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ANATOMICAL LANDMARKS TO THE CAVERNOUS SINUS THROUGH ENDONASAL APPROACH

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Objectives: The endonasal endoscopic approach is an evolving technique, allowing neurosurgeons to reach new frontiers in skull base surgery. This presentation demonstrates the anatomical landmarks regarding the approach to the cavernous sinus through endonasal route.
Materials and methods: Dissected cadaveric specimens and endoscopic video clinical cases were used to illustrated the anatomical landmarks to the cavernous sinus through endonasal approach.
Results: Landmarks in the nasal cavity, sphenoid sinus and pterygopalatine fossa can be identified in most cases. In the nasal cavity the middle turbinate, the choana and the sphenoid ostia are the main references. Once inside the sphenoidal sinus, the lateral optic carotid recess represents the most cranial and posterior limit of the cavernous sinus, while the superior margin of the second trigeminal division impression determinates the inferior limit of the cavernous sinus. In the pterygopalatine fossa, the main landmarks are the anterior openings of the vidian canal and and foramen rotundum.
Conclusions: Detailed anatomical knowledge is an elementary step in the approach of the cavernous sinus through endonasal endoscopic approach. Several reference points can be used to safe navigation when using this route.

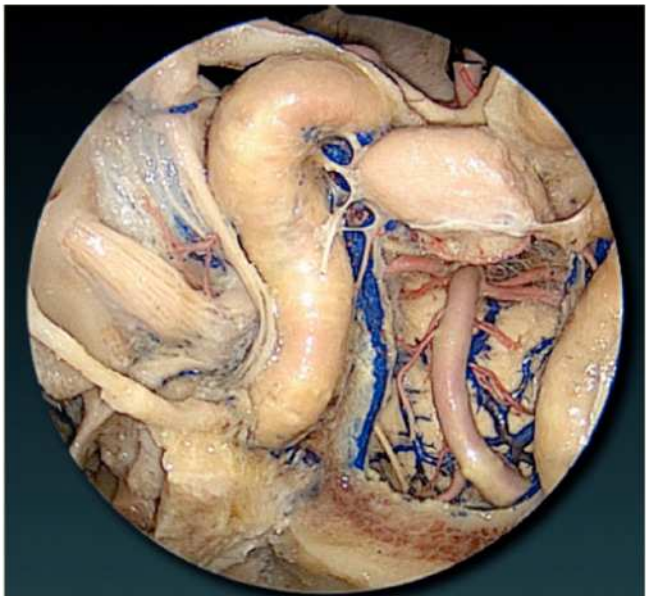

Figure – Endoscopic specimen dissection of the boundaries of the cavernous sinus through the endonasal approach

FAILED ENDOVASCULAR TREATMENT OF CEREBRAL ANEURYMS: CLIP AFTER COIL

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Introduction: Coil instability possibly translating into higher delayed rebleeding rates remains a concern in the endovascular management of cerebral aneurysms.
Objectives: This report is based on 127 patients with sizable endovascular aneurysmal remnants, who underwent retreatment over an 18 yrs. period.
Materials and methods: Patients presenting with aneurysm residuals > 20% of the original lesion, unstable neck remnants, aneurysmal regrowth, or new aneurysmal daughter sacs were treated by an individualized approach using both endovascular and surgical techniques.
Results: Seventy-five aneurysmal remnants (59.1%) were treated by further re-embolisation. Standard coil embolisation was used in 65 cases, stent-protected coiling in 9 cases, and balloon remodeled coiling in 1 case, respectively. Fifty-two (40.9%) aneurysmal remnants were treated surgically. Standard microsurgical clipping was used in 44 patients, parent artery occlusion or trapping under bypass protection in 5 cases, deliberate clipping of the basilar artery trunk in two cases, and aneurysm wrapping in one case, respectively. Mechanisms of aneurysm recurrence were coil compaction in 93 cases and regrowth in 34 cases. A single re-embolisation was sufficient to occlude 78.7% of recurrences from coil compaction but only 14.3% of recurrences from aneurysm regrowth.
Conclusions: The individualized approach described resulted in complete occlusion of 114 aneurysms (89.7%), with necks remnants and residual aneurysms detectable in 11 (8.7%) and 2 (1.6%) cases, respectively. Treatment morbidity was 11.9%,

without significant differences between surgical (15.6%) and endovascular (9.3%) patients (p = 0.09). Recurrences from coil compaction were savely treated by re-embolisation, whereas recurrences from aneurysmal regrowth may best be managed surgically when technically feasible.

ADJACENT SEGMENT DEGENERATION, MYTH OR REALITY?

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Objectives: Adjacent segment degeneration has been in vogue for the last 15 years, particularly after cervical disc prostheses came about. The fact that arthodesis at the cervical and lumbar spine increases the biomechanical stress in segments adjacent to the fused one, is clear and has been demonstrated through biomechanical studies. But is it of any clinical relevance? Is adjacent segment degeneration part of the natural history?
Materials and methods: We have looked at both biomechanical and clinical studies which demonstrate whether or not adjacent segment degeneration is part of the natural history of the disease or it is a post surgical complication after fusing vetebral segments. We also compare diferent types of fusion systems and number of levels fused. We also evaluate biomechanical models to try and undestand the pathophisiology of the degeneration.
Results: We evaluate through a literature search the clinical results and reoperation rates in patients previously fused. Reoperation rates can varie between 3 and 11%. Also patients being operated of cervical disc disease and fused, will have cervical problems in up to 30%, mostly will be treated conservatively. Recent randomized studies seem to demonstrate that with disc prostheses there is a protecting element to adjacent segments, causing less reoperations in that group of patents.
Conclusions: Adjacent Segment degeneration occurs as a result of fusing a vertebral segment. There seems to be a correlation between the number of segments that are fused with adjacent segment degeneration, although there is, in the majority of cases a low reoperation rate. We believe that although there is, surely some influence of the natural history, seems clear that a mobile segment allows less biomechanical stress in the segments adjecent to it and therefore is a reality more than a myth.

MULTIMODALITY MANAGEMENT OF BRAIN AVMS: A RATIONALE

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Objetivos: Establecer las indicaciones de tratamiento de las MAVs cerebrales desde un punto de vista multidisciplinario, intentando establecer criterios según las características morfológicas y clínicas de la lesión, para individualizar la terapia.
Material y métodos: Se revisan las características de cada uno de los tratamientos actuales y los conocimientos de la historia natural de este tipo de lesiones.
Conclusiones: Dada la multiplicidad de tratamientos disponibles y la heterogeneidad de las MAVs cerebrales es necesario establecer unos criterios que permitan individualizar el tratamiento de estas lesiones según sus características y las del paciente.

SURGERY ON PATIENTS WITH SYMPTOMATIC LOW GRADE GLIOMA LOCATED IN CRITICAL BRAIN AREAS

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Objectives: Up to now there still has been no therapeutic standard for the heterogenic groups of low grade gliomas (LGG). Our tumor data bank demonstrates an incidence of 5-10% LGG among averaged 180 primary surgically treated brain tumors per year with an increasing tendency. In this manuscript we describe our operative procedure and its results on patients with symptomatic LGG in critical brain area.
Materials and methods: The analysis revealed 36 patients with LGG who were operated on in the last 3 years. Most patients had diffuse astrocytoma WHO grade 2 (19 patients). Rare tumors such as ganglioglioma (3), central neurocytoma (3) and subependymoma (1) were also diagnosed during this period. The tumor was mostly localized perisylvian (17) less in ventricle (5), brainstem (5), central region (5), language area (2) or basal ganglia (2). All patients were operated on with navigation support, endoscopic microsurgical technique and intraoperative neurophysiologic monitoring (IOM) of different modalities. The morphologic data has been fused with the functional one (fMRI, DTI as well as PET and in the last year nTMS) for navigation setting.
Results: Total excision could be achieved in 17 patients. Subtotal (15) or part resection (4) has had to be performed due to the functional data and the IOM results. Temporary worsening of the neurological finding occurred in 13 patients for several days. The examination 3 months after surgery and later on demonstrates, however, an improvement status in comparison to that of before surgery in 26 patients. During this period no recurrence surgery was needed. The seizures improve in 17/22 patients with or without antiepileptic drugs but in decreased dosage.
Conclusions: Our results show that LGG in critical area can be operated on safely with good outcome thus improvement of the quality of life. This therapeutic option using modern morphologic and functional data should be offered to patients with symptomatic LGG.

CONCEPTUAL CHANGES IN SKULL BASE SURGERY

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Objectives: To present the changes in the neurosurgical criteria used in Skull Base Surgery to select the surgical approach for the different pathologies after the introduction of endoscopic endonasal skull base surgery.
Materials and methods: We review the surgical approaches applied by our team to patients with skull base lesions from 2005 to 2012. We have performed 350 endoscopic endonasal approaches and 175 craniotomies for skull base lesions. We retrospectively analyses the surgical approaches used and the underlying conceptual reasons of these selections in comparison with more classical options.
Results: Transnasal approach was increasingly used because of new surgical indications not previously established or a change in the procedure of choice for a particular pathology: 1. Palliative decompression of neural structures caused by extensive lesions not amenable to a surgical extensive resection. 2. Palliative decompression in poor surgical candidates. 3. Intracavernous

extension of pituitary adenomas previously referred for radiotherapy or radiosurgery. 4. Ectopic adenomas or supradiafragmatic remnants previously treated by craniotomies. 5. Cranyopharingiomas had been approached endoscopically in all cases and previously were approached by craniotomy. 6. Meningiomas of the tuberculum sellae area had been endoscopically approached in less than 50% of the cases. 7. All chordomas and the majority of chondrosarcomas had been treated endoscopically. 8. Odontoidectomy approach changes from transoral or transcondylar to endonasal 9. Extensive clival meningiomas benefit from a combined approach with initial endonasal decompression. 10. Trigeminal neuromas could be treated by endoscopy when growth in the Meckel's Cave and the posterior fossae component by suprameatal retrosigmoid approach, decreasing the use of Kawase approach. 11. Other lesions like cholesterol granulomas and other petrous apex lesions are no longer approached by a lateral approach.
Conclusions: In the last 15 years Skull Base Surgery experienced profound changes, the extensive approaches previously introduced have teached us the key surgical manoeuvres that really make a difference in improving the patients outcome allowing us to use more restricted, precisely designed surgeries, to deal with every tumour remnant or leaving it to be treated, with less morbidity, by radiosurgery. After the introduction of endoscopic endonasal skull base surgery and its increasing use several patients have benefited from a multicorridor approach concept, dealing with every tumour part by the most direct and less dangerous approach. In this surgical armamentarium radiosurgery continue to have a place in selected cases. Further experience will definitively increase the awareness of the general neurosurgical community on the paradigm shift that endoscopy have represented for skull base surgery.

ICG ANGIOGRAPHY – INDICATIONS BEYOND ANEURYSM SURGERY

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Objectives: ICG angiography is an accepted tool in aneurysm surgery for detecting incompletely clipped aneurysms or vessel occlusion. First reports of its usefulness in arteriovenous (AV) malformations and dural AV fistulas has been published. We explored if ICG angiography can be useful in other fields of neurosurgery and focused on microvascular decompression for trigeminal neuralgia and endoscopic third ventriculostomy (ETV).
Materials and methods: In microvascular decompression (MVD) the exact identification of the site of nerve compression sometimes is difficult to define. We assumed that microscopic ICG angiography could be helpful by delineating clearer the course of the vessel and speculated that the fluorescence might shine through the thinned nerve at the compression site. In ETV the clear identification of the basilar artery is necessary for safe puncture of the third ventricular floor. We used a prototype endoscope capable of ICG angiography with the assumption that the course of the basilar artery can be seen through the third ventricular floor.
Results: ICG angiography was used in 13 patients undergoing MVD. We could prove the existence of a shinethrough effect if the nerve is thinned in 4 patients. In another 5 patients ICG angiography allowed the better anticipation of the course of the compressing vessel. In the remaining 4 patients the offending vessel was easily identifiable and ICG angiography gave no further information. The existence of a shine through effect seems to have a high prognostic value as all patients were pain free after surgery. Endoscopic ICG angiography was performed in 10 patients. We could show for the first time that ICG angiography under the endoscope was feasible. Endoscopic ICG angiography allowed to "see" the basilar artery in 5 of the 10 patients with opaque third ventricular floor.
Conclusions: There exist indications for ICG angiography beyond its common use in aneurysm surgery. We showed for the first time that ICG angiography with the endoscope is possible and see good indications in ETV.

INTRAOPERATIVE VISUALIZATION OF FUNCTIONAL BRAIN AREAS BY OPTICAL IMAGING: CHANCES AND LIMITATIONS

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Objectives: Optical imaging of intrinsic signals is a new method for a fast and contact free visualization of stimulated eloquent brain areas during neurosurgical interventions.
Materials and methods: The intensity of the light reflected by the cortical tissue was measured in more than 70 patients using a high resolution camera mounted to an operating microscope. 41 patients had lesions around the somatosensory cortex, others in the vicinity to the speech area or to the visual cortex. Using adequate stimulation methods the difference in the spectral absorption was used to differentiate between activated and non-activated brain areas. The data acquisition time was 9 minutes with alternating 30 seconds with and without stimulation. The difference between averaged frames was calculated and overlaid over an image of the operative site. Brain movements associated with heartbeat and respiration were compensated using a deformable registration algorithm.
Results: Localized activation of cortical tissue could be visualized for the somatosensory cortex, the speech area and the visual field. An excellent imaging quality could be achieved in most of the patients. The calculated location and the size of the activated region corresponded to anatomical landmarks and the results derived by electrophysiological examinations and confirmed the estimation of the neurosurgeon. The results were reproducible in independent examinations. In very few cases no activation of cortical tissue could be deciphered because of technical and biological artifacts.
Conclusions: Optical imaging of intrinsic signals provides an intraoperative high spatial resolution image of brain surface activation, allowing the localization of eloquent brain areas during surgery.
The study is funded by the Carl Zeiss Surgical GmbH and BMBF.

THE ROLE AND THE PRESENT STATE OF ANEURYSM SURGERY

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Objectives: The treatment of cerebral aneurysms has undergone important paradigm changes since the first publication of the ISAT study in 2000. The role of surgical treatment has been challenged in view of wide-spread availability of endovascular techniques and their continuing development. The goal of the present study is to provide an overview about the role of open microsurgery in the endovascular era, and to highlight recent developments in surgical technique and neurovascular research.

Materials and methods: A thorough literature research has been performed regarding contemporary microsurgical indications and techniques for the treatment of unruptured and ruptured cerebral aneurysms. Furthermore, own experience in the treatment of aneurysms in a dedicated hybrid vascular suite (based on Flat Panel Imaging), which allows for joint endovascular and open microsurgical approaches shall be reported on the grounds of a consecutive database.
Results: Microsurgical treatment of unruptured cerebral aneurysms can be performed with minimal morbidity and mortality, the benchmarks being set by reports from neurovascular centers of excellence. It should be performed under intraoperative neurophysiological monitoring, and whenever possible, intraoperative quality control by micro-video-angiography, or by 3D rotational angiography should be employed. Intraoperative control allows for direct change of the clip position in case of incomplete clipping, or in case of parent or perforating artery compromise. Key-hole surgery is an option for unruptured aneurysms in the hand of the experienced, and it can be done assisted by endoscopy. Microsurgery should be considered first choice of treatment for MCA aneurysms, and for aneurysms requiring cerebral revascularization. It is indicated in case of patient-related factors such as renal insufficiency or pregnancy, or in aneurysm-related factors such as very peripheral localization, large neck aneurysms on bifurcation, or other reasons which would render endovascular therapy dangerous. These findings are supported by own experience with a total of 183 aneurysms clipped in 126 operation and 114 patients in the hybrid neurovascular suite, including n = 28 aneurysms clipped in 19 operations and 18 patients with the further aid of augmented reality.
Conclusions: Microsurgical treatment of cerebral aneurysms is alive. It is continuing to develop technologically- It is still playing a major and complementary role on the crossroads between clinical and endovascular management of ruptured and unruptured cerebral aneurysms as weel as in neurovascular research. There are clear indications for open microsurgery, but only coordinaited efforts joining - endovascular AND microsurgical AND scientists - will lead to further improvement of patient care and of the understanding of the underlying disease.

SURGERY OF ANTERIOR AND ANTERO-LATERAL MENINGIOMAS OF THE FORAMEN MAGNUM – CLINICAL EXPERIENCES IN 72 PATIENTS

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Anterior and anterio-lateral located meningiomas of the foramen magnum are difficult tumors to be treated surgically. A wide variety of surgical approaches have been proposed and described over the years to gain access to these treacherous lesions. Recently, extended skull base approaches with partial or radical resection of the condyle and mobilisation of the vertebral artery have been described. Although excellent exposure of anteriorly located foramen magnum meningiomas by this approach is possible, the radicality of this approach with prolonged operative time, the possibility of additional approach related morbidity and the inherent necessity of a uni-or bilateral stabilization procedure has been criticized by many neurosurgeons. In this presentation we report of a series of 72 foramen magnum meningiomas operated on exclusively by a simple and straight-foreward far-lateral retrocondylar approach without condylectomy over a period of 20 years. The clinical characteristics of the patients including outcome will be described. The surgical procedure applied by us for these tumors will be presented in detail. Specific operative aspects and key-points will be laid out and shown by intraoperative videopresentations.

UNILATERAL APPROACH FOR BILATERAL DECOMPRESSION OF LUMBAR SPINAL STENOSIS. SYNOPSIS OF 15 YEARS OF EXPERIENCE WITH THIS METHOD

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Objectives: The surgical aim in the treatment of symptomatic lumbar spinal stenosis is the relief of the patient's complaints by an adequate neural decompression. In a preliminary cadaver study the unilateral laminotomy for bilateral access to the lumbar spinal canal was investigated, and the experiences were evaluated in a clinical study.
Materials and methods: Microsurgical decompression was performed by partial resection of the ipsilateral facet, the medial portion of the laminar arch, the contralateral facet and by complete removal of the ligamentum flavum bilaterally. Anatomical, radiological and morphometrical studies on 4 adult cadaver spine specimens have proved the feasibility of this unilateral approach (Spetzger et al. Acta Neurochir (Wien). 1997;139:392-7). Complete bilateral flavectomy and partial bilateral facetectomy were the essential surgical steps for an adequate operative decompression. The clinical practicability in the treatment of lumbar spinal stenosis was initially confirmed in 29 patients (Spetzger et al. Acta Neurochir (Wien). 1997;139:397-403) and in a further evaluation in 254 patients.
Results: The postoperative morphometric evaluation in the cadaver study clearly demonstrates that bilateral ligamentectomy and recess decompression were adequately and successfully achieved via unilateral approach. The clinical evaluation of this technique was performed in 254 patients with symptomatic mono- or multisegmental lumbar stenosis. Postoperatively, 229 of the 254 patients with neurogenic claudication (90.2%) demonstrated a marked improvement of the walking distance. The follow-up of 249 patients (mean follow-up time was 37 months) demonstrated an excellent result without pain in 6 patients (30%); a good outcome with mild residual pain, but a normal working capacity in 15 patients (62%); and a fair outcome with unchanged postoperative low-back pain but markedly improved working capacity and walking distance in 3 patients (16%). There was only one patient with surgically induced, permanent neurological deterioration. In nine patients, an inadvertent dural tear occurred, and due to unchanged symptoms three patients with a multisegmental stenosis had to be re-operated on at an additional level. During the last 15 years the author has experience with this method in over 1,400 microsurgical decompression procedures.
Conclusions: Unilateral laminotomy and bilateral spinal canal decompression represents a safe, effective and minimally invasive surgical method and meanwhile is a routine microsurgical strategy for the treatment of patients with lumbar spinal stenosis.

SURGICAL APPROACHES TO BRAINSTEM TUMORS

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Introduction: The anatomy of the brainstem is one of the most challenging of the Central Nervous System. The brainstem can

harbor different tumors, among them cavernomas and tumors from glial origin. The first consideration is about the indication for surgery. Young patients with cavernomatous lesions that have bled are amenable for surgery. Regarding tumors of glial origin, bulky/exophytic lesions can be resected. The surgical approach must be tailored for every case, trying to incorporate the concept of "safe entry zone" (some specific areas of the brainstem surface/IV ventricle that can entered without neurological injury). It may need skull base osteotomies to improve the access.

Material, methods and results: The ventral medullary region can be approached through the retrolivary sulcus (between C1-XII nerve root exit). The far lateral approach can be really useful for that purpose. The posterior medullary region can be entered through the posterior median, paramedian and lateral sulcus. The pons can be approach through the forth ventricle: median sulcus and pericollicular area (suprainfrafacial triangle). The cerebral peduncles can be reached sometimes through the fourth ventricle and also through a supratonsilar route or retrosigmoid craniotomy. The ventral pons can be reached through a retrosigmoid, presigmoid or transpetrosal approach (safe entry zone: the peritrigeminal - anterolaterally placed-area). There is also another entrance between the exit of V and VII nerves. The subtemporal approach or a cranio-zygomatic approach can lead to the mesencephalic median sulcus, the safe entry zone of the ventral mesencephalon. The dorsal mesencephalon can be reached through a supracerebellar-infratentorial approach.

Conclusions: The surgery of brainstem tumors must be done in the context of a perfect knowledge of the anatomical neurovascular structures. Some skull base approaches can be really helpful to enter the safe entry zones, along with intraoperative neurophysiological monitoring.

INTRAOPERATIVE MRI FOR RESECTION CONTROL IN PITUITARY SURGERY

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The benefit of resection control in pituitary surgery has first been described by Fahlbusch et al a decade ago. We sought to investigate the value of intraoperative high-field MRI (1.5 Tesla) in the treatment of a large series of unselected patients with pituitary adenomas in elective transsphenoidal surgery. Starting in late 2009, 172 consecutive patients with pituitary adenomas were operated using intraoperative MRI (1.5 Tesla, Siemens, Germany) for resection control. Age distribution ranged from 9 to 88 years. 57% of the adenomas were hormone inactive, 43% revealed hormonal activity. 79% were macroadenomas, 21% microadenomas. All resections were performed by experienced neurosurgeons. 61% of the operations were started endoscopically. Intraoperative MRI suggested remaining tumor tissue in 35.5%. This led to further inspection, guided by neuronavigation. In 15% remaining adenoma tissue could not be detected. Thus, surgery was finished at this point. In 21%, however, tumor resection was continued and further adenoma tissue was taken out. A further subgroup analysis was performed to analyze in which cases iMRI is truly beneficial. This turned out for large hormone expressing tumors, sized 20-29 mm as well as in large inactive adenomas, measuring between 30-39 mm. Nevertheless, also in some microadenomas, e.g. causing M. Cushing, a MRI was of great benefit. All together, there were no complications related to iMRI or related to patient transport to the scanner (Miyabi-solution). Taken together, intraoperative highfield MRI was definitely superior and enabled further adenoma resection in ca. 20% of an unselected series of pituitary adenomas with elective transsphenoidal surgery, even in the hands of experienced neurosurgeons. iMRI is of particular value to improve resection of hormonactive and larger hormoninactive adenomas.

IMAGE-GUIDED SPINAL SURGERY: FROM X-RAYS TO VIRTUAL REALITY

CIRUGÍA RAQUÍDEA GUIADA POR IMAGEN: DE LOS RAYOS X A LA REALIDAD VIRTUAL

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Introduction: Before the appearance of image guidance, surgeons relied on their knowledge of the anatomy of the spine complemented by images acquired pre-operatively and intra-operative fluoroscopic images. Plain radiography is commonly used to assist in localization of the skin incision, identification of the proper anatomical level and confirmation of the correct positioning of spinal implants. However, conventional methods such as these have several weak spots, even in the hands of experienced surgeons: experimental and clinical studies have revealed pedicle screw misplacement rates of up to 20–30% using these techniques. In contrast, image guidance provides 3D visualization of the spine, which can be used for pre-operative planning and intra-operative navigation, as well as for the confirmation of the accurate localization of concealed anatomical spinal structures that cannot be directly visualized during standard surgical exposures and fluoroscopy. One key factor in the advances in Image-Guided Surgery (IGS) is the ability to register images derived from the various imaging modalities amongst themselves, but also to register them to the patient. The other crucial aspect of IGS is the ability to track instruments in real time during the procedure, and to portray them as part of a realistic model of the operative volume. IGS nevertheless relies heavily on the assumption that the images acquired prior to surgery, and upon which the surgical guidance is based, accurately represent the morphology of the tissue during the surgical procedure. In many instances this assumption is invalid, and intraoperative real-time imaging, using intraoperative CT and electrophysiological recordings are often employed to overcome this limitation. In image-guided surgery, virtual reality techniques are beginning to play increasingly important roles as the emphasis grows towards the use of minimally invasive procedures. Since direct visualization of the surgical field becomes more and more difficult as the surgical opening becomes smaller, the natural direction of research is towards the model-based realization of the structures being operated. Computer graphics technology can provide realistic 3-D images of structures derived from MRI or CT. Both surface- and volume-rendering approaches are commonly employed in this field, and stereoscopic visualization is often employed to maximize the advantage of the 3-D image representation.

Materials, methods and results: We describe our experience of the last two years with the use of a multi-dimensional surgical imaging system (O-arm®) before, during and after different spinal surgery procedures including occipitocervical, thoracic and lumbar surgeries in combination with the StealthStation® navigation system. Specific problems with spinal navigation are discussed, such as movement during image-guided procedures and the subsequent inaccuracies that need to be corrected with a new acquisition of 3-D images.

Finally, we analyze the future IGS applications of virtual reality (VR), augmented reality (AR) and the use of robotics in surgical planning and guidance.
Conclusions: The use of IGS and intraoperative computerized imaging allows improved visualization to complete complex and minimally invasive procedures with ease and with safety for the surgeon and patient. The new development of intraoperative 3D image guidance can be seen as a potentially important tool in spinal surgery. As with all novel technologies there is a learning curve, which can be overcome with training and experience.

NEUROSURGICAL MANAGEMENT OF CRANIOPHARYNGIOMAS

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Introduction: The optimal treatment strategy in craniopharyngiomas is still under debate: conservative symptomatic treatment versus extendet surgery. However, today complete tumor resection with acceptable morbidity can be obtained in 80-90% of the patients. This experience is based on a personal learning curve over the last 3 decades.
Materials and methods: The author's operative series in all craniopharyngiomas is related to 350 patients. We compare in this presentation a series of primary operations in 73 patients between 1997 and 2005 (Hofmann et al. J Neurosurgery. 2011;115) with a former series between1983 and 1996 with 168 patients (Fahlbusch et al. J Neurosurg. 1999;90:237-50; Honegger et al. J Neurosurg. 1999;90:251-7). 30% were children. All underwent careful endocrinological dynamic testing perioperatively, presenting before surgery pituitary insufficiency – minimum in one axis – in 77% of the cases, and ophthalmological deficits in 70%. Open surgery was only performed if no hypothalalmic damage was present, otherwise symptomatic surgery was indicated. Transsphenoidal surgery was indicated in up to 40%, among the different transcranial approaches the frontolateral one is meanwhile dominating. In the last 11 years neuronavigation and intraoperative MRI control improved the surgical decade outcome too.
Results: In the last series 8 out of 73 patients underwent merely stereotactic cyst puncture. Following t'sphenoidal surgery in intra- and suprasellar (subdiafragmatic type) tumors a total removal could be obtained in 88.5%, in the larger supra- and retrosellar tumors in 88% and in intra- and suprasellar tumors (supradiafragmatic type) in 75%, following bitrontal translaminar and frontolateral approaches. There was no perioperative mortality, the rate of pure surgical complications was 11%. In the literature mortality rates are higher and resection rates lower. Meticulous control of water/electrolyte balance (cave hyponatremia!) in the early postoperative phase is mandatory. In general endocrinological deficits increased postoperatively, improvements, such as in pituitary adenomas, are exceptional. As a result of increasing higher rate of total removal and lower recurrence rate (10-15%) the deficits increased mildly in the later series. They were lower after t'sphenoidal than after t'cranial surgery, although the pituitary stalk as origin of the tumor could be preserved in part in general. T'SPHENOIDAL: preop/postop DIAB.INSIP. 18-45%, ADREN. 38-58%, THYROID. 35-42%, GONADAL 57-57%. T'CRANIAL: 10-70%, ADR 20-78%, THYR 32-58%, GON 53-65%. GH deficiency was present in 90% of the cases. Careful follow- up with endocrinological- and MRI examinations in nearly all patients demonstrated true recurrences in 10-15% within 10 years. In about 20% radiotherapy was necessary over the years to prevent further growth of residual tumors and of inoperabel true recurrences.
Conclusions: Open surgery with the goal of total tumor removal remains the treatment of choice in most patients, since the results of primary radiotherapy are worse in comparison. Previous stereotactic cyst aspiration can be indicated in special cases and might be necessary to improve the patient's condition before major surgery. Consequent and regular endocrinological controls and adequate hormonal replacement are essential for quality of life.

INTRAOPERATIVE VISUALISATION OF BRAIN TUMORS BY FUNCTIONAL NEURONAVIGATION AND INTRAOPERATIVE MRI

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Objectives: The significance of intraoperative (iop) MRI as an instrument for objective visualisation in brain tumor surgery is widely accepted. However advantages and disadvantages for low (0.15-0.5 T) and high field (1.5-3 T) systems, including availability and practicability are still in discussion. The user demands for "only" useful imaging and/or functional and metabolic research are still diverging. We present our latest experiences with iop visualisation by MRI and functional neuronavigation in glioma surgery.
Material, methods and results: Since 2002 the senior author had good experiences in more than 600 patients, starting with a robust, user-friendly "Brain-Suite" in Erlangen, including functional navigation and a 1.5T Siemens Magnetom Sonata with a rotating table. In a series of 137 patients with supratentorial gliomas we could extend complete tumor removal from primary 27% to definitely 40% in respectable tumors and preserve motoric, respectively language functions-after transient deficits in 10.2%- in 97.1% of the patients (Nimsky et al. Neurol Res. 2006;28:482-7). From 2.2007 till 11.2012 four neurosurgeons (A. + M. Samii, R. Fahlbusch, since 2011 H. Bertalanffy) have performed 766 operations, among them 423 with gliomas and 155 with pituitary tumors at the INI in Hannover: The installed 1.5T MRI Siemens Espree is more userfriendly, offering an open bore of 70 cm. The acquisition time is faster and the resolution is higher. The acquisition for anatomical, functional (cognitive mapping, Diffusion Tensor imaging (Stieglitz et al. Neurosurgery. 2011;68:1239-51) and metabolic (H-MR spectroscopy) data can be provided by a 3T MRI Siemens Allegra as well, installed in our institute-runned by neuroradiologists and neurologists (Profs. Freund and Münte) offering a high expertise in cognitive mapping. Microscope based navigation is provided by Vector Vision cranial (BrainLab) and Zeiss Pentero. Again we could confirm that our patients with complex, however resectable gliomas could profit even in a higher amount from iop MRI: in about 45% in gliomas continued resections lead to complete and functionally safe tumor removal. 1 out of 94 (= 1%) low grade gliomas WHO grade I + II had a continous neurological deterioration, and 8 out of 421 (= 1.9%) gliomas WHO grade III and IV. All resectable pituitary adenomas – via a transsphenoidal approach - could be resected completely, among them about one third after repeated iop MRI control examination.
Conclusions: Worldwide more than 150 OP theatres with low and high field iop MRI are installed. The actual trend is installation of high-field MRI's, especially with 3 Tesla field strength. We are also prepared to switch over to a 3 T MRI version, the radiofrequency shielding and all other equipment is prepared for this at the INI.

TRATAMIENTO MICROQUIRÚRGICO DE LA ESTENOSIS LUMBAR

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La estenosis del canal lumbar es el estadio final del proceso de degeneración de la columna lumbar. La altísima prevalencia de esta enfermedad aumenta constantemente a medida que aumenta la esperanza de vida de la población. Se presentan ejemplos de una extensa serie de más de 1.500 casos con especial énfasis en la cínica y aspectos diagnósticos y de la imagen. La estrategia quirúrgica ha ido variando progresivamente desde la introducción de la disciplina microquirúrgica en el tratamiento de la patología del raquis en 1984. Se revisan técnicas de descompresión y limitación de la movilidad segmentaria o fijación, que hemos utilizado. El uso de sistemas de limitación-fijación interespinosos, se ha generalizado en los últimos 10 años siguiendo la evolución tecnológica de los diversos elementos disponibles. En el trabajo se puntualizan los principios básicos del tratamiento quirúrgico adaptado este criterio mínimo agresivo. Actualmente la combinación de la microdescompresión uni o bilateral del segmento vertebral, acompañado o no, de la implantación de un sistema de ayuda ha mejorado el resultado a medio-largo plazo en técnicas realizadas de forma poco invasiva adaptadas a la edad de los pacientes. 86% de los pacientes mejoran del dolor, 76% aumentan la distancia de claudicación y 80% mejoran su marcha. 11% presentan complicaciones quirúrgicas dignas de mención. De esta manera, concluimos que el planteamiento minimalista de nuestras descompresiones limitadas y el escaso uso de estabilizaciones mediante instrumentaciones clásicas, mejoran el resultado, sobre todo a expensas de una mejor tolerancia, menor incidencia de complicaciones, lo que permite su indicación en enfermos realmente ancianos, portadores, de esta patología.

TUMORES CEREBRALES INFILTRANTES: UN DESAFÍO

INFILTRATIVE CEREBRAL TUMORS: A CHALLENGE

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Objetivos: Mostrar cuáles son las características moleculares, histopatológicas y neuro-radiológicas que muestran los tumores cerebrales que tienen un carácter infiltrante e invasivo. A partir de aquí, mostrar cuáles son las armas terapéuticas de las que disponemos en la actualidad para luchar contra este aspecto del crecimiento y desarrollo tumoral.
Material y métodos: Revisión de la bibliografía, experiencia mostrada por autores del GTNO y experiencia personal, comparando estas características en una serie de pacientes intervenidos durante el año 2012 en el HUPM.
Resultados: El carácter infiltrativo o invasivo de los tumores cerebrales primarios parece relacionarse no solo al fenómeno de la angiogénesis, sino también a otros eventos moleculares, como la expresión de EGFRw- t. En el caso del glioblastoma (GB), esta propiedad es también diferente en los GB primarios de los secundarios, y podemos sospecharla analizando el lugar de la oncogénesis (origen y vías de asociación), las características radiológicas (en RM) y las características histopatológicas de las zonas limítrofes tumorales (desde la zona cortical a las zonas lobares y capsulares). Esta visión o perspectiva nos ha cambiado en la forma de enfocar el abordaje quirúrgico de estos tumores infiltrativos.
Conclusiones: Las características moleculares, histopatológicas y radiológicas de los tumores cerebrales intrínsecos que poseen un carácter infiltrante e invasivo, varían nuestra concepción a la hora de contemplar su abordaje quirúrgico y la tecnología de la que valernos para ello.

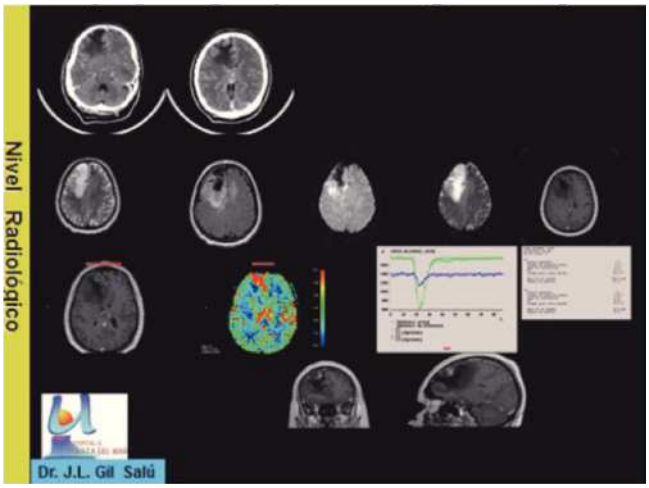

Figura – Características radiológicas de un oligo-astrocitoma anaplásico.

PITFALLS IN PARACLINOID ANEURYSMS SURGERY

SITUACIONES IMPREVISTAS EN LA CIRUGÍA DE LOS ANEURISMAS PARACLINOIDEOS

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Objectives: The microsurgical management of paraclinoid aneurysms is a complex task. The elements involved are, at least, the complexity of the lesion itself, the complex and variable anatomical relationships, and the severity of the neurological symptoms and complications related with the lesion and its management. However, an additional factor is the number of unexpected situations and dangers found during the microsurgical procedure leading to a more complex surgery and eventually to a new neurological deficit for the patient. The objective of this presentation is to review the pitfalls involved in the microsurgical management of paraclinoid aneurysms.
Materials and methods: The most frequent sources of pitfalls in the microsurgical management of paraclinoid aneurysms are identified and listed. A proposal strategy for prevention and resolution is drawn. Some illustrative cases are presented.
Results: The most important and frequent source of pitfalls is related with the surgeon, namely with the surgeon's experience, skills and learning curve. Surgeons showing confidence in their procedures have less chance for pitfalls. Most experienced surgeons solve much efficiently pitfalls. The anatomical relationships of the paraclinoid area must be well known by the surgeon thanks to the laboratory training. There are also anatomical elements in the aneurysm that increases the complexity: size, orientation of the fundus, related arteries,

intradural or extradural location of the neck, type of the aneurysm, additional elements such as intraluminal coils or thrombosis, wall or neck calcification, revision surgery, and multiplicity. In these cases some microsurgical strategies can facilitate the final clipping (anterior clinoidectomy, Dallas technique, intraoperative aids). The lack of a 'state-of-the-art' in the management of paraclinoid aneurysms can be solved by a 'surgical check-list'.
Conclusions: Paraclinoid aneurysms are complex lesions with a high chance of unexpected intraoperative dangers or difficulties leading to additional troubles or neurological complications. A delicate mixture of surgeon's confidence, detailed knowledge both of the microsurgical anatomy and the aneurysm, as well as the development of an ad hoc 'surgical check-list' are the best weapons to prevent and solve pitfalls related with the microsurgical management of paraclinoid aneurysms.

MINIMALLY INVASIVE VASCULAR NEUROSURGERY

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Introduction: Minimally invasive techniques have been applied to a variety of neurosurgical operations over the last years including the use of keyhole approaches and endoscopic technique. However, most neurosurgeons still hesitate to apply minimally invasive techniques to vascular lesions.
Materials and methods: We operated between 2008 and 2012 on different vascular lesion including 184 aneurysms, 14 arteriovenous fistulas, and 62 cavernous hemangiomas using minimally invasive technique. The supraorbital and retrosigmoid keyhole approach was used most frequently. Endoscopy was applied as endoscope-assisted or endoscope-controlled technique using 4 mm rigid endoscopes with 0° and 30° viewing angles and full HD video equipment.
Results: All lesions could be managed in the intended manner using the described keyhole approaches. Endoscopy was extremely helpfull to achieve the surgical goal in providing unique visual information on both, the individual anatomy and pathology of the patient. Complications related to the use of endoscopes or keyhole craniotomies did not occur.
Conclusions: Minimally invasive neurosurgery is safe and sufficient for the management of various vascular lesions. However, advanced experience in minimally invasive Neurosurgery is recommende before apllying this technique to vascular lesions.

NUEVAS INDICACIONES Y DIANAS EN ESTIMULACIÓN ELÉCTRICA CEREBRAL

NEW INDICATIONS AND TARGETS FOR ELECTRIC BRAIN STIMULATION

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Objetivos: Hasta ahora, la estimulación cerebral profunda para el tratamiento de enfermedades neurológicas o psiquiáricas se ha limitado a simular las lesiones de la cirugía estereotáctica clásica bajo dos premisas: 1. La estimulación de alta frecuencia tiene un efecto inhibidor; 2. Cada enfermedad tiene una diana cerebral única. Datos recientes sugieren que la estimulación se puede usar con otros fines plásticos o regenerativos y que se puede escoger una diana individualizada para cada paciente.
Materiales y métodos: Se emplearon técnicas de conectividad efectiva (estructural y funcional) para identificar dianas individualizadas en pacientes con trastorno obsesivo-compulsivo. Brevemente, se realizaron técnicas de identificación de áreas corticales con resonancia magnética funcional usando el test de Maudsley y se trazaros sus conexiones al estriado mediante tractografía. También se realizó estimulación cortical con alta frecuencia para inducir plasticidad cortical en tumores localizados en áreas elocuentes.
Resultados: Las técnicas de conectividad permiten identificar dianas individualizadas para cada paciente distintas de la clásica en núcleo accumbens-nucleo del lecho de la estría terminalis. La estimulación cortical con alta frecuencia permite inducir plasticidad cortical, desplazando la localización de áreas elocuentes lejos de los tumores situados previamente en su inmediatez.

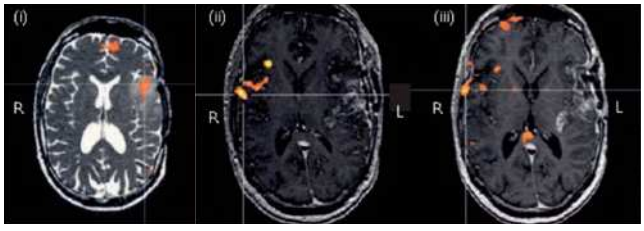

Figura – RM funcional de producción de lenguaje en un paciente con un astrocitoma anaplásico en el área de Broca. i. Antes de la estimulación cortical, ii. Tras un mes de estimulación cortical con alta frecuencia, iii. Dos meses tras la intervención final.

Conclusiones: Las técnicas de conectividad efectiva y la posibilidad de inducir plasticidad cortical permitirán el uso de dianas individualizadas y la búsqueda de nuevas indicaciones para la estimulación eléctrica cerebral.