



## SGN

### 01 A computed tomography-based determination of a safe trajectory for placement of transarticular facet screws in the subaxial cervical spine (Free communication)

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**Introduction:** Placement of transarticular facet screws is one option for stabilization of the subaxial cervical spine. Small clinical series and biomechanical data support their role as a substitute for other posterior stabilization techniques; however, the application of transarticular facet screws in the subaxial cervical spine has not been widely adopted, possibly because of surgeon unfamiliarity with the trajectory. In this study, the authors objective is to define insertion points and angles of safe trajectory for transarticular facet screw in the subaxial cervical spine.

**Methods:** Thirty fine-cut computed tomography (CT) scans of cervical spines were reconstructed in the multiplanar mode and evaluated for safe transarticular screw placement in the subaxial cervical spine (C2/3, C3/4, C4/5, C5/6, C6/7). As in placement of lateral mass screws, the vertebral artery and exiting nerve root were bypassed posterolaterally. On the cranial lateral mass, the entry point was set 1 mm medial to the center. From this entry point, the sagittal angulation was set to traverse the facet joint plane approximately perpendicularly. For the axial angulation, the exit point was set posterolaterally to the transverse process (► Fig. 1). After ideal insertion angles and screw lengths were identified, the trajectory was simulated on CTs of 20 different cervical spines to confirm safe screw placement.

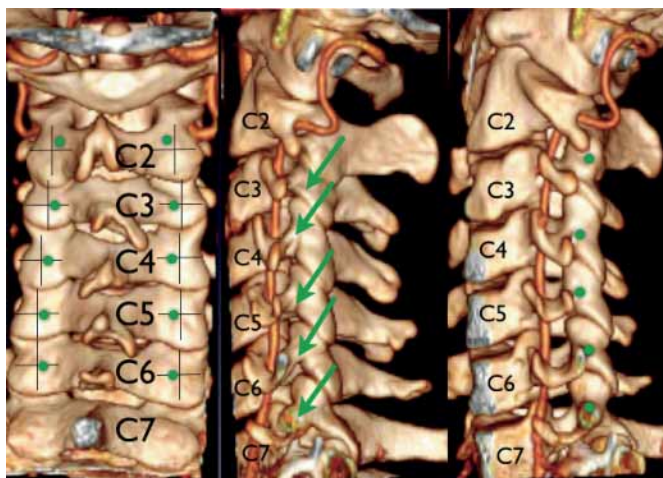


Fig. 1

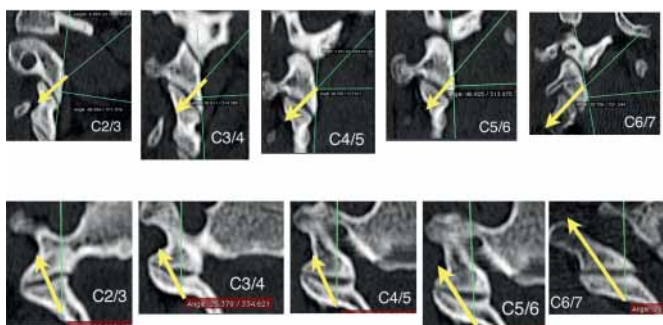


Fig. 2

**Results:** The mean optimal mediolateral insertion angles were C2/3 22±5°; C3/4 25±6°; C4/5 28±5°; C5/6 30±6°; and C6/7 34±7°. The mean sagittal insertion angles measured to a plane perpendicular to the surface of the two adjacent lateral masses were C2/3 50±12°; C3/4 47±8°; C4/5 47°±9°; C5/6 45°±8°; and C6/7 39±11°. Screw lengths were C2/3 17±4 mm; C3/4 15±3 mm; C4/5 16±2 mm; C5/6 16±2 mm; and C6/7 24±5 mm (► Fig. 2). Simulation of these insertion angles on 20 different cervical spine CTs yielded a safe screw placement in 85%–90% of spines for C2/3, C3/4, C4/5, and C6/7 and 72.5% of spines for C5/6.

**Conclusion:** The calculated optimal insertion angles and screw lengths for each vertebra may guide the safe placement of subaxial cervical transfacet screws.

### 02 Bow Hunter's syndrome: report of two cases and literature review

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**Introduction:** Among the many causes of vertebral artery insufficiency, rotational occlusion of the vertebral artery or Bow Hunter's syndrome is a rare yet treatable cause. The underlying pathology is a dynamic stenosis of the vertebral artery (VA) in its atlanto-axial, subaxial or proximal course with neck rotation or extension. Impingement of the vertebral artery by cervical spondylosis and osteophytes, fibrous bands, or lateral disc herniations have been reported as morphologic correlates.

**Methods:** We discuss the semiology, diagnostic workup, and surgical management of two patients with Bow Hunter's syndrome. In addition, the literature on rotational occlusion of the VA is reviewed, examining 126 cases published from 1960–2010 with regard to epidemiologic data, the location of the occlusion and the treatment recommendation.

**Results:** Both patients were managed by a combination of vertebral artery decompression and fusion of the subaxial spine. Each patient had > 50% occlusion of the left vertebral artery at the point of entry into the transverse foramen (1 C5/6, 1 C6/7) with a contralateral VA that ended in the posterior inferior cerebellar artery (PICA). 50% of published cases had stenosis in the subaxial spine (V2), 29% at the atlanto-axial (V3) and 21% within the proximal course of the vertebral artery (V1). Based on the literature review, patients present in the fifth to seventh decade (V1 47±4; V2 56±11; V3 58±13) and are more often male (male V1 59%, V2 73%, V3 57%). The most common recommendation for treatment was decompression alone (V1 100%; V2 92%; V3 64%). Less commonly, fusion or decompression and fusion was used (V2 8%; V3 36%). Most authors reported complete resolution of symptoms after surgery.

**Conclusion:** The results of the literature review provide epidemiologic data on this rare cause of vertebral artery insufficiency that is amenable to surgical treatment. Two patients with deficient collateral circulation in the vertebral-basilar system were successfully treated with decompression and stabilization.

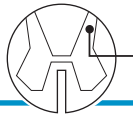
### 03 Cerebrovascular surgery within the concept of a hybrid operation room (Free communication)

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**Aim:** Intraoperative digital subtraction angiography (iDSA) is a rarely applied tool in cerebrovascular surgery, limited to the existence of an Hybrid Operation Room. In recent studies, iDSA has been shown to alter surgical treatment in approximately 12% of cases. It prevents unnecessary surgical manipulations after occlusion of aneurysms and accurately demonstrates occlusion rates. Primarily endovascular approaches even in crucial cases can be done with an option of immediate neurosurgical intervention in case of failure or complication. Our experience on cerebrovascular surgery within the concept of a hybrid operation room is presented.

**Methods and Results:** Since its introduction of iDSA in our center in August 2006, a total of 102 patients underwent iDSA. Indications included intraoperative eva-



luation of occlusion rate of clipped aneurysms and patency of vicinity vessels (n=30), chemical angioplasty with papaverin (n=4), balloon angioplasty (n=2) and primarily endovascular coiling with option on neurosurgical intervention (n=4). In two patients a reposition of the clip was needed due to neck remnant and perfusion of the aneurysm sack after clipping. In one case the clip was repositioned due to occlusion of a vicinity vessel to the aneurysm. In one case a sub-optimal occlusion of an aneurysm (Acom) could be documented. In this case reposition of the clip was unsuccessful in reaching a total occlusion of the aneurysm and the postoperative follow-up conventional angiogram and coiling of the remnant aneurysm uneventfully performed. All endovascular aneurysm embolizations were successful; in one case the coiling was followed by craniotomy to evacuate an intracerebral hematoma. A total of 5 cases underwent combined microsurgical and endovascular treatment of ruptured aneurysms and AVMs.

**Conclusions:** The concept of a hybrid operation room should be considered in the planning and design of operation rooms dedicated to cerebrovascular surgery. Hybrid procedures combining endovascular with microsurgical strategies within the same surgical session are feasible and safe. iDSA within the hybrid OR enhances the quality especially in identifying cases of vessel occlusion or aneurysm remnant after clipping and facilitates the definitive treatment of cerebrovascular pathologies. These procedures are associated with cost-benefit advantages.

#### 04 Clinically relevant complications related to pedicle screw placement in thoracolumbar surgery and their management: a literature review of 35 630 pedicle screws

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**Object:** The technique of pedicle screw insertion is a mainstay of spinal instrumentation. Some of its potential complications are clinically relevant and may require reoperation or for further postoperative care.

**Methods:** A literature search was performed using MEDLINE (between 1999 and June 2011) for studies on pedicle screw placement in thoracolumbar surgery. The authors included randomized controlled trials, case-control studies, and case series (20 patients) from the English-, German-, and French-language literature. The authors assessed study type, the number of patients, the anatomical area, the number of pedicle screws, duration of follow-up, type of pedicle screw placement, incidence of complications, and type of complication. The management of specific complications is discussed.

**Results:** Thirty-nine articles with 46 patient groups were reviewed with a total of 35,630 pedicle screws. One study was a randomized controlled trial, 8 were case-control studies, and the remaining articles were case series. Dural lesions and irritation of nerve roots were reported in a mean of 0.18% and 0.19% per pedicle screws, respectively. Thirty-two patients in 10 studies (of 5 654 patients from all 39 studies) required further revision surgeries for misplaced pedicle screws causing neurological problems. None of the analyzed studies reported vascular complications, and only 2 studies reported visceral complications of clinical significance.

**Conclusions:** Pedicle screw placement in the thoracolumbar region is a safe procedure with an overall high accuracy and a very low rate of clinically relevant complications.

#### 05 Comparison of robot-assisted and free-hand pedicle screw insertion for spinal instrumentation (Posterflash)

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**Introduction:** Recent years have been marked by efforts to improve pedicle-screw placement in spinal instrumentation. A robotic spine surgery system which indicates the direction of screw placement was developed to increase the accuracy of instrumentation. A number of reports on the system are surfacing with a range

of different opinions. After confirming the safety and accuracy of this system at our center, we compared the performance of the system with a cohort of patients who underwent freehand (i.e. fluoroscopy-guided only) spinal instrumentation.

**Methods:** Patients requiring elective spine surgery with posterior instrumentation were included in the study. In the robot cohort, pedicle screw trajectories were planned on the MAZOR (SpineAssist, Israel) image processing unit prior to surgery. Using a modified intraoperative fluoroscope and a spinous-process-clamp, we performed an intraoperative dataset matching and screws were inserted by the surgeon after receiving indications on the correct trajectory by the robot arm. Freehand screws were inserted using anatomical landmarks and lateral fluoroscopy. We recorded the duration of intervention. On postoperative CT scans, we evaluated the accuracy of screw placement using a scale by Gertzbein and Robbins (from A to E. A: perfect intrapedicular localization, E: >6mm deviation from ideal intrapedicular trajectory).

**Results:** The robotic system was used in n=38 patients, while n=52 patients were operated freehand during the same period. Surgery was indicated for degenerative (n=60, 6.7%), traumatic (n=17, 66.7%), osteoporotic (n=6, 18.9%) and oncological (n=7, 7.7%) disease. The instrumented segments (in %) were cervical (1%), thoracic (18%), lumbar (69%) and sacral (12%). Median age was 56 years (range: 27 to 83 years). Surgeries had a mean±SD duration of 211±48 minutes in the robot group and 200±53 minutes. The average number of instrumented levels was 2.2 (range 2 to 5) and a total of n=160 screws were placed in the robot group and n=327 in the freehand group. The trajectory was excellent (A or B) in 91.3% in the robot and 87.8% in the freehand group, satisfactory (C or D) in 5% and 10% and poor or revised (E) in 3.7/2.2% of cases. In the robot group, four screws had to be repositioned manually. There were no postoperative neurological deficits. The rate of good screws (groups A and B) was slightly higher (91.3% vs 87.8%, p<0.05) in the robot than in the freehand group (p<0.05).

**Conclusion:** We demonstrate that the use of the MAZOR system for robot-guided pedicle screw placement is safe and useful. Moreover, it can be associated with other techniques such as vertebroplasty, PLIF or TLIF. The added benefit of accurate screw placement may outweigh the slightly prolonged duration of surgery which we observed as part of the learning curve, although no neurologically apparent screw-related complications were noted in either group. In our experience, one of the merits of this system lies in its ability to facilitate access to regions where pedicle anatomy is difficult to visualize, such as the upper thoracic spine or in revision surgeries.

#### 06 Continuous monitoring of corticobulbar motor evoked potentials during skull base and brainstem surgery using the double stimulation technique (Posterflash)

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**Introduction:** To optimize cranial nerve (CN) monitoring recording of corticobulbar motor evoked potentials (MEP) of the facial and the vagal nerve have been described recently. As conventional mapping techniques can only be applied intermittently, methods for continuous monitoring of the functional integrity of the upper and lower motor neuron for all motor CN are needed.

**Methods:** A consecutive series of 35 patients who underwent skull base or brainstem surgery in our department from May 2009 to February 2011 was stratified in three different groups (G): G1=acoustic neuromas (n=13), G2=tumors in or close to the cranial brainstem (n=7) and G3=tumors in or close to the caudal brainstem (n=15). The following motor CN were continuously monitored by transcranial electrical stimulation (TES): CN III (n=4), CN V (n=27), CN VI (n=8), CN VII (n=34), CN IX (n=16), CN X (n=13), CN XI (n=8) and CN XII (n=12). TES was performed with a train of five anodic stimuli, pulse duration of 0.5 ms within one pulse and an interstimulus interval of 4.0ms. With an inter-train interval of 90ms after this first train, a single pulse was delivered called double stimulation technique. A single pulse which already elicited a motor response was considered as a peripheral response which activated the CN directly and thus this response was not used for further monitoring.



**Results:** In 26 out of 35 patients (74%) corticobulbar tract (CBT) monitoring was obtained with a high reproductively. In 6 patients (17%) monitoring of corticobulbar MEP had slight restrictions due to small MEP amplitude or high stimulation intensity. In 3 patients (9%) no continuous corticobulbar MEP could be obtained at baseline due to direct CN activation. Continuous reliable IOM was possible in the following percentage: CN III 75%, CN V 70%, CN VI 50%, CN VII 88%, CN IX 75%, CN X 85%, CN XI 75% and CN XII 83%.

**Conclusion:** Double stimulation technique provides continuous online assessment of the CBT, the motor CN nuclei and the peripheral CNs in many cases. This method may increase safety of brainstem or cranial base surgery.

## 07 Développement d'un nouvel indicateur de l'évolution et du pronostic chez le lombalgie chronique

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La lombalgie chronique est une problématique engendrant des coûts directs et indirects élevés même si elle ne touche qu'une petite partie de la population. Les patients les plus chers sont ceux en arrêt de travail prolongé. Il y a de nombreuses possibilités de traitement. Mais nous ne savons pas quel traitement proposer pour quel patient, à défaut d'une réponse claire on peut être tenté d'appliquer une approche multidisciplinaire. Mais c'est une approche engendrant des coûts sans garantie que l'approche bénéficie au patient. Dans ce contexte, quelques marqueurs de mauvais pronostic existent, comme les Test de Valens. Le but de cette étude préliminaire était de voir si, parmi le bilan initial, il existe une évaluation qui laisse présager une mauvaise évolution.

**Méthode:** Dans cette étude rétrospective, nous avons repris les dossiers de 500 de nos patients ayant accomplis un programme multi-disciplinaire se déroulant dans un contexte cognitivo-comportemental. Nous avons étudié différents auto-questionnaires (Oswestry; Roland-Morris, auto-questionnaire de Dallas; SF-36, HADS, Fabq) en parallèle à l'évaluation et l'évolution clinique associée à la reprise de travail.

**Résultats:** Nous avons constaté des restrictions de mobilité au niveau des ceintures scapulaires au départ, chez des nombreux patients qui n'arrivaient pas à reprendre le travail, même à une année du programme. Cette restriction était corrélée au FABQ et sa partie liée au travail. Ainsi nous avons développé un index, le FLAB, qui résulte de la somme des amplitudes articulaires au niveau de l'épaule en flexion et en abduction. Le FLAB max est à 720, et il existe une claire chute dans les résultats, dès FLAB initial inférieur à 600.

**Conclusion:** Ainsi, même si sur le plan physique il y avait des progrès, avec globalement une reprise de travail à 67%, l'index de FLAB permet de trier des patients ne bénéficiant pas d'une prise en charge multi-disciplinaire. La corrélation se trouvait sur le plan psychologique avec plus d'appréhensions et une mauvaise évolution dans les différents questionnaires de la douleur. Chez ces patients d'autres approches, avec un appui plus cognitivo-comportemental, seraient probablement plus efficaces.

## 08 Do statins reduce the risk of aneurysm development: a case-control study

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**Object:** Recent studies in rats demonstrated that statins may have an inhibitory effect on intracranial aneurysm (IA) development. The purpose of this study was to assess whether long-term statin use is associated with a reduced risk of IA formation in humans.

**Methods:** This was a single-center case-control study that included consecutive patients admitted to our institution from January 1, 2005 to December 31, 2008. A case was defined as a patient with confirmed diagnosis of IA by cerebral angiography. Three controls were matched to each case based on age, gender, and index year. The primary exposure of interest was cumulative statin use. Condition-

nal logistic regression was used to assess the relationship between statin intake and incidence of IA.

**Results:** In total, 1200 patients were included in the study. No overall association was found between statin use and incidence of IA (OR = 1.08; 95% CI 0.69–1.69), nor when dichotomized into hydrophilic and lipophilic user or by short ( $\leq 12$  months) and long ( $\geq 36$  months) duration of intake. Hypertension and smoking significantly increased the risk of IA development (OR = 4.02, 95% CI 2.49–6.45; OR = 1.67, 95% CI 1.02–2.72, respectively).

**Conclusions:** In contrast to recent experimental reports of the association between statins and reduction of IA, our findings suggest that in humans, statins may have no significant beneficial effect on IA suppression.

## 09 Does intra-operative magnetic resonance imaging extend resection rate in meningiomasurgery? (Posterflash)

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**Object:** Intraoperative magnetic resonance imaging (iMRI) has gained importance in the treatment of gliomas, sellar tumors and tumor biopsy. In meningiomas the extent of surgical tumor removal is one of the most important factors in the prevention of tumor recurrence. The aim of this study was to evaluate whether iMRI helps to extend surgical resection and procedural safety in complex meningioma surgery.

**Methods:** Patients undergoing meningioma resection using iMRI from January 2007 to January 2011 were included in this study. Indications for iMRI were invasive skull base meningiomas or meningiomas located adjacent to eloquent brain areas where the achievement of a Simpson-grade I resection was unlikely. Intraoperative MRI-scan (PoleStar N20<sup>®</sup> system, Medtronic Navigation, Louisville, CO, USA) was performed before and upon maximal achievable microsurgical and 5-ALA fluorescence guided tumor resection. Following data were recorded for analysis: tumor localization, histological grade, Simpson resection grade, procedure time, iMRI scan time, iMRI results, resection extended based on post-resection iMRI, mean hospitalization time, clinical outcome (<48 hours and after 2–27 months) and MRI imaging follow-up 2–27 months post-operative.

**Results:** 27 patients underwent surgery using iMRI. In 26 patients no further tumor resection was performed upon intra-operative post-resection imaging. Based on the intra-operative and post-operative image findings, total tumor resection (Simpson grade I and II) was achieved in 17 (58.6%) patients. Tumor resection was continued in one case (3.8%) without further extent of Simpson resection grade. Early (<48 hours) and delayed (after 11.6 $\pm$ 8.3 months) postoperative morbidity were 55.2% and 64.3%, respectively. The early and overall delayed post-operative mortality was 3.4% (n=1) and 10.3% (n=3), respectively; yet none was a result of surgical related brain or vascular injury. The iMRI results correlated in 20 cases (83.3%) with post-operative MRI scans.

**Conclusions:** iMRI is save for complex meningioma surgery with reasonable prolongation of procedure time. However, it does not provide additional benefit to improve clinical outcome and Simpson resection grade in complex meningioma surgery.

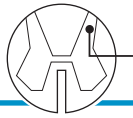
## 10 Early brain injury linearly correlates with reduction in cerebral perfusion pressure during the hyperacute phase during subarachnoid hemorrhage (Free communication)

Marbacher<sup>1</sup>; Neuschmelting<sup>3</sup>; Andereggen<sup>4</sup>; Widmer<sup>4</sup>; VonGunten<sup>5</sup>; Takala<sup>1</sup>; Jakob<sup>1</sup>; Fandino<sup>1</sup>

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**Introduction:** Early brain injury (EBI) after aneurysmal subarachnoid hemorrhage (SAH) emerged as a recent concept which embraces complex pathophy-



biological mechanisms that are linked to the initial bleed. The triggers and consequences of EBI are still poorly understood. The aim of the present study was to investigate whether hyperacute depletion of cerebral perfusion pressure is correlated with an increase in neuronal injury following experimental SAH.

**Methods:** Various degrees of SAH in terms of intracranial pressure (ICP) increase were initiated and controlled using an EC/IC blood shunt SAH model in 16 rabbits. Standard cardiovascular monitoring, intracranial pressure, cerebral perfusion pressure (CPP), and bilateral regional cerebral blood flow (rCBF) were continuously measured. Apoptosis was detected using the terminal deoxynucleotidyl transferase dUTP nick end labeling (TUNEL). Neurodegeneration secondary to ischemia was determined 24 hours after SAH using Fluoro-jade B (FJB) in bilateral basal cortex (BC) and hippocampal regions (CA1 and CA3).

**Results:** rCBF was significantly correlated to reduction in CPP during the initial 15 minutes after SAH in a linear regression pattern (reg coeff  $r=0.82$ ,  $r^2=0.68$ ,  $p<0.001$ ). The mean amount of FJB and TUNEL labeled cells were linearly correlated to reduction in CPP during the first 3 minutes of hemorrhage in CA1 and CA3 (reg coeff  $r=0.71$ ,  $r^2=0.50$ ,  $p<0.01$ ) and BC (reg coeff  $r=0.76$ ,  $r^2=0.54$ ,  $p<0.01$ ), respectively.

**Conclusion:** The degree of EBI in terms of neuronal cell degeneration in both, hippocampal regions and BC linearly correlates with the first few minutes of reduced CPP and impeded rCBF following SAH. The detected neuronal injury did not correlate with the amount of subarachnoid blood.

## 11 Focused ultrasound-surgery for aneurysms treatment (Posterflash)

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**Introduction:** High-intensity focused ultrasound allows distinct and non-invasive thermocoagulation of tissue. Combining the delivery of ultrasonic beam with a Magnetic Resonance Image-guidance, it is possible to target an intracranial lesion selectively and precisely for ablation. Focused Ultrasound has been shown not only to be capable of altering parenchyma but also to influence blood flow in vessels, assumable by a combination of thermal and mechanical energy. Using an animal aneurysm-model the aim of this study is to evaluate the influence of non-invasive Magnetic Resonance Image-guided Focused Ultrasound (MRIGFUS) on vessels and aneurysms typically found intracranial and hence evaluate this innovative technique as an option in future neurovascular treatment.

**Methods:** Monosaccular venous pouch aneurysms were surgically formed at an artificially created bifurcation of both common carotid arteries in 10 New Zealand White rabbits. While placed in a mounting on the ultrasound transducer plate, 3.0-T magnetic resonance (MR) angiography is performed. Under simultaneous MRI-guided temperature-control, aneurysms are sonicated. After sonication the effect on aneurysms and vessels is monitored immediately by MR- and in a 1 week and 3 month follow up by Digital Subtraction-Angiography. Additionally, a histological workup of the aneurysms is performed.

**Results:** Using the first mounting-prototype for the rabbits, a temperature of  $>50^{\circ}\text{C}$  could be achieved in the cervical region close to the carotic arteries. Such a thermal energy is reported of being capable of producing time depended thermocoagulation. The positioning of the rabbit has been optimized in order to get the target point in the area of the aneurysm and this ongoing study is proceeded with a new mounting-prototype. Data on the influence of non-invasive MRIGFUS on aneurysms will be reported.

**Conclusion:** The preliminary results of this study are promising and demonstrate the feasibility of the rabbit model for the validation of the methods for percutaneous treatment of experimental aneurysms.

## 12 Integrated intraoperative flat-panel CT, vascular imaging and navigation in skull basesurgery: an initial experience in the Genevahybrid operating suite

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**Introduction:** While the advantages of intraoperative imaging in intraaxial tumors are well documented, their role in skull base surgery is not clarified yet. Here, we used an integrated hybrid operating room equipped with a flat panel arm for intraoperative angiography, interventional procedures and CT acquisition for skull base tumor procedures and describe our initial experience with 15 procedures.

**Methods:** A flat panel system, integrating a pivoting C-arc intraoperative CT (Philips Allura FD 20), a surgical microscope (Zeiss Pentero) and infrared-based neuronavigation (Brainlab VectorVision II) was used. Intraoperative 3D angiography and same-session interventional procedures were also possible. Acquisition of images were performed pre-, per- or post-operatively.

**Results:** 15 surgeries were performed on 12 patients from February 2008 to February 2011: 5 meningiomas (2 foramen magnum, 1 pontocerebellar, 1 sellar, 1 petro-sigmoid), 8 chordomas and chondrosarcomas (6 of the clivus, 1 petrous, 1 petroclival), 1 foramen jugulare schwannoma and 1 suprasellar teratoma. Neuronavigation was used in 11 surgeries. An intraoperative CT was done and correlated to navigation in 5 patients (1 meningiomas and 4 chordomas) for resection control in 4 cases and anatomical orientation in 2 cases. Intraoperative CT imaging was categorized as useful in all patients who had intraoperative CT (6/15, 40%) by helping surgical decisions (change or confirmation of surgical plan). Associated interventional procedures (one immediate preoperative tumor embolization and one endovascular obliteration of an associated dural arteriovenous fistula) were done in two patients.

**Conclusion:** Peroperative CT imaging and navigation can be successfully integrated in skull base procedures without significantly disrupting the surgical workflow. The main advantages of this setting are real time anatomic orientation and resection control when needed. Moreover the possibility of one-session pre or postoperative CT imaging, vascular imaging or associated interventional procedures can further optimise surgical workflow. Overall, we judge that an integrated interventional suite and peroperative CT imaging increase the comfort of the surgeon in many procedures although intraoperative CT was not always judged necessary. Whether integrated peroperative imaging increases resection rates or avoids complications needs to be assessed in further studies with more patients.

## 13 Intracranial pressure controlled extra-intracranial blood shunt model for the study of early brain injury after subarachnoid hemorrhage (Free communication)

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**Introduction:** Cerebral vasospasm is no longer believed to be solely responsible for unfavorable outcome following subarachnoid hemorrhage (SAH). Pathophysiological derangements at the time of bleeding and within the first few days are made responsible for significant brain damage. This phenomenon of early brain injury (EBI) after SAH moved into the center of current research activities. These days, a rabbit model that reflects early events after SAH is missing. The aim of this study was to verify whether the non-craniotomy extra-intracranial (EC/IC) shunt bleeding technique qualifies as model for the study of EBI after SAH.

**Methods:** Experimental SAH was initiated by opening of an extra-intracranial (EC/IC) shunt from the subclavian artery into the cerebromedullary cistern to let blood stream into the subarachnoid space under arterial pressure. Standard car-



diovascular monitoring (arterial blood pressure, heart rate, ECG, end-tidal carbon dioxide partial pressure), intracranial pressure (ICP), cerebral perfusion pressure (CPP), and bilateral regional cerebral blood flow (rCBF) were continuously measured during the acute phase of SAH. Apoptosis was detected 24 hours post SAH using terminal deoxynucleotidyl transferase dUTP nick end labeling (TUNEL). Neurodegeneration secondary to ischemia was determined using Fluoro-jade B (FJB) in bilateral basal cortex, hippocampal regions (CA1 and CA3), and basal artery (BA) endothelial cells.

**Results:** After initiation of the EC/IC blood shunt ICP rose to diastolic blood pressure within one to two minutes and returned to a steady state in three to five minutes. Increase of ICP caused decrease of CPP to almost zero ( $7.5 \pm 4.7$  mmHg) and drop of left and right rCBF to  $23 \pm 8\%$  and  $19 \pm 9\%$  of its baseline value. Marked SAH was noted in all brain specimens. TUNEL- and FJB-stained sections revealed significant apoptosis and neurodegeneration in both cortex and hippocampal regions when compared to sham operated animals ( $p < 0.05$ ). The BA apoptotic index was 74%.

**Conclusion:** The results of the present study demonstrate marked early damage to the hippocampus, basal cortex, and cerebral vasculature 24 hours post SAH. Thereby, the ICP-controlled EC/IC shunt induced SAH model seems to qualify as a valid tool for further investigations of pathophysiological mechanism and potential treatment modalities in the pre-vasospasm phase after SAH.

#### 14 Intraoperative MRI and endocrinological outcome of transsphenoidal surgery

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**Introduction:** The question whether the use of intraoperative MRI (iMRI) in transsphenoidal surgery for pituitary adenoma has an impact on endocrinological outcome has not been answered. The aim of this study is to compare the endocrinological outcome of transsphenoidal surgery guided by iMRI to a matched control.

**Methods:** The endocrinological outcome of patients treated by iMRI-guided surgery for inactive pituitary adenomas ( $n=60$ ) was compared to a matched control group ( $n=32$ ).

**Results:** Total resection rates were 85% in the iMRI group, and 69% in the control group. iMRI-guided resection of tumor remnants lead to a higher total resection rate ( $P=0.007$ ). Specificity and sensitivity for detection of residual tumor by iMRI was 0.98, and 1, respectively. No patient in the iMRI group needed further treatment for tumor remnants, as opposed to 13% of the control cases. The rate of impaired pituitary function was 29% in the iMRI and 45% in the control group. Predictors of new hypopituitarism in the iMRI group were age  $>65$  years, Hardy's grade 3 and 4 tumors, and hypertension. Recovery rates were 59% in the iMRI and 45% in the control group. In the iMRI group adrenal, thyroid, gonadal, and somatotroph function recovered in 26%, 40%, 44%, and 40%, respectively. Predictors of better recovery rates were female gender ( $P=0.04$ ), and age below 65 years ( $P=0.002$ ). iMRI lead to an endocrinological benefit in the following cases: (1) more axes recovered in patients with Hardy's grade 1/2 tumors ( $P=0.04$ ); (2) less axes lost in correlation with age below 65 years ( $P=0.02$ ), absence of hypertension ( $P=0.003$ ), smoking ( $P=0.04$ ), pituitary apoplexy ( $P=0.005$ ); (3) less patients with loss of axes in the case of 2 or 3 impaired axes preoperatively ( $P=0.05$ ), and pituitary apoplexy ( $P=0.002$ ).

**Conclusion:** The use of iMRI in transsphenoidal surgery for nonfunctioning pituitary adenoma leads to a higher rate of total resection. Resection of tumor remnants detected by iMRI does not provoke higher incidences of postoperative hypopituitarism, or lower recovery rates of defunct pituitary axes. Patients with pituitary apoplexy show smaller loss of pituitary function, and patients with small tumors recover more axes if resection is guided by iMRI. Predictors of new hypopituitarism in iMRI assisted transsphenoidal surgery are age over 65 years, Har-

dy's grade 3 and 4 tumors, and arterial hypertension. Women and patients below 65 years show better recovery of function.

#### 15 Intrathecal morphine analgesia after cervical and thoracic spinal cord tumor surgery (Posterflash)

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**Introduction:** The objective of this study was to find evidence for the safety and efficacy of intrathecal morphine application for postoperative pain control after multilevel cervical and thoracic laminectomy for resection of spinal cord tumors.

**Methods:** Twenty consecutive patients undergoing resection of cervical and thoracic spinal cord tumors were enrolled in a prospective open proof-of-concept study approved by the local ethical committee. General anesthesia was maintained using propofol and remifentanyl, and in some patients ketamine. Immediately before dural closure morphine ( $7 \mu\text{g}/\text{kg}$  normal body weight) was injected into the subarachnoid space over a surgically placed catheter. Postoperatively all patients were monitored on an ICU overnight. All received acetaminophen and metamizol. Additional morphine was given intravenously as needed. At 1, 2, 4, 6, 8, 10, 12, 16, 20, 24, 48 and 72h after surgery pain was assessed using a numeric rating scale. The additional amount of morphine given and side effects of morphine, respiratory rate, oxygen saturation, mean arterial blood pressure, and heart rate were documented.

**Results:** Six patients (7–71 years, mean 52) received a mean morphine dose of  $365 \mu\text{g}$  (140–450) between C3 and C7. Fourteen patients (7–76 years, mean 42) received  $436 \mu\text{g}$  morphine (150–550) between Th2 and Th12. Mean NRS was highest upon admission (1.2 in the cervical and 2.5 in the thoracic groups respectively) and declined in the first 12 hours in both groups (0.5 cervical, 0.8 thoracic). Both groups showed a second peak at 24 hours (0.9 cervical, 1.6 thoracic). Only minimal extra morphine was given in both groups. Nausea and vomiting occurred in six patients, and pruritus in one. The lowest respiratory rate was seven. There was no significant desaturation below 90%. Blood pressure and heart rate were stable and unremarkable in both groups throughout.

**Conclusion:** Intrathecal morphine used for postoperative analgesia in patients undergoing laminectomy for cervical and thoracic spinal cord tumors is effective and cervical or thoracic injection is safe.

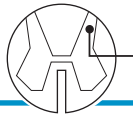
#### 16 Long-term patency of complex bilobular, bisaccular, and broad-neck aneurysms in the rabbit microsurgical venous pouch bifurcation model (Posterflash)

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**Background and Purpose:** In experimental aneurysm models, long-term patency without spontaneous thrombosis is the most important precondition for analyses of embolization devices. We recently reported the feasibility of creating complex venous pouch bifurcation aneurysms in the rabbit with low morbidity, low mortality, and high short-term aneurysm patency. In order to further evaluate our model we examined the long-term patency rate.

**Materials and Methods:** Various sizes of complex bilobular, bisaccular, and broad-neck venous pouch aneurysms were surgically formed at an artificially created bifurcation of both common carotid arteries in 17 New Zealand White rabbits. Early aggressive anticoagulation was continued for one month. The rabbits were followed up using contrast-enhanced three-dimensional 1.5-T magnetic resonance angiography (CE-3D-MRA) at 1 month and up to 1 year after creation of the bifurcation.



**Results:** At one-month follow-up all but one of the created aneurysms and all parent vessels proved to be patent. Three animals (18%) were lost during follow-up for reasons unrelated to aneurysm surgery. At one-year follow-up one animal showed partial and one complete spontaneous aneurysm thrombosis (aneurysm patency rate: 86%). Six out of 42 parent vessels were occluded at that time (vessel patency rate: 86%).

**Conclusion:** Complex bilobular, bisaccular, and broad-neck microsurgical aneurysm formation in the rabbit bifurcation model demonstrates a high long-term patency rate. Initial aggressive anticoagulation seems likely to be effectual for low rates of short-term thrombosis. There is no need for prolonged anticoagulation to achieve good long-term patency. Long-term evaluation is complicated by high rates of unrelated procedural mortality and morbidity.

## 17 Management of severe cerebral vasospasm refractory to initial endovascular treatment: feasibility and safety

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**Background and purpose:** Cerebral vasospasm (CVS) remains a major cause for delayed neurological morbidity and mortality in patients with aneurysmal subarachnoid hemorrhage (SAH). In patients suffering from severe CVS which is refractory to medical and hemodynamic therapies, treatment options are limited. This study evaluates the clinical outcome of patients undergoing the approach of repetitive endovascular interventions during treatment of severe CVS.

**Materials and methods:** During a 2 ½ year period 256 patients with SAH (4.2%) were treated in our neurovascular center. Eleven patients (7 female, 4 male, mean age: 49 years) were retrospectively included in the study. All these patients met the criteria of medically and hemodynamic refractory cerebral vasospasm. Furthermore, in order to prevent cerebral ischemia, endovascular spasmolysis had to be applied in these patients at least three times during CVS course. Response to therapy was monitored angiographically by digital subtraction angiography (DSA), by transcranial Doppler (TCD), MR and /or CT Perfusion and neurologic examination during the treatment course. Functional outcome was assessed using GCS score, modified Ranking Scale (mRS) at discharge and at the last follow-up.

**Results:** The number of endovascular treatments ranged from at least three to six times at most. A total of 46 angiographic interventions (mean 4.2) were performed in this group of patients, treating a total number of 92 vessels territories (mean 8.7) during the course of CVS. There was no treatment-related mortality. However, in two cases (18.2%) dissection in the access vessel was observed, in one case requiring further treatment. Mean mRS at discharge was 4, mean mRS at the last follow-up was 2.6. In seven patients, the mRS at the last follow-up was ≤2 (63.6%).

**Conclusion:** The approach of repetitive endovascular interventions during the treatment of severe CVS refractory to medical and hemodynamic therapies is effective. Favorable functional outcome can be achieved in this small selected group of patients. Due to the fact that IAN acts only temporary, efficiency could only be obtained using an aggressive approach with the need of multiple endovascular treatments.

## 18 Motor cortex stimulation for treatment of chronic phantom limb pain (Posterflash)

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**Introduction:** Motor cortex stimulation with implanted electrodes has been used for refractory central pain syndromes involving facial pain, and pain related to thalamic infarction. Treatment for pain following plexus avulsion or spinal cord injury unresponsive to spinal cord stimulation has also been reported.

**Methods:** This is a case report about a 60 year old man with traumatic amputation of the right arm in 1972. The patient had unsuccessfully undergone deep

brain stimulation in the 1980s and ever since suffered from phantom limb pain with verbal rating scales of 5–8 with frequent daily peaks to 10. Due to scarring and a cervical myelopathy he was no candidate for spinal cord stimulation.

**Results:** A therapeutic trial of motor cortex stimulation was initiated in 2009. Two four-tip strip-electrodes (Resume<sup>®</sup>) were placed epidurally over the contralateral motor strip using both neuronavigation with anatomic landmarks and direct stimulation during awake craniotomy. After a two-week trial period suggesting a favorable effect a neurostimulator (PrimeAdvanced<sup>®</sup>, Medtronic) was implanted. Stimulation parameters were 210 microseconds, 6V, 40Hz. Stimulation was most effective with one single anodal electrode point regardless to the vector direction (ap, lat-med). During the two-year follow up pain scores were consistently reduced to 4–5 and the frequent pain peaks were entirely eliminated resulting in significant patient satisfaction. An accidental turnoff „trial“ of two weeks resulted in reemergence of the prior pain pattern, which was suppressed again with the stimulator turned back on.

**Conclusion:** Motor cortex stimulation resulted in significant long term pain reduction even in a seemingly hopeless decade long phantom limb pain syndrome.

## 19 Neurokinin type 1-receptor-based targeting of glioblastoma multiforme with toxin-labelled substance P (Free communication)

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**Introduction:** Local recurrence of glioblastoma multiforme (GBM) after standard treatment, i.e. surgery and radiochemotherapy, occurs in more than 90%. Local tumor control correlates to improved survival. In clinical trials, NK1-R overexpression of gliomas has been exploited by intratumoral injection of radiolabelled substance P (SP). However, the therapeutic effect of radiolabelled SP was difficult to predict despite proven NK1-R expression. Furthermore, radiopharmaceuticals carry substantial disadvantages. This study aims to develop a non-radioactive, SP-based local therapeutic system and at the elucidation of the underlying mechanism.

**Methods:** In this study we examined nine established human GBM cell lines quantifying their expression levels of NK1-R by Western Blot and qRT-PCR, discriminating between the full-length NK1-R-variant and the truncated NK1-R variant. Cell lines were exposed to toxin-SP-conjugates. Saporin and cholera-toxin were used as toxins. Cell survival and proliferation were quantified in a standardized photometric assay. Furthermore, we examine the physiological pathway of SP.

**Results:** NK1-R were expressed in all GBM cell lines with a 12-fold difference in expression levels. Cholera-toxin-SP remained without effect on cell proliferation in all cell lines. Saporin-SP exhibited a cytoreductive effect on six cell lines, with an impressive specific effect in one cell line. The level of NK1-R expression did not correlate with the cytoreductive effect. Predominant expression of full-length NK1-R is potentially a prerequisite for specific cytoreductive effect.

**Conclusion:** Toxin-SP-conjugates may be promising candidates for effective local GBM treatment. Further analysis of permissive or inhibitory factors besides the expressed NK1-R subtype on the action of the toxin-SP-compounds is ongoing.

## 20 New developments in nitric oxide research for the treatment of cerebral vasospasm

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Dysfunction of endothelial nitric oxide synthase (eNOS) resulting in deprivation of nitric oxide (NO) in the cerebral arteries is well known to contribute to initiation and maintenance of delayed cerebral vasospasm (dCVS) after subarachnoid hemorrhage (SAH). A variety of NO donors were tested for the treatment of vasospasm. However, their effectiveness against dCVS has been limited due to specific metabolic and kinetic characteristics, their side effects, and methods of



drug delivery. Newer generations of NO donors were developed to facilitate drug delivery and to bypass systemic adverse effects. Among them, sodium nitrite has proven to be effective in both prevention as well as reversal of dCVS in a primate model of SAH. This drug can be administered intravenously and has proven to be safe in humans in a phase I healthy volunteers study. This paper introduces pharmacological features of sodium nitrite, as a "new generation" NO donor and summarizes the results of our primate studies and healthy volunteer phase one study. The potential of a newly developed therapeutic approach for the treatment of dCVS is discussed.

## 21 Obersteiner-Redlich Zone of the nervus intermedius and its implications for the microsurgical treatment of the nervus intermedius neuralgia

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**Introduction:** Nervus intermedius neuralgia (NIN) is a very uncommon disorder with the following diagnostic criteria: pain paroxysms felt in the depth of the ear, lasting for seconds or minutes and intermittent occurrence; the presence of a trigger zone in the posterior wall of the auditory canal, and exclusion of a structural lesion. The pathophysiology of NIN is supposed to be similar to the other more popular cranial nerve neuralgias and consequently microvascular decompression of the NI is currently described as a suitable treatment. The Obersteiner-Redlich zone (ORZ), also referred to as the 'central myelin-peripheral myelin transitional zone' or 'glial/Schwann junction', of the nervus intermedius is thought to play a major role in the physiopathology NIN.

**Methods:** To confirm the presence and evaluate the histological features of the Obersteiner-Redlich zone (ORZ) of the nervus intermedius (NI), ten NI specimens from five fresh cadavers were microscopically analyzed for structural differences between their CNS and PNS segments. The entire NI was exposed, from the brainstem to the ganglion geniculi. The cisternal portion of the nerve along with the adjacent part of the brainstem was isolated and measured. The specimens were then embedded in paraffin, and longitudinal sections were stained with Luxol fast blue. The ORZ was analyzed under a light microscope.

**Results:** The diameter of the NI showed a mean of 0.62 mm (range: 0.5–0.8 mm, SEM: 0.033). The cisternal segment of the NI from the brainstem to the porus acusticus internus had a mean length of 13.97 mm (range: 9–18.8 mm, SEM: 1.13). The mean extent of central myelin was 0.5 mm (range: 0.189–0.797 mm, SEM: 0.067 mm) from the brainstem on the medial side and 0.33 mm (range: 0.102–0.546 mm, SEM: 0.06 mm) on the lateral side. Moreover, the length of the ORZ had a mean of 0.279 mm (range: 0.024–0.5 mm, SEM: 0.06 mm) on the medial side and 0.134 mm (range: 0.059–0.233 mm, SEM: 0.018 mm) on the lateral side.

**Conclusions:** Similar to the facial, vestibulocochlear and trigeminal nerves, the NI also presents an ORZ. However, the ORZ of the NI appears closer to the brainstem compared with the other cranial nerves. The exact location of the ORZ may play a role in diagnostic preoperative imaging and in the planning of surgical procedures for NIN.

## 22 Outer skull landmark based coordinates for measurement of cerebral blood flow and intracranial pressure in rabbits

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**Objectives:** Despite the increased use of intracranial neuromonitoring for the evaluation of acute pathophysiological derangements during experimental subarachnoid hemorrhage (SAH) reliable coordinates for the placement of monitoring

probes in rabbits are missing. The aim of the presented study was to determine and evaluate the safety and reliability of various locations of intraparenchymal intracranial pressure (ICP) and cerebral blood flow (CBF) probes according to outer skull landmarks.

**Method:** Experimental SAH was performed in 17 rabbits using an extracranial-intracranial shunt model. Intraparenchymal recordings from ICP probes placed in the frontal lobe were compared to measurements recorded from the olfactory bulb. CBF probes were placed on various locations in the frontal cortex anterior to the coronary suture. Insertion depth, relation to the ventricular system, and ideal placement location were determined on postmortem gross total dissections and histological examination.

**Results:** ICP recordings measured at the time of SAH from the right frontal lobe (baseline: 7.8±1.9; peak: 67.2±20.1; steady state: 20.6±3) did not differ significantly from those obtained from the right olfactory bulb (baseline: 8.4±2.1; peak: 71.2±28.2; steady state: 20.6±3). Ideal coordinates for intraparenchymal CBF probes in the left and right frontal lobe were found to be located 4.6±0.9 and 4.5±1.2 anterior to the bregma, 4.7±0.7 mm and 4.7±0.5 mm parasagittal, and in a depth of 4±0.5 mm and 3.9±0.5 mm, respectively.

**Conclusions:** The results of this study demonstrates that coordinates in relation to skull landmarks allow reliable and fast hitting of intraparenchymal locations for ICP and CBF probes. Practical accuracy of these coordinates can be warranted for safe and reproducible neuromonitoring in the rabbits' brain without the use of a stereotactic frame.

## 23 Percutaneous treatment of unstable thoracolumbar fractures including reconstruction of the anterior spinal column

M.G. Gugliotta; S.B. Berkmann; S.M. Marbacher; A.K. Khamis; A.F. Fathi; J.F. Fandino

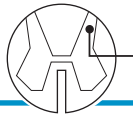
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**Introduction:** Fixation of traumatic unstable thoracolumbar fracture usually requires posterior fixation and restorage of the anterior spinal column in order to avoid anterior column failure resulting in secondary kyphosis, pain, instability, or late onset of neurological deficits. Anterior stabilization requires a second approach and often leads to considerable postoperative morbidity. We reported 3 patients presenting with an unstable thoracolumbar fracture undergoing percutaneous posterior fixation and reconstruction of anterior column using a by transpedicular ballonkyphoplasty (BKP).

**Material:** Two patients (1 female, 1 male) were admitted from June to August 2011 with traumatic unstable fracture of L1 and L2 respectively. Both patients received CT scan on admission and preoperative MRI to confirm the fracture as well as the disco-ligamentous injury. Mean age was 43 years (range from 27–58 years). Both patients underwent posterior transpedicular instrumentation in order to achieve restorage of the spinal alignment. Then a transpedicular BKP was performed on the fractured vertebra. For safety reasons only patients with an intact posterior longitudinal ligament (PLL) were treated.

**Results:** The average extra operative time of the BKP was 45 minutes (mean surgery time 180 min). Mean blood loss was 250 ml. The average amount of cement injected was 7.2 ml. The average vertebral body height increased anteriorly from 74% to 96% and centrally from 55% to 85%. No patient showed posterior bone displacement. The mean Cobb angle correction was 6°. No intraoperative, especially cement leakage, or postoperative complications were seen. Postoperative pain was managed using standard medication and resolved within 2–3 days after surgery.

**Conclusions:** Percutaneous treatment of complex thoracolumbar fractures including reconstruction of the anterior column in terms of BKP is safe and associated with low morbidity. Clinical and radiological long-term outcomes as well as possible complication such as cement leakage will be evaluated in our ongoing prospective study.



## 24 Phosphoproteomic analysis of malignant gliomas reveals distinct molecular subclasses

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**Introduction:** Malignant gliomas, especially glioblastoma multiforme, are largely heterogenous tumor entities. We intended to perform a selective phosphoproteomic and concomitant transcriptomic profiling analysis and correlating it to (a) prognosis (b) stem cell forming capacity in vitro and (c) standard molecular subclassifications based on published microarray data.

**Methods:** More than 60 freshly asserved tumor and control biopsies from tumor center and periphery (based on neuronavigation) were subjected to phosphoprotein and RNA extraction as well as tissue culture in stem cell conditions. Proteomic experiments were performed using reverse-phase protein arrays incubated with selected antibodies against an array of posttranslationally modified cancer pathway proteins. Corresponding transcriptional analysis was performed using qRT-PCR. All samples were histopathologically validated. Clinical and research data were pooled in a newly established brain tumor database based on the software ipath.

**Results:** We could confirm distinct molecular subclassifications of malignant gliomas by reverse-phase protein arrays that clustered according to recent publications by the cancer genome atlas (Proneural, Neural, Classical, and Mesenchymal) (1). Additionally, the ratio of phosphorylated to non-phosphorylated signaling molecules reflects the real-time activation pattern of selected pathways in an individual tumor. qPCR expression analysis was used as an internal quality control of baseline proteomic data. Correlation of profiling data to clinical parameters is currently in progress.

**Conclusion:** We present an in-depth molecular analysis of selected phosphoproteomic activation patterns in malignant glioma vs. control tumors and normal brain tissue. In contrast to earlier studies, our data reflect the current activation status of selected drugable pathways in the tumor tissue. Reverse-phase protein arrays represent a fast and reliable tool to supplement morphologic diagnosis with pathway-specific information in each individual tumor. Moreover, proteomic data corresponded to the underlying transcriptional profiling. These data can be further exploited for molecular stratification of future therapeutic approaches.

**References:** (1) Cancer Cell 2010 Jan 19; 17 (1): 98–110.

## 25 Pregnancy and childbirth after microsurgery for lumbar disc herniation

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**Introduction:** The influence of previous lumbar discectomy on pregnancy and childbirth has not been extensively studied. This study reports the course of pregnancies after lumbar discectomy.

**Methods:** Twenty-six 31.5±3.6 year-old patients who delivered 39 children were included. All patients underwent lumbar microsurgical discectomy prior to childbirth. Demographic and surgical data were collected from hospital records and patient questionnaires. The presence and course of low back pain (LBP) and radiculopathy signs were noted.

**Results:** Mean latency between surgery and childbirth was 42.5±34.8 months. Delivery was at gestational week 36 to 42, and the average weight of the new-born was 3390±0.490 g. Prevalence and new onset of symptoms during pregnancy was as follows: low back pain, 76% and 60%; leg pain 37% and 18%; motor deficits 13% and 6%; and sensory deficits 39% and 19%, respectively. No recurrent lumbar disc herniation was diagnosed within 6 months after pregnancy. Patients suffering from radicular pain during pregnancy were at risk of persistence of symptoms 6 months after delivery. Three patients had had surgery because of recurrent lumbar disc herniation during the follow-up of 7.73±2.66 years.

**Conclusions:** There is a low incidence of radicular symptoms during pregnancy after microsurgical discectomy. The incidence and prevalence of LBP are noteworthy. The incidence of symptoms does not vary in subsequent pregnancies.

Pre-existing radicular pain and LBP are likely to continue during pregnancy. The revision rate for recurrent lumbar disc herniation does not seem to increase after pregnancy.

## 26 Primary spinal anaplastic ganglioglioma – a very rare intramedullary spinal cord tumor

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**Introduction:** Gangliogliomas (GG) form a small subset of intramedullary spinal cord tumors (IMSCT) in children. The anaplastic variant (aGG, WHO III) appears to be an extreme rarity. A literature research revealed only 14 case reports of intramedullary aGG and only three pediatric cases.

**Methods:** We present the case of an 18 month old boy with sudden onset of paraparesis after an episode of a seemingly trivial malaise. Spinal MR imaging revealed a contrast-enhancing IMSCT ranging from Th6 to Th12.

**Results:** The patient underwent a standard laminectomy/laminoplasty and gross total resection of the lesion. His neurological status remained unchanged post-operatively and he recovered very well during inpatient neurorehabilitation. Neuropathologic examination revealed an anaplastic Ganglioglioma WHO III. Because of the high grade histology, adjuvant proton beam radiotherapy and extended chemotherapy with temozolomide was administered. The patient subsequently recovered to a normal functional status. Clinical and radiographic progression free survival is now four years.

**Conclusions:** Following an extensive literature review this is the forth case of a primary intramedullary AGG in a pediatric patient and the first case with a documented progression free survival of over four years. Another seven primary intramedullary AGG cases in adults and four cases of secondary spinal AGG cases subsequent to dissemination of a cerebral AGG have been reported. In comparison to the published case reports often indicating significant neurological dysfunction, the neurological recovery in our patient was favorable.

## 27 Radicular pain from lumbar stenosis in addition to preexisting phantom limb pain and disappearance of pain after lumbar decompression: case report

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**Introduction:** „Phantom limb pain“ (PLP) is a term which is used to designate the sensation of feeling the presence of an extremity following its amputation and that may be seen immediately after injury or years later in a part of the body that is deafferented or amputated.

**Methods/Case report:** To report a rare case of a 71-year-old male who had in 1997 an amputation of the left leg after a sepsis following a left iliac surgery. After this operation the patient described a classical phantom limb in the left leg with an irradiation to the first left toe. Since October 2010 he describes an “other pain”, different from the phantom pain and he complains also of radicular pain, following the dermatomes L5 and S1, from gluteal muscle to popliteal muscle, in both of legs. In the left leg he describes as cramps in the thigh and also in the leg-prosthesis, in correspondence of the left calf. This pain is present only after walking, about 200 meters, and it is not present at rest or by sleeping. Magnetic resonance imaging (MRI) of the lumbar spine showed multisegmental degenerative lumbar alterations with hypertrophic spondyloarthrosis and secondary lumbar stenosis at the levels L3-L4 and L4-L5, with compression of the left nerve root L5, and a left paramedian lumbar disc herniation L3-L4. The patient underwent surgery by fenestration with foraminotomy L3-L4 and L4-L5 (with decompression of the left nerve root L5), and sequester- and discectomy L3-L4 left.

**Results:** The patient reported complete relief of this radicular pain in the phantom limb after the decompression. There was no pain recurrence 6 weeks after the procedure.





**Conclusions:** This report demonstrates not only the difficulties in diagnosing radicular pain in amputees, but especially that the lack of significant back pain and the presence of this pain from the beginning made the diagnosis more challenging. A handful of cases have reported sciatica in amputees. These symptoms typically occur with back pain and are distinct from the patient's usual symptoms. As our case shows, these findings are not universal. Radiculopathy should be included in the differential diagnosis in amputees who have refractory phantom pain or a change in their usual pain symptoms, and maybe we should also discuss about the definition of "radicular" or "pseudoradicular phantom limb pain".

## 28 Risk of shunt dependent hydrocephalus in 389 patients with aneurysmal associated non-traumatic subarachnoid hemorrhage

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**Objective:** Ventricular peritoneal Shunt placement (VPS) after non-traumatic subarachnoid hemorrhage (SAH) is an essential and common procedure for the treatment of post hemorrhagic hydrocephalus. Since several predisposing factors for the occurrence of VPS have been controversially discussed in the literature, we sought to determine in this study significant factors in this regard.

**Methods:** Between January 2005 and December 2010, 389 consecutive patients with aneurysma associated non-traumatic SAH were treated at our department and included in this analysis. Initial diagnostics using computed tomography scan (CT) and digital subtraction angiography (DSA) were performed in all patients and decision for intervention (Clipping versus Coiling) was determined interdisciplinary. External ventricular drainage placement (EVD) was performed as part of the treatment plan in acute hydrocephalus and VPS shunting in chronic hydrocephalus, respectively. Data were statistically analyzed using t-test, Fisher exact test, and logistic regression analysis.

**Results:** Overall, shunt dependency was documented in 91 of the 389 patients (23%). Using logistic regression analysis Glasgow Coma Scale (GCS) (8 – 14 vs. 3 – 7,  $p = 0.016$ ; 15 vs. 3 – 7,  $p = 0.55$ ) and coiling ( $p = 0.017$ ) correlated statistically significant with VPS placement. The treatment modality surgical clipping was not a statistically significant variable for the need of VPS ( $p = 0.16$ ). Further analysis using a best fitting model (selected using stepwise regression with AIC) to predict shunt dependency was performed containing the variables Gender, GCS, Coiling, Clipping, Hunt and Hess Classification and Fisher Grading. While the best fitting model took all variables into account, only GCS ( $p = 0.0063$ ), coiling ( $p = 0.034$ ) and clipping ( $p = 0.022$ ) were statistically significant.

**Conclusion:** In this cohort we showed that patients with an initial GCS of 8 to 14 after aneurysmal associated non-traumatic SAH had a 2.5 times higher odds of receiving a VPS than those with a GCS of 3 to 7. Therefore, this subgroup needs to be followed-up closely and VPS should be performed if clinical or radiological signs are present, especially after coiling.

## 29 Targeted alpha-radionuclide therapy of functionally critical located gliomas with 213Bismuth-DOTA-substance P – a 4-year follow-up

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**Introduction:** In functionally critical located gliomas, therapeutic standards often cannot be applied because radical treatment and preservation of neurologi-

cal function are contrary goals. Intratumoral injection of beta-radiation emitting [90Yttrium]-DOTAGA-substance P has previously been shown successfully. In 2007, we launched a study to evaluate intratumorally injected [213Bismuth]-DOTA-substance in functionally critical gliomas. The alpha-radiation emitter 213Bismuth (mean tissue range only 81  $\mu\text{m}$ ) was expected to have a superior toxicity profile to 90Yttrium (tissue range 5 mm).

**Patients and procedures:** In a pilot study, we included five patients with critically located gliomas (WHO grades II-IV). After diagnosis by biopsy, [213Bismuth]-DOTA-substance P was locally injected, followed by tumor resection in two patients. Serial MR-imaging and clinical follow-up examinations were performed. Besides feasibility and toxicity, the functional outcome and tumor recurrence was evaluated.

**Results:** Targeted radioreptide therapy using [213Bismuth]-DOTA-substance P was feasible and tolerated without additional neurological deficit. The two patients with WHO grade IV-gliomas had survival times of 19 resp. 16 months. The patient with a grade III glioma is still in good clinical condition with local tumor recurrence 42 months after therapeutic injection. The two patients with grade II gliomas are without clinical or radiological evidence for tumor recurrence for 43 resp. 37 months.

**Conclusion:** This study provides proof of concept that targeted local radiotherapy using [213Bismuth]-DOTA-substance P is feasible and may represent an innovative and effective treatment for critically located gliomas. Especially for patients with low grade gliomas the data are encouraging and warrant further investigation.

## 30 The ubiquitin ligase Nedd4-2 is a potent regulator of the voltage-gated sodium channel Nav1.7 and is implicated in neuropathic pain

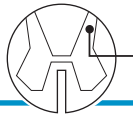
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**Introduction:** Neuropathic pain (NP) occurs after a lesion of the nervous system and is associated with nervous system hyperexcitability. Peripheral nerve activity is mainly carried by voltage-gated sodium channels (VGSC), with Nav1.7 isoform being important for nociception. Ubiquitin ligases from the Nedd4 family are well known proteins that downregulate the expression of many membrane proteins such as VGSC. We hypothesized that Nedd4-2 is decreased in NP, leading to an increase of functional Nav1.7 at the membrane of nociceptors, in turn responsible for the hypersensitivity observed in NP.

**Methods:** We used the spared nerve injury (SNI) as an animal model of neuropathic pain. Allodynia after SNI was assessed with Von Frey monofilament. Subcellular fractionation of dorsal root ganglia (DRG) allowing the separation of membrane and cytosol enriched fraction was performed to study the targeting of Nav1.7 after SNI. Nedd4-2 expression after SNI was investigated using both immunohistochemistry and western blotting. In vitro whole cell patch clamp on HEK293 transiently transfected with Nav1.7 alone, or Nav1.7 and Nedd4-2 was used to record sodium currents (INa), where the peak current of INa reflects the quantity of functional Nav1.7 expressed at the membrane. Nav1.7 currents were also recorded in DRG cells in culture. We used an adeno-associated virus intrathecally injected to exogenously overexpress Nedd4-2 in the DRG. T-test was used to compare SNI to Sham groups with GraphPadPrism software.

**Results:** The subcellular fractionation of DRG showed that Nav1.7 was only increased in the membrane enriched fractions. Nedd4-2 was decreased in DRG after SNI in immunohistochemistry (40%,  $p=0.0045$ ) and western blotting (50%,  $p=0.0078$ ). Co-transfection of Nav1.7 with Nedd4-2 reduced Nav1.7 current amplitude by ~80% ( $p=0.0023$ ) confirming that Nedd4-2 downregulates Nav1.7 at the membrane. Viral overexpression of Nedd4-2 in nociceptors decreased both the mechanical allodynia and Nav1.7 current (43%,  $p=0.027$ ) in dissociated nociceptors observed after SNI, indicating that Nedd4-2 is sufficient for counteracting full development of allodynia.



**Conclusions:** Our observations pave the way for new avenues in therapeutics against neuropathic pain. We could decrease NP behaviour and restore normal level of excitability by acting on regulatory mechanisms such as the ubiquitin ligase pathway instead of directly targeting VGSC.

## SGSS

### 31 A novel radiofrequency denervation method for cervical zygapophyseal joint pain based on ultrasound localisation of the nerves

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**Introduction:** In several studies, radiofrequency neurotomy of the cervical facet joint nerves has provided complete pain relief in 60–70% of the patients for about 9 months. The main disadvantages are procedural times of 2–4 hours, because several lesions need to be made due to the variable nerve course. Ultrasound imaging enables localisation of these nerves. This information could be used in order to reduce the amount of thermal lesions performed per nerve. We tested the hypothesis, that a shortened radiofrequency procedure based on ultrasound localization of the nerves would reach the benchmark of at least 80% pain relief in 80% of patients for a median duration of 35 weeks.

**Methods:** We studied 15 consecutive patients with cervical facet joint pain. They were treated using a shortened radiofrequency procedure under fluoroscopic control, based on ultrasound localisation of the joint supplying nerves, with only two lesions performed per nerve. Successful treatment was defined as at least 80% pain relief in the VAS.

**Results:** 14 of the 15 patients were successfully treated (93%, 95% CI 80–100%) with a median time of pain relief of 44 weeks. At 6 and 12 months, 13 (87%, 95% CI 70–100%) and 6 patients (40%, 95% CI 15–65%) reported successful treatment, respectively. The median duration of the procedure was 35 minutes (interquartile range 27–48 minutes).

**Conclusion:** In patients suffering from chronic cervical facet joint pain, radiofrequency denervation according to a shortened protocol based on ultrasound localisation of the nerves reached the benchmark of the standard technique.

### 32 Cervical facet joint nerve blocks, a novel technique based on ultrasound guided needle placement

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**Introduction:** Cervical facet joint nerve blocks are typically performed with fluoroscopic needle guidance. The use of ultrasound imaging to block the third occipital nerve has been described in a previous study, but whether this technique is accurate to block the remaining cervical medial branches, is unknown. The aim of this study was to determine the accuracy of ultrasound guided cervical facet joint nerve blocks.

**Methods:** In 60 volunteers, ultrasound imaging was used to place the needle to the bony target of cervical facet joint nerve blocks. The level of needle placement was determined by randomization (1–3 levels per volunteer). After ultrasound guided needle placement and application of 0.2 ml of contrast dye, fluoroscopic imaging was performed and the pictures saved for later evaluation by a blinded pain physician.

**Results:** A total of 106 needles were placed in 60 volunteers. In 90 attempts, the contrast dye reached the bony target, corresponding to a simulated block success rate of 85% (95% CI 78–92%). Successful block rate varied from 94% (95% CI

84–100%) for a medial branch block of C4 to 88% (95% CI 74–100%) for a third occipital nerve block, the great exception being the C7 medial branch, where successful block was achieved in only 41% (95% CI 19–63%).

**Conclusions:** Ultrasound imaging is an accurate technique to perform cervical facet joint nerve blocks in healthy volunteers, with exception of medial branch blocks of C7, where accuracy was low.

### 33 Complex regional pain syndrome: treatment related to aberrant inflammation mechanisms?

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**Introduction:** Complex regional pain syndrome (CRPS) is a painful disorder characterized by a continuing regional pain with various combinations of abnormal sensory, motor, sudomotor, vasomotor, or trophic changes (1). The field has been moving away from the traditional use of the CRPS-1/CRPS-2 dichotomy underscoring the implication of aberrant inflammation, vasomotor dysfunction, and maladaptive neuroplasticity in the development of this disabling disorder. According to the autoimmune hypothesis, a recent randomized controlled trial of low-dose (0.5g/kg) intravenous infusions of human immunoglobulins (IVIG) showed significantly reduced pain intensity in the treated group among 13 chronic CRPS patients (2). We recently encountered a young disabled CRPS patient and treated him immediately with IVIG: the improvement was so drastically evident that the case is briefly reported here, emphasizing that IVIG might also be a promising therapeutic alternative in the acute phase of the disorder.

**Case report:** D.C. is a 19 year-old man who recovered from a 7 hour-duration mandibular osteotomy with a right foot drop. Serum CK levels were elevated (3700 U/L, normal < 200). Examination revealed a right greater than left MRC grade 4 weakness of the extensors of the toes and feet, a right Achilles areflexia, as well as hypoesthesia of the whole right foot. Electrodiagnostic studies revealed non homogeneous motor and sensory axonal loss of the right sciatic nerve. Two weeks later, the patient reported hyperalgesia and neuropathic pain of the entire right leg with mechanical hypersensitivity, edema and erythema of the feet. As maximal dosage of pregabalin and tramadol did not reduced intensity of the pain, infusions of IVIG (total dose of 2g/kg) were given over 4 days. Within the first days of the IVIG treatment, pain decreased continuously and 2 weeks after CRPS onset (one month after surgery), the pain and skin manifestations completely disappeared with a slight residual muscle weakness of the right foot extensor. Quickly, he took up employment and had no further functional restrictions.

**Conclusions:** The most likely diagnosis for the patient is post-surgical compressive sciatic neuropathy with secondary CRPS. The elevated CK-levels and the long operation in reclined position in a slim patient makes a post-surgical inflammatory neuropathy in this context unlikely (3). The role of posttraumatic inflammation mediated by cytokines and substance P is well documented in CRPS1 and this pathway might be the targets of the beneficial action of IVIG, but the time, place and duration of IVIG infusions are not known in CRPS yet. Our reported patient underscores that early and high IVIG doses (2g/kg vs. 0.5g/kg) might speed healing this disabling disease in some patients. However to determine who should receive IVIG requires further, multicenter trials.

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### 34 Conditioned pain modulation in patients with low back and neck pain

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**Background and Aims:** Conditioned pain modulation (CPM) is an endogenous pain modulatory mechanism that occurs when response to a painful test stimulus is inhibited by an additional conditioning painful stimulus. Disturbed CPM is assumed in chronic pain patients and may be one of the mechanisms underlying central hypersensitivity. We tested whether patients with low back and neck pain display altered CPM.

**Methods:** In a running study, we analyzed 34 patients with chronic low back, 40 with acute low back, 36 with chronic neck pain and 21 healthy controls. Test-stimulus was pressure pain tolerance threshold (PPt, expressed in kPa) at the 2nd toe, measured before and immediately after conditioning stimulus at the hand (ice water test). PPt was defined as the point at which the subject felt the pain as intolerable. CPM was calculated as absolute difference between PPt after and PPt before ice water test. Mean differences were compared by Kruskal-Wallis ANOVA on ranks and multiple comparisons versus control group.

**Results:** All groups displayed significantly higher PPt after cold water test, i.e. a CPM effect ( $p < 0.001$ ). The mean differences (95% confidence intervals) of PPt after – before ice water test were: 161 (93 – 228) in chronic low back, 164 (120 – 207) in acute low back, 88 (49 – 126) in chronic neck pain and 141 (89 – 193) in controls. There were no statistically significant differences among groups.

**Conclusions:** In this preliminary analysis, we did not observe alterations of CPM in acute or chronic low back pain, and in chronic neck pain.

### 35 Congruence in the assessment of pain between patients and multidisciplinary care providers

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**Objective:** Cross-sectional study assessing pain prevalence in a medical rehabilitation division and comparing patients' and care providers' appraisals of pain and its treatment.

**Methods:** A questionnaire was developed and administered to the patients, physicians, nurses, and physical therapists of the division, investigating various aspects of pain during the hospital stay: prevalence of various types of pain including the neuropathic component, treatment-induced pain, documentation of pain in medical charts, and satisfaction regarding pain management.

**Results:** All the patients (N=97) hospitalized on the day of the survey were contacted; 80 patients could be included; mean age was 70 years (SD=13); 37% were female; median Charlson comorbidity score was 12. Pain was described as present in 80% of the patients with 92% of them describing it as requiring treatment, and 68% reporting treatment-induced pain (i.e. nursing, physiotherapy). Pain was mainly back- and cancer-related; prevalence of neuropathic pain was 21% (DN4 scale >4). Mean present intensity was 45 mm (VAS); 85% of the patients were satisfied with the information and the treatment of pain. Globally, care providers, whatever their specialty, had a significantly lower appraisal of pain; in particular, care providers failed to describe 30%-50% of patients' treatment-induced pain reports. However, care providers' satisfaction with the treatment of pain paralleled the patients' responses with 75%-80% of satisfaction (management, team commitment). Documentation of pain in medical charts (at the admission and during follow-up) was not optimal in all professional categories as compared with institutional recommendations.

**Conclusions:** Patients report a high pain prevalence during their hospitalization. This report is not congruent with care providers' appraisal. The recommended institutional procedures for the management of pain are underused. These results stress the necessity of further implementation of standardized pain assessment and follow-up measures.

### 36 Correlation between electrophysiological pain-parameters and peritoneal fluid inflammatory cytokine concentrations in endometriosis patients with chronic pelvic pain

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**Background:** Chronic pelvic pain in endometriosis is associated with hypersensitivity of the central nervous system, and also with elevated concentrations of cytokines and growth factors in the peritoneal fluid. We tested the hypothesis that the concentrations of inflammatory cytokines in the peritoneal fluid (PF) correlate with electrophysiological parameters of central pain hypersensitivity in endometriosis patients with chronic pelvic pain.

**Methods:** Eleven patients with histological diagnosis of endometriosis and suffering from chronic pelvic pain were tested. During surgery, PF was aspirated quantitatively, clarified by centrifugation and stored at  $-35^{\circ}\text{C}$  in aliquots. The concentrations of IL-8, tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), pregnancy-associated plasma protein A (PAPP-A), glycodeilin (PP14), RANTES, leptin, osteoprotegerin (OPG), midkine, macrophage colony stimulating factor-1 (MCP-1), IP-10, ficolin-2 lectin, defensin, human epididymal protein-4 (HE-4) and CA-125 were determined by single manual ELISA. The following electrophysiological tests were performed: (i) the size of reflex receptive fields (RRF) = area of the foot sole from which a reflex of the anterior tibial muscle could be elicited; (ii) the reflex threshold after single (RtSS) and (iii) repeated (RtRS) electrical stimulation of the sural nerve (current intensity that elicits a withdrawal reflex in hamstrings). Correlations were determined using Pearson's correlation. A  $p < 0.05$  was considered as significant.

**Results:** RRF area correlated positively with PP-14 (Pearson's rho  $\rho = 0.64$ ,  $p < 0.05$ ) and with ficolin-2 ( $\rho = 0.72$ ,  $p < 0.05$ ): the higher the concentration of PP-14 and ficolin-2, the larger the RRF area (meaning higher central pain sensitivity), and vice versa. IL-8 ( $\rho = 0.69$ ,  $p < 0.05$ ), PP-14 ( $\rho = 0.78$ ,  $p < 0.01$ ), MCP-1 ( $\rho = 0.69$ ,  $p < 0.05$ ), and CA-125 ( $\rho = 0.67$ ,  $p < 0.05$ ) displayed a positive correlation with RRF volume, indicating again an association between these cytokines and central pain sensitivity. RtRS correlated negatively with TNF- $\alpha$  ( $\rho = -0.80$ ,  $p < 0.01$ ): the higher the TNF- $\alpha$  concentration, the lower the RtRS (meaning higher central pain sensitivity), and vice versa. No correlation was observed between RtSS and the concentration of any cytokine tested.

### 37 Do we care enough about the social aspect of pain?

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**Introduction:** Looking at chronic pain following the principles of bio-psychosocial understanding of disease problems in social life are able to disturb the well being on other levels as mood, body functions, etc. In multidisciplinary pain treatment the role of the "psychosocial" - factors is emphasised. Although in most of our treatment units a specialized service of social workers is not provided.

**Purpose:** The purpose of the study was to estimate the percentage of persons attending a multidisciplinary pain centre, who need the help of a social worker. Furthermore we wanted to find out what kind of problems burden the patients.

**Methods:** To get the informations we developed a structured social interview.



The aspects of habitation, work, financial situation, insurance, family and social support were evaluated. The Interview was applied by social workers in 90 consecutive persons seeking treatment in a multidisciplinary pain centre because of chronic pain conditions. No selections were made.

**Results:** In 38% of the interviewed persons the investigation showed burden in two or more social aspects. The data are related to clinical data as chronicity of pain, signs of depression and anxiety and quality of life (SF-12). This analysis shows, that social factors are independent and not a secondary problem to pain or mood disturbance.

**Conclusions:** The developed interview is a first step to establish a screening for problems in social life. The high percentage of burden in different social aspects confirms the need for professional social work as a regular part in multidisciplinary pain assessment and treatment.

### 38 Effects of GABA-agonists on pain modulation: an experimental study in healthy volunteers

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**Background and Aims:** Neuropathic and inflammatory pain are associated with plastic changes of the central nervous system, leading to reduced glycinergic and GABAergic inhibitory control within the spinal cord. This diminished inhibitory control can be modulated by GABA-agonists, producing anti-nociception in animal models. The aim of this study was to explore GABA-agonists using a multimodal experimental testing procedure. Positive findings would encourage further development in the field of GABA-modulation.

**Methods:** Sixteen healthy male volunteers were tested in a double-blind, crossover, placebo-controlled study. Each volunteer randomly received 3 drugs on 3 different sessions: tolterodine (active placebo), clonazepam (typical GABA-agonist for neuropathic pain) and clobazam (less sedative GABA-agonist). Experimental pain tests were: area of secondary hyperalgesia induced by capsaicin, electrical stimulation of sural nerve and tibialis anterior muscle, pressure algometry on the second toe, ischemic cuff algometry, conditioned pain modulation

with ice-water stimulus as conditioning stimulus and pressure algometry as test stimulus.

**Results:** In a preliminary analysis clonazepam, but not clobazam, produced higher pain threshold to muscular repeated electrical stimulation, compared to placebo (► Fig. 3). The analyses for all the other quantitative pain measurements failed to show statistically significant differences between clobazam or clonazepam and placebo.

**Conclusions:** Based on preliminary analyses, we detected an analgesic action of clonazepam in only one of the experimental models used. Clobazam did not display analgesic action in any model. Because pharmacogenomic and pharmacokinetic analyses are pending, these results have to be considered as preliminary.

### 39 Expansion of nociceptive reflex receptive fields in patients with low back and neck pain

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**Background and Aims:** Expansion of receptive fields of spinal cord neurons may be one of the mechanisms underlying central hypersensitivity, and can be measured in humans with a new method involving nociceptive reflexes. We tested the hypothesis that patients with low back pain and neck pain display an expansion of nociceptive reflex receptive fields.

**Methods:** 40 patients with chronic low back pain, 40 with chronic neck pain and 14 with acute low back pain (data collection is running) were tested and compared with a cohort of 300 pain-free subjects. All subjects were tested by the same investigator (A.N.). Electrical stimuli were applied to 10 sites of the foot sole to evoke reflexes in the tibialis anterior muscle. The reflex receptive field area was defined as the area of the foot sole (expressed as fraction of the foot sole) from which a muscle contraction was evoked by the electrical stimulus. The groups were compared by Kruskal-Wallis ANOVA on ranks and Multiple Comparisons versus control group.

**Results:** All three patient groups displayed significantly larger RRF area, compared with pain-free subjects. Medians (25 and 75 percentiles, p-value compared to controls) were: acute low back pain 0.46 (0.33–0.52, p=0.004), chronic low back pain 0.39 (0.26–0.55, p=0.047), chronic neck pain 0.40 (0.29–0.48, p=0.006) and control group 0.30 (0.18–0.44). No significant differences between patients were observed.

**Conclusions:** This study provides the first evidence for widespread expansion of reflex receptive fields in acute and chronic musculoskeletal pain.

### 40 Family doctors' consultations with people suffering from chronic pain without objective findings: which protective practices might they develop in these challenging medical encounters?

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**Introduction:** Consultations with patients suffering from chronic pain without objective findings represent a challenge for family doctors (FDs). A mutual lack of understanding may arise, which threatens the doctor-patient relationship and may lead to dissatisfaction of both patient and doctor and to a breakdown of the therapeutic alliance.

**Objectives:** This study aims to investigate FDs' potential protective practices to preserve the doctor-patient relationship during this type of consultation.

**Method:** In the first step of this qualitative research, I carried out a range of 10 semi-structured interviews with FDs to explore their reported practices and representations during consultations with people suffering from chronic pain with

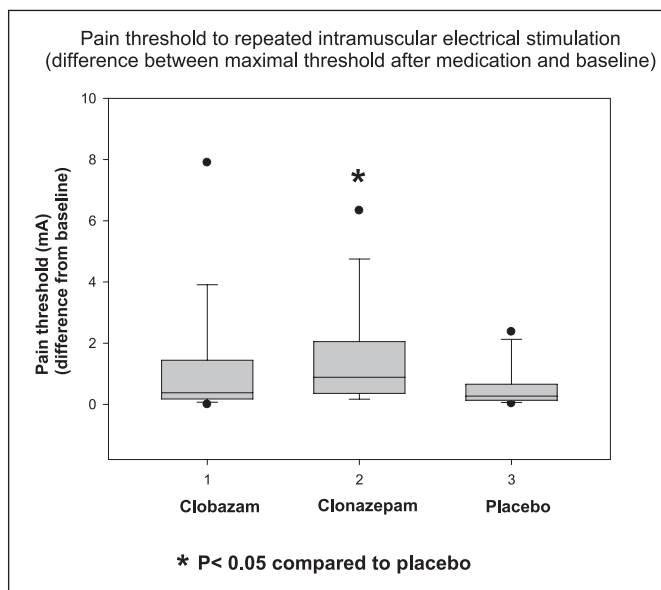


Fig. 3 Photography of the patient 2 weeks after surgery, demonstrating features of acute CRPS of the right foot, with swelling and hyperaemia.



hout objective findings. The interviews' transcripts were integrally analysed with computer-assisted thematic content analysis (QSR NVivo®) to highlight the main themes related to the topic in the participants' talk.

**Results:** At this point of the research, two types of FDs' protective practices can be identified: first the use of complementary sources of knowledge in addition to the medical model to provide explanations to patients, second the collaboration with multidisciplinary teams or support groups that allow them to share professional expertise and emotional experiences.

**Conclusion:** The findings could be useful to develop ways to improve the follow-up of patients suffering from chronic pain without objective findings and consequently the FDs' work satisfaction.

#### 41 Image guided percutaneous balloon compression in the treatment of trigeminal neuralgia

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**Introduction:** Among the percutaneous surgical techniques used for treating trigeminal neuralgia, balloon compression has shown successful results. We present our experience with this procedure (assisted by neuronavigation) and discuss the advantages and limits of the technique.

**Methods:** We retrospectively evaluated 14 consecutive percutaneous balloon compressions were performed in 13 patients under general anesthesia. Ratio male: female was 5:8, age was between 32 and 79 years old. The causes were in 23% multiple sclerosis and in 77% classic trigeminal neuralgia (atypical pain in 23%). In 77% of cases the trigeminal division affected was V2, in 4% V3 and in the rest of the cases 2 branches of trigeminal nerve were affected (15%V2+V1, 4%V2+V3). All the patients were resistant to previous medical therapy. 46% of the patients had a previous intervention (thermo coagulation or micro vascular decompression). All patients underwent the procedure at CHUV assisted by neuronavigation and radioscopy control, using the Mullan Percutaneous Trigeminal Ganglion Microcompression Set, with a compression of 2 (in 3 patients) /1,5 Bars (in 10 patients), with a compression time of 4+3+2 (in 3 patients)/3+2+1 minutes (in 10 patients) using KYPHON device (Medtronic). The patients were reevaluated 3 months and 1 year after the procedure.

**Results:** The mean duration time was 60 min. Navigation showed high correlation with fluoroscopic intraoperative images and was the only tool for guiding the catheter. In 3 cases the foramen ovale was not clearly visible on intraoperative fluoroscopic images. Triangular shape of the balloon correlated with a rapidly increasing and stable pressure over time. The initial success rate was 93% at one week postop, 85% at 3 months postop (1 patient needed a second compression). With a mean follow-up of 8,2 months (3 months-3 years), 72% are pain free. We observed a hypoesthesia of limited area in >70% of the cases (1 persistent diminution of the corneal reflex at 1 year without corneal injury), and 1 transient paresis of the motor branch. No anesthesia dolorosa was reported. We noticed 1 induced transient VI nerve paresia.

**Conclusion:** Image guided balloon compression is a safe and effective treatment for trigeminal neuralgia. Patients with multiple sclerosis and previous operations seem to have a higher rate of pain recurrence. Typical triangular shape of the balloon seems correlated with a higher reliability and stability of the compression as well as a lower morbidity.

#### 42 Is there a connection between low back pain, body posture and control?

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**Introduction:** Most of the persons suffering from chronic low back pain do not have a pathology that explains their condition. Recent publications report alterations in the muscular stabilisation system in these persons compared to healthy persons (Bouche, K (Eur Spine J) 2005, Brummage, S (Eur Spine J) 2008, Ha-

maoui, A. (Neuroscience Letters) 2004, Mok, N. (Spine) 2004, Popa, T. (Exp Brain Res) 2007, Ratzon, N. (Work) 2006, della Volpe, R. (Gait and Posture) 2006). Measurements of patients show an increase of body sway in standing position due to a perturbation of proprioception and a shift in posture control from "hip compensation" to "ankle compensation".

**Purpose:** The purpose of the study was to detect these changes in body sway, which is interpreted as a sign for disturbed body posture control, in our patients in contrast to healthy controls.

**Methods:** We tried to repeat these findings by measuring the body sway with open and closed eyes, recording the sway of the centre of pressure of the feet. The participants had to stand on a flat pressure-sensitive device. Simultaneously the movement of the tips of the spinal process C7 and S1 in anterior/posterior direction during measurement were recorded to have a direct measurement of body motion. Furthermore the shape of the spine from c7 to s1 was recorded. These measures were taken by optical stereography of the back. The ongoing measurement is performed in up to fifty persons with chronic low back pain and up to fifty healthy controls. The two groups are characterised by differences in pain, impairment, quality of life and mood.

**Results:** So far no significant differences in body sway or posture in both groups could be shown (work in progress). The reasons for this contradictory finding compared to literature are discussed.

**Conclusions:** If the concept of disturbed proprioception and subsequently changes of posture control, measured by increased body sway, as a cause of low back pain can only be proven under extreme laboratory conditions the question whether these findings do really matter is raised.

#### 43 Lack of efficacy of intravenous tropisetron on modulation of pain and central hypersensitivity in chronic low back pain patients

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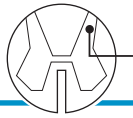
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**Background and Aims:** The activation of 5-HT-3 receptors may be one mediator of widespread central hypersensitivity, leading to exaggerated pain responses. The analgesic effects of 5-HT-3 receptor antagonists have been proven in patients with fibromyalgia. To our knowledge, no data on the efficacy of 5-HT-3 receptor antagonists in low back pain are available. This randomized, double-blind, placebo-controlled cross-over study was undertaken to test the hypothesis that the 5-HT-3 receptor antagonist tropisetron attenuates pain and central hypersensitivity in patients with chronic low back pain.

**Methods:** We studied thirty patients with chronic low back pain, 15 were women (age 53±14) and 15 men (age 48±14). A single intravenous injection of 0.9% saline solution, tropisetron 2 mg and tropisetron 5 mg was administered in three different sessions, in a double blind crossover manner. The main outcome was the pain VAS score before, 15, 30, 60 and 90 minutes after drug administration. Secondary outcomes were nociceptive withdrawal reflexes to single and repeated electrical stimulation, reflex receptive fields, pressure pain detection and tolerance thresholds at 2nd toe and pain drawing area. The data were analyzed by panel multiple regression.

**Results:** All three medication reduced VAS scores. However, there was no statistically significant difference between tropisetron and placebo in VAS scores. No effect of tropisetron compared to placebo on any secondary outcome was detected.

**Conclusions:** A single dose intravenous administration of tropisetron in patients with chronic low back pain had no significant specific effect on intensity of pain and parameters of central hypersensitivity.



#### 44 Measures of shoulder pain and function – a systematic review

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**Introduction:** More than 30 outcome instruments for measurement of shoulder pain and function exist in literature. This study aimed to review, to rate, and to compare the psychometric properties of the tools. The result is a chapter in the standard issue "Outcome Measures in Rheumatology" of the American College of Rheumatology (ACR).

**Methods:** Systematic review of >3000 abstracts and >300 studies.

**Results:** The DASH/QuickDASH (Disabilities of the Arm, Shoulder and Hand) is the best tested and most used self-rated questionnaire. However, it is region-specific for the arm, not shoulder joint-specific, and the use of a pain subscore was originally not described but can be performed. The SPADI (Shoulder Pain and Disability Index) and the ASES (American Shoulder and Elbow Surgeons) revealed highest validity and responsiveness. The partly examiner-based CS (Constant Score) has only one global pain question of questionable validity. The OSS (Oxford Shoulder Score) is fairly responsive but its validity is not well tested and it has no pain subscore. The SST (Simple Shoulder Test) and the SDQ (Shoulder Disability Questionnaire) provide only function scores and have binary item response options which affects the psychometric properties. For shoulder instability, the WOSI (Western Ontario Shoulder Instability) showed up the best data.

**Conclusions:** As a "set" of outcome measures in clinical assessment with focus on shoulder pain, the SPADI, the patient-ASES as an alternative, and the QuickDASH are recommended; the WOSI for instability. For a research set, the SPADI, the clinical-ASES eventually, and the DASH are most appropriate.

**Reference:** Angst F et al. *Arthritis Rheum* 2011; in press.

#### 45 Pain severity and pain chronicity might be negative outcome predictors for rTMS efficacy in neuropathic pain patients

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**Introduction:** The medical treatment of neuropathic pain is often disappointing because of low effectiveness and substantial side effects. New therapeutic options such as repetitive transcranial magnetic stimulation (rTMS) offer new approaches to the treatment of patients with neuropathic pain. There are controversial data regard the efficacy of rTMS in neuropathic pain. We investigate the efficacy of rTMS with regard to bio-psycho-social aspects of pain as pain severity, chronicity, quality of life and psychological comorbidity.

**Method:** We investigated 12 patients with neuropathic pain and one patient with persistent idiopathic facial pain who were refractory to medical treatment (8 females and 5 males). The diagnoses included central neuropathic pain (stroke: n=1; cervical myelopathy: n=3) as well peripheral neuropathic pain as trigeminal neuropathy (n=1), trigeminal neuralgia (n=1), nerve injury (n=2), cauda equina lesion (n=1) and CRPS type I (n=3). Patients were treated on 3 consecutive days according to the following schedule: a series of 20 trains of 5 s duration, 55 s intertrain interval, stimulation rate 10Hz, and 80% of resting motor threshold intensity using a figure-of-eight-shaped coil (1000 pulses per session). The pain intensity was recorded prior, during and over 2 weeks after the treatment using the numeric rating scale (NRS 0–10/10).

**Results:** There was no clinical meaningful change of pain intensities within 14 days after rTMS treatment (improvement less than 2 points at the numeric rating scale in all patients). The patients showed only mild suspect values for HADS anxiety 7,2 (range 1–16) and depression 8,5 (range 1–16). Eleven patients showed moderate and severe pain chronicity according to the Mainz pain staging score (MPSS). Eleven patients showed high von Korff stages as three and four indicating severe pain-related dysfunction. The SF-12 showed low physical 31,4

(range 16,2–52,5) and low psychic ratings 45,6 (range 28,7–62,7) which means low health related quality of life.

**Conclusions:** There are many reasons for rTMS treatment failure (1) in a tertiary pain treatment center one has to expect patients with multiple pain sites and one of those may be a neuropathic type pain; (2) a longtime conservative treatment failed; (3) pain chronicity stages are high describing mental and physical dysfunction; (4) high pain severity scores as a combination of pain intensities and pain-related interferences is another measure of mental and physical maladaptation; (5) intensive and logical medication did not positively interfere with the mechanisms of neuropathic pains; (6) the number of patients treated was too small.

#### 46 Perforation of a catheter for intrathecal medication – difficulties in diagnostics – a case report

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**Introduction:** Spasticity is a frequent comorbid condition of patients with spinal cord injury and consecutive paraplegic syndroms. One therapeutic approach is the oral application of baclofen. If unacceptable adverse effects occur, the therapy of choice is the intrathecal medication by means of an implanted pump.

**History:** Case report of a 53 year-old male patient with a traumatic incomplete sensorimotor quadriplegia below C7 since 1979. Conservative therapy (oral administration of baclofen) for leg and abdominal spasticity has not been successful, therefore, 2009 an intrathecal pump system has been implanted. Despite increased dosage no sufficient improvement of spasticity could be achieved during the days following the implantation; however, the application of a bolus regularly produced positive effects. A post-operative accumulation of liquid in the pump pocket was classified as seroma in the sonography. The technical functioning of the pump was secured, and X-ray images showed the catheter without a visible leakage. In the consecutive CT scan, however, a leakage was strongly suspected. Intraoperative findings showed a perforation of the catheter behind the connection point between catheter and pump.

**Discussion:** The clinical history indicated an insufficient intrathecal medication, which can be the result of a leakage in the catheter or a functional disorder of the implanted pump. The leakage could not be proven by conventional X-ray diagnostics. Only after the CT-scan was it possible to verify the clinical suspicion of a leakage. With this small perforation, given the low flow rate of the intrathecal pump (approximately 0.004 ml/h), it must be assumed that most of the baclofen was lost due to the leakage. In the depiction with the contrast medium, however, a relatively large volume was injected, which made it possible to depict the catheter as a whole. As the concentration of the contrast medium was low in the seroma (dilution effect!), the leakage could not be detected until the highly sensitive CT scan was made.

**Conclusion:** If there is a suspicion of an insufficient intrathecal supply, while the technical functioning of the pump is secured, an operative revision of the pump must be considered after exclusion of other clinical reasons.

#### 47 Quantitative sensory testing in chronic pain patients with non-dermatome sensory deficits

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**Introduction:** About 20–40% of chronic pain patients have widespread sensory deficits often in hemisensory distribution ipsilateral to the site of pain, a phenomenon termed non-dermatome sensory deficits (NDSs). Patients with



NDSs show no pathological findings in standard investigations, but decreased activity in the contralateral thalamus and somatosensory cortex have been found in PET and fMRI studies. Decreased sensitivity to light touch, temperature or pinprick has been described. Quantitative sensory testing (QST) revealed increased detection thresholds for touch, cold and heat as well as an increased heat pain threshold in patients with complex regional pain syndrome and hemisensory deficit. It was the aim of the present study to compare QST profiles in chronic pain patients with and without hemisensory NDSs.

**Methods:** In the ongoing study to date 25 chronic pain patients with hemisensory NDSs, and 11 without NDSs, in whom lesions of the central or peripheral nervous system had been excluded, were enrolled. Patients were investigated independently by two experienced neurologists at different dates. Only patients with consistent sensory deficits or who consistently showed no sensory abnormality in the clinical investigation were included. The following QST parameters were investigated in the face (cheek), dorsum of hand and dorsum of foot: Cold detection threshold (CDT), warm detection threshold (WDT), cold pain threshold (CPT), heat pain threshold (HPT), mechanical detection threshold (MDT), mechanical pain threshold (MPT), vibration detection threshold, pressure pain threshold (PPT).

**Results:** Patients with NDSs had a significantly lower sensitivity on the side ipsilateral to the pain for several parameters, with MDT, MPT, and CDT lower in two or more regions. Side differences were least pronounced on the dorsum of the hand, where only the parameter MDT was significantly lower on the ipsilateral side. In patients without NDSs no significant side differences were found for any of the parameters.

**Conclusions:** QST confirmed the clinical finding that in patients with NDSs the threshold to different sensory modalities is significantly increased on the side of pain compared to the contralateral side. This is in accordance with a QST study in complex regional pain syndrome with sensory deficits. The involvement of different sensory modalities would be consistent with a central mechanism for hemisensory impairment.

#### 48 Reliability of quantitative sensory testing in a low back pain population

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**Background and Aims:** Reliability is an essential condition for using quantitative sensory tests (QST) in research and clinical practice, but information on chronic pain patients is sparse. The aim of this study is to evaluate the reliability of different QST assessments in chronic low back pain patients.

**Methods:** The first 19 patients were included in this preliminary analysis. Patients received QST on two different sessions: pressure, electrical, heat and cold stimulation, and conditioned pain modulation using ice water (CPM). The data were analyzed with Pearson product moment correlation.

**Results:** The correlation coefficients (p-values) were: pressure pain detection threshold 0.75 (0.0002), pressure pain tolerance threshold 0.75 (0.0002), electric pain single stimulation threshold 0.49 (0.0337), electric pain temporal summation threshold 0.32 (0.189), NRS at supra-threshold electric temporal summation 0.75 (0.0002), heat pain detection threshold 0.33 (0.168), heat pain tolerance threshold 0.72 (0.0006), cold pain detection threshold 0.51 (0.0271), time to reach NRS 7 in ice-water 0.89 (0.0000), CPM on pressure pain tolerance 0.45 (0.0512), CPM on electric pain 0.53 (0.021).

**Conclusions:** Most QST were reliable. In this preliminary analysis, low reliability of some tests may partly be due to lack of statistical power.

#### 49 Réseau douleur des Hôpitaux Universitaires de Genève: déploiement d'un dossier informatique standardisé d'évaluation de la douleur

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**Introduction:** Le Réseau douleur des Hôpitaux Universitaires de Genève (HUG) a été institué pour améliorer la prise en charge de la douleur (<http://reseaudouleur.hug-ge.ch/>). Afin d'améliorer le dépistage et la documentation de la douleur des patients hospitalisés, un dossier patient intégré (DPI) informatisé a été développé pour l'institution.

**Méthode:** Des cliniciens médico-infirmiers, des infirmiers chargés de qualité et informaticiens ont conjointement développé puis mis en ligne un recueil de données structuré permettant de documenter le dépistage et le suivi de la douleur. Ce recueil comprend notamment des items centrés sur le vécu et sur les attentes de soins des patients ainsi qu'une sélection d'échelles d'évaluation (auto-évaluation/hétéro-évaluation) de la douleur assorties de recommandations d'utilisation pratiques. Le dossier patient intégré garantit également un accès facilité aux recommandations thérapeutiques disponibles sur le site internet du Réseau douleur. Des directives d'utilisation du dossier informatisé ainsi que des standards de soins validés (critères de choix des outils d'évaluation de la douleur, fréquence et modalités de documentation) sont diffusées aux collaborateurs.

**Résultats:** Le dossier douleur informatisé est disponible à tous les soignants des HUG depuis juin 2011. Sur la base des standards de soins validés dans l'institution, il est prévu de procéder à des analyses quantitatives et qualitatives des dossiers douleur. Ces analyses permettront de générer, par service, des indicateurs cliniques de prise en charge des patients.

**Conclusion:** L'amélioration de la prise en charge de la douleur au sein d'une institution est un défi qui nécessite la mise en œuvre d'actions interdisciplinaires multiples (consultations spécialisées, formations des collaborateurs, élaboration et diffusion de recommandations, accès à un support de documentation), et des collaborations interprofessionnelles centrées sur le patient et son bien-être. L'informatisation du dossier clinique ouvre des perspectives en termes de facilitation du travail des professionnels et de monitoring de la qualité de la prise en charge. L'impact de l'ensemble de ces mesures sur des outcomes cliniques et sur la satisfaction des patients fait partie de ce processus.

#### 50 Rufinamide alleviates mechanical allodynia in a mouse neuropathic pain model

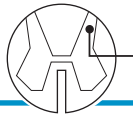
M.R. Suter<sup>1</sup>; G. Kirschmann<sup>1</sup>; H. Abriel<sup>2</sup>; I. Decosterd<sup>1</sup>

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**Background:** Lack of efficiency and heavy side effects of available drugs prevent satisfactory treatment of neuropathic pain. Dysregulation of voltage-gated Na channels (Nav1.x) is a central feature of pain hyperexcitability. Nav1.7 isoform is essential to pain perception since mutations in its gene are associated to either inherited pain syndromes or insensitivity to pain. We tested the potential of rufinamide (RUF), a Na channel blocker anticonvulsant licensed for treatment of Lennox-Gastaut syndrome (a severe form of epilepsy resistant to conventional therapy). In the present study, we compared the effect of RUF to amitriptyline (AMI, currently used to treat chronic pain) on a model of neuropathic pain and on Nav1.7 channel.

**Methods:** We used the SNI model of neuropathic pain in C57BL/6 mice (n=8-10/group). One week after nerve injury, RUF (5, 10, 25 or 50mg/kg) was injected (ip). A week later AMI (10 or 20mg/kg) was tested. Mechanical allodynia was assessed with von Frey filaments for 1 day. Drugs were also tested on naïve animals. Whole-cell patch clamp was performed to test RUF and AMI on Nav1.7 expressed in HEK293 cells.

**Results and Discussion:** RUF dose-dependently alleviated mechanical allodynia for 4h (p< 0.05, 25 and 50mg/kg vs ctrl) as well as AMI (p< 0.05, 10 and 20mg/kg vs ctrl). At 24 hours effect had worn off. On naïve animals, AMI increases



withdrawal threshold to mechanical stimulation and latency of withdrawal to heat stimulation whereas RUF had no effect at the doses used. IC50 to decrease peak current for AMI was 10µM and the reduction for RUF was 21.2% at 100µM (highest achieved in physiological solution). No significant difference on the V1/2 of voltage-dependence of activation was seen; however a shift in the steady-state inactivation curve was observed (-5.76mV for RUF and -9.56mV for AMI, p< 0.005). Use dependent block was observed at 5, 10, 25 and 50Hz (p< 0.05). RUF and AMI modulate Nav1.7 in vitro and demonstrated efficacy in alleviating neuropathic in an animal model. At equipotent doses on SNI induced allodynia, AMI showed alteration in behavioral response in naive animals possibly due to either alteration of basal pain sensitivity or a sedative effect.

**Conclusion:** Side effect is a major problem with drugs such as AMI. RUF shows a better tolerability in an experimental pain model. Taken together our results suggest RUF could be a new alternative for the treatment of neuropathic pain.

### 51 Success and pertinence of a pilot pain management E-learning program for nursing staff

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**Introduction:** At the University Hospital of Lausanne (CHUV), a policy named «Pain management» states that all health care professionals are accountable for pain management. To train nursing staff, a pilot e-learning program on pain management was created.

**Methods:** Different entities were involved with the training construction : clinical staff of Traumatology wards, Continuing education department and pain project manager. Pilot training consists of 17 short videos of about 5 minutes each deposited on an e-learning platform. An identical questionnaire is filled in before and after each video in order to test gain knowledge at pre-post viewing. The program is available during 2 ½ months from inside and outside hospital. Staff can train during their shift. Topics were: definition, assessment, management of acute pain and specialized techniques. Teams' training participation is voluntary but strongly encouraged. Team leaders' and trainers' support is specially marked during the training's period.

**Results:** 3 indicators demonstrate the pilot training's pertinence: high participation rate, increases in knowledge rates in pre and post questionnaires, and a very positive satisfaction rate regarding the pilot training's format. Traumatology team leaders noticed a better pain anticipation and pain management assessment, as well as the development of a more elaborate professional positioning regarding pain and pain management.

**Conclusions:** This program tested by the traumatology ward at CHUV was very successful. Supportive clinical leadership is a key element of program success. A long term evaluation of knowledge retention is being developed. The program is easily transferrable to other wards.

### 52 Tell me your troubles: a detailed observation of patient-physiotherapist interaction during initial encounters for low back pain problem

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**Introduction:** The aim of this study was to explore how physiotherapists and patients with low back pain address the patient's pain experience and its assessment during initial encounters.

**Methods:** Six consenting outpatients with low back pain and two physiotherapists (novice and expert) were videotaped during three initial treatment sessions. Conversation analysis was chosen as a method to help describe actual interaction. This approach provides an understanding of how sequences of interaction shape the encounter in an institutional setting. The video data were watched and sequences related to pain assessment were selected. The focus was on aspects

as turn-taking interaction, structural organisation and sequence organisation.

**Results:** The exploration of pain and its implication on function were key aspects of physiotherapist's investigation. The novice used recipient-designed questions and 'Okay' as a resource for initiating closure and to shift to a new topic. An evaluation framework was strictly followed and the patient interrupted when digression whereas the expert constructed the next question on the basis of the patient's discourse. The expert invited the patient to talk by a very open initial question "tell me your troubles?", acknowledged minimally the patient's description (yes, hm hm...) and used gaze and nodding as continuers. Some concerns as for example previous ineffective physiotherapy experienced by the patient were not fully investigated by the novice. The expert on the other hand was clearly addressing all issues. In order to close down the activity of pain and functional investigation, the expert also summarized his findings including a prognostic assessment of the patient's problem. It can be argued that this practice of communication aimed at initiating a fruitful collaboration. In regards to the investigation of pain components, the sensory-discriminative components were explored by the novice whereas the expert had a more global approach.

**Conclusions:** This paper examines the shared effort by patient and therapists during initial encounters in physiotherapy and describes the complexity of professionals' communication skills when evaluating patient's pain experience. It also shows some evidence of the novice's difficulties to listen and grasp the patient's perspective, essential with patients suffering from chronic pain. This implies a need to further teach and develop interpersonal communication skills in university professional schools.

### 53 The responsiveness of the SF-36 in the measurement of chronic pain

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**Introduction:** In rehabilitation of chronic pain, sensitive outcome instruments are needed to quantify changes of health and quality of life before and after therapy. We aimed to determine and compare responsiveness, i.e. the sensitivity to change of the following tools: Short Form 36 (SF-36), Multidimensional Pain Inventory (MPI), Numeric Rating Scale (NRS) for pain, and the cervical version of the Northern American Spine Society questionnaire (NASS).

**Methods:** The results of two prospective cohort studies before and after a four week inpatient interdisciplinary pain management program were summarized with a focus on the SF-36. Responsiveness was quantified by the standardized effect size and the difference of two effect sizes was tested on significance by the modified Jackknife test.

**Results:** Effect sizes (► Tab. 1)

**Conclusions:** The generic, i.e. "unspecific" SF-36 was equally sensitive/responsive in assessing pain when compared to condition-specific instruments. For the measurement of function, the SF-36 was more responsive than the specific questionnaires. These results are derived from chronic pain condition and might be different in acute pain.

**References:** (1) Angst et al. BMC Med Res Methodol 2008; 8: 26; (2) Angst et al. Clin Rehabil 2011; in press.

**Tab. 1** Effect sizes

Pain					Function				
SF-36	MPI	NRS	NASS	Significance	SF-36	MPI	NRS	NASS	Significance
0.72	0.85	-	-	no	0.41	0.15	-	-	yes
0.72	-	0.62	-	no	-	-	-	-	-
0.61	-	-	0.62	no	0.63	-	-	0.23	yes





**54 Widespread nondermatomal somatosensory deficits in chronic pain patients: pain history and psychological background**

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**Introduction:** Patients with chronic pain disorders often show nondermatomal somatosensory deficits (NDSDs) that are considered to be functional. According to DSM-IV and ICD-10 functional somatosensory deficits are classified among mental disorders (chapter “conversion disorder”). Nevertheless, there are increasing data from quantitative sensory testing (QST) and from neuroimaging studies which provide evidence for objective findings in NDSDs. Doubts are increasing about a one-sided psychiatric view of these neurofunctional deficits. We aimed to better characterize the profile of pain patients with NDSDs.

**Methods:** We compared two groups of in-patients all with chronic pain that could not be completely and solely explained by a persistent somatic nociceptive lesion. Ninety suffered from NDSDs whereas 90 did not. The Patients with NDSDs all showed widespread somatosensory deficits with hemibody distribution. The clinical examination included a thorough psychiatric and neurological examination. We compared socio-demographic data, clinical symptoms, pain history, history of adverse life events, as well as comorbid psychiatric diagnoses and medication between the two patient groups.

**Results:** Patients with NDSDs had significantly more often a history of an incident physical trauma (e.g. accidents) ( $p < 0.001$ ). They did not differ in the frequency of comorbid depression, anxiety disorders and medication. Patients with NDSDs showed significantly fewer adverse childhood experiences and comorbid personality disorder, whereas posttraumatic stress disorder in adulthood was more frequent (all  $p$ -values  $< 0.01$ ) (► Tab. 2).

**Discussion:** Chronic pain patients with NDSDs do not apparently differ psychologically from those without NDSDs. The history of a prior physical trauma suggests pain disorders of a reactive nature, similar as in complex regional pain syndromes (CRPS). Terms like „hysterical“ or „convulsive“ should not be applied to patients with chronic pain and NDSDs any longer.

**55 Wie ist die Qualität des Schmerzmanagements im Akutspital?**

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Verein Outcome Zürich

**Einleitung:** Die Wichtigkeit und Komplexität des Schmerzmanagements im Spital hat vielerorts zur Einführung gezielter Konzepte geführt. Um deren Wirksamkeit zu evaluieren und Optimierungspotenzial zu erkennen wurde durch den Verein Outcome in Zürich eine Ergebnismessung entwickelt.

**Methoden:** Nach Literaturrecherche zu geeigneten Indikatoren und bereits bestehenden Erhebungsinstrumenten wurde eine erste Auswahl getroffen. In Zusammenarbeit mit Experten aus der klinischen Praxis wurden die Qualitätskriterien und -indikatoren, die Messinstrumente sowie die Messorganisation entwickelt. Der Patientenfragebogen wurde aus Anteilen von bereits bestehenden Instrumenten und einigen neu formulierten Fragen konstruiert, , , . Die parallel laufende klinische Datenerhebung beinhaltet demografische sowie relevante Patientenmerkmale zur Erkrankung, chirurgischen Interventionen, Informationen zur Schmerzsituation und -therapie. Wissensdefizite & unangepasste Haltungen bei Pflegenden und Ärzten gelten als Barrieren eines effektiven Schmerzmanagements. Um eventuelle Defizite zu identifizieren, wird bei der Messung eine Mitarbeiterbefragung mit einem bereits bestehenden Instrument durchgeführt.

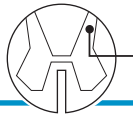
**Ergebnisse:** Die Daten liefern Hinweise zur Qualität des Schmerzmanagements in Schweizer Spitälern. So können z. B. Aussagen zum postoperativen Schmerzmanagement und zur Schmerzintensität bei Austritt dargestellt werden. Die Zufriedenheit der Patienten mit der Schmerzbehandlung, Wartezeiten auf Schmerzmedikamente sowie der erlebte Umgang durch die Pflegenden und Ärzte sind wichtige Indikatoren. Es ist möglich, die Ergebnisse der Patientenbefragung für spezifische Gruppen, wie z. B. Patienten mit chronischen Schmerzen oder eines spezifischen Fachbereiches genauer zu analysieren. Mit den Ergebnissen der Mitarbeiterbefragung konnten Bereiche, in welchen Defizite vorhanden waren, identifiziert werden. Die Entwicklung gezielter Weiterbildungsangebote wird erleichtert. Die Daten aus der Pilotmessung wurden auf ihre psychometrische Güte untersucht.

**Schlussfolgerungen:** Ungenügend behandelte Schmerzen führen nicht nur zu unnötigem Leiden, sondern auch zu ökonomischen Auswirkungen, wie Verlän-

Variables entered	Step 1	Step 2	Step 3
<b>Socio-demographic Data</b>			
Age	.979 (.953–1.006)	.993 (.963–1.024)	.996 (.965–1.029)
Gender	.649 (.351–1.201)	.623 (.320–1.211)	.730 (.356–1.496)
Migration	2.819 (1.367–5.811)	1.834 (.823–4.089)	1.254 (.504–3.115)
<b>History</b>			
History of prior physical trauma		3.825 (1.916–7.635)	3.773 (1.779–8.000)
History of adverse childhood experience		.334 (.169–.662)	.281 (.135–.584)
<b>Concomitant psychiatric diagnoses</b>			
Depression			.642 (.254–1.624)
Anxiety disorders			.623 (.274–1.415)
Posttraumatic stress disorder			1.781 (.688–4.611)
Personality disorder			.104 (.026–.412)
<b>Model statistics</b>	<b>R<sup>2</sup>=.082*</b>	<b>R<sup>2</sup>=.247***</b>	<b>R<sup>2</sup>=.357**</b>

**Tab. 2**  
Logistic linear regression analysis

The table shows the Odd's ratios with corresponding Confidence Intervals; \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$  *Migration* and *History of prior physical trauma* are positively predictive for nondermatomal somatosensory deficits (NDSDs) in patients with chronic pain disorders. *Adverse Childhood Experience* and *Personality disorder* are positively predictive for the control group with chronic pain disorders without NDSDs.



gerung der Spitalaufenthalte als Folge von Komplikationen oder zur Chronifizierung von Schmerzen. Die Entwicklung von geeigneten Instrumenten zur Qualitätsoptimierung für den sensiblen Bereich des Schmerzmanagements ist demzufolge von großer Bedeutung. Erfahrungen in bisher 14 Spitälern zeigen eine gute Praktikabilität sowie spannende Ergebnisse mit Hinweisen auf Optimierungspotenzial.

## SKG

### 56 High prevalence of headache syndromes in chronic pain patients

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**Introduction:** The estimated prevalence of chronic pain in Switzerland is 16% in the general population. Current data estimate the prevalence of headache in Europe as: migraine 15%, tension type headache 62,6%, chronic headache 3,3% and medication overuse headache 1–2%. We investigated the prevalence of headaches in patients who were referred for pain to our tertiary care pain centre.

**Methods:** Within a 12 month period (Mai 2009 to April 2010) all patients newly admitted to our pain clinic who complained about headache were seen by a headache experienced neurologist, underwent a standardized pain and headache interview and a complete neurological examination. The headache diagnoses were established according to the criteria of the International Headache Society (ICHD-II). In addition questionnaires were used to assess pain severity (von Korff), pain chronicity (MPSS), psychological distress (Hospital Anxiety and Depression Scale, HADS) as well health-related quality of life (SF-12).

**Results:** 769 patients were newly admitted for any type of pain problem. 18,3% (n=141) reported headache as a relevant pain syndrome. In the pain patient group the prevalence of headaches was 7,6% for migraine, 3,6% for non chronic tension type headache, 3,5% for chronic tension type headache and 4,8% for medication overuse headache. Within the headache group the diagnoses were: migraine 41,8%, non chronic tension type headache 19,9%, chronic tension type headache 19,1% and medication overuse headache 26,2%. According to SF12 quality of life was low (mean physical score 31,1,SD 9,0; mean psychological score 38,1,SD 10,5). 81,4% of patients showed pain severity (von Korff) stadium

III and IV. 62,8% of patients had suspect or or abnormal HADS depression subscores.

**Conclusions:** We conclude that the prevalence of headache in 18,3% of the patients in our cohort of chronic pain patients represents an important comorbidity. Our data suggest that all pain patients should carefully be screened for headaches as well as all headache patients should be screened for addition pain syndromes. Our findings might have diagnostic and therapeutic implications, but this need to be confirmed.

### 57 Orthostatic headache with tachycardia

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Orthostatic headache is most often a symptom of low cerebrospinal fluid (CSF) pressure. CSF hypotension can result from a traumatic (e. g. lumbar puncture or spinal anesthesia) or a spontaneous CSF leak. Rarely, there are orthostatic headaches without CSF leak, as will be illustrated by the following case report. A 17 year old male patient presented with a history of orthostatic headache (only present in the upright position) for several months. Occasionally it was associated with dizziness. There was no preceding infection or trauma. The orthostatic headache became so severe, that the patient had to give up his work as a mechanic. The diagnostic investigations with MRI (including gadolinium enhanced images) of the head and spine revealed no signs of an intracranial hypotension or a CSF leak. Lumbar puncture (with an atraumatic needle) showed a normal CSF opening pressure of 180 mm H<sub>2</sub>O. In standing position, a significant raise of the heart rate (> 30 bpm) without fall of the blood pressure occurred together with bilateral, pressure-like headache. A diagnosis of postural tachycardia syndrome (PoTS) was made. Its cause remained unknown. Treatment with increase of fluid and salt intake, elastic compression stockings and regular exercise was successful. PoTS is a partial dysautonomia (most commonly a partial autonomic autoimmune neuropathy). PoTS mainly affects young people and often evolves after viral infections, also after trauma or operations. Dysfunctional vascular regulation in the legs results in an abnormal venous pooling in the lower body while upright. The reduced venous backflow to the heart leads to a central hypovolemia. Orthostatic headache can be the presenting symptom of a PoTS. Other common complaints include dizziness, nausea, palpitations, general weakness and exercise intolerance. The treatment aims at correcting the central hypovolemia and reconditioning the cardiovascular system.