methods and Results: The U373 model is of astrocytic origin and 1p19q non-deleted. The 1p19q deleted Hs683 malignant oligodendroglialoma model has been chosen as a positive control. The data show that the U373 model is resistant to pro-apoptotic cytotoxic insults, while it is sensitive to the TMZ-induced pro-autophagic insults. The in vivo duration of TMZ treatment relates directly to the therapeutic benefits contributed by this drug in the human U373 orthotopic xenograft model. In addition, the sooner the TMZ treatment begins, the higher the survival rates are.

Conclusion: Temozolomide is a pro-autophagic drug that therefore overcomes, at least partly, the problem of resistance to apoptosis observed in migrating glioblastoma cells. Temozolomide, which is a well-tolerated orally active drug, could therefore be administered in each individual glioblastoma patient who is candidate for such a treatment i) as soon as radiotherapy begins and ii) as long as no adverse effects are observed in each patient on an individual basis.
Long-term Outcome of Epilepsy Surgery among 399 Patients with Non-lesional Pathology including Mesial Temporal Lobe Sclerosis


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Keywords: Epilepsy surgery, Outcome, Gliosis, Mesial temporal lobe sclerosis, Long-term

Objective: We reviewed the long-term outcome of focal resective surgery in a large consecutive group of patients from a single institution with intractable partial non-lesional epilepsy, including mesial temporal lobe sclerosis, to evaluate the long-term efficacy of epilepsy surgery and the preoperative factors associated with seizure outcome.

Methods: This retrospective analysis included 399 consecutive patients who underwent epilepsy surgery at Mayo Clinic (Rochester, MN) between 1988 and 1996. The average age of patients at surgery was 32.12 (SD) years (range, 3-69) and at seizure onset was 12.11 years (range, 0-55). There were 214 (54%) females and 185 (46%) males. Their mean duration of epilepsy was 20.12 years (range: 1-56). Of our patients, 237 (59%) had a history of complex partial seizures, 119 (30%) had a history of generalized seizures, 26 (6%) had a history of simple partial seizures, and 17 (4%) had a history of a combination of these. Preoperative evaluation included a routine and video-electroencephalogram (EEG) recordings, MRI head seizure protocol, neuropsychological testing, and sodium amobarbital study. Patients with undefined epileptogenic focus and discordant preoperative studies underwent an intracranial study. The mean duration of follow-up was 6.2.4.5 (range, 0.6-15.7). Seizure outcome was classified based on the modified Engel classification. Time to event analysis was performed using Kaplan-Meier curves and Cox regression models to evaluate the risk factors associated with outcomes.

Results: Among these patients, 372 (93%) had temporal and 27 (7%) had extratemporal resection of their epileptogenic focus. Histopathological examination of the resected specimen revealed mesial temporal lobe sclerosis in 113 (28%), gliosis in 237 (59%), and normal histopathology in 49 (12%). Based on the Kaplan-Meier analysis, the probability of Engel Class I outcome (seizure-free, auras, or seizures only related to medication withdrawal) for the overall patient group was 81% (CI: 0.77-0.85) at six months, 78% (CI: 0.74-0.82) at one year, 76% (0.72-0.80) at 2 years, 74% (CI: 0.69-0.78) at 5 years, and 72% (CI: 0.67-0.77) at 10 years postoperatively. The rate of class I outcome remained 72% for patients (N=73) with more than 10 years of follow-up. If a patient was in class I at one year postoperatively, the probability of seizure remission at ten years postoperatively was 92% (CI: 0.89-0.96); almost all seizures occurred during the first year following surgery. Factors predictive of poor outcome from surgery were normal tissue pathology (p = 0.038), male gender (p = 0.035), history of previous surgery (p<0.001), and an extratemporal origin of seizures (p < 0.001).

Conclusions: The response to epilepsy surgery during the first follow-up year is a reliable indicator of the long-term Engel class I operative outcome. This finding may have important implications for patient counseling and postoperative discontinuation of anticonvulsant medications.
Nonlesional central lobule seizures: use of awake cortical mapping and subdural grid monitoring for resection of seizure focus


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Keywords: Epilepsy, Central lobule, Awake craniotomy, Cortical mapping

Object. Surgical treatment options for intractable seizures caused by a nonlesional epileptogenic focus located in the central sulcus region are limited. The authors describe an alternative surgical approach for treating medically refractory nonlesional perirolandic epilepsy.

Methods. Five consecutive patients who were treated between 1996 and 2000 for nonlesional partial epilepsy that had originated in the central lobule were studied. The patients’ ages ranged from 16 to 56 years (mean 28.6 years; there were four men and one woman). The duration of their epilepsy ranged from 8 to 39 years (mean 20.2 years), with a mean seizure frequency of 19 partial seizures per week. Preoperative assessment included video electroencephalography (EEG) and subtracted ictal-interictal single-photon emission computerized tomography coregistered with magnetic resonance imaging (SISCOM). Patients underwent an awake craniotomy stereotactically guided by the ictal EEG and SISCOM studies. Cortical stimulation was used to identify the sensorimotor cortex and to reproduce the patient’s aura. A subdural grid was then implanted based on these results. Subsequent postoperative ictal electrocorticographic recordings and cortical stimulation further delineated the site of seizure onset and functional anatomy. During a second awake craniotomy, a limited resection of the epileptogenic central lobule region was performed while function was continuously monitored intraoperatively. One resection was limited to the precentral gyrus, two to the postcentral gyrus, and in two the excisions involved regions of both the pre- and postcentral gyri.

Results. In three patients a hemiparesis occurred postsurgery but later resolved. In the four patients whose resection involved the postcentral gyrus, transient cortical sensory loss and apraxia occurred, which completely resolved in three. Two patients are completely seizure free, two have experienced occasional nondisabling seizures, and one patient has benefitted from a more than 75% reduction in seizure frequency. The follow-up period ranged from 2 to 5.5 years (mean 3.5 years).

Conclusions. A limited resection of the sensorimotor cortex may be performed with acceptable neurological morbidity in patients with medically refractory perirolandic epilepsy. This procedure is an alternative to multiple subpial transections in the surgical management of intractable nonlesional epilepsy originating from the sensorimotor cortex.
Alteration in expression of connexin subtypes may play a role in human mesial temporal lobe epilepsy

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Object: The causes of epileptic events remain unclear. Numerous in vitro and in vivo experimental evidence suggests that gap junctions formed by connexins between neurons and or astrocytes could contribute to the generation and maintenance of seizure. However, in humans few experiments have been made and have shown controversial data. Our study was designed to compare the level of expression of connexins in hippocampi from epileptic and non epileptic patients in order to assess if an alteration of gap junction expression in epileptic tissue could play a role in seizure origin and propagation.

Methods: Expression of connexins 32, 36 and 43 was studied in 47 consecutive samples of hippocampi obtained from epileptic patients who had an amygdalohippocampectomy performed for treatment of intractable seizure. It was compared with the connexin expression in non epileptic patients hippocampi obtained after postmortem dissection. Immunostaining was performed to create one slide for each of three connexins. Each slide had multiple cells from each of six regions (CA1, CA2, CA3, CA4, dentate, subiculum). Two independent reviewers rated each connexin-region combination according to the German immunoreactive score (IRS).

Results: Across all three measures, Cx 32 appears to be expressed significantly less in the epilepsy patients compared to the controls (each \(<0.001\)) while Cx 43 appears to be expressed more among the epilepsy patients (each \(<0.001\)). We did not find evidence of differential expression of Cx 36. There was, however, regional variation within each connexin. For Cx36, SI was higher in the CA2 region among the epilepsy group.

Conclusions: Increase of Cx43, loss of Cx32 expression and preservation of C36 expression in epileptic hippocampus could play a role in seizure developed by patients with temporal sclerosis. Further studies must be completed to better understand this mechanism.
Recombinant AAV serotype 1 as vector for gene transfer in rat striatal fetal graft: An in vitro and in vivo study

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Keywords: Huntington's disease, Graft, Gene therapy

Introduction: Huntington's disease (HD) is an inherited autosomal dominant neurodegenerative disorder affecting 10/100000. The major symptoms of the disease are progressive dementia, various psychiatric disorders, and abnormalities of movement, emotion and cognition. Although, the mechanisms of selective striatal degeneration are intensively studied, current pharmacological therapies are not efficient and do not prevent disease progression. Fetal striatal grafts have demonstrated their efficiency in animal models of HD. Nevertheless, the first experimental clinical studies suggest a gradual loss of graft viability and/or disease progression. Neurotrophic factors (NF) could be used to protect both patient's and grafted cells.

Material and methods:

i) Detection of transgene expression. The efficiency of rAAV1 as vector for gene transfer into ganglionic eminence (GE) has been evaluated using the eGFP (green fluorescent protein) reporter gene.

ii) Cell culture. Primary embryonic (E15) and postnatal (Day 3) striatal primary cultures were obtained by dissection of GE, dissociation and seeding in serum-free medium. Cells were infected by rAAV1-eGFP and further cultured. Transduced, GFP-positive cells were evidenced by native fluorescence.

iii) Transplantation. Fragments of E15 embryonic GE (~1mm3) were infected, trypsinized and transplanted in the striatum of healthy adult rats. Two months posttransplantation, brain sections were analyzed by immunofluorescence.

Results: In postnatal and embryonic striatal cells cultures, early and sustained transgene expression has been observed (3 days to 3 weeks). After transplantation of rAAV1-infected embryonic GE in the striatum, 22% of the grafted cells expressed GFP for at least 2 months. The majority (more than 90%) of the cells expressing the transgene (GFP-immunoreactive) in the graft were colabelled with NeuN suggesting a neuronal nature.

Conclusion: Our data suggests that rAAV-serotype 1 vector constitutes an interesting tool for gene transfer into fetal grafts in order to provide efficient and sustained in situ delivery of neurotrophic factors (NF).
Anterior capsulotomy for OCD - could a unilateral right-sided approach suffice

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Keywords: Anterior capsulotomy, Obsessive compulsive disorder

Introduction: Anterior capsulotomy (AC) has a success rate of about 64% in otherwise intractable obsessive compulsive disorder (OCD), but it can produce side effects such as persistent fatigue, apathy, executive problems, and weight gain. We report on an observation that could be consistent with a more selective approach and potentially less side effects.

Methods: A 33-year-old patient with OCD since the age of 11 was considered to be a good candidate for AC. He scored 18/20 points for obsessional thinking and 18/20 points for compulsive activity on the Yale-Brown obsessive-compulsive scale (Y-BOCS). Stereotactic surgery was performed on the awake patient, starting with his right side. High-frequency test stimulation was applied to the basal part of the anterior limb of the right internal capsula (IC) and produced a reversible reduction of the long-standing anxiety. With subsequent AC using thermocoagulation, anxiety vanished. When the procedure was continued on the left side and high-frequency stimulation was applied to the anterior limb of the left IC, this test generated a reappearance of anxiety in a reproducible manner. AC was therefore not performed on the left side.

Results: CT and MRI confirmed the unilateral lesion. Short-term follow-up showed a significant improvement, with the patient scoring 5/20 points for obsessional thinking and 7/20 points for compulsive activity according to the Y-BOCS.

Discussion: Being described in 1949, AC has been performed bilaterally since decades. In one study on the outcome of bilateral AC, the notion was raised of a common anatomical denominator in the right-sided internal capsula as a condition for successful treatment of OCD [Lippitz B et al., 1999]. This notion was, however, challenged with respect to bilateral AC in the treatment of refractory anxiety [Ruck C et al., 2005].

Conclusion: This observation is an incentive to first explore the effect of AC on the right side and to possibly renounce on lesioning the left side.
Implantation of surgical electrodes for spinal cord stimulation: comparison of classical midline laminotomy technique versus a minimal invasive unilateral technique concerning postoperative outcome

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**Keywords:** Spinal cord stimulation, Surgical techniques

**Background:** Surgical electrodes for spinal cord stimulation (SCS) have technical advantages towards percutaneous electrodes. The disadvantage however is the surgical procedure and its postoperative consequences. A minimal invasive technique should try to reduce these disadvantages. This prospective study compares ten patients in the minimal invasive unilateral technique (MIT) group to ten patients in the classical midline laminotomy (CML) group for electrodes at thoracic level.

**Methods:** In both groups postoperative wound pain was measured by an independent observer using the VAS score on the first and third day after electrode implantation. Length of hospital stay was compared. Patients were asked (on the third day) if they would, if necessary, undergo the same procedure again.

**Results:** The CML group had a mean VAS score, concerning local post-implantation pain, at the first day of 4 (3-6) and at the third day of 3 (2-6). The MIT group had a mean VAS score at the first day of 2.3 (1-3) and at the third day of 1.6 (1-3). In the MIT group, 90% would undergo the procedure again, against 70% in the CML group. Hospital stay in the MIT group was 3.2 days versus 4.1 days in the CML group.

**Conclusion:** The minimal invasive unilateral technique for implantation of electrodes at thoracic level has advantages to classical midline laminotomy. Less local discomfort the first days and shorter hospital stay. In a combination with spinal (intrathecal) anaesthesia, the MIT combines the advantages of a fully awake implantation procedure, less postoperative discomfort and a surgical electrode.
A comparative study between anterior cervical discectomy-fusion and cervical disc replacement

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Keywords: Cervical, Arthroplasty, Fusion

Cervical arthroplasty is gaining acceptance for treatment of cervical disc disease (CDD). We retrospectively compared short term efficacy and side effects of fusion versus arthroplasty. We reviewed 6 months postoperatively two series of CDD patients, 46 treated with anterior cervical discectomy and fusion (ACDF) (Group A), and 18 with Prodisc-C arthroplasty (Group B). In Group A, mean age was 43, 52% men, 48% women. One level was treated in 86%, and two in 14%. The operated levels were C3C4 (2%), C4C5 (8%), C5C6 (52%) and C6C7 (38%). In Group B, mean age was 41, 39% men, 61% women. One level was treated in 89%, and two in 11%. The operated levels were C3C4 (15%), C4C5 (10%), C5C6 (40%) et C6C7 (35%). 4/18 patients were operated for adjacent level disease. Prosthesis height was 5 mm (75%) or 6 mm (25%).

Surgery took 90' in group A, and 120' in group B. Mean length-of-stay was 4 days in both groups. Results 6 months after surgery were classified as excellent, good, fair or poor. There was no infection, neurological morbidity nor mortality in any group. Group A results were excellent in 38 patients (83%) and good in 5 (11%). Three (6%) had poor or fair results. There were one transient laryngeal palsy (2%), 3 transient dysphagias (15%) and one prevertebral hematoma.. Cage subsidence occurred in 7 patients always asymptomatic and with titanium cages. Group B results were excellent in 16 patients (89%). Two (11%) had a fair evolution (one shoulder freezing and one algodystrophy). One had transient dysphagia (5%). Mean postoperative prosthesis mobility was 13.5°. No prosthesis subsidence or migration was observed.

We concluded that both ACDF and Prodisc-C arthroplasty are safe and provide excellent results. A longer follow-up of the arthroplasty group is needed to assess prevention of adjacent level disease.
Cervical Arthroplasty with the Bryan Disc: 4-year results

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Keywords: Arthroplasty, Spine, Cervical

Purpose of the Study: Cervical arthroplasty is a new technology for treating degenerative diseases of the cervical spine. However, no long-term clinical and radiological data is available at this time.

Methods: From 2000 to 2004 a European multi-center prospective clinical trial with the Bryan cervical artificial disc was carried out. One hundred and three patients were included in the single-level and 43 in the bi-level study. According to the protocol, the study was concluded after a 2-years follow-up period. Consequently a post-market prospective long-term study was initiated in Leuven, Belgium: this new study consisted out of those Leuven-patients, that were already included in the first multi-center study, as well as a consecutive series of patients who were also operated upon in Leuven after termination of the inclusion period for the first trial. The eventual inclusion of patients in this post-market study was terminated end of December 2002. Sixty-three patients already passed for their 4-years follow-up examination (January 7, 2006): 55 single-level and 8 bi-level patients.

Results: According to the Odom's criteria 34 of the single-level cases had an excellent outcome at 4 years, 15 a good, 5 a fair and 1 a poor: this last patient developed multiple sclerosis. Five of the bi-level patients had an excellent outcome, 3 had a good outcome. From a radiological viewpoint motion was preserved in 45 single-level patients (81.8 %). For the bi-level group motion was preserved at the cranial level in all 8 patients and at the caudal level in 5 patients. At 4-years follow-up paravertebral ossification was detected on plain X-rays in 13 patients of the single-level group (23.6 %) and at 6 out of the total of 16 disc levels of the bi-level group. However, only 4 single-level patients and 1 disc of the bi-level patients lost motion due to this paravertebral ossification. Anti-inflammatory medication was only rarely used at the time all these patients with now 4-years follow-up were operated upon. At baseline 22 single-level patients had no disc degeneration at adjacent levels: only 1 of these 22 cases developed any adjacent level degeneration at 4 years. Thirty-three one-level patients had already preoperatively more or less disc degeneration at adjacent levels: 17 of these patients had no additional adjacent level-arthritis at 4 years, whereas 16 developed some additional degeneration at 1 of these levels. For the bi-level cases there was at baseline no arthrosis at adjacent levels in 7 cases: 6 remained without adjacent level disc degeneration at 4 years, whereas 1 developed some arthrosis. The only patient who had preoperatively already some degeneration at an adjacent level, presented with an increase of this degeneration at 4 years.

Conclusions: This data is a first indication that the concept of preventing acceleration of adjacent level degeneration - as seen with ACDF's - by using an artificial disc according to Bryan might hold true.
Minimally invasive decompression versus classical anterior transposition for ulnar nerve entrapment: A prospective study in 61 patients

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Keywords: Ulnar nerve, Minimally invasive decompression, Anterior transposition

Introduction: In recent years, neurosurgical literature has re-evoked the discussion about the adequate treatment of ulnar nerve entrapment. Numerous articles have discussed the pros and cons of anterior nerve transposition. Because of great interest in peripheral nerve surgery in our center, we were interested in evaluating our own clinical results and in comparing multiple techniques for ulnar nerve decompression.

Material and methods: In January 2003 we started to perform ulnar nerve decompression surgery through a minimally invasive incision and without transposition, including twenty-five consecutive patients in a one-year follow-up series. The following year we re-performed the classical anterior nerve transposition in thirty-six consecutive patients. Pre- and postoperative pain, paresthesia, hypoesthesia and muscle strength were scored with visual analogue scales and descriptive scores. The nature and number of complications, overall satisfaction, professional repercussions and recurrence rates were also reviewed by means of medical charts, telephone inquiries and fill-out forms.

Results: In comparing minimally invasive and classical surgery, we found a comparable decrease of VAS for PAIN (-3.52 vs 3.17) and paresthesia (-4.24 vs -4.26). The VAS for hypoesthesia decreased more with the minimally invasive procedure (-6.66) than with classical surgery (-5.42). Regaining muscle strength was comparable in both groups (VAS +3.64 vs +3.0). Complication rates were not significantly different, neither were postoperative professional repercussions.

Conclusion: Analysis of postoperative neurological function, complication rates, patient satisfaction and professional repercussions could not detect significant differences between both techniques, suggesting that anterior transposition of the nerve might not be essential to treatment. Both techniques have their pros and cons and can be considered in each patient.
Initial outcome and efficacy of kyphoplasty in the treatment of painful osteoporotic vertebral compression fractures

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Keywords: Kyphoplasty, Osteoporosis, Vertebral Fracture, Pain

Introduction: Kyphoplasty is emerging as a new treatment option for osteoporotic vertebral fractures. As compared to vertebroplasty, it appears to potentially better restore vertebral body height and to decrease the risk of pulmonary embolism and bony cement leakage into the vertebral canal, although some authors have described an increased risk of new adjacent vertebral fractures. We present the results of kyphoplasty in 32 consecutive fractures.

Material and Methods: Between October 2003 and January 2006, 26 patients were treated for 32 osteoporotic vertebral fractures. Preoperative dorsolumbar radiography and CT have been systematically performed, scintigraphy and MRI if needed. Age, sex, pain outcome using the 10 point visual analog scale (VAS), vertebral body height restoration, deformity correction calculated by the Cobb angle, hospitalisation duration, delay between fracture and treatment, complication such as pulmonary embolism or bone cement extravasation were evaluated.

Results: The mean age was 77 years (53 to 90 years). The levels treated were distributed from D8 to L4. Average inpatient hospitalisation was 2.5 days. Mean duration of symptoms before treatment was 45 days (4 to 180 days). Pain control was evaluated as excellent in all patients. All could be mobilized on the first day postoperatively. In 70 % of the treated vertebrae, kyphoplasty restored 47 % of the lost height. The results were better if the procedure was done before 3 months. The mean deformity correction evaluated by the difference between the preoperative and postoperative Cobb angle was 9.7 degrees. No complications, such as bone cement extravasation, pulmonary embolism and neurological deterioration, were encountered. No fractures in adjacent vertebral segments were seen.

Conclusion: Kyphoplasty is a safe and efficient technique for pain control in osteoporotic fractures. Our data confirms recent literature which shows this technique to be associated with a very low percentage of cement leakage and pulmonary embolism. In addition, we did not encounter any supplementary fractures in adjacent segments. Body height restoration and deformity correction are less effective if kyphoplasty is performed after 3 months. Pain control is always excellent, even if the procedure is performed late. The costs of the procedure must be balanced with the cost of conservative treatment, complications of alternative techniques, and complications of the disease.
Local Cerebral Ischemia Induced By Brain Retraction During Craniotomy, Monitored By Cerebral Microdialysis, Comparing Pterygional To Supra-Orbital Approach

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Keywords: Ischemia, Brain Retraction, Microdialysis

Background and Goal of study: Brain retractors inserted during craniotomy are known to induce local changes in cerebral perfusion by applying local pressure to brain tissue under the retractors. Cerebral microdialysis (MD) is a recently available tool for monitoring local cerebral metabolism and ischemia. Previous results already indicated that MD revealed significant changes, of clinical relevance, in local metabolism in the brain area under the retractor.

Materials and Methods: With IRB approval, 18 pts scheduled for large tumor resection by pterygional approach (P group) received peroperative MD. Their results were compared tot 4 pts scheduled for surgery by supra-orbital approach (S group). In both groups, after opening of the dura, the MD catheter was inserted into the brain cortex and was perfused at 5µl/min enabling analysis (for glucose, lactate, pyruvate, glycerol and glutamate) of the dialysates every 3 min. A brain retractor was finally applied for the period of tumor resection above the area of MD catheter insertion.

Results and Discussion: In both groups, insertion of the brain retractor, resulted in a overall decrease in local glucose concentration, most probably reflecting a decrease in local perfusion. In 10 P-patients, there was a further progressive and marked decrease in glucose during brain retraction. In these 10 pts, we observed an increase in local lactate concentration. In 6 of these 10 patients, we also observed an increase in lactate/pyruvate ratio, revealing the development of local cerebral ischemia under the retractor. All these 6 episodes also revealed a large increase in glycerol, a sign of ongoing cerebral cell death. In one patient, these metabolic ischemic events were observed 15 min before any neurosurgical warning sign (extensive brain bulging) occurred. In this case, replacement of the retractor resulted in an immediate normalization of all parameters. Only in the last pt, an extensive increase in glutamate was observed. Postoperative outcome was uneventfull for all pts, except for this last one.

In 1 S-pt we found an increased lactate/pyruvate ratio, without any significant changes in glycerol. In the other 3 pts, we did not find any significant change in lactate, pyruvate, glycerol or glutamate.

Conclusion(s): Use of MD during routine brain retraction revealed the possible presence of pronounced local cerebral ischemia under the retractor. Peroperative use of high flow MD, enabling almost on-line metabolic monitoring of brain tissue under the retractor, might be a valuable tool to compare the intracerebral effects of different approaches, e.g. pterygional vs supra-orbital approach.
Variants of the basal vein of Rosenthal and perimesencephalic nonaneurysmal haemorrhage

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Keywords: Basal vein of Rosenthal, Perimesencephalic hemorrhage, Subarachnoid hemorrhage, Angiography

Background and Purpose: The cause of a perimesencephalic nonaneurysmal subarachnoid hemorrhage (PMH) is not known. Earlier studies reported a possible contribution of a primitive variant of the basal vein of Rosenthal (BVR) in the pathogenesis of PMH. We compared the variants of BVR between patients with PMH and aneurysmal subarachnoid hemorrhage (SAH) by studying the venous phase of the digital subtraction angiography (DSA).

Methods: Two observers reviewed the DSAs of 59 patients with PMH and 59 patients with SAH. The variants of BVR were classified into: (1) normal continuous: BVR is continuous with the deep middle cerebral vein and drains mainly to the vein of Galen (VG); (2) normal discontinuous: drainage anterior to uncal veins and posterior to VG; (3) primitive variant: drainage to other veins than VG.

Results: 118 patients were enrolled with a mean age of 49 +/- 12 years. There were 31 males and 28 females in both groups. Patients with PMH were older than patients with SAH (52 versus 46, p=0.01). Primitive variants were found in 21% on the left side, and 29% on the right side (p=0.27). There was no association between PMH and the presence of a primitive variant on the left (25% in PMH versus 19 % in SAH, p=0.65) or on the right side (31% in PMH versus 30% in SAH, p=0.92) in univariate analysis. After correction for age and sex, variants on neither side were associated with PMH (OR 1.4 , p=0.53 for left variants, OR 1.2 , p=0.67 for right variants).

Conclusions: In this large controlled study we were unable to confirm a contribution of a primitive variant of the basal vein of Rosenthal in the pathogenesis of PMH.
Selective image-guided surgical exposure of the transverse sinus for direct transvenous embolization of dural arteriovenous fistula: Technical case report


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Keywords: Dural arteriovenous fistula, Craniectomy, Endovascular, Percutaneous

Introduction: We report the technique of selective image-guided craniectomy (SIGC) for percutaneous transvenous embolization of dural arteriovenous fistula (DAVF).

Clinical presentation: This 58-year-old woman presented a sudden deep coma. CT showed a right-sided cerebellar hematoma with acute hydrocephalus. Emergency surgical drainage had to deal with abnormal bleedings. MRI demonstrated abnormal vessels suggesting a DAVF. Angiography confirmed a left transverse sinus DAVF, fed by branches from the left vertebral artery, left internal and left external carotid arteries, draining into the transverse sinus with retrograde flow in cortical veins. Transvenous retrograde embolization was impeded by internal jugular vein thrombosis and torcular septa. During the same anaesthetic session, a 5-centimeter selective MR-guided craniectomy shaped according to the left transverse sinus was tailored with high-speed drill. The bone outside the dural sinus boundaries was left in place but make thinner. Thereafter, back in the angiography room, the transverse sinus was taped and coiled resulting in a complete exclusion of the DAVF.

Discussion: Transcranial approaches for trans-sinus endovascular therapy have been sporadically reported. Large craniectomies were generally recommended. Indeed, small or incorrectly placed craniectomies did not necessarily allow the needle angulation needed to access the DAVF. Puncture should also be distal to the DAVF to permit dense packing with coils. Larger craniectomies carries a risk of post-embolization extradural hematoma, reduced by delaying the endovascular procedure of 1 week for subcutaneous fibrosis. Our SIGC technique permits to obtain a selective sinus exposure. Leaving bone beside the sinus prevents a parenchymal traumatic puncture. This bone has nevertheless to be drilled to allow an adequate sharp puncture angle. Moreover, postoperative hematoma is prevented by the small bone opening, the natural adherence of the dura matter and the possibility of direct compression.

Conclusion: IGSC is efficient and safe for direct percutaneous transvenous embolization of DAVF in a single anesthetic session.
Neuropsychological and radiological evolution in patients harboring unruptured intracranial aneurysms treated using surgical clipping versus endovascular embolization

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Keywords: Unruptured intracranial aneurysm, neuropsychological outcome, radiological damage area

Introduction:
There are few data in the literature comparing the neuropsychological and radiological outcome of patients harboring unruptured intracranial aneurysms (UIA) that were treated by endovascular embolization (EE) or surgical clipping (SC). The use of the Glasgow Coma Scale (GCS) score for assessment of the treatment outcome of patients with subarachnoid haemorrhage (SAH) is relatively insensitive to disability and the use of other validated scales in the assessment of aneurysm outcome is more frequent nowadays, but the time of the evaluation after therapy has not been standardized. In 1998 a published series confirmed a cognitive decline after EE or SC as measured by Mini Mental Status Examination (MMSE) ranging from 5.5% in the subgroup of patients without prior SAH to 9.6% in the subgroup of patients with previous SAH. In our own published series which included patients with and without previous SAH, a permanent morbidity rate of 7.5% was observed in patients treated by EE versus 1.5% for those treated by SC, with the significant reserve that MMSE was not performed pre and postoperatively in our patients.

Objective:
Our objective is to prospectively evaluate the neuropsychological and radiological outcomes in patients harboring UIA after treatment using SC versus EE.

Patients & Methods:
45 patients with at least one UIA were included in this study: 12 patients were treated by EE (12 aneurysms), and 33 patients by SC (40 aneurysms). Six patients were excluded from the study either because it was impossible to perform magnetic resonance imaging (MRI) (3 patients) or no treatment was carried out (3 patients). EE is preferred if the fundus/neck ratio (F/N) is greater or equal to 2.5 and the neck size is less than 4mm. SC is proposed only if complete EE seems unlikely or when EE failed (stable occlusion being less than 95%). Patients in the SC group were operated on under mild hypothermia (33°) and burst suppression. All patients had an MRI before and 48 hours after the procedure. The post-therapeutic MR status was compared by quantifying the newly appeared damage areas on both the diffusion weighted (DW) and the T2 weighted images. Lesion volume was calculated by manual planning contouring. A double-blind clinical evaluation using the Modified Rankin Scale (MRS) score and MMSE score was performed in all patients before and after (9 days, 6 months) the treatment by an independent investigator (a neuropsychologist).

Results:
The preliminary MRI results showed that 4 patients in the EE group had a newly appeared damage area on T2 and DW images, and 7 patients in the SC group. The unique case of death (8%) was recorded in the EE group after bleeding during the procedure followed by severe vasospasme. Two (16%) patients had permanent deficits in the EE group (slight right hemiparesis, cerebellar disorders) and one had a transient deficit (slight SAH). In SC group two patients had transient deficits (left diplopia, CSF fistula) and none permanent. No death occurred in the SC group. In both groups none of patients had MMSE or MRS changes after the procedures.

Conclusion:
Our preliminary results confirm that, in our group, patients with UIA treated by SC presented a better clinical outcome than patients treated by EE, but there were no difference concerning the neuropsychological status for both techniques.
Spontaneous spinal epidural hematoma: A pediatric case report


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Keywords: Spontaneous hematoma, Tetraparesis, MRI, Laminotomy

Background: Spontaneous spinal bleeding is a rare entity in pediatric neurosurgical practice. A few case reports are been described in the literature, majority of them presenting patients with spectacular neurological deficits as tetra-or paraparesis. Not much is known or published concerning the pathophysiology causing the bleeding. Previous reports recommend urgent surgical decompression (within 48 hours).

Method: We report a 14-years-old boy presenting with fluctuating degree of paraparesis started short after an acute pain in the cervical region during teeth brushing. Amazingly, at the pediatric emergency department no objective neurological signs were found. The patient developed a tetrapareses with global loss of sphincter control within the first 24 hours after his admission. A spontaneous epidural cervical spine hematoma (C5-D1) was diagnosed after carrying out an urgent CT and MRI scan. Before taking the patient to the operation theatre, an angiographical exam of the medullary vessels was performed. An AVM or other vascular malformations were excluded. Laminotomy from C5 to D1 with epidural clot evacuation was done. Six months later, the patient is able to walk independent with normal upper extremity function. Physiotherapy is still going on in order to achieve a full recovery of leg weakness and bladder problems.

Conclusion: No underlying condition was diagnosed to explain the spontaneous spinal epidural hematoma. Treatment is on decompressive surgical basis.
Spontaneous extradural hematoma associated with pansinusitis: Case illustration


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Keywords: Extradural hematoma, Pansinusitis

Importance: The most important cause of spontaneous extradural hematoma is coagulation disorders, dural vascular malformation and infection. To the best of our knowledge, a connection with sinusitis has only been reported four times.

Clinical presentation: A 14-year-old female with no history of trauma had mild fever and nausea one day before admission. The night prior to admission she developed a headache and started vomiting. On admission, she was fully alert with no neurological deficiency. The patient’s temperature was 38.8 °C, the white cell count was elevated at 21,600/mm³ with markedly raised C-reactive protein at 260. Amoxicillin-Clavulanate treatment was initiated. The next day right periorbital edema was observed. CT-scan revealed a right frontal extradural hematoma with a slight shift of midline structures; fluid was also noted in the sinuses. There was no evidence of skull fracture or bony defect.

Technique: A craniotomy was performed and a hematoma was evacuated. The frontal bone was intact, but the dura was thickened and a sample was obtained. No pus was seen. A Functional Endoscopic Sinus Surgery was performed after the neurosurgical intervention. Microbiological examination of the extradural hematoma, the sinus mucosa and the pus from the air sinus all revealed Streptococcus anginosus. Ceftriaxone was administered intravenously. One week after surgery she was symptom free. In the cases previously described in the literature the extradural hematoma was always adjacent to the infected region. In the presented case there was a distance, nevertheless we assume that the extradural hematoma was caused by spread of inflammation beyond the confines of the sinus and maybe precipitated by a rupture of a small inflamed meningeal vessel traversing a thickened dura mater.

Conclusion: When symptoms of elevated intracranial pressure develop in a patient with a coexisting infective condition, an urgent CT is recommended to exclude not only brain abscess and subdural empyema but also the rarer spontaneous extradural hematoma. Prompt evacuation of the hematoma and a course of antibiotics should lead to complete recovery.
**Sagittal balance of 100 patients with a lumbar degenerative disease - A comparative study**


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**Keywords:** Sagittal balance, Pelvis, Lumbar lordosis, Disc herniation, Spondylolisthesis

Objective: The main objective of this study was to analyse spino-pelvic parameters in a population of 100 patients with a lumbar degenerative disease. We have also determined the influence of the lumbar lordosis morphology on the type of lumbar degenerative pathology occurred.

Methods: Four pathologies were considered: disc herniation, discopathy, lumbar stenosis and degenerative spondylolisthesis. Spino-pelvic parameters were analysed on full spine radiographs. Pelvic parameters measured were: pelvic incidence, sacral slope and pelvic tilt. Spinal parameters measured were: lumbar lordosis, thoracic kyphosis, spino-sacral angle and the C7/SFD ratio. The type of lordosis according Massues classification was also determined. The population of 100 patients as each group of degenerative disease were compared with a control population of 160 asymptomatic adults that was the subject of a previous study.

Results: Each pathology lumbar disease was characterised by an antepulsed sagittal C7 plumb line, a loss of lordosis and an increase of the pelvic tilt. No significant difference was found between the group of disc herniation and the group of discopathy concerning all spino-pelvic parameters. The two groups of patients demonstrated a pelvic incidence slightly decreased with a low sacral slope and flat spine curves, p < 0.05. On the opposite patients with degenerative spondylolisthesis demonstrated a great pelvic incidence (mean: 60°) and the tendency to have a sacrum more vertical with less sacral slope, p < 0.05. We could not conclude concerning the stenosis group regarding to the size of the sample.

Conclusion: The type of lumbar degenerative disease appeared to be well influenced by the spino-pelvic alignment of the patient.
Evaluation of a hand-held pedicle drilling tool for help in the posterior pedicle screw placement

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Keywords: Pediguard, Pedicle screw

Introduction: We evaluate the efficiency of a free-hand electrical conductivity measuring device (PediGuard, SpineVision) to prevent the misplacement of screws in posterior pedicle screw fixation (PPSF).

Methods: Since January 2005, 40 patients were treated by PPSF using the PediGuard. After a usual location of the pedicle entry point, the inserting of the device through it must remain silent to confirm the good trajectory. After drilling, the screws were placed and a fluoroscopic imaging confirmed the good positioning of them. All patients were evaluated by pre and postoperative neurological examination and CT scan and X-rays were taken postoperatively to assess screw position.

Results: twenty-four women and 16 men (mean age of 50.6 years) were treated (7 spondylolisthesis, 7 fractures and 26 degenerative lesions). A total of 188 screws were inserted from D4 to S1. On postoperative X-rays and CT scans, 5 screws were misplaced (breaches of lateral wall of the spinal canal): 2 thoracic and 3 lumbar. Postoperatively, no neurological deficit was recorded but three patients noted an impairment of a sciatic pain due to a screw misplacement justifying a repositioning procedure. Our good positioning rate was 97.3 percent.

Discussion: The optimal screw placement constitutes a challenge especially in cases with high deformity. A variable rate (5.4 to 40%) of misplacement is reported. Some techniques (surgical navigation, EMG, SSEPs) aid to better define the screws trajectories. However, no per-operative technique allows to detect in real-time a breach in the pedicle wall. The PediGuard is a new hand-free device that detects breaches of pedicle wall with a sensitivity of 98 %. Moreover, The PediGuard reduces the required amount of X-ray exposure during the surgical procedure.

Conclusion: PediGuard is an instrument easy to use without hardware and ancillary tools necessary. In our experiment, it aids to obtain a good positioning rate of 97.3%.
Surgical treatment of high-grade lumbosacral spondylolisthesis: Report of two cases

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Keywords: Spondylolisthesis, Spine fusion

Introduction: Indication of surgical reduction of severe spondylolisthesis is controversial. The main reason for this extensive surgery is correction of sagittal spine imbalance and malalignment, combined with appropriate central and foraminal decompressions.

Cases description: We present and discuss two cases (2 girls aged 12, 17 years respectively) with a severe-grade isthmic spondylolisthesis who underwent reduction and stabilization using a 2-stage procedure (posterior and anterior). Clinical symptoms were pain in the lumbosacral spine associated with lower extremity radiculopathies for both. Radiologic investigations, including plain radiographs and CT confirmed the diagnosis. For all cases we combined, as first step, a posterior reduction of the deformity with releasing of posterior structures to prevent neurologic, using a posterior pedicle screw instrumentation (UNI-Thread SPL reduction instrument, SpineVision) and, as second procedure, an anterior interbody fusion. The first step lead to restoration of an almost normal sagittal alignment and the second improve the biomechanic stabilization. Postoperatively, a CT confirms the good correction of the sagittal imbalance in all cases and patients described important clinical improvement.

Discussion: As reported in literature, isolated posterior fusion is not sufficient to prevent deformity progression in severe-grade lumbosacral spondylolisthesis. Therefore, a combined anterior and posterior fusion is necessary. Reduction of the deformity leads to restoration of normal sagittal alignment with an excellent cosmetic result. Reduction without release of posterior structures may lead to neurologic deficit.

Conclusion: In our experiment of 2 cases, this two-step procedure provides an efficient reduction of the deformity with minimal risk of neurologic deficit. A long term follow-up is necessary.
Hypertrophic spinal pachymeningitis. Report of two cases
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Keywords: Spinal pachymeningitis

Introduction: Chronic hypertrophic pachymeningitis (CHP) is a rare diffuse inflammatory and fibrotic disease that causes thickening of the dura mater. Based on anatomic site, CHP can be subdivided into spinal, intracranial and the much less frequent craniospinal pachymeningitis.

Case reports: We present two cases of idiopathic CHP, one of spinal and the second of craniospinal distribution. We discuss the clinical, radiological and pathological findings. There was no stabilization of the neurological function with conservative treatment. Surgical decompression and excision of the involved dura was necessary. The postoperative follow-up is now respectively 2 and 1.5 years.

Conclusion: The etiology of the CHP is usually unclear, however several causative factors have been recognized. The diagnosis and follow up of patients has been facilitated with the widespread application of gadolinium enhanced MRI. Surgical biopsy is however essential for making the diagnosis. The treatment is not well defined. Thickening of the dura may be improved by subsequent steroid therapy over rather a long period. In the suspicion that the disease is more a systemic auto-immune inflammation, immunosuppressive drugs may be beneficial. If not, surgical resection leads to neurological stabilization and improvement. The long term evolution is unclear.
A symptomatic sacral extradural cyst due to compression and stretching of a short filum terminale with associated diastematomyelia - Case report and review of literature.

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Keywords: Extradural sacral cyst, Tethered cord syndrome

Introduction: Extradural sacral cysts are a relatively uncommon cause of nerve root compression. They are usually an asymptomatic radiological finding. To our knowledge, the coexistence with tethered cord due to a short filum terminale has never been reported. Tethered Cord syndrome in adult patients is often asymptomatic, but occasionally becomes symptomatic due to secondary events.

Methods: We report on a case of an extradural sacral cyst diagnosed in a 64-year-old woman, presenting with radicular pain and paraesthesias of the left leg. Clinical examination revealed left-sided absent ankle reflexes, hypoesthesia in the S1 dermatome and a positive straight leg raising test. Magnetic resonance imaging revealed an extradural cystic lesion extending from S1 to S4, low positioned conus medullaris and a coincidental diastematomyelia at L1. We performed a sacral laminectomy and marsupialisation of the cyst. The communication with the subarachnoid space at the caudal end of the dura was sealed with conventional methods. Additionally the paravertebral muscles were transposed into the dilated sacral canal and sutured to the anterior wall in order to secure a water-tight closure.

Results: The preoperative symptoms completely disappeared in spite of the hypoesthesia. Postoperative MRI showed the disappearance of the cyst and absence of CSF leakage. T1 weighted images confirmed the lipomatous nature of the filum terminale that was “floppy” instead of stretched.

Conclusion: We report on a rare case of a sacral extradural Tarlov-type cyst, in association with a type II split cord malformation or diastematomyelia and tethered spinal cord. Although extradural cysts rarely cause radicular symptoms, this did not seem the case in our patient. We hypothesize that in our case the symptomatic tethering of the spinal cord was caused by anterior compression of the dura and stretching of the intradural filum terminale by the extradural cyst.
Endoscopic aquaductoplasty in trapped fourth ventricle syndrome - A neuronavigation guided suboccipital approach

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Keywords: Aquaductoplasty, Endoscopy, Neuronavigation

Object: Endoscopic techniques have proven to be a valuable alternative for shunting procedures in the management of hydrocephalus. Endoscopy may render patients independent of shunts, thus avoiding shunt complications and failure. Different treatments of isolated fourth ventricle have been proposed: suboccipital ventriculoperitoneal shunt, microsurgical fenestration or endoscopic fenestration. We report 2 cases of trapped fourth ventricle syndrome in which an endoscopic aquaductoplasty by means of a trans-fourth ventricle approach resulted in a successful outcome.

Methods: Two patients, a 24-year old male and a 25-year old female, both having a history of hydrocephalus and ventriculoperitoneal shunting, presented to our department with signs of intracranial hypertension due to an isolated fourth ventricle. The diagnosis was established on magnetic resonance imaging, which clearly showed a dilated fourth ventricle and rather small supratentorial ventricular dimensions. In order to avoid additional intracranial catheter and considering the limited space in the lateral ventricles, we performed an endoscopic aquaductoplasty via posterior approach, thus creating a communication between the fourth and the third ventricle. The endoscope was introduced in the fourth ventricle through a suboccipital burr hole, according to a neuronavigation planned trajectory. The membraneous occlusion of the aquaduct was fenestrated with a Fogarty balloon catheter. After this procedure both patients were relieved of their preoperative intracranial hypertension symptomatology. Postoperative imaging confirmed the regression of the fourth ventricle dilation. There was no permanent morbidity. During the followup one patient underwent a shunt revision because of shunt dysfunction.

Conclusions: In our experience, performing cerebral aquaductoplasty via the suboccipital trans-fourth ventricle approach is both technically feasible and effective and should be considered as an possible therapeutic measure for trapped fourth ventricle syndrome.
Voxel-based frameless registration clinical accuracy evaluation - Impact on image-guided neurosurgery treatments

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Keywords: Registration, Radiosurgery, Neuronavigation

Introduction: Gamma Knife radiosurgery uses a frame-based approach for multimodality medical image registration and treatment application to provide superior accuracy and reproducibility. The advent of frameless techniques for the registration of medical images and their accuracy assessment fostered the use of multimodal information in neurosurgery, radiotherapy and radiosurgery treatments. Our study aims at assessing the clinical validity of such an approach. For this purpose, we chose to study the most accuracy demanding application, Gamma Knife radiosurgery and infer clinical impact of frameless registration on all image-guided neurosurgery procedures.

Material and Methods: 50 radiosurgery treatment planning (RTP) data from Gamma Knife patients were retrospectively included in our study. For each RTP, the frame-based MRI pulse sequences used in the treatment plan were registered using the similarity measure voxel-based registration provided by the new release of the LGP4C Gamma Knife RTP system (Elekta, Sweden). Registration parameters were extracted from LGP4C for frameless and frame-based algorithms as applied to MRI pulse sequences (Tmri-ct, Tmri-frame) and CT (Tctframe) series. From these matrices, the error geometric transform generated by the frameless technique as opposed to the frame-based registration was derived: Terror = Tctframe * Tmri-ct * inv(Tmri-frame). This error transform was then applied to the treatment prescribed isodose volume (PIV) leaving the target volume (TV) unchanged to simulate errors due to the frameless registration on the placement of isocenters. A modified conformance ratio (TVpiv*PIV/TV where TVpiv is the target volume fraction covered by PIV) was computed and compared to the original conformance ratio to assess the validity of the frameless registration.

Conclusion: Results and their classification according to treatment indication and volume suggest that registration of frameless MRI to frame-based CT Accuracy and reproducibility is highly dependent on specific guidelines for the MRI acquisition and registration strategy. Radiosurgery accuracy requirements still prevent the use of frameless for specific applications such as Vestibular Schwannomas. Frameless registration is accurate enough for Image-Guided neurosurgery (aka neuronavigation).
Motor Cortex Stimulation In A Three Years Old Child With Trigeminal Neuropathic Pain Due To A Malignant Glioma In The Cerebellopontine Angle

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Keywords: Motor Cortex Stimulation, Trigeminal Nerve Pain, Tumors

Introduction: Motor cortex stimulation (MCS) is an accepted treatment in neuropathic pain syndromes. This technique was never used in trigeminal neuralgia due to a malignant glioma and not in children. This case report presents the first case in the literature of a three years old boy with an unbearable refractory trigeminal neuralgia due to glioma in the cerebellopontine angle. The patient benefited from MCS with early postoperative improvement of 75% and then progressive complete disappearance of the pain.

Case report: A 3 years-old boy presented at our department with a right temporal tumor with extension to the sinus cavernous and following the root of the V nerve. During first surgical procedure, the temporal part of the tumour was resected. Because of the apparition of a medically refractory trigeminal neuralgia, we decided to explore the cerebellopontine angle and removed partially the tumor from the retroclival cisterna, residual tumor remained in pericavernous area. The histopathogical study revealed a malignant glioma, so the patient was treated also with radiotherapy and chemotherapy. The effect of surgery on his pain was temporary. After some months he again developed unbearable medically intractable pain. After multidisciplinary discussion and expecting the potential effect of radiotherapy, we purposed a surgical treatment: destructive surgery on the trigeminal nerve versus neurostimulation. Motor cortex stimulation on a child for intractable pain due to tumor was never described and we choose from this non-destructive treatment.

Results: Pain improvement 48 hours postoperatively was estimated by the mother around 75%. This improvement rapidly increased to 100% and stayed stable during 12 months.

Conclusion: MCS, less invasive surgical technique, is a possible treatment in cases of multidisciplinary staff selected children suffering from very heavy neuropathic pain after failure of medical treatment, even in neoplastic context.
Dopaminergic modulation of neurotransmitter release in the subthalamic nucleus: in vivo microdialysis study in intact and 6-hydroxydopamine lesioned rats

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Keywords: Dopaminergic modulation, Subyhalamic nucleus, Microdialysis

Introduction: Hyperactivity of the subthalamic nucleus (STN) is believed to play a key-role in the pathophysiology of Parkinson's disease. The cause of this abnormal activity hasn't been fully clarified yet, but it is hypothesised that the loss of dopaminergic innervation from the substantia nigra pars compacta (SNc) to the STN contributes to this phenomenon. The effects of dopamine (DA) and DA agonists on the activity of the STN remains a matter of debate and despite numerous investigations discrepancies still exist with regard to the effects of DA at the level of the STN.

Objective/Methods: In the present work we investigated the in vivo dopaminergic modulation of neurotransmitter release in both intact and 6-hydroxydopamine (6-OHDA) lesioned rats using the microdialysis technique. Samples were collected and analysed for GABA and glutamate by HPLC. We examined the effects of subthalamic perfusion during one hour of DA (20nM), SKF 38393 (100µM) (DA D1 receptor agonist) and quinpirole (100µM) (DA D2 receptor agonist) on the release of GABA and glutamate in the STN.

Results/Discussion: Our results indicate that DA exerts its effect on subthalamic glutamate concentrations in the intact rat via the DA D1 receptor, while in the 6-OHDA lesioned rats subthalamic glutamate concentrations seemed not to be affected by DA. The effects of DA on subthalamic GABA concentrations in the intact rat seemed to be established via both the DA D1 and the DA D2 receptor, whereas in the 6-OHDA lesioned rats the effect of DA was achieved only by the DA D1 receptor. Our results point out a role of DA in neurotransmitter release in the STN. They also show that this dopaminergic modulation is clearly altered in 6-OHDA lesioned rats.
Delayed tension pneumocephalus complicating a skull base fracture

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**Keywords:** Head trauma, Tension, Pneumocephalus

Introduction: Pneumocephalus is commonly observed after head and facial trauma, ear infection or neurosurgical procedures (cranial or spinal procedures with leakage of cerebrospinal fluid (CSF)). However, tension pneumocephalus is an uncommon, but potentially fatal complication due to the mass effect with abnormal neurological signs.

Case report: A 74-year-old male patient was admitted because of sudden severe headache and gait disorders. He had no relevant clinical history except a low-velocity head trauma one year before, requiring a short hospital observation because of a thin right-sided occipital subdural haematoma and a left petrous bone fracture. The patient had completely recovered with a normal condition up to the day of admission when he developed severe headache of abrupt onset followed by gait apraxia. We noted no rhinorrhoea or otorrhoea. A CT scan of the brain revealed a huge intracranial air collection compressing both frontal lobes, also known as the Mount Fuji sign. The complete imaging work-up, including enhanced multi-slice CT, MR imaging and CT cisternography, failed to demonstrate any CSF leak. We subsequently decided to explore surgically the left temporal fossae to localise the source of pneumocephalus. We found a dural tear of about one square cm, tamponated by brain tissue. We closed the dura watertight and covered it by a pediculated muscle flap. The patient made an uneventful recovery and was discharged home five days after surgery. The postoperative CT, performed one month later was normal.

Discussion: The occurrence of tension pneumocephalus depends on the presence of an intracranial air pathway, a factor that promotes air inflow, or an air augmentation mechanism. We demonstrated the need of neurosurgical exploration to detect leakage even when the radiological investigation is formally negative.
Strain Tolerance of Bridging Veins in Tensile Testing


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Keywords: Bridging veins, Traumatic ASDH, Ultimate stretch, Ultimate stress, Biomechanics

To improve existing bicycle helmets, it is necessary to start from the biomechanics underlying the most frequently occurred head injuries during cycling accidents. Traumatic acute subdural haematoma (ASDH) is one of those injuries. It is associated with a mortality rate ranging between 30 and 90%, and has an incidence ranging between 26 and 63% of non-missile severe head injuries. An ASDH can arise from three sources: a haemorrhagic contusion that breaks through the arachnoid, the rupture of a bridging vein or the laceration of a cortical artery or vein. In an autopsy series by Maxeiner, the cause of the ASDHs was an underlying contusion in two thirds and a ruptured bridging vein in nearly one third of the cases, which is in agreement with a 29% rate of non-contusion associated ASDH in a clinical series by Haselsberger. To determine the biomechanical characteristics of bridging vein rupture, we considered bridging veins as a uniform tubular structure and determined the ultimate stretch, the ultimate stress and the strain-rate sensitivity of bridging veins by loading them to failure in a tensile stretch test. We dissected 10 bridging veins from 5 fresh cadavers and tested them within 6 days after decease. 4 specimens were tested at 5 mm/s, 3 at 20 mm/s and 3 at 50 mm/s. The bridging vein geometry was obtained by microscopy and force-time and stretch-time histories were measured during testing. From these we calculated an average ultimate stress of 2.36 ±0.50 Mpa, 1.90 ± 0.92 Mpa and 2.29 ± 0.88 Mpa respectively. The respective ultimate strain was 133 ± 24%, 122 ±15% and 118±7%. We found no strain-rate sensitivity. These results can be implemented in a finite element model of the head that can predict head injury by simulating crashes. Such simulations can help improve and design protective measurements, such as bicycle helmets.
Subcutaneously implanted brain tumor rejection by immunomodulation in two strains of rat

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Keywords: Immunomodulation, GBM, Rejection

Purpose: The goal of this study was to determine whether allogeneic tumor producing cell lines (CL) could be used to induce the immune mediated rejection of syngeneic tumor producing CL in two strains of rat.

Methods and Materials: Fisher344 and Sprague Dawley (SD) rats received left flank injections with two tumor producing CL C6 and 9L. 9L is syngeneic to the Fisher344 and allogeneic to the SD; while C6 is syngeneic to the SD and allogeneic to the Fisher344. In the treatment group, rats injected subcutaneously with allogeneic producing CL and lysis from the same syngeneic tumor. As a further study, rats rejecting their tumor were once again injected with the same syngeneic tumor producing CL until five times the number of cells. Finally, SD and Fisher rats initially injected with allogeneic CL were injected with syngeneic CL.

Results: Allogeneic(9L) CL injected into SD rats never produced a palpable tumor, while the same CL produced significant tumor growth, allogeneic(C6) CL did produce a palpable tumor in Fisher344 rats, but these were rejected. Syngeneics CL was able to produce tumors in all of SD and Fischer344 rats. Rats treated with allogeneic CL and syngeneic lysis were able to significantly reduce, in the Fisher344, or completely reject, as in the SD rats, their tumors. "Cured" SD rats re-injected with C6 CL at five times the original dosage remain tumor free at 150 days. Also, both SD and Fisher344 rats initially rejecting allogeneic tumor were unable to develop syngeneic tumors.

Conclusion: Allogeneic CL and syngeneic lysis can induce the rejection of cancers and offer protective effect. In the future this may prove to be a useful addition to the cancer treatment or even as a means of vaccination.
Spontaneous pneumocephalus caused by the association of a pneumosinus dilatans and meningioma

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Keywords: Pneumosinus dilatans, Meningioma, Pneumocephalus

Pneumosinus dilatans (PSD) describes an abnormally enlarged, air-filled paranasal sinus without radiological evidence of localized bone destruction, hyperostosis, or mucous-membrane thickening. PSD has been reported in association with meningioma, especially optic nerve sheath meningiomas but the pathophysiology remains unclear. Spontaneous pneumocephalus is an exceptional mode of presentation of PSD. To our knowledge, it has never been reported in the literature in association with a meningioma.

A 74-year-old man in previously excellent general condition was admitted to our hospital for acute headache and progressive obnubilation. A head computed tomography (CT) revealed a pneumocephalus and a PSD involving the paranasal sinuses. The posterior wall of the right frontal sinus showed complete erosion by a 3 cm intracranial calcified frontal mass. Interestingly, a head CT performed one month before the admission did already showed both the PSD and the meningioma that was closely located to the frontal sinus with incomplete erosion of its posterior wall. There were no radiological sign of pneumocephalus.

An emergent evacuation of the pneumocephalus was initially carried out via bilateral burr holes. The patient improved dramatically and a bicoronal craniotomy was performed. Operatively, there was a large bony defect of the posterior wall of the right frontal sinus and the dura was thickened and adherent to a grey extra-axial mass invading the surrounding brain. The tumor and overlying dura were resected and the frontal sinus was plugged with bone dust and fibrin glue. The dural defect was closed with parietal pericranium completed and a frontal flap of pericranial tissue was folded over the frontal sinus and laid along the anterior cranial base. Neuropathological examination of the lesion revealed a fibrous meningioma.

The association of PSD and meningioma both eroding the posterior wall of the sinus could be origin the occurrence of the pneumocephalus. Because the risk of dramatic neurological deterioration is present, a neurosurgical procedure consisting in bifrontal craniotomy, cranialisation of the PSD and resection of the meningioma should be discussed, even if the patient is asymptomatic.
Paraganglioma of the cauda equina: a report of two cases

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Keywords: Paraganglioma, Cauda equina

Introduction: Cauda equina paraganglioma (CEP) is a rare tumour. The first case was described in 1970 and since then less than 200 cases have been reported. The origin of CEP is uncertain since the existence of paraganglia cells in the central nervous system remains unclear. There is a male predominance and low back pain is the main symptom in more than 90% with sciatica in 72%. MRI is the study of choice and treatment consists of total excision when feasible. Definitive diagnosis can only be made after immunohistochemical investigation. CEP is classified as grade I WHO and the prognosis is excellent. Nonetheless tumour recurrence rate after subtotal removal is 10%.

Case reports: We present two cases of paraganglioma of the cauda equina, pre-operatively diagnosed as an intradural mass on MRI. In 1999, a 37 year old man presented with bilateral sciatica without neurological deficits. MRI showed an intradural mass at L3-L4. Total resection of the tumour was performed and postoperatively there was a full recovery. There is no recurrence after six years. In 2005, a 51 year old man presented with low back pain with bilateral irradiation to the gluteal region. No neurological deficits were present. MRI showed an intradural mass at L4. Also in this case total resection was performed after which the patient fully recovered.

Conclusion: Paraganglioma of the cauda equina is a rare tumour and we diagnosed two of such tumours on a total of 104 intradural extramedullary tumours (1994 - 2005). Both cases presented with low back pain as most often reported in the literature. In retrospect MRI was not completely typical for Schwannoma or ependymoma, but the final diagnosis can only be made histologically.
Neurofibrosarcoma of the vagus nerve associated with neurofibromas of the phrenic nerve: A Case report

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Keywords: MPNST, Neurofibrosarcoma, Vagus nerve, Phrenic nerve

Introduction: we report the case of a malignant peripheral nerve sheath tumor (MPNST) of the intrathoracic vagus nerve associated with multiple neurofibromas originating from the phrenic nerves in a patient with a neurofibromatosis type I (NF1).

Case report: a 32-year-old woman with a history of NF 1 was referred after suffering from a persistent dry cough. Chest X-rays and computed tomography showed three homogeneous and sharply circumscribed masses in the anterior mediastinum while Pet-scan revealed a strong hypermetabolic activity in the left hilar region. The patient underwent a left thoracotomy. A chain of four tumors was discovered originating from the left phrenic nerve, the largest one measuring 4 x 2 cm and the others 5 to 10 mm. A 6 cm fusiform mass and an other smaller tumor arising from the left vagus nerve proximal to the origin of the recurrent nerve were also found. Complete en bloc resection of all tumors together with the left intrathoracic vagus and phrenic nerve was performed. Histological diagnosis was high grade MPNST for the largest tumor of the vagus nerve and neurofibroma for the five others. A mediastinal radiation therapy was therefore given postoperatively. The patient kept a left vocal cord palsy after the operation.

Discussion and Conclusion: neurofibromas of the vagus nerve are uncommon and malignant transformation is extremely rare. Of the five cases reported in the literature, four were associated with NF1. The prognosis is poor with survival rarely exceeding a year even after complete resection. The association with phrenic neurofibromas was never described.
Two aneurysmal bone cysts, one located in the spine and one located in the skull


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Keywords: Aneurysmal bone cysts

Introduction: Aneurysmal bone cysts are benign, rare, slow growing expansile bone lesions, usually found in the long bones and the vertebrae. Their occurrence in the calvarium is rare (5%). Histological differential diagnosis is sometimes difficult, from osteoclastoma, fibrous dysplasia, ossifying haematoma and cavernous hemangioma of the bone. On CT and MRI they are typically lytic, expansile and surrounded by a thin shell of bone. Radiological differential diagnosis should include giant cell reparative granulomas, giant cell tumour, hemorrhagic cysts and fibrous dysplasia. Total excision is the ideal treatment. Recurrent lesions occur frequently.

Methods/ Results: We present two cases we operated on.

Case 1: 11 years old girl with occipital swelling. The clinical neurologcal examination was normal. On CT and MRI scan a well-circumscribed expansile lesion with fluid-fluid levels was visualised in the occipital bone and a craniectomy was performed and a reconstruction was made with polymethylmethacrylate cement. There was no recurrence 5 years later.

Case 2: 38 years old lady, with low back pain. CT scan showed a hypervascular tumor, and a needle biopsy was performed and showed an aneurysmal bone cyst for which an operative resection was performed. There was no recurrence three years later.

Conclusion: We present two cases of aneurysmal bone cysts, one located in the spine and one located in the skull. They are benign, rare slow growing expansile lesions, with typical findings on CT and MRI. Total excision has to be considered as the primary treatment. Recurrent lesions occur frequently.
Primary intraosseous meningioma of the skull: a case report

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Keywords: Meningeoma, Intraosseous

Introduction: Primary intraosseous meningioma of the skull is an uncommon lesion often confused with a primary bone tumor of the skull. The clinical presentation of primary intraosseous meningiomas varies depending on the size and location of the lesion. Most lesions present as a palpable mass, headaches or seizures. The exact origin of these lesions is not known. They may originate from arachnoid cap cells which were trapped in the cranial sutures which may explain why most lesions are found in the vicinity of cranial sutures. Another possible cause can be a previous trauma.

Method: We report the case of a primary intraosseous meningioma in a 74-year-old Caucasian man. Patient was known with a primary bladder tumor. Because patient was complaining of headaches a computed tomography scan was performed which showed a left frontal osteolytic lesion. A surgical excision was performed. No post-operative complications were noted.

Conclusion: Primary intraosseous meningiomas are generally benign lesions for which a surgical resection is recommended if the lesion is symptomatic or in case of diagnostic purposes. Resection should be as wide as possible. If only partial resection is obtained, the lesion should be followed radiographically.
Vestibular schwannomas (VS). Intra-canalicular (InCan) involvement and associated hearing loss (HL). Volumetric analyses


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Keywords: Vestibular schwannoma, Hearing loss, Pathophysiology, Volumetric neuroimaging

Purpose: In VS, to elucidate underlying pathophysiological mechanisms of auditory dysfunction through the identification of tumor and internal auditory canal (IAC) variables associated with HL.

Materials and methods: Planar (2D) and volumetric variables, derived from gamma knife treatment neuroimaging of 27 exclusively intra-canalicular (InCan) VS and 114 Dual VS ((with an InCan and an extra-canalicular (ExCan) component)), were evaluated. Variables were chosen to reveal hypothetic mechanisms of HL. InCan, ExCan tumor and bony canal volumes and their linear correlates were measured. Relative canalicular involvement by tumor, and tumor growth in the area of the IAC meatus were evaluated.

Results: Dual VS intracanalicular volume was smaller than that of InCan VS and they resided in smaller canals. No correlation was found between intra canalicular and extracanalicular tumor volumes. In volumetric analyses, InCan tumor volume correlated with HL. For Dual VS, relative canalicular tumor involvement and canal volume, which enlarged parallel to tumor growth, predicted HL. Planar variables associated with HL were: within the canal tumor width (for InCan VS), absolute tumor length and relative to bony canal length (all VS; Dual VS) and the extent of peri-meatal tumor involvement. No correlation was found with maximal ExCan tumor extension or volume.

Conclusions: In Dual VS, tumor growth seems to begin at variable distances from outside the IAC. Compression and stretch probably play a role in the pathophysiology of HL. In addition to InCan tumor enlargement, bony canal expansion, which accompanies VS growth, is associated with hearing deterioration. It is suggested that peri-canalicular changes are the cause of auditory dysfunction and not extra-canalicular tumor expansion in itself. Treatment associated HL could emanate from suboptimal management of this potentially sensitive region. It is to be further evaluated whether changing treatment parameters for this zone, could reduce the incidence of treatment induced HL.
Unusual clinical presentation of haemangioblastoma: Our experience in three cases

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Keywords: Haemangioblastoma, Clinical presentation, Haemorrhage, Nerve root, Von Hippel-Lindau disease

Introduction: Haemangioblastoma are rare tumors, they account up to 2-3 % of all central nervous system tumors. The typical clinical presentation is that of a mass lesion in the posterior fossa with signs of cerebellar dysfunction and symptoms of raised intracranial hypertension. The lesion is typically isolated and located in the cerebellar hemisphere. We want to present our experience in three cases without this typical clinical and radiological presentation.

Methods and Materials:

Case 1: A 49 year old male presents on the emergency unit with a sudden onset of headache and gait instability. A CT scan reveals a cerebellar haematoma in the left hemisphere. MRI and angiography confirms our impression of an underlying highly vascular tumor in the tonsil and the floor of the fourth ventricle. Posterior fossa craniectomy can achieve a total resection of a, histologically confirmed, haemangioblastoma. Due to the adherence of the tumor to the lower cranial nerves the patient is in need of rehabilitation for trapezius muscle weakness and has a non invalidating hoarsness.

Case 2: A 48 year old male is known with the diagnosis of von Hippel-Lindau disease. He is deaf and blind, due to retinal angiomatosis, and canonically communicate by the Lorn-alphabet. He presents with nausea, somnolence and gait instability. MRI reveals a large cerebellar cyste with a small intramural nodule and a large cyst in the upper cervical medulla, with the typical characteristics of haemangioblastoma. By posterior fossa craniectomy the cyst was opened and the nodule resected. Postoperative evolution is very satisfying with recovery of all symptoms.

Case 3: The chest X ray of an asymptomatic 57 year old female shows a paraspinal left-sided coin lesion. On MRI the lesion has the typical characteristics of a radicular schwannoma, dumbbell-shaped with an intraspinal diameter of 1,5 cm and an extraspinal diameter of three cm lying in contact with the parietal pleura. The surgical resection after costotransversectomy and partial facetectomy was hampered by the intensive vascularisation of the tumor. Histological examination diagnosed the lesion as haemangioblastoma.

Discussion: Our cases represent some of the not typical presentations of haemangioblastoma. Due to the intensive vascularisation a spontaneous haemorrhage can be explained, but is rather rarely seen in common clinical practise. More frequent are small intracystic bleedings without important clinical findings. Large lethal haemorrhage is also rare. The von Hippel-Lindau disease is a rare autosomal dominant genetic disease with variable penetrance with a prevalence of 1:40000. Patients frequently have multiple lesions. The diagnosis of a proximal nerve root haemangioblastoma, mimicking a radicular schwannoma, is extremely rare. Only a few cases in literature are described and to our knowledge none originating a thoracic nerve root.

Conclusion: Although haemangioblastoma is an uncommon tumor originating in the central nervous system and predominantly in the posterior fossa, the clinical presentation can be very diverse and should be therefore included in the differential diagnosis of every (vascular) mass lesion.
A pleomorphic xantho-astrocytoma of the posterior hippocampus with an intratumoral AVM - Case report and review of literature.

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Keywords: Pleomorphic xanthoastrocytoma

Introduction: A pleomorphic xanthoastrocytoma (PXA) is a relatively rare tumor, most often in children and young adults. In the beginning it was considered as a meningo-cerebral tumor.

Methods: We report on a case of a left sided posterior hippocampal tumor in a 20 year old male language student. MRI showed a homogenous tumor enhancing with gadolinium, a trapped left temporal ventricle and vascular structures suggestive for an intratumoral AVM. Preoperative angiography confirmed arterial supply from a branch of the posterior cerebral artery, a small intratumoral vascular nidus, and early venous drainage before capillary filling of the tumoral mass. A left sided temporal craniotomy was performed with complete resection of a well delineated intraparenchymatous moderately vascular tumor that reached the tentorium without dural invasion. Only after partial tumor resection, the afferent artery hidden at the base of the tumor and feeding the intratumoral nidus, could be clipped.

Results: The postoperative evolution was uneventful, with temporary dysphasia but complete recovery after a few weeks. The patient remains seizure free. Pathological examination revealed a PXA with ganglion cells. A part of the vascular nidus was recognized.

Discussion: We report on a rare case of hippocampal PXA with intratumoral AVM. Because of the presence of ganglion cells, this kind of tumor is sometimes considered as a rare composite tumor with a ganglioglioma. The astrocytic nature of the tumor however determines the prognosis. The combination with an AVM has only rarely been described and some authors think that such an angioglioma may be the product of reactive gial proliferation and transformation secondary to a pre-existing vascular malformation and hemorrhage. In our patient no evidence of previous hemorrhage was found. Conclusively, the origin of the tumor remains a matter of discussion, probably being a developmental neuroglioma tumor with prominent glioproliferative changes sometimes associated with focal cortical dysplasia.