Temozolomide displays anti-migratory effects in human glioblastoma cells mediated through neuregulin-1 down-regulation

Keywords: temozolomide, malignant gliomas, migration, mechanism of action

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In vitro temozolomide cytotoxicity on glioblastoma cells seems to be exerted through pro-autophagic and late apoptotic processes. However, we do not believe that these effects of temozolomide in vitro at 100µM can explain the significant therapeutic benefits of relatively low repeat temozolomide p.o. or i.v. administration to athymic mice bearing human glioblastomas.

We have investigated the: i) impact of temozolomide treatment duration on the survival of glioblastoma bearing mice, ii) effects of temozolomide on human glioblastoma cell migration and iii) genome-wide effects of temozolomide treatment in vitro and in vivo on U373 glioblastomas.

Our results reveal that the U373 and T98G malignant astrocytic invasive cells as well as several glioblastoma primocultures present a methylated MGMT promoter. No clear-cut cytotoxic effects are achieved with temozolomide up to 100µM in vitro in several glioblastoma cell lines and primocultures although this concentration induces a significant decrease in the wound healing process of U373 cells. The therapeutic benefit of temozolomide in mouse models of human glioblastoma is found to correlate directly to the duration of treatment. The sooner the treatment begins, the higher the survival rate is achieved. Genomic analysis of temozolomide-treated U373 cells reveals 30 genes, including clusters involved in morphogenesis and iron ion homeostasis, with >2 or <0.5 fold modification in expression compared to untreated cells. One of these, neuregulin-1, known to activate the erbB receptor and enhance glioma cell motility, is significantly decreased after temozolomide treatment.

In conclusion, these data bring additional understanding how temozolomide contributes therapeutic benefits to glioblastoma patients.
Introduction:
The intraoperative MRI is used as an intraoperative updated neuronavigation and/or as a quality control tool. Although no randomized control studies proved the usefulness of iMRI in patients' survival and quality of life, survival is correlated to the extent of brain tumor resection in glioma surgery. Concerning spinal cord tumors, it has been widely claimed and accepted that the extent of tumor resection would not affect the patient's outcome. However, recent publications challenged this view and suggested the extent of resection of low-grade astrocytoma could be a predictor of good surgical outcome (Raco et al., 2005; Nakamura et al. 2007) and renown spinal cord neurosurgeon advocate complete resection whenever possible (Brotchi, 2002). We assessed feasibility and safety of an intra-operative MR procedure in three cases of resection of spinal cord glioma using a dual independent MR-OR intra-operative suite at 3 Tesla.

Case 1: A 26-year-old man presenting with a spinal cord glioma extending from C5 to T7 had a spinal cord iMRI after complete surgical wound closure, image quality was considered good, no adverse effect was observed.

Case 2: A 44-year-old woman with an ependymoma at T1-T2 level, had a spinal cord iMRI after complete surgical wound closure, image quality was considered excellent, no adverse effect was observed.

Case 3: A 48-year-old man had iMRI procedure for resection of an ependymoma extending from C0 to T7 had a spinal cord iMRI after partial surgical wound closure, image quality was considered excellent, no adverse effect was observed.

Conclusions:
These first three cases demonstrated the feasibility of spinal cord iMRI at 3T for tumor resection. The image quality using standard surface coils was higher than anticipated and the team of neuroradiologist considered it to be excellent. So far, no adverse effect was observed.
Adjuvant dendritic cell-based tumour vaccination for children with malignant brain tumours: preliminary results

Keywords: Malignant brain tumours; immunotherapy; children

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Introduction
We have gained a large experience with dendritic cell (DC)-based vaccination for adult and paediatric malignant brain tumours during the last years. In all of these tumours the prognosis at time of relapse is dismal with short median survival. Here we report on the paediatric population that has been vaccinated at our institute.

Material and Methods
In total 45 children (median age 13 years; range 1 # 18 years) were vaccinated with autologous, monocyte-derived DC loaded with autologous tumour lysate after Ethics Committee approval. We treated 33 patients with high-grade glioma (HGG) (21 glioblastoma # 8 anaplastic astrocytoma # 2 recurrent malignant pleomorphic astrocytoma (PXA) # 1 oligo-astrocytoma grade III # 1 diffuse intrinsic pontine glioma (DIPG)), five patients with medulloblastoma/PNET, four patients with ependymoma grade III and three patients with atypical teratoid rhabdoid tumour (ATRT). Response was studied with MRI (McDonald criteria). Overall and progression-free survival (OS/PFS) were the primary endpoints.

Results
Of the 33 HGG-patients, 19 patients are still alive at present with a median follow-up of 11.6 months (range 2.7 # 79.2 months). The median overall survival is not yet reached in this group. The five patients with medulloblastoma/PNET all died in course of their disease (median OS 5.7 months; range 4.3 # 51.2 months). Of the four patients with ependymoma one patient is still alive at present with a follow-up of 10.3 months. The other three patients had overall survivals of 7.7, 30.1 and 31.5 months respectively. The three children with ATRT are still alive at present, at respectively 22.1, 40.5 and 49 months. No severe adverse events were noticed.

Conclusion
Immunotherapy for children with malignant brain tumour is feasible without major adverse events, even in young children. Of the different types of malignant brain tumours, high grade glioma and ATRT seem to respond most favourably to vaccination. Although preliminary, our results are promising and support the integration of DC-based immunotherapy in new treatment protocols for HGG and ATRT.
**Keywords:** intracranial tumorlike lesions, ADEM, stereotactic biopsy

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**Objective:**
To present 3 patients referred for stereotactic biopsy because of multiple intracranial lesions in which the diagnosis of ADEM (Acute Disseminated Encephalomyelitis) was made.

**Material and methods:**
Patient 1 presented with recurrent grand mal seizures and visual hallucinations. MRI of the brain showed multiple lesions, predominantly in the gray matter, in the left parieto-occipital region with peripheral contrast enhancement.

Patient 2 had also generalized seizures with truncal instability and frontal behaviour. MRI of the brain demonstrated multiple partially contrast enhancing lesions in the right frontal lobe.

Patient 3 presented with seizures and motoric dysphasia. MRI of the brain demonstrated multiple contrast enhancing lesions in the left frontal lobe.

**Results:**
All patients were referred to our department for stereotactic biopsy after extensive investigations for malignancy or infections. All had atypical CSF findings. In patient 1 a stereotactic biopsy was performed. Microscopic examination showed atypical inflammatory findings. MR spectroscopy and diffusion-weighted imaging showed typical findings for ADEM. Patients 2 and 3 were refused for biopsy based on radiological findings (MRI/MR spectroscopy and diffusion-weighted imaging).

**Conclusions:**
In young patients presenting with multiple atypical intracranial lesions and sometimes severe neurological deficits differential diagnosis of ADEM should be retained. MRI of the brain with MR spectroscopy and diffusion-weighted imaging is mandatory. No stereotactic biopsy or other neurosurgical procedure should be performed.
Surgical treatment of rolandic brain tumors with neuro-electrophysiological monitoring: a retrospective study

Keywords: Rolandic brain tumors

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Objective
Resection of hemispheric intra-axial brain tumors located in the rolandic and perirolandic area, might benefit from intra-operative neurophysiologic monitoring techniques. In order to reduce the post-operative neurological morbidity we started to use motor cortex identification as well as stimulation mapping of subcortical white matter tracts (MEP/SEP). In this study we describe our experience with the technique, collecting data of these patients regarding their pre- an postoperative neurological status and the predictability of a temporary/permanent neurological deficit.

Materials & Methods
We retrospectively reviewed the files of patients with intra-axial rolandic tumours operated with peri-operative monitoring in our department from 1/2003 until 12/2007. We describe the exact location of the lesion and the type of monitoring we used in that area. We look for the functional neurological outcome in relation to the monitoring values, additional deficits, and the extent of the resection.

Results
34 patients were included in the study (24 right hemisphere, 10 left). The location was pre-central in 18, post-central in 12 and both pre-and post-central in 4 patients. There was a macroscopic complete resection in 23 patients; a subtotal in 11 patients. The functional outcome: 9 patients improved post-operatively (less neurologic deficit); 10 patients had the same status pre-post-operatively; 12 patients a temporary neurologic deficit with full recovery after weeks; 3 patients a definite additional deficit. We find a good correlation between the estimated neurologic deficit by monitoring and the clinical outcome.

Conclusion
Intra-operative electrophysiological monitoring is an additional tool to be more safe in surgery of lesions in the peri-rolandic area. It can be useful to have an idea of the neurological outcome after surgery and the evolution of an eventual neurologic deficit.
Early assessment of the intra-operative use of 5-aminolevulinic acid (5-ALA) in patients with glioblastoma multiforme (GBM)

**Keywords:** 5-ALA, GBM

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Introduction: The extent of surgery is one of the significant, independent prognostic factors in patient with GBM. Operating microscopes and neuronavigation as such do not improve the rate of radical resection. Moreover, the evaluation of the exact extension of these highly infiltrative tumors remains a difficult task.

Material and methods: We conducted a retrospective analysis of a consecutive series of 66 patients thought to have a malignant glioma on preoperative MRI. An oral application of 20mg/kg was administered 3 hours before induction of anesthesia. It has been established that 5-ALA leads to a specific accumulation of fluorescent protoporphyrin in malignant gliomas. Intra-operatively tumor fluorescence was visualized using a dedicated operating microscope. Fluorescent tissue was removed whenever it was considered safe.

Results: All GBM showed bright fluorescence, whereas metastasis, radionecrosis and low grade gliomas faint or no fluorescence at all. Complete resection was obtained in 36 patients. Residual intra-operative fluorescence predicted residual enhancement on early postoperative MRI. Vomitus after 5-ALA intake was seen twice. One patient developed a focal photosensitisation after unintended exposition to white light. No significant increase in persistent postoperative neurological deficit was noticed.

Conclusion: Our results confirm that the intra-operative use of 5-ALA is a safe, feasible and effective tool improving the radicality of tumor resection without additional morbidity or mortality. The surgeons' intra-operative impression of the extent of the resection correlates well with postoperative MRI findings. Long-term follow-up of patients suffering from GBM is mandatory to evaluate if complete 5-ALA resection also improves their survival.
Objective: To analyze the clinical and radiological outcome of patients treated with Gamma Knife radiosurgery (GKR) for vestibular schwannoma (VS) using a high-conformational dosimetric planning and a low margin dose. Material & Methods: Between January 2000 and December 2007, 300 patients with a VS were treated by GKR in our center using a margin dose of 12 Gy and a high-conformational multi-isocenters dosimetry. For 267 patients, GKR represented the first surgical treatment of their VS and for 33 patients (11%) GKR was used for a residue or recurrent schwannoma after surgery. A clinical and radiological follow-up (mean 32 months) was available for respectively 199 and 207 patients. Evolution of tumor volume on MRI and hearing on audiogram was retrospectively analyzed.

Results: The tumor volume decreased in 53%, remained stable in 20% and increased in 27% of patients; the median (+/-SD) volume reduction was 35% (+/-23%). Increased tumor volume was found mainly in patients with a follow-up <2y and could represent transient increase related to the radiation-induced central tumor necrosis effect. Eight patients (3.8%) need a new treatment after LGK because of tumor progression: 4 patients were treated by surgical removal and 4 patients by a second LGK procedure. No patient (0%) had new facial paresis following LGK. Audiological outcome was as follows: stable hearing in 61%, improved hearing in 3% and hearing worsening in 36%. Only 10 patients (5%) worsened hearing to cophosis after LGK, and only 38 patients (19%) with functional hearing before LGK worsened to non-functional hearing at the end of follow-up.

Conclusion: Using a highly conformational dosimetry and a 12-Gy margin dose, GKR is an effective treatment of VS and is associated with a very low morbidity in comparison with microsurgical treatment: no induced facial palsy and a low risk of hearing worsening.
**Cystic craniopharyngioma treatment by stereotactic instillation of β emitting radioisotopes (Yttrium 90)**

**Keywords:** cystic craniopharyngioma, stereotactic instillation, Yttrium 90

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Background: Craniopharyngiomas remain a challenging pathology for the neurosurgeon as radical surgical resection is often hazardous. Among the different treatment modalities, stereotactic instillation of Yttrium 90 for cystic craniopharyngiomas offers an effective and minimally invasive treatment according to the literature. The use of this technique in our Department is reviewed.

Material and methods: nine patients harbouring a cystic craniopharyngioma and treated by intracavitary irradiation with 90Yttrium silicate are reviewed. The radioisotope dilution technique, the CT and MRI cyst volumetry methods are used to reach a cumulative dose of 200 Gy at the inner surface of the cyst wall. The planning and the instillation are performed using a Leksell stereotactic software and frame.

Results: among the 9 patients, 5 were males and 4 females. The mean age was 31 years (range 6-65). The mean progression-free survival after intracavitary irradiation is 6.1 years (range 3 m- 23 y). The stereotactic intracavitary instillation was not in all the cases used as first modality treatment. Cyst shrinkage for more than 80% (up to disappearance) occurred in 4 cases. In 3 others the cyst was reduced for about 50%. In 2 cases it was considered as “unchanged”. The vision improved in 6 cases. In 1 case there was some improvement but the patient developed a visual field defect after a few months. In 2 patients there was no improvement. No complications occurred during the procedure or in the perioperative period. One patient died three months later from an unrelated reason.

Conclusion: from our experience, we consider the treatment of cystic craniopharyngiomas by stereotactic 90 yttrium instillation as a safe, versatile and effective method. It can keep the patient stable for years and can be repeated.
Epidural Anesthesia for Surgical Lead Placement in Spinal Cord Stimulation: Special Conditions

Keywords: SCS, epidural anaesthesia, surgical leads

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Introduction
Spinal cord stimulation (SCS), used since the eighties, has proven to be an effective treatment for patients with intractable pain syndromes (e.g. failed back surgery syndrome). A correct implantation of the SCS device is a prerequisite for a successful outcome. This can be done via a percutaneous implant protocol or a neurosurgical implant protocol. As the authors' expertise and preference, the placement of plate electrodes, with peroperative stimulation is the choice of implantation.

Methods
To optimize lead positioning, the patient must be awake in order to locate the paresthesias, as precise lead placement determines success.

Therefore intraoperative stimulation is the cornerstone during the procedure. A classical midline flavectomy was performed under epidural anesthesia using an epidural catheter inserted at level D12-L1, with the tip of the catheter reflecting at level D10. A loading dose of 0.75% ropivacaine with 0.5 microgram sufenta per milliliter was injected through the epidural catheter. Top up doses of 4 milliliter ropivacaine were given for reaching segmental sensory block of the region of intervention, which allows perfect intraoperative stimulation testing of the posterior placed epidural plate electrodes. As compared with midline placement of the electrodes under fluoroscopy, this technique allows us to replace the electrodes after intraoperative testing in the following conditions associated with neuropathic pain: severe scoliosis, complex pain syndromes with coccygodynia, elective phantom pain, tethered cord syndrome and other spinal malformations.

Conclusion
Exact placement of the surgical electrodes is essential for success. Mostly midline position gives the best results, but in special conditions with severe malformations, the electrodes must be replaced for better results. This technique of epidural anesthesia allows the neurosurgeon a larger space of placing the electrodes in order to stimulate the exact region and level for maximal pain relief.
**Burst stimulation: a new form of paresthesia free spinal cord stimulation**

**Keywords**: Spinal cord stimulation, pain, DCS, burst stimulation

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Introduction: Spinal cord stimulation is commonly used for neuropathic pain modulation. The major side effect is the onset of paresthesias. The authors describe a new stimulation design which suppresses the pain as well, or even better, but without creating paresthesias.

Methods: 9 patients were implanted with a spinal cord stimulator for neuropathic pain. All underwent implantation of a laminrode 44 (ANSMedical, Plano, TX) via laminectomy: 3 at the level of C2 and 6 at D11 for cervicobrachialgia and lumboischialgia respectively. During the period of external stimulation the patients received the classical tonic stimulation (40 or 50 Hz) and the new burst stimulation (40 Hz burst with 5 spikes at 500 Hz/burst). Results: Pain scores were measured using a visual analogue scale (VAS) and a McGill Shortform during pre-operative, tonic and burst stimulation. Paresthesias were scored as present or not present. Burst stimulation is significantly better for pain suppression, both on VAS ($Z=2.37 \ p=0.018$) as well as on the McGill Short form ($Z=1.96, \ p=0.050$). Paresthesias were present in all patients during tonic stimulation, during burst stimulation they were absent in 67%. Conclusion: The authors present a new way of spinal cord stimulation using bursts in stead of tonic stimuli which suppresses neuropathic pain equally well or potentially better with as a major advantage that this novel form of stimulation does not create paresthesias.
Nonsuture Dural Rapiar Using a Patch and Fibrin Glue after Posterior Fossa Decompression in Chiari I Malformation

Keywords: Chiari I, nonsuture dural, Fibrin glue

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INTRODUCTION
An increasing body of evidence shows that using fibrin glue as adjuvant to the conventional dural closure with suture decreases the incidence of postoperative cerebrospinal fluid (CSF) leakage and its related morbidities.

OBJECTIVE
We describe a new technique of nonsuture dural closure using fibrin glue with graft placed subdurally applied for Chiari I patients treated via extra-arachnoidal posterior fossa decompression procedure (arachnoid preserved intact).

METHODS
Twenty-three patients were included in our study between June 1996 and June 2007. They were seven male and sixteen female patients, mean age 27 years (range 5-54 years). The mean follow-up was 44 months (range, 1-72 months). Dural substitution was performed using lyophilized fascia lata (LFL) (n = 16), Neuropatch (n = 3), Duragen (n = 2), and Duraform (n = 2). All patients received a lumbar drainage (LD) for a 3-5 day period postoperatively. The LD was performed using a 19-guage needle.

RESULTS
Surgical complications were recorded in three patients (13%) of our series. One patient had skin necrosis which was managed surgically (4.3%). Two patients (8.7%) developed a CSF fistula. Both had no incidental arachnoid opening at initial surgery, and dural substitution was performed using neuropatch and lyophilized fascia lata, respectively. Both patients required a surgical closure of CSF using fascia lata and tissucol in one of them, whereas gelfoam® and histoacryl® in the other. All patients of this series had a favorable evolution and no post-LD headache or surgery-related complications were recorded.

CONCLUSION
This reliable closure technique provides comparable results to that obtained using more sophisticated techniques (preventing CSF leakage in 91.3% in our series). It is a reasonable alternative for Chiari I treatment to be very quick and simple.
Recommendations of good practice for cervical disc replacement.

**Keywords:** Cervical, total disc replacement

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**Objective**
Implants for cervical and lumbar disc replacement are becoming increasingly popular. Medical Insurance companies reported a rise of 300% between 2002 and 2005. Yet, no clear evidence can be found in the literature about the indications for these implants. The Belgian Neurosurgical Spine Society (BNSS), felt it was its duty to try and clarify the rightful indications for these novel implants by the development of recommendations of good practice.

**Method**
As a complete consensus amongst all disc prosthesis users was unlikely to be achieved, the BNSS board developed a frame of what they considered to be acceptable indications, then contacted very frequent users of disc prostheses, and the latter’s recommendations were implemented in the existing frame.

**Results**
The following situations would be considered as acceptable for cervical disc replacement: Age between 18 and 60, Radiculopathy due to soft disc herniation and/or moderate uncarthrosis, 1 or 2 levels maximum. None of the following contra indications should be found: Severe uncarthrosis, Severe facet arthritis, Clinical or radiological myelopathy with exception of myelopathy due to a big soft disc herniation in combination with a sufficiently large spinal canal, Spinal canal narrowing, Fracture, Infection. In conclusion, although these recommendations of good practice are in no way meant to be compulsory guidelines, we believe that they can be helpful to rationalize the use of cervical disc prostheses, in order to achieve a greater quality of care for our patients, yet keeping the costs for society contained.
Recommendations of good practice for lumbar disc replacement.

Keywords: Lumbar, Total disc replacement


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Lumbar total disc replacement (TDR) is increasingly popular. Medical Insurance companies reported a 300% rise between 2002 and 2005 but no clear evidence can be found in the literature about the indications for these implants. The Belgian Neurosurgical Spine Society (BNSS), felt it should try and clarify the rightful indications for these implants by developing recommendations of good practice. Therefore the BNSS board developed a frame of indications, then contacted very frequent users of disc prosthesis, and the latter’s recommendations were implemented. As a first recommendation, the surgeon should prove his ability to perform this operation (training certificate) or do it in collaboration with a dedicated abdominal/vascular surgeon or with one of those on standby in the hospital during the procedure. The following situations could be considered for lumbar TDR: Clear history of DDD, no sudden onset, preferably no radicular pain; One level, maximum two; Lumbar MRI showing clear signs of DDD; Age 18 to 55 years and a minimum of 6 months well managed conservative treatment. None of the following contra indications should be found: BMI > 28, Disc height under 3 mm, Spinal/foraminal stenosis, Fracture, Osteoporosis#osteopenia, scoliosis greater than 15° Cobb angle, Spondylolysis/Spondylolisthesis, Extreme facet degeneration, Extreme muscular degeneration or muscular disease, Tumor, Infection. Some additional tests can be suggested on a case to case basis: psychological evaluation, Bone scan, Full spine and dynamic X-ray. Surgeon driven discography may be also of interest in multiple degenerated levels. Caution is recommended with L5S1 (higher failure rate).

In conclusion, although these recommendations of good practice are in no way meant to be compulsory, we believe that they can help to rationalize the use of lumbar TDR, achieving a greater quality of care, yet keeping the costs for society contained.
Effect of preoperative degeneration, segmental alignment and surgical technique on postoperative segmental alignment with the Bryan Cervical Disc Prosthesis

Keywords: Segmental alignment, Prosthesis, Spine, Cervical

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Introduction:
Various short and intermediate follow-up studies have reported promising clinical results after treatment of degenerative disc disease with the Bryan Cervical Disc Prosthesis (BCDP). However, several research groups also reported adverse outcomes, such as postoperative segmental kyphosis. Therefore, the aim of this study is to investigate the influence of preoperative degeneration, preoperative segmental kyphosis and surgical technique on the postoperative segmental alignment (PSA) after surgery with a BCDP.

Methods:
In a retrospective study, PSA of 20 consecutive patients, operated by J.G. with a BCDP in 2000-2001 (Group 1), was compared with PSA of 20 consecutive patients, operated by the same surgeon with a modified surgical technique, i.e. changing the angle of approach, in 2005-2006 (Group 2). In both groups, PSA was correlated with preoperative degeneration, preoperative segmental alignment and surgical technique. Preoperative degeneration of the treatment level was scored using an objective scoring system. Based on lateral radiographs, the disc insertion angle (aDI), i.e. angle between the bisector of the prosthesis shells and the line connecting the posterior superior corner of the superior vertebra with the posterior inferior corner of the inferior vertebra; the angle of the functional spinal unit (aFSU), i.e. the angle between the superior endplate of the superior vertebra and the inferior endplate of the inferior vertebra; intervertebral range of motion (ROM); and angle between the shells of the prosthesis (aSH), were calculated. Lordosis is represented by a negative value, kyphosis by a positive value. PSA is expressed as aFSU.

Results:
ROM was maintained postoperatively in both groups (8.9° versus 10.6°; p>0.05). Preoperative degeneration and preoperative aFSU were independent. A significant difference in degeneration score (p<0.01) as well as in aDI (91.7° versus 93.8°; p<0.05) between Group 1 and 2 was observed. There was a significant difference in preoperative aFSU (5.8° versus -0.1°; p<0.05). A positive significant correlation between preoperative aFSU and postoperative aFSU was found (Pearson r: 0.75; p<0.05). A difference, however not significant, in postoperative aFSU between both groups was observed (3.6° versus 0.1°; p>0.1). Group 1 showed postoperatively significantly more kyphosis of the aSH than Group 2 (2.6° versus -6.7°; p<0.05).

Conclusions:
Between the two groups, preoperative degeneration, preoperative segmental alignment as well as surgical technique were (significantly) different. The results of this study prove that postoperative segmental malalignment associated with the Bryan Cervical Disc Prosthesis is device unrelated.
Complete resolution of longstanding sciatica persisting after one or multiple discectomies by radical nerve root decompression

Keywords: Failed Lumbar Discectomy, Sciatica, Transforaminal Lumbar Interbody Fusion

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Background: Sciatica persisting after discectomy without evidence of disc herniation on the postoperative imaging, is usually treated conservatively. We report 4 patients in whom persisting sciatica completely resolved after Transforaminal Lumbar Interbody Fusion (TLIF), thereby removing the facet joint and decompressing the nerve root over its entire course.

Cases: Over the past two years, 4 patients were referred to us that complained of sciatica which had never disappeared after discectomy. Patient age ranged between 39 and 50 and all were male. They all had significant back pain since the time of the discectomy. In 3 patients the immediate postoperative imaging had revealed no residual/recurrent herniation and in 2 of them a dorsal column stimulator (DCS) was implanted. The leg pain increased again, which was the reason for their visit, and repeat lumbar scans revealed disc degeneration, periradicular scar tissue and a disc protrusion in all three. The 4th patient underwent a discectomy twice with no effect on the sciatica. A subsequent scan showed a small disc protrusion, but was mainly characterized by massive intraspinal scar tissue.

All 4 underwent a TLIF and pedicle screw fixation at the affected level(s) with radical decompression of the nerve root including complete facet joint removal. The intervals between the last discectomy and the TLIF were 7 months, 2, 4 and 5 years. Post TLIF follow up ranged between 3 and 8 months. Back pain generally improved with mean Numeric Rating Scores (NRS) changing from 7.75 to 3.00. Leg pain not just improved to post-discectomy levels, but completely disappeared (mean NRS 7.25 to 0). One of the DCS implants has been removed since.

Discussion: After completely removing the facet joint, scar tissue has less chance of being compressive. We believe this explains how TLIF procedures led to complete resolution of leg pain persisting after discectomies.
Acute myelopathy due to thoracic disc herniation: report of 6 cases and management recommendations

Keywords: Myelopathy, non-traumatic acute paraplegia, thoracic disc herniation, thoracoscopic microdiscectomy, treatment

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Thoracic disc herniations (TDHs) occasionally present with an acute myelopathy. Due to a low incidence and different surgical technique in scarce case reports, management recommendations are non-existent. We encountered 6 patients in a consecutive series of 158 thoracoscopic microdiscectomies (TMDs). These 6 patients all had a hernia at or below T9-T10 and MR-documented myelomalacia. Surprisingly, 4 patients (66%) had a calcified TDH. Moreover, although sudden dorsalgia was the initial symptom in all but one, a precipitating event was noted in only one. Due to late diagnosis and/or referral patients were treated within a variable time interval (from less than 24 hours to 9 days), using standard TMD technique, carefull blood-pressure monitoring and high-dose methylprednisolone. All patients regained continence and ambulation, which may be due to the progressive character of the clinical picture and/or the applied surgical technique and timing.

We hypothesize that mechanical and vascular factors interact at the level of the spinal cord, resulting in cumulative microtrauma until a clinical threshold is reached and pain and/or myelopathy develop. Fortunately, in our experience even in case of profound acute myelopathy present for several days remarkable recovery is possible with adequate decompression. This would suggest timing is less relevant than surgical technique. Importantly, standard laminectomy is no longer acceptable because of a high risk of neurological deterioration. Alternative approaches may be used, however, the anterior transthoracic approach has the major advantage of reaching the hernia in front of the compromised cord, whereas TMD has the additional advantage of improved visualization and minimal postoperative discomfort.

In conclusion, TDHs presenting with an acute myelopathy may have a favourable outcome when diagnosed and managed timely and above all correctly. Sudden dorsalgia may be an important sign leading to an early diagnosis. Based on our results we strongly recommend surgical decompression in every case.
Lumbar microdiscectomy in a day surgery setting

Keywords: lumbar microdiscectomy, day surgery

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Introduction Since January 2007 patients can choose to undergo elective lumbar microdiscectomy in a day surgery setting in the University Hospitals Leuven if they fulfill the following criteria: ASA score 1-2, age 16 to 60 years, no coagulation deficits, no previous extensive lumbar surgery, living within a 30 km radius and relative available to watch the patient in the first 24 hours. This is a report of the author's experience with lumbar discectomies in day surgery.

Methods The author performed 27 day surgery lumbar discectomies in 2007 using the Metrx tubular retraction system. Patients received preoperative information on postoperative mobility by a physiotherapist. A customized physiotherapy program was started at two weeks post surgery. Follow up included two weeks and three months clinic visits. Patients were invited to fill out standardized questionnaires preoperatively and at 3 months postoperatively. A patient satisfaction questionnaire was distributed by mail.

Results Twenty-six patients were successfully discharged within 4-6 hours after surgery. One patient was admitted from the day surgery unit because of nausea and pain. No patient was readmitted after discharge from the hospital. At 3 months follow up leg pain had disappeared in 16 patients, disappeared almost completely in 7 and improved moderately in 4. For the nine patients that returned both pre- and postoperative questionnaires, the mean Oswestry score improved from 37.1 to 10.7 and the Numeric Rating Scores for back and leg pain respectively changed from 4.3 to 1.4 and 6.4 to 1.2. Two recurrences were seen (at 1 week and 7 months). Of the 18 patients that returned the satisfaction form, all were satisfied and 15 would choose for day surgery again.

Conclusion Outcomes are comparable to general discectomy outcomes in the literature. According to our first results, offering lumbar discectomy in day surgery is a safe and feasible option.
Objective: Minimal invasive spinal (MIS) techniques for posterior spinal fusion (PSF) associate percutaneous and minimal access techniques. They aim primarily at minimizing the traumatism induced by extended surgical spine exposure. Recent progresses in the instrumentations developed specifically-designed tools for insertion via minimally access approaches have highly contributed to their improvement. In this study, we have prospectively evaluated and followed 75 patients operated by MIS and compared their clinical and radiological result with patients operated by standard open posterior approach.

Materials and methods.
Since September 2005, 75 patients (32 women and 43 men, mean age: 44 yrs (20-76)) underwent PSF with MIS techniques. Preoperative and postoperative clinical evaluation was based on Oswestry score and analogical visual pain scale (VAS). Per- and postoperative complications were noted. Intraoperative radiation exposure was measured using specific captors. A systematic postoperative CT scans was performed to assess screw position. Patients were followed routinely at 6 week, 3,6,12 and 24 month postoperative. The same prospective evaluation was made for 110 patients (65 women and 45 men, mean age: 52 yrs (23- 89) who underwent PSF using a standard open approach. Both approaches were statistically compared.

Results: No significant demographic difference was observed between both groups. Complication rate were similar. Patients operated with MIS noted a significant decreased of their operative duration, transfusion necessity, postoperative pain and hospital stay. A significative improvement of Oswestry and VAS was noted for both techniques between pre and 1 year follow-up (p<0.05). A similar optimal screw-positioning rate was noted in both group but a higher dose of irradiation (P<0.05) was measured in MIS group.

Conclusion: MIS approaches for PSF allowed to minimize the morbidity associated with classical posterior open spinal arthrodesis with a similar long-term efficacy. Strategies to minimized radiation exposure associated with MIS must be encouraged.
Nucleus Replacement with the DASCOR# Disc Arthroplasty System: Two year follow up results of the European multi-center clinical studies

Keywords: Disc degeneration, nucleus replacement, 2 years follow up

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PURPOSE
The DASCOR# Disc Arthroplasty System is a nucleus replacement device used to alleviate discogenic pain and restore or maintain disc height and segmental mobility in the early stages of degenerative disc disease. The DASCOR# device made from a two-part in situ cured polyurethane, is implanted under controlled pressure while still liquid using a minimally invasive procedure. The polymer is contained within a polyurethane expandable balloon and cures to a firm, but pliable form within minutes. The DASCOR# Disc Arthroplasty System received CE Mark approval in July 2005 and a post market study has been started. The purpose of this studies is to evaluate the two year safety and effectiveness of the DASCOR# device in patients of ongoing multi-center prospective European studies.

METHODS
Eligible patients between February 2003 and November 2007 were followed for up to two years. Study inclusion criteria included mild to moderate single-level degenerative disc disease with concordant provocation discography, significant back pain (at least 5 and 40 on the respective VAS and Oswestry scale), six month failed non-operative care, and no prior fusion surgery. A standardized retroperitoneal mini-ALIF or ALPA approach was used to perform a total nucleus removal and implant the DASCOR# device. VAS and Oswestry scores, radiographic assessments and analgesic medication use (a three point scale) were all collected preoperatively and were postoperatively followed at multiple intervals throughout the twenty four months. Clinical success was defined as a 2 and 15 point decrease in the respective VAS and Oswestry scores.

FINDINGS
To date eighty three patients were implanted. Mean pre-operative VAS and Oswestry scores were 7.5 and 58. VAS and Oswestry scores improved post-operatively after twelve months, to 3.2 and 30 and after twenty four months to 2.7 and 15 respectively. Generally, analgesic medication use decreased dramatically over time with all patients experiencing significant improvements after three months. The analgesic medication use score of patients in the twenty four month follow up period was zero. MRI evaluations showed no subsidence or device migration. Finally, radiographic film assessments showed disc height and range of motion were maintained.

CONCLUSIONS
The two year clinical experience of the DASCOR# Disc Arthroplasty System demonstrated high clinical success and safety based on the significant postoperative pain reduction, functional improvement, and a low complication rate. The use of a standardized minimally invasive surgical technique proved to be reliable and safe with a low complication rate. The concept of total nucleus removal required for a successful DASCOR # device implantation demonstrated reliability in clinical use since the device conformed to the nuclectomy size and shape as confirmed in post-operative MRI.
Preliminary experience with PoleStar N20 iMRI in pediatric neuro-oncology

Keywords: Intraoperative imaging, magnetic resonance imaging, pediatric neuro-oncology, treatment

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Two years ago a PoleStar N20 iMRI system and StarShield were installed at our institution. We present our preliminary experience in pediatric brain tumor resection, a small yet well-documented series including supra- and infratentorial tumors in patients aged 5 weeks to 13 years. Patients were scanned using mostly 7min 4mm T1 sequences in 2, sometimes 3 orientations. Intravenous contrast (Magnevist 1ml /5kg) was administered after bulk resection, not before, enabling a comparison of pre- and post-gadolineum images looking for residual enhancement, which was found in 5 patients and subsequently resected in 2 of them.

One highly vascular infratentorial tumor was incompletely resected because of blood loss and large vessels surrounding the residual, leaving approximately 10% high in the tentorial notch. Six months later the residual was completely resected again using iMRI. One highly malignant tumor in a 5-week-old baby with marked hydrocephalus was debulked leaving a small periventricular tumor rim, preventing opening the ventricle with cerebral collapse and extracerebral fluid collections. The child did well and was reoperated (again using iMRI) 4 months later to achieve maximal debulking pre-chemotherapy. Surprisingly pathology now revealed a much better differentiated proces.

0.15 Tesla iMR images were satisfactory in all patients and were compared by a neuroradiologist to high-field strength MR images acquired within 24 hours postoperatively. Assessment of the amount of tumor resection or residual was identical in all paired examinations. The resection cavity was much better delineated on iMR images, with open skull and clear irrigation fluid inside, and was invariably obliterated even the day after surgery by postoperative oedema. The PoleStar N20 proved particularly well suited for pediatric cases, both supra- and infratentorial, providing fast, reliable images of surprisingly good quality. In all cases (posterior fossa included) the field of view was large enough to assess ventricular volume changes in realtime.
Three dimensional methylacrylate and wax skull modelling preparing cranioplasty in the treatment of complex craniosynostosis and skull malformation

Keywords: cranioplasty, three dimensional skull modelling, craniosynostosis

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Background: Complex craniosynostosis (e.g. coronal plagiocephaly, trigonocephaly, multisuture synostosis or skull malformation of unknown etiology) requires complex and prolonged cranioplastic procedures with high risk of comorbidity (blood loss, temperature decrease, cerebrospinal fluid leak, air embolism...) while most of the treated patients are still infants. Also, the cosmetic results are not always as expected; as evaluation during surgery is time consuming and difficult to obtain one often remains uncertain determining where to saw, how far to mobilise, how to rotate and how to fix the bone flaps. Certainly in cases of coronal plagiocephaly, when one has to decide how far to advance and how to incline the orbital rim, preoperative planning could be of valuable help. Therefore, we decided to realise three dimensional skull models in dental wax, enabling us to prepare surgery.

Materials and methods: With 1 mm thick and contiguous sliced CT scan of the skull in bone windowing, a three dimensional skull model was created in methylacrylate by Materialise, a corporation at Leuven, Belgium, spin-off of the Leuven University. At our department, by realising a negative cast in silicones, numerous copies of these methylacrylate models were produced in dental wax. These wax models proved anatomically exact and were quite easy and cheap to manufacture. They were extremely useful in preparing surgery as we could easily cut “bone flaps” with heated knives. These “bone flaps” could be bent, broken, rotated and fixated as in real surgery. However, realising these wax models was time consuming (in the range of 5 hours in a period of 2 days).

Results: From March 2005 up to now, we performed cranioplasty on 5 patients with the help of three dimensional skull modelling. Two patients suffered from unilateral coronal plagiocephaly (5m old male, 5m old female), one from multisuture craniosynostosis (6m old male with Apert's syndrome), one from trigonocephaly (5m old male) and one from a malformation in the maxillofrontotemporonasal region of unknown etiology (17y old male). On those 5 patients surgery was performed in a faster and more confident way. None of the patients suffered from complications related to the surgery. Apart from postoperative respiratory infection problems, no significant postop morbidity was encountered. None of these patients needed reoperations. We are confident that surgical comorbidity was reduced and that cosmetic outcome improved significantly thanks to the preoperative planning on the wax models.

Conclusion: Although the very limited number of patients and the time consuming preparation, we consider preoperative three dimensional skull modelling in dental wax as an affordable, reliable, very helpfull tool allowing to reduce operative duration and therefore comorbidity and to significantly improve cosmetic outcome. We will continue this preoperative planning in cases of complex craniosynostosis.
POSTERIOR FOSSA DECOMPRESSION IN SYRINGOMYELIA ASSOCIATED WITH TONSILLAR HERNIATION: CORRELATION OF MRI AND CLINICAL EVOLUTION

Keywords: Syringomyela, Tonsillar Herniation, MRI

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Background: Posterior fossa decompression has become the first surgical option in the treatment of hindbrain associated syringomyelia. We present a retrospective analysis of 55 patients with this pathology who underwent the procedure from 1989 until 2007.

Methods: Diagnosis was made by MRI of the craniospinal junction. The operation consisted of a tailored suboccipital craniectomy, removal of the posterior arc of C1 and a wide duraplasty (vicryl collagen in the early period, Preclude Goretex since 1995). The amount of necessary bone removal was estimated on the MRI to avoid slumping. The intradural manipulations were limited, and coagulation of the tonsils was only performed in exceptional cases. Postoperative clinical outcome and MRI findings were assessed.

Results: Nine patients experienced complications (4 aseptic meningitis, 2 hydrocephalus, 1 extradural hematoma, 1 pneumonia, 1 epileptic seizure). Follow up of 1 year minimum is available in 49 patients. At the latest follow up, 32 patients (65%) were improved, 11 were stabilized, whereas 6 experienced deterioration. Second procedures were performed in 5 patients: 3 redo posterior fossa decompressions, 2 syrinx shunts. In the recurrences, arachnoid adhesions at the level of the duraplasty were found. Postoperative MR images showed a favorable result in 42 out of 47 patients, consisting of syrinx collapse or reduction of the syrinx diameter. The correlation between clinical improvement and imaging findings was statistically significant, although this was not always true in individual cases.

Conclusions: We conclude that craniocervical decompression is a safe procedure with a considerable chance of clinical improvement or long-term stabilisation. Although total syrinx collapse is not as frequently seen as in syrinx shunting procedures, the clinical outcome appears to be better.