

CS1-1-1 Venous Anatomy for C-P angle Surgeries

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I am going to present the surgical anatomy of the following two venous systems, which is very useful for the C-P angle surgeries. One is the superior petrosal vein (SPV) in the upper C-P angle because its tributaries often act as an obstacle during surgery, and when sacrificed serious postoperative complications may occur. The other is the posterior condylar emissary vein, which can be used as an intraoperative anatomical landmark during removal of the lateral foramen magnum, especially through trans-condylar fossa approach.

In the former its tributaries and the classification based on the tributaries will be explained. Since the most dangerous tributary of the SPV is the vein of the cerebellopontine fissure, the vein will be explained in detail. Anatomical knowledge of the SPV drainage pathways is also very important to safely expose lesions in the upper C-P angle. The superior petrosal sinus is the final SPV drainage pathway, and the sinus has sometimes a partial defect. The superior petrosal sinus is separated into anterior and posterior parts based on the draining point of the SPVs. Careful preoperative assessment of venous drainage pathways will be emphasized.

In the latter, variations of the posterior condylar emissary vein and the posterior condylar canal will be presented. Then, it will be explained how to be found and how to be used as an anatomical landmark during the trans-condylar fossa approach.

CS1-1-2 Cerebellopontine angle epidermoid cysts: New pathogenesis of cranial nerve dysfunction and their surgical outcome

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Epidermoid cysts are rare intra-cranial tumors. Forty percent of them are located in cerebellopontine angle (CPA), and show various cranial nerve (CN) dysfunction. Although several mechanisms for the CN dysfunction have been proposed, no direct evaluation has been done. In this case series, pathophysiology of cranial nerve dysfunction in CPA epidermoid cysts was evaluated, and a new mechanism of capsule strangulation was proposed. Twenty-five cases with CPA epidermoid cysts (2005-2016) were approached through retrosigmoid route except two cases treated with anterior petrosal route. Mass

reduction of cyst contents was associated with marked improvement of the symptoms. However, two exceptional young cases showed strangulation of the affected facial and abducent nerves by the tumor capsule whose preoperative dysfunction did not improve after surgery in spite of meticulous microsurgical removal of the lesion. Involved facial nerve showed marked nerve atrophy distal to the strangulation site.

In this paper, surgical technique and their surgical outcome for CPA epidermoid cyst will be presented with focuses on characteristics for the cases with the strangulation mechanism.

CS1-1-3 Surgical resection of cerebellopontine epidermoid cysts; Outcome & complications

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Background, Epidermoid cyst is a congenital slow growing lesion. 32 patients were operated upon for microsurgical excision of CPA epidermoid cysts, between 2003 and 2013. We report a thorough analysis of these patients as regards the adherence of the secretory capsule and the clinical outcome when radical surgical removal was attempted. **Material and methods,** the age ranged between 20 and 65 years. All patients suffered from symptoms of c-p angle syndrome or signs of posterior fossa tumor. All patients were operated through a retromastoid approach. **Results,** Total resection of the epidermoid cysts was accomplished in 26 cases, and subtotal resection in 4 cases. Two patients underwent partial resection. 2 patients showed deteriorations of the pre-operative neurological status. A persisting neurologic deficit was observed in two cases (hearing loss, dysphonia). Two patients were lost in the follow-up period. **Conclusions,** Epidermoid cyst is a benign tumor. Total resection is the ideal treatment, but surgeons have to be aware of the critical complications that might occur when attempting total excision especially in cases where the capsule is adherent to the brainstem.

CS1-1-4 Surgical management of intracranial epidermoid tumors; Lessons learned from 334 cases over 3 decades

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Surgery of intracranial epidermoid tumor is a difficult challenge. Traditionally, because of

adherence to surrounding neurovascular structures, subtotal resection leaving the adherent capsule, was advocated. More recently, some experts reported radical total resection, including capsule dissection, has been advised to for cure. Herein, we present our experience with 334 cases of intracranial epidermoid tumors wherein complete resection of the tumor including the capsule was attempted in all cases. This is the largest series, to date, of patients operated for intracranial epidermoid tumors. Distribution of the tumor, surgical results, complication avoidance, and long-term follow up will be discussed.

CS1-1-5 Surgical management of cerebello-pontine angle epidermoid tumors

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OBJECTIVES: To evaluate the efficacy of various modes of surgical management of CPA epidermoids with regard to removal and preservation of the Cranial Nerves. To study the role of endoscopy in assessing excision of Epidermoid.

METHODS: From 2009 to 2016, 42 patients were admitted in Dunakhe Hospital Aurangabad. All patients underwent CT and MRI of brain and were operated by Retrosigmoid approach. Endoscopy was used to assess the excision. Follow up was based on outpatient imaging.

RESULTS: Patients presented with Headache (33 cases), cerebellar signs (4 cases), Trigeminal neuralgia (1 case), facial palsy (1 case), Hydrocephalus (9 cases). The mean duration of symptoms was 20 months. The mean follow up was 18 months. 1 patient died due to aseptic meningitis. Compared with preoperative clinical status 83% improved, no patient had cranial nerve deficit post operatively.

CONCLUSION: Meticulous surgical technique is important to achieve safe and effective total excision. To avoid recurrence all corners of CPA should be checked. Endoscope assisted excision helps in total excision of tumor.

It is very difficult for single surgeon to go till the level of total excision due to limited resources.

CS1-1-6 Development of TED scale for the surgery of petroclival tumors

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CS1-1-7 Surgical management of trigeminal neuroma

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Trigeminal neuroma (TN) may arise from any part of trigeminal nerve, from cisternal part to its distal branches. TN may involve any compartment, including posterior fossa, middle fossa, or along its distal branches, or may involve multiple compartments. They produce various shapes involving in various locations.

56 patients with TN were treated until recently. Tumors were classified as follows: tumor confined to the middle fossa (10 cases, 17.6%), tumor confined to the posterior fossa (7 cases, 12.5%), tumor involving both middle and posterior fossae (7 cases, 12.5%), tumor confined predominantly to the middle fossa with posterior fossa extension (11 cases, 19.6%), tumor confined predominantly to the posterior fossa with middle fossa extension (13 cases, 23.2%), tumor confined predominantly to the middle fossa with extracranial extension (4 cases, 7.2%), and tumor predominantly occupy the middle fossa and also involve the posterior fossa and intracranial branch (4 cases, 7.2%). Various surgical approaches were chosen according to the tumor type. Gross total resection was achieved in 91.1% of patients.

Details of clinical presentation and surgical outcomes will be presented.

CS1-2-1 Microsurgery of giant aneurysms

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CS1-2-2 Skull base approaches for vascular lesions

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CS1-2-3 Analysis of supraorbital keyhole approach in groups of middle cerebral artery(MCA) aneurysms and anterior communicating artery(AcoA) aneurysms

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OBJECT:The supraorbital keyhole approach via an eyebrow skin incision provides a method for the minimally invasive clipping of aneurysms located in the circle of Willis, but has disadvantages for aneurysms located in the lateral Sylvian fissure. We compare the groups of aneurysms of the MCA and AcoA.

METHODS:The procedure consists of a usual eyebrow skin incision, and a 20~25mm keyhole minicraniotomy to expose the frontal base. Each seventeen keyhole clipping procedures were performed in ruptured or unruptured MCA and AcoA aneurysms.

RESULTS: Two patients showed a permanent ischemic neurological deficit due to vascular accident in MCA aneurysm group, however only one minor perforator problem in AcoA group. No shaving of scalp hair, drain placement, nor stichout were required. Most patients were discharged on the early postoperative day. No patients showed weakness of the frontalis muscle without damaging the frontal branch of the facial nerve.

CONCLUSIONS: Large or posterior and/or inferior directed MCA aneurysms, large sylvian vein, prominent sphenoid ridge and located below the sphenoid ridge were not good indication of the supraorbital keyhole approach.

CS1-2-4 Skull base procedure and suction decompression method for large and giant paraclinoid aneurysm clipping

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Suction decompression method is useful for large and giant paraclinoid aneurysm clipping. To date, we performed clipping of 29 cases by using this method. The proximal portion of the internal carotid (IC) artery is controlled at the neck of the patient. Ultrasonic bone curette is used to remove the bone around the aneurysm. Suction decompression procedure starts using 6 cm length catheter from the IC at the neck of the patient. For downward directed aneurysms, multiple fenestrated clips are commonly used, especially short, curved ones. For upward directed aneurysm,

long straight clips are commonly used, usually 2 clips in parallel fashion. Intraoperative Doppler and ICG are useful in order to check the flow of the parent artery and no flow into the aneurysm. Multiple syringes for suction should be prepared to perform continuous suctioning procedure. Ipsilateral ischemic complication occurred only in one case and visual symptoms improved postoperatively in 9 out of 15 cases with preoperative visual disturbance.

Video is used to demonstrate our setting, procedure and selection of clips.

CS1-2-5 Surgery for the intracranial aneurysms

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[Background] Although a neuroendoscope is useful for visualizing structures in the dead angles of the microscope, ordinary endoscopy cannot evaluate arterial flow. To overcome this shortcoming, we have developed endoscopic fluorescence video angiography, and analyzed its efficacy for aneurysm surgery. [Methods] Thirty-one clipping surgeries were enrolled in this study. Both microscopic and endoscopic fluorescence angiographies were performed before and after clip placement. [Results] Endoscopic fluorescence angiography enabled the observation of blood flow in the dead angles, and revealed additional information about aneurysmal occlusion and perforator patency in 29 aneurysms (93.5%) compared to microscopic fluorescence angiography. Furthermore, only endoscopic fluorescence angiography could depict the incomplete clipping and occlusion of perforating arteries after clipping in two and three aneurysms, respectively. [Conclusion] Endoscopic fluorescence angiography can contribute to the improvement of patients' outcome in aneurysm surgery facilitating real-time assessment of blood flow in the blind area of microscopic video angiography.

CS1-2-6 Future of art of clipping of aneurysm?

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Aneurysm surgery has gradually evolved considerably, with a long learning curve due to unmatched dedication, hard work and outstanding research by Neurosurgeons and allies, into each and every possible step of surgery to avoid complications. Due to all those inputs, most

of the anterior circulation Aneurysms and three fourth of posterior circulation Aneurysms have been surgically treated successfully with much of improved mortality, morbidity, and QOL. With advent of Endovascular Intervention owing to Market forces, patient's fear of surgery, multiple trials and comparable results ... The trend towards endovascular coiling has increased significantly resulting into much decreased exposure of younger Neurosurgeons to Aneurysm surgery. With this trend, open Micro neurosurgery has become limited. Ultimately one fears the day when we will not have experienced Neurosurgeons to manage even simple Aneurysms leaving aside the complex and complicated ones. This may be the reason that the younger neurosurgeons unfamiliar / less confident of open micro neurosurgery are referring large number of these patients for endovascular therapy.

CS1-2-7 Unruptured aneurysms - The real challenge

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In the presence of a patient with an unruptured aneurysm (UIA), it is difficult to conduct the decision toward an invasive treatment, risking of morbidity or mortality. In addition, living with an "unexploded bomb" inside the head might be daunting. The issue of unruptured aneurysms in a patient harboring multiple aneurysms (MAs) out of which one has bled is equally controversial.

METHOD 810 operated aneurysms in 713 patients. 64 patients operated for solitary UIAs (SUIAs), whereas 97 other UIAs were operated in 61 patients with MAs, operated in "single stage-single opening".

RESULTS In cases operated for SUIAs, 98.4% were discharged with GOS 4 and 5, only a single case being GOS 3. In MAs only 58% were discharged with GOS 4 and 5, mainly due to the previously altered neurological status caused by the ruptured aneurysm.

CONCLUSION With an appropriate selection of cases, surgery offers definitive good surgical results in SUIAs handled by an experienced team. "Single-stage surgery" is a good option for MAs.

CS1-3-1 Handshake approach - A contribution to the management of intra - extracranial anterior skull base tumors

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We demonstrate that handshake approach is a feasible and safe option to anterior skull base tumors. Its advantages are: one-staged resection, good cosmetic result, excelent surgical field, acceptable rate of complications and adequate skull base reconstruction. Using this strategy procedures lasts less and it is posible to perform a one-stage gross total resection in a safe manner, avoiding long or repeated surgeries, reducing risks. The role of transcranial team is to resect dural/intradural component and release the tumor towards the sella and protect neurologic structures. The endonasal team should work on infra-sellar component making its debulking and resection, besides works on corner areas no visible from superior such as OCR.

Performing removal of the biggest component from inferior makes bleeding come to nose, not to the intracranial space. At the end of removal, both teams should meet at etmoidal/sphenoidal plane, making the so-called "handshake approach". The reconstruction of anterior cranial base is performed by the transcranial team being adjusted from inferior by the transnasal team. It consists in a three-fold reconstruction.

CS1-3-2 Cranio-Orbital Pretemporal Skull Base Approach to Sellar/ Juxtaseilar Meningiomas

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Cranio-orbital zygomatic approach has become increasingly popular approach in the past 2.5 decades enabling us to resect complex meningiomas in the area of sella turcica, supra-, retro- and juxtaseilar areas including the cavernous sinus compartment. Radical tumor resection has been increasingly achieved while preserving and improving neurological function. Further development of pre-temporal transcavernous skull base approach enhanced multidirectional access to these complex skull base areas. To achieve proficiency in this approaches prolonged training in skull base laboratories is necessary.

The main points of this approaches include removing the roof and the lateral wall of the orbit, opening of the superior orbital fissure and the

lateral wall of the cavernous sinus, extradural resection of the anterior clinoid, opening/incision of the tentorium and mobilizing III nerve, opening of the falxiform ligament over the optic nerve and microsurgical resection of the lesion.

We will be presenting our experiences utilizing this approach over the past 12 years for a variety of meningiomas including sellar, clinoidal and cavernous sinus meningiomas. The demographic, neurologic, radiologic and operative treatment details and outcomes will be provided. In addition, operative pitfalls and traps as well as complication will be discussed.

CS1-3-3 Technical strategy and pitfall in surgery for juxtaseilar skull base meningioma

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To clarify the technical strategy and pitfall of functional preservation in surgery for juxtaseilar meningioma, I reviewed 86 surgical cases retrospectively. I evaluated surgical result of 87 patients with parasellar meningiomas. There are woman predominant (62 vs. 25). Age of average is 58.2. Tumor origins are medial sphenoid wing in 24, tuberculum sellae in 22, anterior clinoidal in 17, olfactory groove in 16, cavernous sinus in 6, posterior clinoidal in 2. We choose basal interhemispheric approach for midline located tumors and lateral approach, mainly zygomatic approach for tumors located laterally. Among 31 patients with visual impairment before surgery, Improving of visual acuity was seen in 17, no change in 12, deteriorating in 2. In all of 7 patients with blindness before surgery, their visual function was not improved, except for one patient who suffering extradural compression. There were 3 patients with complication related perforators. An appropriate surgical strategy, knowledge of detail surgical anatomy and meticulous microsurgical technique could produce good functional outcome in patients with juxtaseilar skull base meningioma.

CS1-3-4 Epidural approach for parasellar tumors

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Objective: Dolenc's transcranial epidural approach has recently been used in the treatment of the parasellar regions. In this approach, the temporal dural layer is separated from the deep layer to

expose the cavernous sinus extradurally. We report and show video of our experiences with 38 cases in which parasellar tumors invading the cavernous sinus was resected via the transcranial epidural approach. **Patients and Methods:** Between January 1995 and March 2015, the transcranial epidural approach was used for 38 patients who had parasellar tumors. The 11 patients had a giant pituitary adenoma. Five patients had a craniopharyngioma, and 13 patients had a meningioma. **Results:** There was no operative mortality or major morbidity. Transient oculomotor palsy occurred in 6 cases postoperatively. This approach provided excellent exposure of the tumor, relevant cranial nerves and arteries in and around the cavernous sinus through extradural retraction of the temporal lobe, allowing for sufficient resection of the parasellar portion of the tumor. **Conclusion:** Our findings suggest that the epidural approach is useful for resection of parasellar tumors invading the cavernous sinus.

CS1-3-5 Skull base midline tumors: Approaches selection and treatment strategy

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Objective To investigate the approaches selection and treatment strategy of skull base midline tumors. **Methods** We reviewed the skull base tumors of midline areas, such as craniopharyngiomas, petroclival meningiomas, clival chordomas, from 1993 to 2014, analyzed the evolution of incision and approaches, and the features of the lesion, then choose suitable approaches to resect the tumors. **Results** Different approaches were selected for the skull base midline tumors, such as transfrontal approach, modified Kawase's approach, presigmoid approach, far-lateral approach, and the tumors were resected satisfactory. **Conclusion** Skull base midline tumors should be treated individually, approaches selection and treatment strategy should be depended mainly on the location of the lesion, the arteries, and the relationship between the brain stem.

CS1-3-6 Cavernous sinus meningioma surgery again

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The advent of stereotactic radiosurgery (STR) seems to have made it entirely unnecessary for us neurosurgeons to remove cavernous sinus (CS) meningiomas (Mxs). We agree with this idea in most of primary CSMx cases, but argue that the

situation is rather different in cases in which Mxs involve the CS secondarily. Among 63 tuberculum sellae(TS) Mxs, 85 medial sphenoid wing(MSW) Mxs and 79 petrocliv-petrotent(PCT) Mxs, recently experienced 26 cases are surgically removed not only of their original site tumors but of the tumors secondarily involving the CS. As for surgical approach to the CS, we chose medial approach(Hakuba) in TSMxs, anterior approach(Dolenc) in MSWMxs, and posterior approach(Sekhar, Kawase) in PCTMxs. In any case IIIrd, Vth, VIth cranial nerves(CN) were carefully preserved, but IVth CN was sometimes sacrificed when it could not be helped. By reducing the bulk of the CSMx as far as possible, additional STR became more effective and, in fortunate cases, long-term follow up was possible without either tumor regrowth or additional STR. Some examples of our argument for these points are illustrated by surgical notes and video.

CS1-4-1 Management of anterior cranial base meningoencephaloceles

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INTRO The goals of repair of meningoencephaloceles (ME) include removal of the lesion followed by repair of the skull base defect. An institutional review of 31 cases of nasal ME having surgery is presented. **METHODS** Retrospective cohort study of patients with sinonasal ME treated at a single institution between 2001 and 2013. **RESULTS** Of the 36 patients diagnosed, 31 underwent surgical repair (29 endoscopic, 2 open) by a multidisciplinary team. The mean age was 55.8 ±11.2, with the majority being women (n=22). The most common symptoms at presentation included CSF rhinorrhea (61%), meningitis (10%), meningitis and CSF rhinorrhea (6%). The most common sites affected were the sphenoid sinus (39%), cribriform plate (26%), ethmoid sinus (10%), frontal sinus (10%), and other sites (15%). Follow-up ranged from 0.5-103 months. There were two cases of recurrent ME (6%), confirmed by MRI. Both of these recurrent cases were successfully treated using an expanded endoscopic approach. There were four postoperative complications (one wound infection, two septal perforations, and one case of epistaxis). **CONC** Most of the ME in this series were successfully treated with an endoscopic approach.

CS1-4-2 Congenital skull base lesions

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 Congenital skull base lesions are rare. These lesions can be divided into those that affect the anterior, middle and posterior cranial base. Some may present only with a small dimple but have a much larger, deeper component such as a nasal dermoid, while others can be externally quite large and sometimes be obstructing the airway such as a teratoma or lymphatic malformation. Some lesions may need to be identified *in utero* as they may cause congenital high airway obstruction syndrome (CHAOS) and preparations for the fetus to be delivered via an *Ex Utero Interpartum Treatment (EXIT)* procedure may need to be coordinated. Meningoencephalocele and encephaloceles are the most common congenital lesions in the posterior cranial base.

There are challenges in considering surgery in a newborn or infant. The developing anatomy of infants also needs to be considered when formulating a plan for management of congenital skull base lesions. Additionally, there are concerns for the effects of radiation and anesthesia to a newborn.

Consideration of the issues surrounding the management of congenital skull base lesions shall be discussed.

CS1-4-3 Bumpy calvarial deformity after cranial expansion

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 Fifty-five cases of primary cranial expansion with distraction have been experienced since February, 2000 in our team. Secondary surgery was done in 6 cases of 4 syndromic craniosynostosis, 1 oxycephaly, and 1 coronal band syndrome, because of insufficient cranial volume. In over 10 years follow up of all, 2 cases have resulted in a bumpy calvarial deformity, and illustrated as follows.

Case1; 18-year-old male, oxycephaly. Seven devices had been applied for calvarial expansion when 3-year-old, 15 years ago, and obtained its morphological improvement for a few years. But since around puberty, it gradually deformed uneven throughout the cranium, required a contouring surgery. The CT imaging showed wave shaped outer cortex of that, thickness seemed uniform, and bone marrow looked fatty yellowish in some part intraoperatively.

Case 2) 12-year-old male, mild trigonocephaly

with increased ICP. When 2-year-old, frontal advancement was carried out by distraction and had passed uneventfully without mental retardation, and after about six years, bumpy skull deformation came marked in front of the coronal. In the imaging findings, wavy cortical bone was observed as well. The patient didn't want no cosmetic treatment, is in observation.

Both cases above underwent surgery late than the optimal time, and postoperative hematoma were not found and passed well in short-term. The bumpy deformation after years is considered to be caused by an over-reaction mainly expressed in medulla in the adolescent film ossification accelerated phase.

CS1-4-4 Posterior cranial distraction for the treatment of craniosynostosis

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Background: The purpose of this study was to review our series of patients treated with posterior cranial distraction and consider a change in the treatment algorithm for craniosynostosis. **Methods:** Sixteen patients (8 males, 8 females) aged between 3 months and 7 years were included in this report. These included 8 patients with syndromic craniosynostosis, 2 with multiple-suture synostosis, 3 with single-suture synostosis, 1 with pancraniosynostosis, 1 with frontonasal dysplasia, and 1 with a cranial cleft. **Results:** Sufficient posterior cranial expansion was achieved. Subarachnoid spaces were expanded and the stricture of the occipital lobe and cerebellum was improved, as shown by MRI. In two cases of Pfeiffer syndrome and multiple-suture synostosis, preoperative MRI revealed a Chiari malformation. In both cases, the ascent of the cerebellar tonsil was noticed on MRI following expansion of the occipital bone. **Conclusions:** Our procedures included performing a posterior cranial vault distraction osteogenesis as the initial treatment for craniosynostosis with posterior flattening, such as in multiple suture synostosis, bicoronal synostosis, and syndromic craniosynostosis.

CS1-4-5 Anterior skull base endoscopic-assisted surgery of nonsyndromic hemicoronal craniosynostosis in children

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INTRODUCTION: The objective of this research is to present our own experience of performing endoscopic-assisted surgery for treatment of nonsyndromic hemicoronal craniosynostosis in children.

METHODS: Within the period between January, 2012 and May, 2015 in Federal Centre of Neurosurgery (Tyumen, Russia) there were 134 pediatric patients (104 boys and 30 girls) aged 5.02 ±1.1 months old with nonsyndromic craniosynostosis, including cases of scaphocephaly (n=74), trigonocephaly (n=45) and plagiocephaly (n=15). All patients underwent endoscopic-assisted surgery. In 6 cases of group plagiocephaly we used anterior skull base technique. Presented surgical technique is basically a fixation of the frontal bone and the upper edge of the orbit with the fixation plates using an endoscope.

RESULTS: After performing endoscopic-assisted surgery there were no cases of fatality or deterioration in neurological status in the cohort group of children during the whole follow-up period. This technology has allowed us to get a good cosmetic result immediately after endoscopic surgery with minimal trauma to the patient. None of the patients required recurrent surgery. No recurrence of nonsyndromic craniosynostosis in any of the patients was registered.

CONCLUSION: Taking into account a good results after endoscopic-assisted surgery in treatment of nonsyndromic hemicoronal craniosynostosis in children, we have come to the conclusion that the offered method can be considered safe and effective for treatment of children with nonsyndromic hemicoronal craniosynostosis.

CS1-4-6 Surgical treatment of pediatric sarcomas in the skull base

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Surgical removal of the residual pediatric sarcoma after initial chemotherapy is essential for complete cure. However, that in the parameningeal region still presents a formidable challenge.

We reviewed the skull base surgery for parameningeal pediatric sarcoma and its outcome. From 2001 to 2012, 25 cases with parameningeal sarcoma underwent skull base surgery. Tumor sites, surgical approach, complications, regional recurrence after surgery, and survival rate were analyzed. The sites of tumor were the infratemporal fossa (14), nasal cavity and paranasal sinus (11). In all cases, total resection of the tumor was achieved by means of craniofacial approach. No perioperative death was noted in this series. Facial nerve palsy (9), facial deformity (4), visual disturbance (2) and occlusal imbalance (1) occurred. However, those complications subsided gradually. Local recurrence occurred in 5 cases and distant metastasis was observed in 4 cases. The overall 5-years survival rate was 42% (Kaplan-Meier method). Although an outcome of the skull base surgery for pediatric parameningeal sarcoma is still poor, this salvage surgery is acceptable to remove residual tumor after the initial chemotherapy.

CS1-4-7 Different onset pattern of pediatric blowout fractures with oculo-cardiac reflex

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PURPOSE: We report the pediatric patients who had orbital trap-door fracture with oculo-cardiac reflex (OCR) mimicking head injury.
METHODS: This is the retrospective report of six boys (4 to 13 years) who developed diplopia, nausea/vomiting and malaise following orbital trauma. However, the onset patterns of OCR were different; (#1) a sudden onset of OCR after injury, ophthalmologist referred us, (#2) delayed onset of OCR following forced duction, (#3) OCR diminished within next day, observation recommended, (#4) firstly aided by neurosurgeon, patient administrated with the diagnosis of brain contusion, (#5) prolonged OCR in spite of forced duction, (#6) repetitive vomiting in spite of minimum trauma.
RESULTS: Early operations led complete normalization of ocular motility.
CONCLUSION: In the half of cases, patients were firstly aided by physician who had not been accustomed to OCR caused by blowout fractures. Prompt diagnosis and treatment is critical to maximize clinical outcome for this trauma.

CS1-4-8 A robust, Non-invasive MRI tractography method to describe the location and length of the optic radiations in children for pre-surgical planning

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Introduction Imaging is important in surgical resections, but the close proximity of many complex white matter pathways makes them difficult to distinguish using conventional MRI. We have developed a robust, noninvasive method to fully describe the normal development of the optic radiations in the paediatric population, in terms of length and myelination of the pathways. Our method uses probabilistic tractography of diffusion tensor imaging (DTI), and works with clinical MRI scanners.

Methods We enrolled 65 controls aged between 0.2–18 years (mean 8 years). MRI echo-planar diffusion-weighted images were acquired with 2.5 mm cubic voxels. We used fractional anisotropy (FA) as a myelination marker of white matter development. The optic radiation lengths were measured from the tractography maps.

Results and conclusions The mean FA of the optic radiations has a logarithmic distribution with age, with a rapid increase in the first four years of life followed by a smaller increase into adulthood. The mean length of the optic radiations was 69±12 mm. We found evidence for structural development in paediatric optic radiations, and demonstrated the diagnostic potential of DTI for resections.

CS1-5-1 Indication of surgery for small acoustic neuroma

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CS1-5-2 Conservatively managed sporadic vestibular schwannoma: Quality of life

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Introduction: The objective was to evaluate the quality of life (QoL) of patients with conservatively managed Vestibular Schwannomas (VS) and describe their sociodemographic characteristics.

Methods: The questionnaires were answered by patients via a website.

Results: 87.7% response rate (994/1133). The questionnaires included Short Form 12 Health Survey Version 2 (SF-12v2), the Hearing Handicap Inventory (HHI), Tinnitus Handicap Inventory (THI), Dizziness Handicap Inventory (DHI), The Penn Acoustic Neuroma Quality-of-Life Scale (PANQOL scale), and questions on sociodemographic characteristics. 898 patients reported hearing loss (95.8%). Six hundred eighty four reported tinnitus (72.9%) and 463 reported imbalance (49.4%). Regression analysis showed that DHI score and age were strong predictors of physical component summary. DHI and THI scores were significant predictors of mental component summary.

Conclusion: Dizziness is the most significant audiovestibular predictor of QoL in patients with VS. Tinnitus also has an impact on mental QoL. Hearing loss does also influence QoL significantly. Other factors may have an important role to play in determining QoL.

CS1-5-3 Long-term outcome of small acoustic neurinoma removal with hearing preservation

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Object: To clarify the long-term outcome of retrosigmoid removal of small acoustic neurinoma (AN) with hearing preservation. **Methods:** We performed retrosigmoid tumor removal attempting hearing preservation in 44 patients with small AN and preserved hearing, and 37 of these 44 patients (84%) preserved hearing postoperatively. These 37

patients were regularly examined \geq twice a year, and underwent the follow-up MRI every year to evaluate tumor recurrence and audiological exam to evaluate the long-term outcome of preserved hearing. **Results:** Long-term MRI follow-up during 6.7 ± 1.9 y-period showed no tumor recurrence. In the postoperative follow-up period of 5.1 ± 3.1 years, pure tone average showed a minimal decline to 43 ± 11 dB from 39 ± 15 dB at early after surgery; the rate of annual hearing decrease was 0.78 dB/year. In the follow-up of 5.2 ± 3.1 year, 80% of postoperatively preserved useful hearing stayed in the same hearing level. No hearing was lost during long-term postoperative follow-up period. **Conclusions:** Retrosigmoid small AN removal can accomplish successful curative tumor removal without long-term recurrence and excellent functional outcome.

CS1-5-4 Improving efficacy and safety of radiosurgery in skull base tumors: The role of microsurgery

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Some anterior skull base lesions which involve anterior visual pathways, arteries of anterior circulation and the cavernous sinus are a special problem. The rate of GTR is lower than in other location, and morbidity, mortality and recurrence are higher. GammaKnife SRS also is not feasible using adequate doses in many cases due to compromising of the optical pathway. In this paper, the authors show, with illustrative cases, a special strategy aiming to decrease the risk of radiation associated optic neuropathy (RAON) without compromise of radiosurgical efficacy in the treatment of these challenge lesions in patients whose treatment with isolated microsurgery for total resection or radiosurgery is not safe. It consists in the use of microsurgery for optic pathway decompression without total removal and so, it is possible to create a gap with at least 3 mm between optical structures and the tumor, allowing improvement of total radiosurgical dose delivered to the tumor and avoiding RAON. This strategy allowed us to reduce the radiation dose over optic apparatus to acceptable levels turning the treatment safe with the adequate radiodose in the lesion.

CS1-5-5 Surgical results and technical refinements in translabyrinthine excision of vestibular schwannomas: The gruppo otologico experience

Alessandra Russo
Gruppo Otologico, Italy

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OBJECTIVE: To evaluate the results after removal of VS through the enlarged translabyrinthine approach (ETLA) , which is a widening of the classic translabyrinthine approach that gives larger access and provides more room to facilitate tumor removal and to minimize surgery-related morbidities.

METHODS: This was a retrospective study of 3000 patients who underwent VS excision through the ETLA between 1987 and 2015.

RESULTS: Total removal was achieved in 92.33% of cases; 198 patients had incomplete resection with evidence of regrowth in 8. In previously untreated patients, anatomic preservation of facial nerve was achieved in 95.35%, and House-Brackmann grade I or II was reached in 59.87% patients. Surgical complications included CSF leakage in 0.85%, meningitis in 0.10%, intracranial bleeding in 0.80%, non-VII/VIII cranial nerve palsy in 0.96%, cerebellar ataxia in 0.69%, and death in 0.10%.

CONCLUSION: The ETLA is a safe and effective approach for the removal of VS. In our experience, the complication rate is very low and tumor size is still the main factor influencing postoperative facial nerve function with a cutoff point at around 20 mm.

CS1-5-6 Quality of life in neurofibromatosis 2 patients - More than just vestibular schwannomas

Scott Plotkin
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CS1-6-1 Management of sinonasal malignancy and anterior craniofacial resection

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Northwell Health, Lenox Hill Hospital, NYHNI
Otolaryngology, USA

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The author will provide a thorough review regarding the contemporary management of sinonasal malignancy. There has been a major

paradigm shift in terms of the previous utilization of open skull base surgery to endoscopic resection. The author will highlight the biologic principles of the many tumor types that occur within the sinonasal cavity. Indications and contraindications for both endoscopic and open surgery will be detailed. Outcome measures in terms of local tumor control and survival will also be discussed. For patients with advanced lesions requiring open type procedures, integration of reconstructive strategies to optimize functional status and cosmetic outcomes will also be detailed. Integration of the multidisciplinary team including Medical and Radiation Oncology will also be stressed. Upon completion of the course, the attendee will understand the subtleties in terms of management of sinonasal malignancy and the anticipated outcomes.

CS1-6-2 Oncologic outcomes of treatment of sinonasal cancers

Ehab Y. Hanna
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Over the last two decades significant advances have been made in both the diagnosis and management of cancer of the nasal cavity and paranasal sinuses. The most significant advances in diagnosis are office endoscopy and high-resolution imaging. These diagnostic tools have allowed more accurate delineation of the extent of sinonasal tumors, and hence, improved treatment planning. Significant advances in treatment include progress made in cranial base surgery allowing for safe excision of tumors involving the cranial base. In addition, the development of microvascular free tissue transfer has made effective reconstruction of more extensive surgical defects possible. Advances have also been made in both planning and delivery of radiotherapy such intensity modulated radiation therapy (IMRT) and proton therapy. Both modalities allow optimal radiation dosimetry to the tumor while sparing normal surrounding tissue. Various new combinations of effective cytotoxic chemotherapeutic and targeted biologic agents are also being increasingly incorporated in the overall management of patients with sinonasal cancer.

CS1-6-3 Resection of malignant nasopharyngeal carcinomas in western countries then and now

Luiz Paulo Kowalski
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CS1-6-4 Treatment selection for advanced paranasal cancer

Masashi Sugawara, Hituhiko Nakahira, Kazuhiko Minami, Yasuhiro Ebihara, Yasunao Kogashiwa, Kiyomi Kuba, Hitoshi Inoue, Susumu Ooba, Satoko Matumura

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The usefulness of skull base surgery has been established at the end of the 20th century. However, recent progress in chemotherapy, advances in radiation equipment, therapy and the spread of disease knowledge of patient via the internet, many patients with indication of skull base surgery might tend to select a conservative treatment. The purpose of this presentation is to clarify the significance of skull base surgery by retrospective analysis of sino-nasal malignancy in our department. The subjects were 96 cases who underwent radical treatment from April 2007 to December 2014. They were ranging in age from 28 to 89 years old. Skull base surgery was performed in eight cases. Endoscopic resection was performed in 2 cases. Despite the good indication of skull base surgery, 9 patients select RADplat, and CRT by hope. 5-year crude survival rate of all cases was 74%, progression-free survival rate was 57%. In recent years, RADplat also has been widely performed in advanced SCC. Local control rate of RADplat is about 90% even T4 cases. From the above results, skull base surgery at present has become a position of salvage surgery after primary treatment failure in our department.

CS1-6-5 Sino-nasal malignancies involving anterior skull base: Approaches and our experience

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Introduction: Malignancies of the paranasal sinuses involving the anterior skull base have been a challenge to manage for decades. Minimal access expanded endoscopic approaches have increased the ability to address this subset of patients with lesser morbidity and when used as an adjunct along with traditional approaches, it provides better surgical outcome. **Material & Methods:** A retrospective study with prospective analysis of 26 patients who underwent surgical management of malignancies involving anterior skull base during the period of 2011-2015 was done. Malignancies of varied histology at various stages and the approaches included open approaches, completely endoscopic trans nasal expanded approach &

Combined approaches. All these patients received post operative adjuvant treatment and are being followed up. **Results:** Complete tumour excision was possible in all the patients and tumour free margins were achieved in most of the patient. **Conclusion:** Trans Nasal Expanded Endoscopic approach is an excellent adjunct in the armamentarium of a Head & Neck-Skull base team in treating advanced tumours of the Sino-nasal tract involving the Anterior Skull base.

CS1-6-6 The role of human papilloma virus type 16 associated with malignant transformation of sinonasal squamous cell carcinoma

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Objectives: For the purpose of analyzing mechanisms of malignant transformation by HPV in sinonasal diseases, we analyzed HPV status in inverted papilloma (IP), squamous cell carcinoma (SCC) and SCC ex/in IP.

Materials and Methods: Nineteen patients with SCC, 18 with IP and 12 with SCC ex/in IP were enrolled in this study. HPV status in FFPE samples from all patients were examined by p16(CDKN2A)-IHC, HPV-ISH and HPV-PCR.

Results: A total of 49 patients were successfully analyzed. IHC revealed that positive staining of p16 were 8 of 19 in SCC (42%), 5 of 12 (42%) in SCC ex/in IP and none of 18 in IP, respectively. All p16 positive patients with SCC ex/in IP showed p16 positive only in SCC not IP. PCR revealed that HPV existed in 11 of 19 in SCC (58%), 4 of 12 (33%) in SCC ex/in IP and 10 of 18 (56%) in IP, respectively. HPV typing analysis revealed that the presence of HPV-type16 in HPV positive samples were 8 of 11 (73%) in SCC and 3 of 4 (75%) in SCC ex/in IP and 2 of 10 (20%) in IP. Three HPV integrations (2 in SCC and one in SCC ex IP) were detected by ISH.

Conclusion: Results of this study suggest that HPV-type16 can play a role of malignant transformation in sinonasal tumors.

CS1-6-7 Paranasal sinus and Skull base Malignance Management

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CS1-7-1 Advantages of collaboration between otorhinolaryngologists and neurosurgeons in an endoscopic skull base surgery

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Endoscopic sinus surgery has evolved over the past 40 years as a minimally invasive surgery in otorhinolaryngology. For two decades now this technique has been used for skull base surgery for neurosurgery procedures. One emerging theme of endoscopic surgery is the collaboration between otorhinolaryngologists and neurosurgeons worldwide. In Japan, while this collaboration is not very common, it is beginning to increase gradually. Here we review the advantages of the collaboration between the two different surgeons for endoscopic skull base surgery (ESBS). First, the combination of the otorhinolaryngologist's and neurosurgeon's specialty is useful since ESBS involves two different anatomical fields, the nasal cavity and the cranial base. Second, since nasal cavities have important physiological functions such as olfaction, control of intake air, temperature, humidity and air clearance, the preservation and treatment of intranasal structures by otorhinolaryngologists is critical for the prevention of postoperative nasal discomfort and the empty nose syndrome. We conclude that these advantages can produce better outcomes for ESBS.

CS1-7-2 Hybrid surgery for anterior skull base tumor and how to repair anterior skull base

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Object: We present hybrid surgery with neurosurgeons/ENT physicians for anterior skull base tumors, and how to repair anterior skull base. Cases:32 nasal/paranasal tumors, 3 olfactory neuroblastoma, 2 meningiomas. Post-operative follow-up periods:5.6 years. Mef/femal:32/5. Mean age at operations:45 year-old. Surgical procedure:

Following bifrontal craniotomy and extradural anterior skull base exposure, intradural part of the tumor was removed and dural defect was closed. Then, frontal base was drilled to the nasal/paranasal cavities, and microscopic/endoscopic surgeries were performed simultaneously. The tumor in the blind space was removed cooperatively. After removing the tumor, frontal skull base defect was covered by fat pieces and sealed with fibrin glue. Thereafter, anterior skull base was widely covered by vascularized galeal flap. Lumbar drainage was placed for three days after operation. Results: Any CSF leakage or infection was encountered. Three patients with malignant nasal/paranasal cavities were dead 2.5,3, and 4.5years after surgery, respectively. Conclusions: Efficacy of hybrid surgery for anterior skull base tumors and our repairmen method are emphasized.

CS1-7-3 Multidisciplinary approach for skull base tumors with intra and extracranial extension

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Background The skull base tumors with intra- and extracranial extension has varied origin and pathology with a major portion of malignancies. The surgical treatment for this kind of tumors is highly demanding of the multidisciplinary approaches which involve the vital neurovascular preservation, skull base reconstruction and cosmetic concern.

Method 92 cases of skull base tumors with intra and extracranial extension which were resected by individual designed surgical approaches with microsurgical and/or endoscopic techniques were analyzed retrospectively. The surgical approach, skull base reconstruction and complications avoidance were investigated.

Result Tumor total removal were achieved in 56 cases, subtotal in 29 and partial in 7. Complications relevant to operation occurred in 39 patients without surgical-related mortality.

Conclusion Multidisciplinary approach for the skull base tumors with intra and extracranial extension is safe and effective in selected patients. To tailor the surgical approach individually depends on the size, location, pathology and invading extension of the tumor. The life quality of patients is the biggest surgical concern.

CS1-7-4 Facial reanimation: A multidisciplinary team approach

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Objective: To review and evaluate the surgical options for treating patients with facial paralysis

Material and Methods: 44 patients developed facial paralysis after CPA tumor resection underwent facial reanimation surgery. Facial function and recovery were studied objectively with SunnyBrook Score, and House-Brackman grading system. Other outcome measures included the duration of paralysis, time to recovery, and evidence of synkinesis.

Results: Multidisciplinary team approach comprising of ophthalmologist, plastic surgeon, neurosurgeon and PM&R physician is working together to provide a more dynamic and aesthetic outcome by using several surgical techniques of both static and dynamic procedures. Masseteric nerve grafting resulted in earlier recovery compared with cross facial nerve grafting without baby sitter.

Conclusion: Reinnervation of facial muscles should occur as early as possible. Reanimation of the upper and lower face should be performed separately in order to avoid mass movement. Each procedure should be tailored to the patient's unique requirements.

CS1-7-5 Management of dysphagia and dysphonia following skull base surgery

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In skull base surgery, injury to the vagus nerve is usually proximal to the nodose ganglion and thus involves both the recurrent and superior laryngeal nerves. A high vagal lesion, in addition to other cranial nerve or neurological deficits, produces marked postoperative deglutition and airway morbidity.

Laryngeal framework surgery (LFS) for the management of dysphonia and dysphagia due to high vagal lesion has been proven to be a very reliable method. However, LFS for laryngeal paralysis does not always result in the full recovery of normal voice due to impairment of the vocal fold, which often lacks tension.

We have succeeded in restoring the tone of the vocal fold through laryngeal reinnervation combined with LFS in order to achieve a normal voice after the surgery.

Cricopharyngeal myectomy and laryngeal suspension, in addition to LFS, also decrease the incidence and amount of aspiration following skull base surgery.

This paper will focus mainly on the surgical tips and effects of swallowing and vocal functions following surgery for associated laryngeal paralysis.

CS1-7-6 The management of intracranial complications of ear disease

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Acute and chronic forms of otitis media are still seen relatively commonly in our community. Despite a general trend toward early diagnosis and appropriate treatment we still see intracranial complications of these infections.

This paper will review the presentation, assessment and current management of the range of these complications, particularly the suppurative and vascular conditions. It will review the routine management of ear infection and inflammation aimed at the prevention of spread intracranially.

It will highlight the use of modern imaging techniques. Surgical and intervention techniques will be described. The microbiologic findings will also be reviewed with respect to current best practice of antibiotic use.

Our experience indicates that complications of otitis media should be considered possible in every case and relevant investigations should be undertaken early in suspect cases. Timely involvement of both Otolaryngology and Neurosurgery will lead to best treatment and better patient outcomes.

CS1-8-1 Laminoterminalis as a corridor for retrochiasmatic craniopharyngiomas

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Objectives: Retrochiasmatic craniopharyngiomas are still surgically challenging tumors. The aim of this study is to evaluate the validity of lamina terminalis as a corridor for retrochiasmatic craniopharyngiomas.

Methods: 24 patients with retrochiasmatic craniopharyngiomas were involved in this study. Different surgical corridors utilizing the lamina terminalis were used. Frontolateral minicraniotomy (6 cases), pterional craniotomy (8 cases), and bifrontal craniotomy (10 cases) were utilized. Endoscopic assisted surgery was used in 15 cases.

Results: Gross total removal was achieved in 20 cases (83.3%). Mortality was 12.5 (3 cases). Vision improved in 15 cases (62.5%), unchanged in 5 cases (20.8%) , while deteriorated in 4 cases (16.7 %). Four cases received radiosurgery for residual tumor.

During follow up period, recurrence observed in 3 cases, which necessitates redo.

Conclusion: Trans-laminaterminalis corridor should be considered as a therapeutic option for retrochiasmatic craniopharyngiomas. Usage of endoscopic assisted surgery improves exposure and results.

CS1-8-2 Surgical management of craniopharyngiomas: Results in 287 cases (1985 - 2015)

Kuniaki Tanahashi, Goh Inoue, Ali Zomorodi, John Sampson, Allan Friedman, Takanori Fukushima
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Surgery of craniopharyngiomas is one of the most difficult in neurosurgery. Most patients require long-term care for visual, endocrinological and mental disturbances. We present our operative experience with 287 consecutive cases of craniopharyngiomas who underwent radical microsurgical resection by the senior author (T.F.). We selected endonasal minimally invasive approach for intrasellar tumors with or without suprasellar extension as the initial surgical management. Various transcranial approaches were performed for suprasellar tumors and large third ventricular tumors. Because of the finger-like extensions and invasions into the hypothalamus and adhesion to basilar perforators, some craniopharyngiomas recur even after microsurgical gross total resection (GTR). GTR was achieved in 43% of the cases, near total resection (NTR) in 32%, subtotal resection in 23.3% and partial removal in 1.7%. Despite GTR or NTR (217 cases), 30% of GTR and NTR showed later recurrence. The authors emphasize the critical importance of microsurgical radical resection with preservation of basal perforators and hypothalamus for longevity of craniopharyngioma patients in good conditions.

CS1-8-3 Surgical strategy for craniopharyngioma

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Object: Craniopharyngioma (CP) is an infrequent tumor at hypothalamic-pituitary region with low histological grade (WHO I) and can be considered a challenge for the neurosurgeon. We report our

surgical strategy for CP with our case series analysis. **Method:** The study includes 96 patients (53 men, 43 women), 137 operations, between 1998-2014. Age: 1-79 (average 29.5). These cases were classified into three age groups, I childhood (<18 years old): 37 cases, II adulthood (19-59): 44, and III elderly (60-): 15. **Results:** The proportion of TSS fluctuated through the application period: 39.6% (1998-2003), 18.1% (2004-2010), and 59% (2011-). The number of operations required per case were I 1.57, II 1.35, and III 1. Single operation rate without further treatment was I 37.8%, II 55.8%, and III 86.7%. **Conclusions:** Our surgical innovations improved the total removal rate of CP. Furthermore, surgical strategy for CP regarding choice of approach and extent of tumor removal has changed during these 17 years. Technical innovations, proficiency in endoscopic manipulation, introduction of HD endoscope, and differences of remission rate between three age groups affected surgical strategy.

CS1-8-4 Hybrid microscopic-endoscopic surgery for craniopharyngioma

Tomotsugu Ichikawa, Yoshihiro Otani, Joji Ishida, Kazuhiko Kurozumi, Masahiro Kameda, Isao Date
Department of Neurosurgery, Okayama University Graduate School of Medicine, Japan

Object: The best chance of curing craniopharyngioma is achieved by microsurgical total resection; however, unrecognized residual tumor within microscopic blind spots might result in recurrences. To visualize tissue within these blind spots, we examined the usefulness of hybrid microscopic-endoscopic surgery.

Methods: Four children with craniopharyngiomas underwent microscopic resection using the frontobasal interhemispheric approach. When the neurosurgeon was confident that visible tumor was removed, they used an endoscope to inspect and remove any residual tumor. Two ceiling monitors were mounted side by side in front of the surgeon to observe both microscopic and endoscopic views simultaneously

Results: Residual tumors were observed in the sella, on the ventral surface of the chiasm and optic nerve, or in the third ventricle, and were resected to achieve total resection. None exhibited deterioration related to the surgery.

Conclusions: Simultaneous microscopic and endoscopic observation using dual monitors was ergonomically optimal for the surgeon to perform microsurgery. Hybrid microscopic-endoscopic surgery may contribute to safe and maximal resection to achieve better prognosis.

CS1-8-5 Craniopharyngioma: Skull base endoscopic treatment in pediatric age

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Object: the endoscopic endonasal skull base surgery with its own advantages, such as faster post-operative recovery, shorter hospitalization times, absence of aesthetic damage, seems to be an ideal surgical technique to use in pediatric neurosurgery. **Material and methods:** a retrospective review of medical records of 11 patients treated between 2012 and 2015 was performed. The surgical technique involves a complete removal of the pituitary gland. All patients undergoing hormone replacement therapy in the postoperative period. **Results:** Complete removal was achieved in 90.9 %, subtotal resection in 9.1%. Currently we have not had any complication nor any recurrence. Improvement of visual acuity in 81.8% of patients, while in 18.1% of cases the visual acuity remained stable compared to preoperative period. BMI normal weight postoperatively in 63% of cases; 3 patients remain obese in the postoperative period, an improvement in BMI in 66.6% of cases were observed. **Conclusion.** The use of the endoscope allows to have a viewing angle impossible to obtain with the microscope. When appropriately indicated, endoscopic endonasal surgery may achieve optimal outcomes in the pediatric population.

CS1-8-6 Endoscopic endonasal approach for suprasellar craniopharyngiomas

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Object: To explore the endoscopic endonasal approach assisted with various new technique and vascularized skull base reconstruction in the surgical treatment of suprasellar craniopharyngiomas.

Methods: Fifty patients (31 male, 19 female) with suprasellar craniopharyngiomas were recruited from September 2012 to December 2015, retrospectively. Three of them were kids. Endoscopic endonasal-tuberculum approach were applied in all patients.

Results: Among fifty cases, 30, 14 and 6 cases reached total, subtotal and partial resection, respectively. After tumor resection, the vascularized skull base reconstruction was applied.

Conclusions: Post-operative cerebrospinal rhinorrhea can be prevented efficiently by using the

vascularized skull base reconstruction based on vascularized nasal septal flap. Neuro-navigation can make precise location of important structures of skull base. Electrophysiological monitoring protects the cranial nerves. Arterial hemorrhage can be avoided by intraoperative Doppler monitoring.

CS1-9-1 Microvascular decompression of trigeminal nerve root in patients with trigeminal neuralgia under 75 years

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Objective: To evaluate the efficacy and safety of MVD of the trigeminal nerve root in patients with ITN older than 75 years.

Materials and Methods: From 2012 to 2015, 21 elderly patients affected by ITN underwent MVD (mean age – 77.1). The surgery results were assessed via scales by Miller (2009) and by Kondo A. et al. (2012), VAS, BNIPS and BPI-Facial were used before and after MVD, follow-up period was 2-24 months. All data were compared with group of patients under the age of 75 year old.

Results: The analysis did not reveal any statistically significant differences between the patients of two groups. There were no mortality and any serious surgical complications in patients older than 75 years. The pain was relieved in follow-up period comparable in two groups (in 82.4% in elderly patients and 81.6% in younger patients).

Conclusion: MVD in patients older than 75 years was found to be a safe and effective surgery given that precise preoperative planning which includes the evaluation of physical status of patients.

CS1-9-2 Transtubular microvascular decompression for trigeminal neuralgia

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Object. While microvascular decompression (MVD) is the gold standard for the management of trigeminal neuralgia, there remains a risk of hearing impairment from damage to the vestibulocochlear nerve from excessive cerebellar retraction. Thus, we propose a microscopic and/or endoscopic minimally invasive transtubular retrosigmoid approach for MVD.

Methods. A 1.5 cm retrosigmoid keyhole craniotomy was used to expose the upper cerebellopontine angle (CPA) on 5 cadaveric heads. A ViewSite™

Brain Access System (Vycor Medical) was advanced into the lateral aspect of the upper CPA. The trigeminal roots were identified and their vascular relationships were thoroughly examined.

Results. The tubular retractor provided access to the CPA with minimal cerebellar retraction and excellent visualization of the neurovasculature. Enhanced intraoperative visualization is clinically beneficial as the majority of failed MVD's are caused by misidentification of the offending vessel due to insufficient surgical exposure.

Conclusion. A minimally invasive percutaneous transtubar retroigmoid approach for MVD in trigeminal neuralgia is feasible and effective for avoiding excessive cerebellar retraction.

CS1-9-3 Analysis of relationship between abnormal responses of intraoperative brainstem auditory evoked potential changes during microvascular decompression and immediate postoperative hearing complications

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Objective: The main aims of this study were: 1) to evaluate the intraoperative BAEPs changes and 2) assess the immediate postoperative hearing related complications.

Materials and Methods: Four abnormal responses, based on delay in latency of Peak V, namely 1) 0.4 milliseconds (watching), 2) 0.6 milliseconds (warning), 3) 0.8 milliseconds (double warning) and 4) 1.0 milliseconds & above (critical) were used for references during surgery.

Results: Regarding intraoperative BAEPs changes among patients with HFS, no changes were observed in 625 (58.9%) patients, whereas in 213 (20%) warning level was recorded followed by watching level in 118(11.1%) patients and critical and double warning levels in 91 (8.7%) and 14 (1.3%) patients respectively. Similarly among the patients with TN, in 108 (75%) patients no changes were observed but in 18 (12.5%) patients watching level was observed, warning level in 16 (11.1%) patients and double warning and critical in 1 (0.7%) and 1 (0.7%) patients respectively.

Conclusion: These findings further emphasize that the four abnormal responses based on delay in the latency of Peak V to be practically implicable in setting of BAEP monitoring during MVD.

CS1-10-1 CPA Master neuromonitoring improves rate of hearing preservation after retrolabyrinthine vestibular schwannoma surgery

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The CPA Master is a new system for continuous, active, real-time monitoring of cochlear and facial nerve function during surgery in the cerebello-pontine angle. The system is an improvement in several aspects compared to existing systems. At the Department of Oto-rhino-laryngology in Copenhagen, the CPA Master has been used since 2012, for neuromonitoring during retrolabyrinthine surgery for vestibular schwannoma. Use of the system has improved the hearing preservation rate from 52% to 70%, in tumor sizes up to 25mm extrameatal. Details of CPA Master functionality and surgical technique will be presented.

CS1-10-2 Surgery for the vestibular schwannoma with intraoperative monitorings

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Surgery for the vestibular schwannoma needs high technical demands. In order to obtain better surgical results including facial nerve and hearing functions, intraoperative monitoring of the brainstem, cochlear and facial nerves are essential as well as surgical techniques. In this presentation, surgical techniques under various types of intraoperative monitoring are presented. Surgery was conducted with the patient in the lateral position, and the lateral suboccipital approach was taken. Preservation of the facial nerve function was the top priority followed by total removal of the tumor and hearing preservation: thin layer of the tumor was left unresected when the tumor was tightly adherent to the facial nerve. To monitor the facial nerve function, transcranial facial motor evoked potential (facial MEP), A-train of facial electromyographic monitoring (A-train of facial EMG) and evoked facial EMG. To monitor the cochlear nerve function, auditory brainstem evoked potential (ABR) and cochlear nerve action potential (CNAP) were monitored. Surgical techniques with

intraoperative monitoring will be shown with illustrative cases as well as our surgical results.

CS1-10-3 The cutting edge of hearing preservation surgery with DNAP monitoring for acoustic neuroma

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We had been developing a continuous auditory-evoked dorsal cochlear nucleus action potential (DNAP) monitoring for hearing preservation acoustic neuroma surgery. DNAP electrode was approved in Europe on 2014 and in Japan on March 2016. Further, we propounded that restoration of cochlear nerve function during the surgery is important for good outcome. Through our study two things were revealed as agendas. The first, in case of bad hearing case we can't measure the ABR even from the beginning of the surgery. The second, we often run into unstable monitoring toward the end of tumor removal. To solve these problems, we attempt to use Chirp stimuli which are well-known as a new sound model. This compensate delay of traveling time depending on the difference of frequency in cochlear, as a result we can get large amplitude of peak V of ABR in theory. Chirp stimuli have another feature, which is its frequency specificity. Even in case of bad hearing cases, we could measure stable DNAP monitoring by using this feature.

CS1-10-4 Hearing reconstruction in cases with neurofibromatosis type 2

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Background: In cases with neurofibromatosis type 2, half of cases lose hearing function during their lifetime and experience significant decline of daily activity. It is important to reconstruct hearing function after complete hearing loss. In this presentation, authors report outcome of reconstruction using auditory brainstem implants in Japan.

Methods: In 8 cases, auditory brainstem implants(ABI) using Medel Combi 40+ and Tempo+

were achieved. Also recently, cochlear implants(CI) using Medel Concerto to FLEX 28 were achieved in 6 cases with presumed preservation of cochlear nerve structure.

Results: In ABI cases, 1 to 12 electrodes were useful after surgery and sound effect recognition was obtained in all cases except one. While auditory open set speech recognition rarely pass the 30%, with combined auditory and visual inputs, recognition reached over 30% in 5 cases. In cases with CI, 4cases passed 50% by SDS.

Conclusion: Brain-machine interface technology can improve hearing function as well as daily activity in cases with auditory difficulty with NF2 and other disease.

CS1-10-5 Improving functional preservation in acoustic neuroma surgery Improving functional preservation during acoustic neuroma surgery

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Object: Restoration of cranial nerve functions during acoustic neuroma (AN) surgery is important for good outcome. The effects of minimizing the injury period and maximizing the recuperation period were investigated in 89 consecutive patients who underwent retrosigmoid unilateral AN surgery. **Methods:** Intraoperative cochlear nerve (CN) and facial nerve (FN) functions were evaluated using continuous auditory-evoked dorsal cochlear nucleus action potential (AEDNAP) monitoring and FN root exit zone-elicited compound muscle action potential (FREMAP) monitoring, respectively, and factors affecting same-grade functional preservation were analyzed. **Results:** Twenty-three patients underwent standard treatment and investigated the monitoring threshold for functional preservation. One hundred twenty three patients underwent extended recuperation treatment to assess the effect on recovery of nerve function. Final AEDNAP response, final FREMAP response, and extended recuperation treatment were associated with same-grade functional preservation. **Conclusions:** Patients with extended recuperation treatment had significantly better functional preservation.

CS1-10-6 Planned partial resection followed by GKS for large VSs

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Objective: We have been performing planned partial surgical resections followed by gamma knife radiosurgery (GKS) for large vestibular schwannomas (VSs).

Methods: We treated 40 patients with large unilateral VSs (maximum tumor diameter: at least 25 mm) with planned partial tumor removal followed by GKS for functional preservation. The median maximum diameter of the tumors was 32.5 mm. The median tumor volume at GKS was 3.3 cm³ and the median prescribed dose was 12 Gy. The median follow-up period after GKS was 65 months.

Results: At the final follow-up, facial nerve preservation (House-Brackmann grade I-II) was achieved in 38 patients (95%). Two patients improved from severe hearing loss to PTA less than 50 dB. Five- and 10-year tumor growth control occurred in 86% of patients. Four patients (10%) required salvage surgery; the predictive factor was tumor volume greater than 6ml at GKS (p =0.01).

Conclusions: Planned partial removal of large VSs followed by GKS achieved a high rate of facial nerve and hearing preservation.

CS1-10-7 Novel therapies to treat vestibular schwannomas

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Advances in our understanding of the molecular biology of vestibular schwannomas including the pathways affected by mutations in the merlin gene have resulted in the development of novel therapeutics. The most successful to date is bevacizumab, a monoclonal antibody targeting vascular endothelial growth factor that is gaining acceptance for the treatment of rapidly growing vestibular schwannomas in neurofibromatosis type 2. There is growing evidence to support the importance of inflammation in the growth of vestibular schwannomas. The main pathways involved in the pathogenesis of vestibular schwannomas and the therapeutic agents available to target these will be discussed as well as new evidence for the efficacy of aspirin in preventing tumour growth and other potential areas for development in the future.

CS1-11-1 Minimally invasive surgery for anterior and middle skull base tumors

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There is a trend toward the concept of minimally invasive surgery to treat anterior skull base tumors (mainly meningiomas M or craniopharyngiomas C). Either supra-orbital mini-craniotomies (trans-eyebrow TEB, trans-eyelid TEL, mini-pterional MPR) or endonasal route ETT can be used. Based on anatomical study and a clinical experience of 76 patients operated over the last 5 years, we summarize the respective indications of each approach.

There were 37 ETT, 16 TEB, 13 TEL and 10 MPR. Tumor, ophthalmological, endocrine results and the morbidity were analyzed.

No statistic difference was founded considering GTR and visual outcome. Pituitary functions worsened only for C. ETT provides a good exposition of the retrochiasmatic area. Limits were the absence of control beyond the carotid and the CSF leak. For the supra-orbital routes, the control of the retrochiasmatic space is the main limit.

ETT is the best for midline retrochiasmatic tumors and selected tubercular M. The TEB can be used for middle size tumors in case of well-furnished eyebrow and small frontal sinus. The TEL allows a more lateral approach than TEB but owned the disadvantage of a facial scar and could be replaced by MPR.

CS1-11-2 Endoscopic anterior skull base surgery

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Most importance for endoscopic skull base reconstruction is how materials should be selected. Acellular dermal allografts, septal cartilage or bone, mucoperiosteal vascularized rotation flap, fascia lata, dural substitutes, fat and numerous other synthetic materials have used alone or in a combination. The extent of reconstruction depends on the size and location of the defect. Although mucoperiosteal nasoseptal pedicled flap full of blood flow acts excellently as scaffold for in growth of granulation tissue and fibroblast, there is a limit of the length of the flap as it is difficult for a large anterior skull base defect. When the defect is smaller size, the soft tissue materials (fat or fascia) are inserted into the defect and the defect is overlapped by free flap of a septal mucosa or

inferior turbinate mucosa. The reconstruction of the defect of larger size is placed as an underlay bone or cartilage graft and overlay free mucosal graft or mucoperiosteal nasoseptal pedicled flap. Attention must be paid that the inserted underlay graft is not exposed by pressure of cerebrospinal fluid. Fibrin glue is applied to the second layer followed by large sheets of Gelfoam.

CS1-11-3 The endoscopic endonasal approach to anterior skull base diseases: Experience of skull base team at Verona University Hospital

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Object: To assess surgical outcome of endoscopic endonasal approach (EEA) to anterior skull base.
Methods: A retrospective analysis was conducted on patients underwent expanded endoscopic transnasal surgery from December 2014 to December 2015. Demographics data, tumor characteristics, surgical informations, imaging and post-operative complications were collected.
Results: 43 patients underwent skull base reconstruction: 36 had neoplasms, 5 had csf leakage, 1 had encephalocele, 1 had cerebral abscess. Post-operative csf leak occurred in 5 patients with subsequent revision surgery. One patient died from tumoral recurrence and one from other cause.
Conclusions: Our preliminary results confirm EEA to anterior skull base as reliable technique with acceptable peri-operative morbidity.

CS1-11-4 Anterior skull base surgery using combined endonasal translabellar approach

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We relate our experience about minimal invasive endoscopic surgery by combined approach in the name procedure for anterior skull base tumor removal.
Anterior skull base tumor can invade the bone, the ethmoid and the sphenoid.
The main risk of the surgery is csf leak and meningitis.
The use of two way in the same procedure provide a total removal of the tumor with total safety.
We use endoscopic endonasal approach with endoscopic translabellar approach.

25 procedures have been done between 2011 and 2015.

There were 10 esthesioblastoma, 10 epidermoid carcinoma and 5 meningioma.

The median follow up is 26 month.

At the term of follow up all tumors are controled expect 2 grade 3 meningioma and 2 carcinoma.

CS1-11-5 The usefulness of the musculo-pericranial flaps in the reconstruction of the skull base

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CS1-11-6 Treatment of craniofacial osteosarcoma: A multidisciplinary approach

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Objectives To evaluate treatment outcome of all patients with high-grade craniofacial osteosarcoma (CFOS) treated in our institution between 1980-2015.

Methods Retrospective analysis of 42 patients. Treatment strategy was surgery only in 8 (19%) cases, additional therapy was used in 34 (80.1%) patients, including chemotherapy (ChT) in 9 (21.4%), radiotherapy (XRT) in 7 (16.7%), and a combination of ChT and XRT in 18 (42.9%) cases.

Results Mean follow-up was 79.6 months. Overall survival (OS) rates at 2 and 5 years were 70.5% and 44.7%, respectively. Disease specific survival (DSS) rates were 73% and 49.8%. Stratified analysis by resection margins demonstrated significantly better DSS rates at 2 and 5 years (86.7%/66.7% vs. 65%/39.3%) in cases with negative histological margins. Recurrence free survival (RFS) rates were 62.9% and 56.8% at 2 and 5 years, respectively. Neoadjuvant ChT with subsequent radical resection was correlated to better DSS than surgery alone.

Conclusions We report the largest single-center study of high-grade CFOS to date. Our experience

indicate that neoadjuvant ChT with adequate surgical resection leads to better survival than surgery only.

CS1-11-7 Influence of the surgical approach on development of post-traumatic stress disorder symptoms in skull base surgery

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Objective To compare the incidence and influence of the surgical approach in patients following endonasal or open craniotomy skull base approaches of the development of posttraumatic stress (PTSD) symptoms and the influence on quality of life.

Methods A prospective study of patients undergoing skull base surgery was performed. The incidence and influence of PTSD was compared between patients undergoing an endonasal approach and their counterparts with open transcranial approach were examined before surgery and 3 months postoperatively.

Results There were 9 (50%) patients in the endonasal and 9 (50%) in the open transcranial group. At 3 months follow up PTSD symptoms were detected in 2 (22.2%) and 4 (44.4%) cases in endonasal and open transcranial cases, respectively. These differences were statistically significant (p=0.001) However, there were no differences in quality of between both groups neither before nor after surgery.

Conclusions Endonasal approach to the skull base are associated with lower rates of PTSD development than with open transcranial approaches.

CS1-12-1 Clinical usefulness of the orbito-pterional approach in aneurysm surgery

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Object: We analyzed radiological and clinical outcomes in patients with intracerebral aneurysms treated via the orbito-pterional approach and evaluate the usefulness of the approach focusing on the reduction of surgery-induced brain damage.

Methods: We retrospectively reviewed clinical and radiological data from 10 men and 28 women (mean age, 55.2 years) who underwent clipping of aneurysms through the orbito-pterional approach.

We compared the approach with the pterional approach with respect to location and character of aneurysms.

Results: Overall outcomes at discharge using the modified Rankin Scale were good in 28 (73.6%) patients, fair in 6 (15.7%), and poor in 4 (10.5%). We reviewed the aneurysms' characteristics using this approach: large sized aneurysms (n=15, 39.4%), highly located anterior communicating aneurysms (n=12, 31.5%), basilar apex aneurysms (n=5, 13.2%).

Conclusions: Long-term follow-up data presented the orbito-pterional approach as an alternative for large sized aneurysms, highly located anterior communicating surgery and basilar apex aneurysm. The approach may reduce surgery-related morbidity in patients with poor grade clinical status.

CS1-12-2 Surgery for the paraclinoid aneurysms

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Objective: Operation of Paraclinoid Aneurysm is a complicated procedure. The aneurysm direction and the relationship with surrounding structures make it difficult. We present some operative videos and think about the surgical techniques for them. **Method:** From 1990 to 2012 we operated 175 unruptured cases of the paraclinoid aneurysms. We used the transclinoid approach for these aneurysms.

Results: All aneurysms were completely clipped, and the clinical results were good (Excellent;156, Good;17, Fair;1, poor;1, Dead;0 cases). Permanent complication were visual field defect and declining visual acuity.

Conclusion; We need to understand the anatomical relationship of paraclinoid lesion structures for safety operation. In this approach optic nerve protection and preservation of hypothalamic artery were very important. Micro-Rongeur and Skull-base Forceps were useful to prevent heat injury of optic nerve caused by drilling. The endoscope was useful for preservation of hypothalamic artery in some cases.

This surgical approach was useful for clipping of paraclinoid aneurysms.

CS1-12-3 Technical considerations for safer and reliable direct surgery for paraclinoid aneurysms

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Purpose: In order to achieve safer surgery for paraclinoid aneurysms in this skull base surgery era, our surgical cases were reviewed.

Methods: From April 2010 to December 2015, 21 consecutive patients with paraclinoid aneurysms were treated with direct surgery at our institute. We performed a retrospective review of 18 paraclinoid aneurysms, which were treated with neck clipping. Their surgical procedures and clinical outcomes were analyzed.

Results: The aneurysm size ranged from 4mm to 14mm (mean 5.9mm). Complete obliteration of the aneurysm sac was achieved in all cases. 13 of them underwent extracranial anterior clinoidectomy (using a high-speed drill in 8 and using a micro-rongeur in 5) and five were done without anterior clinoidectomy. Surgical complications occurred in 4 cases, including visual deterioration in 3 cases and one premature rupture. All three visual deteriorations occurred in the case that received anterior clinoidectomy by using a high-speed drill. One premature rupture occurred in removing the anterior clinoid process using a micro-rongeur. All 15 cases had a modified Rankin scale score of 0-1. To avoid surgical complications, our surgical techniques will be presented.

CS1-12-4 Surgical management of ophthalmic aneurysm in solo neurosurgical practice

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Objective: To analyze the results of surgical intervention for ophthalmic aneurysm in the past 13 years in solo neurosurgical practice.

Methods: Between 2003 and 2015 I have treated 39 patients (mean age: 56.0 years) who underwent surgical intervention for unruptured ophthalmic aneurysm. Their location and numbers are as follows: anterior wall 13, medial wall 18, lateral wall 2 and posterior wall 6. Aneurysm location, size and postoperative results were investigated. Outcome was evaluated as no change after surgery, transient postoperative deterioration (TD), or permanent deterioration (PD). **Results:** The overall rate of PD was 5.1% (2 cases) with partial visual deficit. Another two cases (5.1%) with PD were related to general complications. **Conclusion:** The direct clipping of the aneurysm utilizing advanced techniques is the preferred treatment approach.

Careful surgical indication is necessary for elderly and medical risk patients.

CS1-12-5 A case of giant thrombosed vertebral artery aneurysm successfully treated with combined transpetrosal approach

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A 57-year-old man presented with unsteady gait; he had a 45-mm giant thrombosed aneurysm in the right vertebral artery (VA). The aneurysm severely compressed the brain stem and cerebellum. He tolerated balloon test occlusion (BTO) of the right VA for 20 minutes. We attempted to trap the aneurysm and prepared for bypass procedures. The proximal VA was clipped via the lateral suboccipital approach. The approach route to the prepontine cistern was quite difficult. Therefore, a combined transpetrosal approach was needed to divide the tentorium and dura widely in order to facilitate mobility of the aneurysm. The distal VA was successfully occluded just distal to the aneurysm. After trapping the aneurysm, the thrombus was totally removed and the aneurysm was sutured. The cerebellar ataxia worsened for 3 months, but the patient was discharged after independence in activities of daily living. Serial CT scans showed that the aneurysm gradually decreased over 6 months. Sufficient preoperative evaluations of the approach and skull base technique are indispensable in treating giant thrombosed VA aneurysm. Careful radiological observation is also necessary after treatment.

CS1-12-6 Transcondylar approach for large VA-PICA aneurysm

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A transcondylar approach is used for access to the cerebellopontine angle from more ventral and inferior directions, preventing an excessive retraction of the cerebellum. Removal of skull base tumors in the posterior fossa, which extend to the mastoid and the clivus, requires this approach. However, some kinds of cerebrovascular diseases are also good candidates for the transcondylar approach. We applied this approach for neck clipping of a large VA-PICA aneurysm. The precise anatomical investigation and surgical tips of this approach for

the large aneurysm are reported.

CS2-1-1 Surgery on cavernous sinus lesions

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CS2-1-2 Surgery of the cavernous sinus tumors

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CS2-1-3 Surgery for cavernous sinus lesions

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CS2-1-4 Endoscopic endonasal transsphenoidal approach for pituitary adenomas invading the cavernous sinus

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Introduction: VS surgical treatment is the first choice for large lesions causing compression on the brain stem with the goal of a complete resection with preservation of hearing and facial nerve function. **Objective:** To report a T3/T4 VS series of patients operated on from 07/2007 to 1/2016. **Results:** Fifty-seven operations were performed (3 reoperations): 57.8% were female, mean age (47y); most prevalent symptoms: hearing loss (89.5%), tinnitus (45.6%), dizziness (40.4%) and gait ataxia (17.7%). Thirteen patients (22.8%) presented with signs and symptoms of high ICP requiring CSF external drainage or shunt. The average time between the onset of symptoms and first evaluation was 31.3 months. T3/T4 tumors predominated (93%) with a preoperative facial palsy rate of 28%. Complete resection was achieved in 63.2% of the cases, with a PO facial palsy rate of 78.9%. After two-years follow-up, a HB score 1/2 was achieved in 51.4% and a HB 3/4 in 48.6% of the patients, some of them submitted to a facial recuperation surgery. **Conclusion:** surgery allowed complete resection of more than 60% of the T3 and T4 tumours, with preservation of facial nerve function in half of the

patients on the second postoperative year.

CS2-1-5 Endoscopic treatment of invasive pituitary adenomas in cavernous sinus

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CS2-1-6 Review of cavernous sinus surgeries in the past five years

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Objective: Lesions involving cavernous sinus are difficult to treat due to complicated cranial nerves (CN) and internal carotid (ICA). In this article we will review our cavernous sinus surgeries in the past five years and summarize therapeutic experiences. **Methods:** 84 patients who underwent 87 operations involving cavernous sinus in Huashan Hospital were retrospectively enrolled from 2011 to 2015. **Results:** Meningioma was the most prevalent disease, followed by trigeminal schwannoma and pituitary adenoma. Common preoperative symptoms included blurred vision, headache, facial numbness, abnormal eye movement, ptosis and endocrine disorders. Craniotomies were performed in 45 via subdural approach, 34 via epidural approach and 8 via combined approaches. Total removal was gained in 49.4% cases. At discharge, aggravated symptoms were present in 29.9% cases and the most common postoperative complication was oculomotor paralysis. **Conclusions:** Surgery still serves as an effective therapy for lesions involving cavernous sinus. We suggest maximal safe removal as the surgical objective, which requires special care in dealing with CNs and ICA during lesion resection.

CS2-2-1 Techniques of facial nerve preservation in large and giant vestibular schwannomas

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CS2-2-2 Surgical management of giant vestibular schwannoma: A review of 657 cases

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Objective To discuss the surgical technique and common complications from the microsurgical treatment of giant intracranial vestibular schwannoma.

Methods Surgical outcomes were evaluated in a consecutive series of 657 unilateral giant vestibular schwannomas treated in Shanghai Huashan Hospital via suboccipital retrosigmoid approach from 1999 to 2014.

Results Follow-up data were available for 566 of the 657 patients (86.1%). Total tumor resection was achieved in 556 patients (84.6%). The facial nerve was preserved anatomically in 589 cases (89.7%), and the functional valuation of facial nerve according to postoperative House-Brackmann show 216 patients (36.2%) in grade I-II, 308 cases (45.8%) in grade III, 133 patients (18.0%) in grade IV-VI. The common postoperative complications include new deafness (77.9%), intracranial infection (7.61%), low cranial nerve defect (7.45%).

Conclusion To master the clinical anatomy of the approach, using intraoperative nerve monitoring, preoperatively study the individual imaging and clinical data and multidisciplinary cooperation were the keys to avoid the complications of giant intracranial vestibular schwannoma.

CS2-2-3 Surgery of giant or large vestibular schwannoma

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CS2-2-4 ‘Complete extra-arachnoidal dissection’ and ‘Tailored drilling of the internal auditory canal’ – Our techniques for surgery of Giant Vestibular Schwannomas

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Introduction Surgical excision of giant vestibular schwannomas continues to demand high degree of surgical skills. The surgical techniques for this have been described quite extensively and elegantly in the literature over the last 3 decades. We describe our technique for management of these

patients.

Surgical Technique We believe that, in giant tumors, the extra-meatal component needs removal first. We tailor the meatal drilling (determined by the degree of intra-meatal extension) and prefer to maximally decompress the tumor before this step. The aim of ‘complete extra-arachnoidal dissection’ is to always have a barrier of arachnoid layers between the plane of dissection and the tumor. No attempt is made to visualize the 7th -8th nerve complex, either at the brain stem side or at the meatus. Under high magnification, the arachnoid layers are sharply cut and once the ragged tumour surface is seen, tumor decompression is done.

Results of our technique 80 cases of Giant vestibular schwannomas were operated over a period of 4 years from 2009 to 2015 using the complete intra-arachnoidal and tailored drilling technique. Total excision was noted in 70 cases. Anatomical preservation of 7th nerve was achieved in all cases, except one.

Conclusion ‘Complete extra-arachnoidal dissection’ and ‘Tailored drilling of the internal auditory canal’ are highly effective and safe techniques for the excision of giant vestibular schwannomas. They are likely to enhance the safety and efficacy offered by intra-operative monitoring techniques in improving the outcome of patients with giant vestibular schwannomas.

CS2-2-5 Surgical results for the treatment of T3 and T4 acoustic scwannomas

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CS2-2-6 Radical removal of giant acoustic neuromas

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CS2-2-7 Giant vestibular schwannomas - Nuances and challenges of good neurological outcome based on personal experience of about 1000 operations

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Introduction: Progressive improvement in the results of Vestibular Schwannomas (VS) surgery has been due to advent of microsurgery, intraoperative monitoring, imaging innovations, intensive care & progress in radiosurgery. The surgical aims of VS are no mortality, complete tumor excision, no recurrence, preservation of facial nerve function, preservation of hearing and no neurological and operative morbidity.

Materials and Methods: A retrospective analysis of clinical data of 878 patients with VS was done, of which 506 (58%) had large and Giant (>4cm) tumors (GVS).

Results: The mortality rate in our series of 980 VS done until now is 0%. Of 506 patients with GVS, half (256 patients, 51%) had clinical worsening of their facial features of varying grades, even though 91% of patients had their 7th nerve preserved anatomically.

Microsurgery: Microsurgical total excision is still a gold standard treatment for GVS. The basic principles of microsurgery is intra tumoral debulking, staying within the tumor arachnoid, and then gently easing the 'capsule' from the neighboring cranial nerves, blood vessels and brainstem. The 7th and 8th nerves are identified at the brain stem end medially, and in the IAC laterally, finally converging to the intermediate section where tumor is most adherent just outside the IAM. The mantra, "Preservation of cranial nerves is the primary goal, tumor removal merely a by-product", exemplifies the philosophy of maintaining quality of life. It is ideal to remove VS totally, but in an occasional case of dense adherence to the facial nerve a sliver of tumor may be left behind and observed, and in the event of regrowth, subjected to radiosurgery.

Conclusion: The prime goal of VS surgery is to save the patient's life and preserve QOL that permits him to swallow, articulate, walk steadily and not to see double. Preservation of VII and VIII nerves, though ideal, is not always achievable. Factors determining success of microsurgery are tumor size and pre op neurological status. Tumor vascularity and consistency, and arachnoid planes are other key factors that influence the surgical outcome.

CS2-3-1 Lamina terminalis approach for craniopharyngioma

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CS2-3-2 Middle fossa approach to craniopharyngiomas

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OBJECTIVE: To discuss the feasibility, advantages, and disadvantages of the subtemporal approach for resection of craniopharyngiomas, to illustrate selection criteria for this approach and review technical strategies to minimize complications and optimize outcome

RESULTS: The subtemporal approach is a safe and effective option for the resection of craniopharyngiomas with a predominant retroclival extension. With good brain relaxation, a near total resection can be achieved in 80% of the patients and good decompression of the optic apparatus can be offered with minimal surgical morbidity and short operative time.

CONCLUSION: The subtemporal approach represents a feasible approach for retrochiasmatic, retroinfundibular craniopharyngiomas when gross total resection is not mandatory. It provides rapid access to the tumor and a caudal-to-cranial visualization that promotes minimal manipulation of critical neurovascular structures, particularly the optic apparatus

CS2-3-3 Surgery of craniopharyngioma

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CS2-3-4 Craniopharyngioma: Modernistic view

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CS2-3-5 Endoscopic endonasal surgery for the management of pediatric craniopharyngioma

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CS2-3-6 Nuances in supra-sellar tumor surgery

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CS2-4-1 Outcome after surgery of vestibular schwannomas- Morbidity, quality of life, complications or work capacity?

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CS2-4-2 Management trends of vestibular schwannoma in the United States

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Objective: To analyze the changing management of vestibular schwannoma (VS) in the United States (US).

Study Design: Retrospective analysis of the Surveillance, Epidemiology, and End Results (SEER) database. All patients with a diagnosis of unilateral VS were analyzed.

Results: A total of 8,330 patients (average age 54.7, 51.9% female) were included. The mean incidence was ~1.1 per 100,000 per year; and there was a statistically significant decrease in tumor size category at time of diagnosis over time ($p < 0.01$). Management trend analysis demonstrated that surgery was utilized less frequently over time ($p < 0.0001$), observation was used more frequently ($p < 0.0001$), and the frequency of radiation therapy remained unchanged.

Linear regression was utilized to create an equation that was applied to predict future management practices. These data estimate that by 2026, half of all VS will be initially managed with observation.

Conclusion: Tumor size at time of diagnosis has decreased over time. Within the United States there has been a clear recent evolution in management towards observation.

CS2-4-3 Loss of QOL after the skull base surgery

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Typical sequelae after lateral skull base surgery is facial palsy, hearing loss, vertigo, dizziness, mis-swallowing and hoarseness and these symptoms affects patients quality of life in various degree. Among these, facial palsy and hearing loss frequently occur after the surgery. However, communication by hearing can preserve by monaural hearing, so communication itself is not so severely damaged if normal hearing in unaffected side. On the other hand, facial nerve palsy severely affect QOL even in ipsilateral palsy. Degrees of QOL damages are usually depends on surgical procedure itself. Both hearing loss (conductive and sensorineural) and facial palsy can be predictable before the surgery. So the surgeon can prepare an appropriate post operative care and pertinent explanation to the patient. In this presentation, we present our trials for preservation QOL after the skull base surgery.

CS2-4-4 The natural history of tumor growth and hearing in + 1000 observed patients with a vestibular schwannoma – An update from the world largest database in Copenhagen

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Since 1976, all patients diagnosed with a vestibular schwannoma in Denmark have been registered in a national database located at the Department of Oto-rhino-laryngology in Copenhagen. Diagnostic and follow-up data on tumor size and hearing acuity has been registered prospectively. At the end of 2015, more than 3300 patients have been entered into the database. More than 1000 of these patients have been treated conservatively and observed by the wait-and-re-scan policy, including follow-up audiometries. An update on the natural history of tumor growth and the spontaneous course of hearing during long-term observation of these +1000 patients will be presented.

CS2-4-5 Geographic distribution of vestibular schwannomas: A 15-year review

Georgios Kontorinis

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Object: We aimed at presenting a geographical distribution of VS covering West of Scotland and a population of approximately three million over a period of 15 years.

Methods: A total of 520 adults diagnosed with sporadic VS between 2000 and 2015 were identified through the West of Scotland Skull Base database. Postcodes were mapped and analysed using ArcGIS. We performed a cartographic representation of the data and looked for any spatial dependency of VS nationally (Moran's I).

Results: The estimated prevalence of VS was 1 in 10000 patients. The mean age of individuals at the time of diagnosis was 57.5 years with a minimum age of 26 years and maximum age of 88 years. Of the individuals diagnosed with VS, 53.1% were male and 46.7% were female. There was a spatial correlation with certain areas of Scotland demonstrating significantly higher incidence of VS (Moran's I=0.078, p=0.019).

Conclusions: Our data show, for the first time a geographic distribution of VS, which is not incidental. This can be attributed to the links between primary and tertiary care and the socioeconomic background in these areas. Potential correlation with causal factors cannot be excluded.

CS2-4-6 Postoperative tinnitus after vestibular schwannoma surgery: A neglected entity

Jayesh Sardhara

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CS2-4-7 Translabrynthine resection of small acoustic neuromas

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OBJECT Translabrynthine (TL) resection is one of several treatment options available to patients with acoustic neuromas (AN). We review the experience of a single neurosurgeon, working as part of a surgical team, using this approach to resect small ANs.

METHODS Data from a prospective database were reviewed. Consecutive patients with a preoperative

diagnosis of AN with less than one centimeter extension in the cerebellopontine angle, operated between 2008 and 2013, were included. 113 patients were identified, 76.1% with poor preoperative hearing.

RESULTS 8.8% of patients were found to have a tumor other than AN. Excluding 2 malignancies, the tumor control rate was 95.5% as defined by absence of radiographic disease and 99.1% as defined by no need for additional treatment. Facial nerve outcome was normal in 98.2% of patients and was good in 99.1%. Complications included cerebrospinal leak (4.4%) and sigmoid sinus thrombosis (0.9%), without long-term sequelae.

CONCLUSION TL resection of small ANs provides excellent results in terms of avoidance of complications, tumor control, and facial nerve outcomes. This is a hearing-destructive operation that is advocated for selected patients.

CS2-5-1 Multidisciplinary management of aggressive pituitary adenomas

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Object: Although pituitary adenomas are considered benign lesions, a small group may exhibit a clinically aggressive behavior.

Methods: We report our experience, describing a small series of 7 patients harbouring an aggressive pituitary adenoma (invasion and/or infiltration of the surrounding structures, rapid growth to large size, tendency to recur rapidly, resistance to conventional treatments).

Results: Patients underwent a total of 17 surgical procedures. Postoperatively, all patients underwent radiation therapy. Three patients received chemotherapy with temozolomide. Three patients underwent peptide receptor radionuclide therapy (PRRT). The mean follow-up is 43.42 months (range 8-150months). To date, one patient is dead, 2 patients are in poor general conditions and the remaining 4 patients are in fair/good conditions.

Conclusion: Aggressive pituitary tumors represent a specific entity. They are often diagnosed late, and request a specific multidisciplinary approach. Surgical debulking remains first therapeutical option, with the exception of prolactinomas.

CS2-5-2 Transcranial surgery of giant pituitary adenomas

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Object. Treatment strategy for giant pituitary adenomas (GPA) is still controversial. According to

literature data 13,7-15,4% of GPA require transcranial surgery due to risk of postop complications of transsphenoidal surgery (TS).

Methods: From 2010 to 2015 yy. 26 (20,9%) patients with GPA were operated on via transcranial approaches. F/M ratio - 14/12. Mean age- 49.8 (19-68) y. Tumor size ranged from 45 to 89 mm. There were 16 clinically non-secreting and 10 secreting GPAs. Overall 26 craniotomies were performed: via fronto-lateral (9), pterional (13), transcorticaltransventricular (2), bifrontal interhemispheric (2) routes. Tumor irradiation after surgery was performed in 2 patients. Follow up was 8-72 months.

Results: Clinical improvement or stabilization after surgery were documented in 24 (92,3%) cases. Postop complications in 2 pats, no lethal cases. 4 patient (15%) underwent TS as second stage of treatment, and one was reoperated due to tumor progression in 3 years.

Conclusion: Transcranial surgery remains the treatment of choice for part of GPAs as may provide radical tumor removal with satisfactory functional result and effective long-term tumor control.

CS2-5-3 Surgical treatment of giant pituitary adenoma

Kenichi Ishibashi

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Objective: The purpose of this study was to assess the treatment outcome of giant pituitary adenoma (maximum tumor diameter >4cm) with regard to suprasellar vessel involvement.

Methods: From 2010 to 2015, a total of 4 patients with giant pituitary adenoma were treated surgically. The surgical approach, extent of tumor resection, visual symptoms, pituitary function, and surgical complications were evaluated retrospectively. Suprasellar vessel involvement was specifically considered.

Results: A total of 5 craniotomies and 2 endoscopic procedures were performed. Gross total removal was performed in 2 cases and subtotal and partial removal in one case each. Suprasellar vessel involvement was observed in 3 cases. No new permanent neurological deficit were observed in any case. New endocrinopathy (growth hormone deficiency) occurred in 1 case postoperatively.

Conclusion: Giant pituitary adenomas remain a surgical challenge because of associated complications. To reduce treatment risk, detailed preoperative imaging studies, includes those for vascular structures, must be carried out.

CS2-5-4 Snare technique for the remodeling of the arachnoid pouch to prevent cerebrospinal fluid rhinorrhea and hematoma collection during transsphenoidal surgery for suprasellar-extended pituitary tumors

Sun Ho Kim

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Object. During the transsphenoidal surgery (TSS) for large suprasellar pituitary tumor, the chance of developing the CSF leakage is relatively high and tearing of the arachnoid could be multiple. Also, there are high incidences of postoperative hematoma formation in tumor resection cavity. To prevent these complications, we developed a new technique for remodeling the redundant arachnoid pouch, the so-called snare technique.

Methods. In nine macroadenoma patients with huge suprasellar extension, we used the snare technique to remodel the arachnoid pouch via TSS between 2009 and 2014.

Results. CSF leakage was encountered in eight cases, all of which were sealed off using the snare technique. None of the nine patients experienced postoperative CSF rhinorrhea. Lumbar CSF drainage was not required at all. Magnetic resonance studies revealed a remarkable reduction in the height of the diaphragm in all cases. Visual deficits improved in all patients immediately after surgery.

Conclusions. Remodeling of the arachnoid pouch using the snare technique is simple and effective for complete sealing off the CSF leak point and preventing hematoma collection in the tumor resection cavity.

CS2-5-5 Endoscopic combined endonasal and transcranial approach for parasellar lesions

Tadashi Watanabe

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Object : Parasellar tumors extending far laterally beyond carotid artery or growing into the brain are hardly removed totally by endoscopic endonasal approach even with extended skull base technique. Endoscopic minimally invasive transcranial approaches including supraorbital approach and transcyllinder approach are effective for parasellar lesions and intraparenchymal lesions. We report our experience of combined endonasal and transcranial endoscopic approach for parasellar complicated lesions.

Methods : Both approaches are performed simultaneously in one session with two neurosurgical teams and two endoscopic systems. Small opening of endoscopic transcranial surgery allows both surgical fields simple. Surgeons can talk and cooperate each other during the surgery.

Results : We experienced 23 combined endonasal and transcranial approaches including 15 fully endoscopic combined approaches. 14 pituitary adenomas, 3 craniopharyngiomas, 3 chordomas, 2 meningiomas, 1 chondrosarcoma were included. Gross total resection or subtotal resection were achieved.

Conclusion : Safe and effective cooperative manipulation within two corridors are available for giant lobular parasellar lesions.

CS2-5-6 Up-to-date MRI findings for the diagnosis of pituitary adenomas

Masamichi Kurosaki

Department of Neurosurgery, Faculty of Medicine Tottori University, Japan

CS2-5-7 Transsphenoidal endoscopic surgery of pituitary adenomas (experience 4,200 operations)

Vladimir Cherebillo

Department of Neurosurgery, Military Medical Academy, Russia

CS2-6-1 A Transcavernous anterior petrosectomy: An anterolateral perspective of the midclival area

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Object. In select cases, the transcavernous route is insufficiently wide for surgical exposure of lesions that require additional caudal and/or lateral control. We propose a transcavernous anterior petrosectomy that allows for resection of the petrous apex through the transcavernous corridor for lesions with extensions in both the middle and posterior fossae.**Methods.** Orbitozygomatic craniotomies were performed on 5 cadaveric heads. The cavernous sinus was accessed through Parkinson's triangle. Gruber's ligament, Dorello's canal, and CN VI were identified and the petrous apex was resected. The posterior wall of the cavernous sinus was opened and the upper two

thirds of the clivus were accessed.**Results.** This approach provides enhanced caudal exposure of the posterior fossa which allows for access to both regions during the same procedure—exposing CN III to the acousticofacial bundle.**Conclusion.** This approach is a feasible alternative to more invasive combined approaches and provides adequate exposure of both the middle and posterior fossae. The transcavernous anterior petrosectomy provides greater surgical freedom and a wider window of exposure to the midportion of the clivus.

CS2-6-2 The microsurgical treatment of intracranial tumors in the midline skull base

Yugang Jiang

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Object: To improve the treatment efficacy of intracranial tumors in the midline skull base, we analyzed the surgical approach and microsurgical techniques of intracranial tumors in the midline skull base. **Methods:** Patients with intracranial tumors located in the midline skull base were collected from July 2011 to July 2015, 298 patients underwent microsurgical treatment were analyzed: including 104 anterior skull base tumor patients, 93 middle skull base tumor patients and 101 posterior skull base tumor patients. Approaches were adopted according to the tumor size and location. **Results:** 266 patients underwent total resection: including 88.2% total resection rate of meningioma, 90.0% total resection of craniopharyngioma, 90.9% total resection rate of schwannoma, 83.3% total resection rate of pineal tumor, 95.8% total resection of cholesteatoma. 278 patients received well prognosis, 26 patients occurred dysfunction, 6 patients appeared complications and 1 patient died. **Conclusion:** Appropriate skull base surgery approach and fine quality microsurgical techniques not only wide skull base surgery range, improve total resection rate, but also reduce mortality rate and complications.

CS2-6-3 Safe strategy of transpetrosal approach for tumors around the petrous apex

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[Introduction] One of hazardous complications of skull base tumors is injury of venous system. Cranial nerve injury also deteriorates quality of life. In order to make it simpler and safer, the procedure has been arranged. **[Materials and**

Methods] Since 2006 through 2015, we experienced 244 lateral skull base approaches for tumors. Of 244, we carried out transpetrosal approach in 34 cases. Preoperative fusion images were made with 3D-CT angiography and MRI, which detected the veins, arteries, and cranial nerves around tumor. The manner of dural incision was changed individually to preserve venous system. We compartmentalized the tumor into 4 parts and removed tumor systematically. [Results] We were able to preserve cranial nerves, perforators, and veins without any hazardous complications. No case was deteriorated. Postoperative mean Karnofsky performance status was better than preoperative one (87.4 vs. 80.6). [Conclusions] Preoperative imaging, individual dural incision and systematic procedure of tumor removal were very useful in transpetrosal approach for tumors around the petrosal apex.

CS2-6-4 Management of the petrosal apex cholesteatoma: Nagoya city university experience

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Management of the petrosal apex cholesteatoma: Nagoya City University experience. The cholesteatoma in the petrosal apex is a rare but clinically challenging entity due to its difficulties in diagnosis and subsequent surgical management. The surgical management varies by surgeon, mainly based on the difference in each approach to preserve the facial nerve and the inner ear, the two structures that are crucially important for maintaining quality of life. Due to their huge impact of losing their functions on quality of life, both the radical removal and their functional preservations must be pursued simultaneously but in reality sometimes those are balanced utilizing number of approaches developed so far, having different advantages and disadvantages. Here we present our experience in a tertiary referral center in central Japan. The symptoms, imaging manifestations, audiometric outcomes and diagnostic clues of the 10 cases we have operated recently, were reviewed. Also, the outcome of our petrosal apex cholesteatoma management especially that on the facial nerve, and the advantages and disadvantages of each management including ours will be discussed.

CS2-6-5 Surgical treatment of epidermoid cysts presenting with trigeminal neuralgia

Yoshinori Higuchi

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CS2-6-6 Role of vertebral artery occlusion in the management of cervical spine tumours

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Object: Complete surgical resection of cervical spinal tumours can be limited by tumour encasement of the major neck vessels. Permanent vessel sacrifice is well described for aneurysms, but not for tumour surgery. We investigate the safety and efficacy of vertebral artery (VA) balloon occlusion. Methods: A 12-year retrospective study reviewed 18 consecutive patients who underwent elective pre-operative endovascular VA sacrifice followed by surgical resection. Results: The mean age at intervention was 39.7 years. Adverse events related to the endovascular occlusion included an ischaemic event (5%) and a groin haematoma (5%). 16 patients underwent a complete surgical resection. The tumours were malignant in 78% of cases. Intra-operative complications included CSF leakage (17%), infection (17%), and major hemorrhage (5%). The mean survival time from surgery was 22 months. Conclusion: In our series, pre-operative endovascular VA sacrifice by permanent balloon occlusion is technically feasible and safe to perform. Procedure related morbidity was low. This technique is recommended for patient with spinal tumours encasing the vertebral artery that require complete surgical resection.

CS2-6-7 Use of actuator-driven pulsed water jet in meningioma surgery

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Object: To report our first experience of applying a piezo actuator-driven pulsed water jet (ADPJ) system to meningioma surgeries. ADPJ system is a novel surgical instrument that enables dissections without thermal damage. METHODS: Nineteen patients were enrolled in the study. All surgeries were performed with the aid of the ADPJ system. RESULTS: The ADPJ system was useful in dissecting perforating arteries or surrounding

brain / nerve tissues from the tumors.
CONCLUSION: The ADPJ system provided a clear surgical field and enabled surgeons to dissect boundaries between lesions and surrounding tissues. In the meeting, we would like to show how ADPJ system was used in preserving perforators and cranial nerves in representative cases of skull base meningiomas.

CS3-1-1 Involvement of optic apparatus and vessels by supra - sellar meningiomas

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Tuberculum sellae (TSM) and medial sphenoid ridge meningiomas (MSM) may involve or infiltrate the internal carotid artery (ICA) and the optic apparatus (OA). A classification based on the grade of involvement of the ICA and OA is presented. The involvement of ICA and OA was evaluated in a surgical series of 34 cases of TSM and 69 MSM. MSM are classified in 3 types: "En masse A" -no ICA and OA involvement, "En masse B" -ICA &OA involved and "Invasive" -invasion of cavernous sinus (CS) & orbital fissure. Surgical approaches: fronto-lateral, pterional and fronto-orbitozygomatic. High flow bypass (ICA infiltration) = 4 patients). Simpson 1 removal = 31 cases of TSM. In 3 cases Simpson 3 resection due CS infiltration. Optic canal was involved in 16 TSM and CS in 3. Postoperative visual deterioration (one blindness) in 3 cases. Resections: Simpson1&2 -all cases of type "En masse A" (18 cases), in 20/23 patients with type "En masse B" and in 4 cases with invasive MSM. Conclusion: Grade of involvement of ICA and OA was the most important factor for radical surgical removal. MSM classification presented high correlation with the grade of resection.

CS3-1-2 Surgical approach for tuberculum sellae meningioma

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We suggest the contralateral subfrontal approach for TSM and discuss the technical aspects for reducing the approach-related visual deterioration. Between 2005 and 2015, 55 patients with TSMs underwent surgical resection via contralateral approach. Tumor was dissected from optic nerve without manipulation of compromised optic nerve under the direct view of inferomedial aspect of the optic nerve. The tumor extended into the optic canal could be removed easily via dural unroofing of the medial wall of the optic canal. The preservation of visual function on affected eye was achieved 96.4%. However, the deterioration of approach-side eye was developed on 6 patients (10.9%). Interestingly, approach-related visual deterioration was developed more frequently in cases of right-sided approach or patients with bilateral visual deficit. Eccentric located TSM with unilateral visual deficit is absolute indication for contralateral approach.

Midline located TSM with asymmetric bilateral visual deficit can be relative indication for contralateral approach. In case of patient with severe bilateral visual deficit, midline approach can provide a higher chance to improve visual outcome of both eyes.

CS3-1-3 Tuberculum sella meningiomas: Approach choice according to tumor syntopy

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Object: Surgery is the only effective treatment for tuberculum sella meningiomas (TSM) that provides improvement of patients' visual function. The purpose of this study was to emphasize the most important technical nuances for effective microsurgery of TSM.

Methods: 53 patients with TSM were operated in 2005-15yy. F/M ratio was 35/18, age 22-63. Frontolateral craniotomy (FC) in different modifications was applied in all cases. Correlations between clinical presentation of the TSM, MRI data, intraoperative findings and pre/postoperative visual impairment score (VIS) were analysed. Follow up was 6-136 months.

Results: Tumor size ranged from 17 to 46 mm. Total tumour removal was achieved in the 49 (93%) cases. Surgical morbidity: anosmia in 8 (15%), transient visual worsening in 3 (5,6%). No lethal cases.

Conclusion: FC provided optimal access to TSM and radical tumor removal with minimal neurological and ophthalmological morbidity. Anatomical interrelations between tumour, neural and vascular structures predetermined the choice of the FSC on the side of better visual acuity as it assured less traumatic manipulations with optic pathways and direct visualization of tumor attachment point.

CS3-1-4 Craniotomy for tuberculum sellae meningiomas: Is it safer than endoscopy?

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From January 1993 to June 2014, all the patients with tuberculum sellae meningiomas (TSM) that were operated on through microsurgical techniques in our service were included for present analysis. A total of 52 patients were included: 33 women and 19 men. All patients had some visual deficit.

Pterional approach was used in 44 patients, while interhemispheric frontal approach was applied in the remaining 8 cases.

Total tumor removal was achieved in 48 patients; in two out of the 4 remaining patients, dural and bone implant were not removed and in the other two patients there was a firm adherence to the visual system. None of the 32 patients that presented preoperative amaurosis recovered vision. However all the remaining patients presented some degree of visual recovery after surgery. Only 1 patient has shown tumor re-growth.

Microsurgery is still a very good option for a safe removal of TSM. Even though a craniotomy seems to be more aggressive than an endonasal endoscopic approach, results are very similar.

CS3-1-5 Tuberculum sella meningiomas

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 India

CS3-1-6 Transbasal approach vs. endoscopic endonasal approach for olfactory groove meningiomas: Single surgeon's experience and philosophy of approach selection

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CS3-1-7 Microsurgical strategy of giant clinoidal meningioma

Han Kyu Kim
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CS3-1-8 Visual function preservation in microsurgical management of parasellar meningiomas

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 Salvatore Cardali, Felice Esposito,
 Domenico La Torre, Filippo F. Angileri
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Object: Preservation of visual function is the main

goal of parasellar meningioma management. We present our experience in the microsurgical management of parasellar meningiomas with a special emphasis on the visual outcome.

Methods: 147 consecutive patients (98 f, 49 m, mean age 58 yrs) underwent microsurgical resection of a parasellar meningioma. Meningiomas were classified as: Clinoidal (CM) (n=58), Tuberculum sellae (TSM) (n=28), orbital apex (OAM) (n=18) and olfactory groove (OGM) (n=43). In the most recent cases ICG videoangiography was performed.

Results: Gross total resection was obtained in 77.5% of CM, 82.1% in TSM, 95% in OGM and 94.4% in OAM. The visual outcome was stable or improved in 82.7 % of cases of CM, 84% in TSM, 92% in OGM and 94.4% in OAM.

Conclusion: Microsurgical treatment of parasellar meningiomas still represents the gold standard in the management of such tumors and allows the best chance of long term visual preservation. Different surgical strategies such as endonasal endoscopic resection and radiosurgery should compare their results with microsurgical management.

CS3-2-1 Current stereotactic microradiosurgery for cavernous sinus tumors

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Objective: In cavernous sinus tumors (CST), Gamma knife surgery (GKS) has increasingly been in use as a safe and effective for residual, recurrent tumors and those considered to be inoperable. We reviewed our patients treated by GKS based on original image sequence and precise treatment planning according to pathological microanatomy. Materials and Methods: A total of 120 patients harboring CST (pituitary adenomas, meningiomas, cavernous angiomas, and schwannomas) were treated with at least 3 years. Median prescription dose was 12Gy except for functioning adenomas. We used enhanced 3D heavily T2 WI, which enabled clear visualization of the intracavernous sinus structures. Results: Tumor control rate was 97.5%. Endocrinological normalization was seen in 39% of the cases with functioning adenomas. In Complication, 5% of patients experienced transient cranial nerve deficit without any endocrinological deficit. Conclusions: We are convinced that microanatomy based radiosurgery for CST will play a bigger role.

CS3-2-2 Gamma knife radiosurgery for skull base meningiomas – Long-term results of low- dose treatment

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Objection: We evaluated long-term results of gamma knife radiosurgery of cranial base meningiomas. **Methods:** We treated and followed 108 patients with benign cranial base meningiomas using low-dose gamma knife radiosurgery (8-12 Gy for the tumor margin). Tumor volumes ranged from 1.7 to 55.3 cm³ (median: 8.1 cm³). Radiosurgery doses ranged from 8-12 Gy (median: 12 Gy) for the tumor margin. **Results:** The mean duration of follow-up was 86.1 months. Tumor volume decreased in 50 patients (46%), remained stable in 51 patients (47%), and increased (local failure) in 7 patients (6%). Eleven patients experienced tumor recurrence outside the treatment field. Seven patients (6%) were thought to have malignant transformation based on histological or radiological behavior. The actuarial progression-free survival rate including malignant transformation and outside recurrence was 93% at 5 years and 83% at 10 years. Neurological status improved in 16 patients (15%). Permanent radiation injury occurred in 7 patients (6%). **Conclusion:** Gamma knife radiosurgery is a safe and effective treatment modality for cranial base meningiomas over a long-term follow-up period.

CS3-2-3 Boron neutron capture therapy for high-grade skull base meningioma

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Object: Boron neutron capture therapy (BNCT) is tumor-cell selective particle irradiation based upon the nuclear reaction that occur when non-radioactive boron-10 is irradiated with low energy neutrons to produce high energy alpha particles (10B [n, alpha] 7Li). High-grade meningioma (HGM) is difficult pathology and skull-base meningiomas (SBMs) are particularly challenging, because extended surgical resection might be associated with complications. We had been trying

to control HGMs by using BNCT.

Methods: Thirty-one patients with recurrent HGM (7 SBMs) were treated by BNCT between 2005 and 2014, which was carried out in the research reactor (KURRI). All patients had uncontrollably growing tumor after repetitive surgeries / radiation.

Results: HGMs showed good boron accumulation by PET study, as 3.8 times higher than normal brain. In several cases, tumor showed transient increases in size but all lesions were decreased during observation. The median survival time (MST) SBMs after BNCT and after diagnosis as high-grade were 18.9 and 67.5m, respectively (vs non-SBMs: 22.4, 44.2m).

Conclusion: BNCT will become hopeful therapeutic modality in cases of high-grade SBMs.

CS3-2-4 Robotic radiosurgery: Innovation and results in the treatment of parasellar tumors

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Parasellar tumors remain a neurosurgical challenge. Surgery is the first line treatment, but stereotactic radiosurgery (SRS) is an effective adjuvant management for residual tumors and primary treatment for properly selected lesions. Frameless robotic radiosurgery enables the use of multisession radiosurgery expanding the spectrum of tumors that can be managed by SRS. We reviewed our experience in CyberKnife SRS treatment of such tumors including: 147 meningiomas, 25 pituitary adenomas, 13 craniopharyngiomas, 34 head and neck carcinomas, 12 metastases. Tumor control was achieved in 141/147 (96%) meningiomas and in 23/25 pituitary adenoma patients. All patients affected by craniopharyngioma achieved tumor control. Patients with malignant tumors had a median survival of 12 months. Local tumor control was achieved in 67% of patients. No patient had visual acuity and/or visual field impairment. 50% of patients with pituitary adenomas or craniopharyngioma developed new pituitary deficits. Trigeminal neuralgia was reported in 12% of meningiomas. Our results suggest that robotic radiosurgery allow the control of tumor progression in most benign lesions with very low risk of complications.

CS3-2-5 Clinical outcome of gamma knife radiosurgery for skull base meningiomas after surgery: Effect for residual tumors and preservation of cranial nerve function

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Aim: To evaluate long-term outcome of gamma knife (GK) of skull base meningiomas with our conservative strategies avoiding excessive irradiation to cranial nerves.

We included 69 patients; 55 underwent surgery before GK and 48 had tumors invading cavernous sinus. The mean follow-up was 98 months (median 106). The mean tumor volume was 5.7ml. The mean marginal dose was 13.2Gy (10-15). Doses for cavernous sinus walls and superior orbital fissure were set below 13 and 18Gy.

Tumor regrowth was observed in 7 patients and the other 2 had recurrence outside the irradiated areas. Additional treatments were done in 6 patients; repeated surgery for 3 (2 with large tumors >18ml), and re-GK for 3 (2 with recurrence outside irradiation). No regrowth was seen in 14 patients without surgery. The actuarial progression free rate was 88.0%, and the tumor shrinkage rate was 38.7 % at 10 years. There was no malignant transformation. Preexisting diplopia got worsened in one patient. Visual or oculomotor function improved in 4 patients. Tumor volume >10ml was significantly associated with tumor regrowth. GK with our conservative planning is safe and effective over the long term for skull base meningiomas.

CS3-2-6 Cyberknife stereotactic radiosurgery for atypical and malignant meningiomas

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Objective: Adjunct stereotactic radiosurgery (SRS) may greatly improve outcomes for recurrent WHO Grade II and III meningiomas. The authors sought to present the long-term tumor control and safety of a hypo-fractionated SRS regimen.

Methods: We reviewed the prospectively collected information of 44 WHO Grade II and 9 WHO Grade III meningiomas treated by CyberKnife for adjuvant or salvage therapy.

Results: For WHO Grade II patients, recurrence occurred in 41%, with local, regional, and locoregional failure at 60 months recorded as 49%,

58% and 36%, respectively. For WHO Grade III patients, recurrence occurred in 66%, with local, regional, and locoregional failure at 12 months recorded as 57%, 100%, and 43%. Overall, 7 of 44 Grade II patients and 8 of 9 Grade III patients had died at last follow-up. The 60-month and 12-month overall survival rates for Grade II and III meningioma were 87% and 50%, respectively. Serious complications occurred in 7.5% of patients. **Conclusions:** SRS for adjuvant and salvage treatment of WHO Grade II meningioma by a hypofractionated plan is a viable treatment strategy with acceptable long-term tumor control, overall survival, and complication rates.

CS3-2-7 Radiation induced meningioma

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Introduction: Meningioma is the most common radiation induced intracranial tumors. The genetics of radiation induced meningioma is different than spontaneous one, therefore biological behavior differs and tend to be more aggressive.

Patients and methods: 27 patients were operated upon in the last 10 years, 18 females & 7 males. age at presentation ranged between 26-65, latency period was 17-35 years. All patients received high dose radiation.

The primary disease was: Leukemia in 19 patients, Medulloblastoma 4 patients, ependymoma 2 patients basal cell carcinoma of the scalp 1Pt. 17 patients had multiple meningioma. Three patients had atypical meningioma.

Results: total excision was achieved in 23 patients. 3 patients had recurrence. 3 patients had new neurological deficits.

Conclusion: Exposure to ionizing radiation has been shown to significantly increase the risk of meningioma. The risk of meningioma formation increases, and the latency period between exposure and tumor development decreases, with higher doses of radiation. Radiation-induced meningiomas are more aggressive and recur more rapidly.

CS3-3-1 Surgery on mass lesions at cranio-cervical junction

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Background: Tumors located at the foramen magnum close to vital neurovascular structures have been considered to be difficult of access. However, we have undertaken a retrospective analysis of consecutive 63 patients with mass lesions of foramen magnum, who were operated on

in a ten year period in our service. **Materials and methods:** There were 44 extrinsic and 26 intrinsic tumors of different pathology. We used the standard midline, lateral suboccipital or far lateral approach for all tumors located lateral and dorsal to the brainstem. The transoral approach is sufficient for extradural tumor with ventral location. **Results:** A total removal of the lesion was achieved in 51 patients (73%) and subtotal removal in 19 patients (27%). At the time of follow-up (9 to 78 months) 65% of the patients improved, 22% unchanged and 13% deteriorated. **Conclusions:** The relationship of the tumor to adjacent structures and the pathology determines the resectability. Intraoperative monitoring, proficient surgical approach and technique for total tumor resection are necessary for a good outcome. In all patients but three with extradural ventral localized tumor a dorsal approach was used.

CS3-3-2 Hypoglossal Neurilemmoma: Surgical approach and results

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CS3-3-3 Microsurgical management of ventral foramen magnum meningiomas

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Objectives: To explore the personalized surgical approaches and outcomes for ventral or ventrolateral foramen magnum meningiomas.

Patient and Methods: Of the 103 patients with the tumors received surgical treatment in our department from January 2001 to November 2015. The tumor can be divided into 3 subtypes. A: clival type: tumor located at lower clivus. B: clival-spinal type, tumor located at lower clivus growing to spinal canal. C: intra/extracranial type, intracranial tumor grows to extracranial around VA. The transcondylar approach or extensive transcondylar approach were used.

Results: Of the 103 patients, 94 tumors achieved Simpson Grade I or II resection, and 9 were subtotal resection. Post-operative complications (dysfunctions of lower CNs or unilateral limbs, respiratory insufficiency) of type A tumor were severe than other type tumor. Of the 96 patients had the ability of physical activity, and 7 patients died from severe pneumonia .

Conclusions: With the classification of ventral or

ventrolateral foramen magnum meningiomas, appropriate surgical approach can improve the total removal rate and reduce the complications.

CS3-3-4 Condylar preservation in modified far lateral approaches to foramen magnum

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Introduction: Anterior and anterolaterally situated Foramen magnum meningiomas are a technically complex subgroup of meningiomas. In this paper we present our experience with condylar preserving and minimal condylar resection based approaches to these tumors.

Material and methods: All patients who underwent surgical resection of these tumors were included in the analysis. The study period was over 10 years from 2005-2015 at our Institute. The records along with demographic profile, Clinico-radiological features, surgical strategies, outcomes along with mortality and morbidity were analyzed.

Results: There were a total of 21 patients. The average age was 43 years. All patients underwent surgery. While 17 patients' gross total or near total resection could be achieved, 4 patients underwent subtotal resection. 6 patients had fresh morbidity in form of new motor deficits or vascular injury. There was 1 death. The follow-up ranged from 6 months to 7 years.

Conclusion: Foramen magnum meningiomas are an eminently treatable group of tumors. Condylar preservation provides good visualization while helping preserve joint stability, and avoiding instrumental stabilization.

CS3-3-5 Comprehensive surgical management of the cranio-vertebral junction (CVJ) tumors

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Surgical management of cranio-vertebral junction (CVJ) tumors continues to present as a challenge to neurosurgeons especially in cases at the anterior aspect or involving neighboring neurovascular structures. We here describe our surgical strategy and results of CVJ tumors in our institute. Of the 146 patients with CVJ lesions surgically treated since 2000 in our institute, tumors included 36. Tumor type were neurinoma in 14; meningioma in 10; hemangioblastoma in 5; ependymoma in 4; astrocytoma and chordoma, and medulloblastoma in one patient each. The operations were done

under intraoperative neurophysiological monitoring in all cases; SEP and MEP. Temporary pacemaker was inserted in 4 cases. Total removal of the tumors could be accomplished in 30 and subtotal in 6 cases. No deaths occurred in the perioperative period, but complications include postoperative hemorrhage in 2, cerebellar infarct in 2, swallowing disturbance in 2, sore throat in 3, CSF leakage in 6, and infection in 2. In conclusions, we concluded that we have to make surgical strategy for CVJ tumors in consideration of the anatomical complexity and postoperative instability as well.

CS3-3-6 Petro-occipital trans-sigmoid approach for jugular foramen schwannomas

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Objective: To describe petro-occipital trans-sigmoid approach (POTS) for jugular foramen schwannomas, and to analyze the surgical outcome and complications. **Material and methods:** Retrospective study of 12 cases. The tumor size, preoperative nerve function, surgical managements, postoperative nerve functions were collected. **Results:** The total removal was successful in all patients by POTS approach. The facial nerve was not rerouted in all cases, and their facial function did not deteriorate in short-term and long-term. 1 patient presented temporary CSF leakage and recovered with conservative treatment. The lower cranial nerve dysfunction presented in 9 patients but compensated well 1 year later. Postoperative follow-up showed no tumor residual and recurrence. **Conclusion:** Jugular foramen contains lower cranial nerves and important vessels and its surgical approaches involve additionally facial nerve, inner ear, dura, or sigmoid sinus. The tumor size, location and preoperative nerve function determinate the surgical approach. POTS is a better approach for the benign jugular tumors with anterior extension.

Keywords: Jugular foramen, schwannoma, facial nerve, surgical approach

CS3-3-7 Evolving concepts of Chiari malformation

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CS3-4-1 The direction of tumor growth as a predictor of facial nerve outcome and degree of resection in vestibular schwannoma surgery

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OBJECTIVE: To discuss the role of tumor shape in vestibular schwannoma surgery and in particular the association between the predominant direction of growth and facial nerve outcome/degree of resection

RESULTS: Based on a the combined review of vestibular schwannoma surgeries cases from two institutions we were able to identify growth in the anterior direction as well as de degree of brainstem compression as independent factors associated with facial nerve outcome and degree of resection

CONCLUSION: Despite the overwhelming role of tumor size in surgical outcome of vestibular schwannoma, the tumor shape and in particular extension anterior to the internal auditory canal proved to be a good predictor of facial nerve outcome and degree of tumor resection. Accurate assessment of morphological characteristics is useful to properly counsel patients and define the best surgical strategy, in particular for the resection of medium to large vestibular schwannomas

CS3-4-2 Clinical characteristic and surgical outcomes of patients with vestibular schwannomas after failed previous fractionated stereotactic radiotherapy

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Objective: Stereotactic irradiation is effective treatment in patients with small to moderate vestibular schwannoma (VSs), however around 10% of patients suffer tumor progression and require microsurgery. The aim of this study is to clarify clinical characteristics and surgical outcomes of patients with VSs who required salvage surgery after failed fractionated stereotactic radiotherapy (SRT). *Patients and Methods:* A retrospective medical record review was conducted on all patients with vestibular schwannomas surgically treated at Hokkaido University Hospital after underwent SRT. *Results:* Sixteen patients required salvage microsurgery among 228 patients with VS. Salvage surgeries were applied for patients with "no response" (8), "recurrence" (4) and "intratumoral hemorrhage" (4). No response group showed highest mean tumor growth rate of 428.75% and worst outcomes of salvage surgery. Recurrence group had longest duration from SRT to salvage surgery of 91.5 months and showed better facial function. Intratumoral hemorrhage has occurred in relative large tumors. *Conclusion:* Patients with "no response" group may have a most difficult surgery and poor functional outcomes.

CS3-4-3 Growth potential analysis of vestibular schwannoma before and after stereotactic radiosurgery

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Object: We assess the volume change of vestibular schwannoma (VS) before and after stereotactic radiosurgery (SRS) prospectively, and clarify the

growth potential of VS to clinical course after SRS. *Methods:* We managed 45 VS patients conservatively due to small tumor size or elderliness. During follow-up, 17 patients (37.8%) displayed tumor growth. Ten patients chose SRS and were included in this study.

Results: Mean volume doubling time was 20.3 (3.7-38.4) months before SRS. After SRS, mean maximum increase in volume was 37.8 (0~78.2)%. Seven patients showed increase in volume following SRS. Pre-treatment volume doubling time correlated to the post-treatment volume increase.

Conclusion: Growth potential affected increase in tumor volume of VS following SRS.

CS3-4-4 Risk of separate malignancy after radiation of vestibular schwannoma

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OBJECTIVE: To determine the risk of separate intracranial tumor development following treatment of unilateral vestibular schwannoma (VS)

METHODS: Analysis of the Surveillance, Epidemiology, and End Results (SEER) database

RESULTS: 9,774 patients with VS were identified. 91 (0.9%) patients developed a separate intracranial tumor, benign or malignant, following the diagnosis of VS; 14 (0.6%) following radiation, 28 (0.7%) following microsurgery and 49 (1.7%) following observation (P<0.001). The most common second intracranial tumor diagnosed was meningioma (46; 51%) and the mean time to diagnosis was 22 months. A total of 9 (0.09%) intracranial malignancies developed following the diagnosis of VS; 1 (0.04%) following radiation, 3 (0.07%) following surgery, and 5 (0.17%) following observation (P=1.0). The most common tumor was malignant glioma (5; 56%) and the mean latency was 23 months.

CONCLUSIONS: The risk of developing a separate malignant intracranial tumor following diagnosis of unilateral VS is 0.09% or approximately 1 per 1,100 cases. These data suggest sequential tumor development following radiation therapy for VS may be chiefly coincidental rather than causative.

CS3-4-5 Semi-automated volumetric measurements of vestibular schwannomas: Is this feasible in clinical practice?

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Introduction: Previous studies have demonstrated the benefits of volumetric measurements of vestibular schwannomas (VS). Manual segmentation is time consuming and has not been widely adopted. We compare the effectiveness and usability of three different semi-automated volume segmentation methods and compare to conventional linear measurement method.

Method: Linear and volume measurements of 24 intracranial or small VS were made from MRI with 1mm slice thickness using three segmentation tools: OleaSphere, AW Volumeshare and SliceOmatic using 'region growing', 'active contouring' and 'watershed segmentation' respectively. Measurements were made by two observers to determine intra and inter-observer reliability coefficients and intraclass correlation coefficients. A comparison was made with linear measurements and an assessment of feasibility for use in clinical practice.

Results: Intraclass correlation coefficients were higher for the semi-automated volume segmentation tools compared with linear measurement method. OleaSphere and SliceOmatic had the best observer correlation. Regarding usability, the number of steps required per tumour measurement was 5 for linear, 12 for Olea Sphere, 16 for AW Volumeshare and 30 for SliceOmatic. The mean time taken per tumour measurement was 30s for linear, 60s for OleaSphere and 90s for AW Volumeshare and SliceOmatic.

Conclusion: Volumetric measurements of VS were more reliable than linear. OleaSphere was the most feasible to use in clinical practice due to the combination of high repeatability and best feasibility. SliceOmatic was superior when measuring cystic tumours.

CS3-4-6 Stereotactic radiosurgery based on microanatomy in vestibular schwannomas

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In vestibular schwannomas, Gamma Knife surgery (GKS) based on microanatomy provides better preservation of facial nerve function and hearing. **METHODS:** In dose planning, we visualized

cranial nerve deviations and small bony structures using enhanced 3D heavily T2 WI with CT bone images, and then tried to define tumor nerve origin to compare clinical results. The mean marginal dose was mean 11.9 Gy. **RESULTS:** 182 patients who were followed for more than 5 years, the tumor control and shrinkage rates were 98.4 % and 76.4 %, respectively. Preservation of facial nerve function and hearing at the pretreatment level was noted in 97.8 % and 87.9 %, respectively. There was no major morbidity. In hearing preservation rate, superior vestibular schwannoma seems to be higher. **CONCLUSION:** Due to contemporary technological and methodological achievements based on microanatomy, GKS can be controlled with possible reversal of the neurological deficit.

CS3-5-1 Occipito-cervical fusion in huge cranio-cervical junction chordomas

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Huge clival chordomas with cranio-cervical junction (CCJ) involvement is especially challenging due to the instability of the occipito-cervical (OC) joint by the tumor or occurring after surgery. A retrospective analysis was done for clival chordoma patients treated surgically from 1993 until 2014, to investigate the benefit of time frame of OC fusion in huge clival chordomas with CCJ involvement. There were 22 male and 27 female patients with a mean age of 44 years (7 to 74 years). Mean follow-up duration was 7.2 years (1 to 19 years). OC fusion was done in 13 patients with clival chordoma involving the CCJ. OC fusion was performed before tumor removal in four (30.8%), and after tumor resection in nine patients (69.2%). Total removal was achieved in 11 of those 13 cases. OC fusion morbidity could be reduced by staged surgery - OC fusion first, then tumor resection later; especially when CCJ instability is expected either before surgery by the tumor, or after extensive surgical resection of huge chordomas. However, this strategy should be exercised only when OC fusion will not produce further compression of brainstem or cervical spinal cord by the tumor.

CS3-5-2 Multimodal Management outcome of chondrosarcomas of the skull base

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BACKGROUND: Limited data exists to guide the

multimodality management of chondrosarcomas (CSAs) arising in the skull base.

OBJECTIVE: To determine the impact of histological subtype/grade on progression free survival and the indications for surgery, radiation and chemotherapy based on histology.

METHODS: A retrospective review was performed of 37 patients (Conventional type-81%, mesenchymal-16.2%, dedifferentiated-2.7%) treated at The University of Texas M.D. Anderson Cancer Center. Of the conventional subtype, 23% were Grade 1, 63% were Grade 2 and 14% were Grade 3. In addition to surgery, mesenchymal/dedifferentiated CSAs (18% of the cohort) underwent neoadjuvant chemotherapy and 48.6% of the overall cohort received adjuvant radiotherapy. Histological grade/subtype and treatment factors were assessed for impact on median PFS(primary outcome).

RESULTS: Conventional subtype versus mesenchymal/dedifferentiated was positively associated with median PFS (166vs.24 months, $p<0.05$). Increasing conventional grade inversely correlated with median PFS ($p<0.05$). Gross total resection positively impacted PFS in conventional CSAs (111.8vs.42.9 months, $p=0.201$) and mesenchymal/dedifferentiated CSAs (58.2vs.1.0 month, $p<0.05$). Adjuvant radiotherapy(XRT) significantly impacted PFS in conventional grades 2 and 3 (182vs.79 months, $p<0.05$) and a positive trend with mesenchymal/dedifferentiated CSAs (43.5vs.22.0 months). Chemotherapy improved PFS for mesenchymal/dedifferentiated CSAs (50vs.9 months, $p=.089$).

CONCLUSIONS: There is a potential need for histological subtype/grade specific treatment protocols. For conventional CSAs, surgery alone provides optimal results grade 1 CSAs, while resection with adjuvant XRT yields the best outcome for grade 2 and 3 CSAs. Improvements in PFS seen with neoadjuvant therapy in mesenchymal/dedifferentiated CSAs indicate a potential role for systemic therapies. Larger studies are necessary to confirm the proposed treatment protocols.

CS3-5-3 Extended endoscopic approach for clival chordomas & chondrosarcomas

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Cranial base chordomas & chondrosarcomas are a surgical challenge due to their location, aggressive pattern and recurrence. The endonasal endoscopic approach (EEA) is an alternative route to the tumor.

We performed EEA in 1438 patients between 1997 and 2016. We included 26 patients with clival

chordomas and 4 chondrosarcomas in the study. The EEA were performed for superior clivus invaded lesions (n:13), middle clivus invaded lesions (n:16) and inferior clivus invaded lesions (n:12), in 30 cases.

Lesions located in the superior part of the clivus can be resected either by transsellar infrachiasmatic corridor approach or transclinoidal. In middle clivus located lesions are required extended approaches such as transcavernous, transclival, transmaxillar for pterygopalatine fossa lesions, and retrocarotid for lateral petrous apex lesions, Transclival, transmaxillar, transodontoid approaches are needed for the inferior lesions.

The goal of surgery is Gross total resection. However, incomplete resection is achievable for the lesions with extensive, recurrent or significantly invasive. The extent of tumor resection is the most important determinant of recurrence and survival.

CS3-5-4 Extracranial surgery of the skull base and craniovertebral junction chordomas

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Objective: optimization of surgical treatment of skull base and craniovertebral junction chordomas.

Methods. From 1985 to 2015 432 patients with skull base chordomas were operated. In 1985- 2006 were operated 207 patients, of whom 126 (61%)—by transcranial, and 81 (39%)—by extracranial approaches. From 2007 to 2015 225 patients with skull base chordomas were operated, 58 (25,8%)—by a variety of transcranial approaches, and 167 (74,2%)—by extracranial. 28 patients underwent simultaneous combined operation: occipitospindylodesis and transoral removal.

Results. By transnasal approach (n=186) total removal-in 30,6%; in 48.4% – subtotal; in 16.7% – partial; in 1,6%-removed less than 50% of the tumor volume; in 2,7% biopsy. By transoral approach (n=46) total removal - 26%; in 48% – subtotally; in 26% - partially. By simultaneous transoral and transnasal approach (n=19) total removal in 10.5%; in 68.5%-subtotally; in 21% - partially. Postoperative CSF nasal leak (n=186)-in 5.4%. Postoperative mortality by extracranial approaches (n=242) -1.2%.

Conclusion. Using of the new technologies in the skull base and CVJ surgery of the chordomas can improve the results of surgical treatment.

CS3-5-5 Results of endoscopic navigation guided resection of clival chordoma

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Aim of the work: Evaluation of the use of electromagnetic frameless navigation guidance system combined with endoscopy to decompress skull base chordomas Advantages & limitations will be explored

Patients and Methods: Combining the navigation tools to the endoscopic techniques were used in 20 skull base chordomas patients who were successfully treated endoscopically during our experience of 260 endoscopic skull base surgeries. Radiosurgery complemented surgery in some residual lesions.

Results: Removal of large or small chordoma was possible with a high degree of Respectability, low incidence of complication and good functional recovery. More extensive resection was associated with the use of navigation- guided endonasal and enooral endoscopy.

Conclusion: Removal of large or small chordoma was possible with a high degree of respectability, a low incidence of complication and good functional recovery. More resection was associated with the use of navigation controlled endoscopy. Radiosurgery may complement resection.

CS3-5-6 Clival Chordoma - What is the actual state-of-art therapeutic regimen

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Objective: Clival chordomas are histologically low grade neoplasms, but these tumors grow locally aggressive and are highly recurrent, and are therefore clinically malignant tumors. With these different histological and clinical features, the goal during surgical resection remains under discussion: Is total resection essential?

Method: Case series and registers were reviewed. Data of the grade of resection and the according survival, as well as the outcome for microscopic and endoscopic approaches were gathered.

Results: Gross total resection is followed by a significant longer survival compared to subtotal or partial resection. Endoscopic approaches allow for a higher rate of gross total resections and a reduced rate of new neurological deficits compared to open microscopic approaches.

Conclusion: For best patients survival, gross total

resection of clival chordomas is crucial. High rate of gross total resection as well of high rate of preservation of neurological function can be achieved by endoscopic approaches.

CS3-5-7 Indications and problems in endoscopic endonasal surgery for skull base tumors

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Object:In this presentation, we discuss the indications for endoscopic endonasal surgery for skull base tumors and its problems.

Methods:We perform endoscopic endonasal surgery by using 2D-HD endoscopy (Storz) and 3D-HD endoscopy (Machida) in combination. In the recent 100 consecutive endoscopic endonasal surgical cases, we performed 12 skull base surgery.

Results:For craniopharyngiomas, we perform endonasal surgery for tumors located below the optic apparatus, regardless of tumor size. We think that pure intra-third ventricle tumors are not candidates for endonasal surgery because meticulous dissection from the hypothalamus is difficult. Concerning tuberculum sellae meningiomas, our recommended surgical indication is 2- to 3-cm tumors without lateral extension over the internal carotid artery.

Conclusion:Endoscopic endonasal surgery for skull base tumors is a safe and useful technique.

CS3-6-1 Brainstem cavernous malformations: Reconsideration of the surgical strategies

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Object:We aim to summarize our experience on surgical strategies and application of multiple advanced supplementary techniques of this disease.**Methods:**We retrospectively analyzed the clinical data, surgical approach and clinical outcome of 120 patients with BCMs surgically treated in our hospital. The surgical indications, management principle of Developmental Venous Anomaly (DVA) and the application of advanced techniques were discussed. **Results:**Gross total resections were achieved in 116 patients(96.7%) and subtotal resection in 4(3.3%). The DVAs were observed in 19 cases preoperatively and in 42 cases intraoperatively.13 DVAs were coagulated,and no ischemic or hemorrhagic infarction occurred. Postoperative new-onset or worsened neurological deficits occurred in 53

patients and the surgical related mortality was 1.7%. During the follow-up, symptoms improved or resolved in 77 patients (64.2%) and remained stable in 29 patients (24.2%). **Conclusion:** Safely resection and favorable outcome for BCMs can be achieved by microsurgery. We advocate observation for the patients who are not candidate for surgery. Certain DVAs could be removed without any severe neurological dysfunctions.

CS3-6-2 Treatment strategies for brainstem lesions by neuroendoscope

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Cavernous malformations (CMs) are low-flow blood vessel malformation. Surgical removal of brainstem CMs is challenge because they are deep seated lesions located in eloquent areas of the brain. Meticulous attention is necessary not to injure the surrounding normal brainstem and the brain around the corridor of approach during the procedure. The endoscope can provide close observation and brighter view even in such deep areas with minimal entrance and corridor. Using an endoscope can reduce the risk of retraction injury of the brain and related postoperative complication. Endoscope provides a new approaching route, which we call the trans-clival route, for CMs presenting to the ventral surface of the brainstem. With this approach, we can directly reach the brainstem without brain retraction. Endoscope also provides new removal strategies. The CMs can be visualized brightly even through the very thin cylinder. Performing the surgery with the lesion under water can reduce the risk of retraction injury. A lesser diameter cylinder minimizes injury to the surrounding brainstem. Here, we explain our strategy and introduce our surgical techniques for brainstem CMs.

CS3-6-3 Surgical treatment of pediatric brain-stem gliomas

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Objective: To explore the indications and surgical strategy of the pediatric brain-stem gliomas. **Methods:** 22 cases of pediatric brain-stem gliomas were included in the study, 15 males and 7 females, the tumors were located in pons, midbrain and medulla. With the assistance of the diffusion tensor imaging (DTI) technology, the neuronavigation system and indocyanine green

(ICG) angiography, different approaches were taken to remove the tumors. **Results:** 20 cases of the tumors were totally or subtotally removed, and the neurological situation of the patients were relatively same as pre-operation. The main complications were hypoproteinemia, hyponatremia and infection. **Conclusion:** New equipment and technology such as DTI, neuronavigation and ICG were useful for indication selection of the patients and the effectiveness and safety of the operations.

CS3-6-4 Surgical management of medulla oblongata cavernoma

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Aim : To show a short video of the surgery and to demonstrate by clinical photos the good post-op result achieved following the excision of medulla oblongata cavernoma.

Material and method : A forty year old male presented with dysphagia , nasal regurgitation, unsteady gait and loss of weight of nine months duration. On examination he was emaciated, bedridden and had left side 9th and 10th cranial nerve palsy .MRI showed a medullary cavernoma with bleed. Midline sub-occipital craniotomy and excision of cavernoma was done.

Result : Lower cranial nerve palsy recovered over 3 weeks duration and he was mobilised out of bed. Ryles tube was removed and patient started eating both solids and liquids.

Conclusion : Excision of medulla oblongata cavernoma by choosing the right entry zone on the surface of the medulla results in dramatic improvement in the patients condition.

CS3-6-5 Surgical intervention for brainstem hemorrhagic cavernous angiomas and long-term outcomes

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Although surgical intervention for brain stem cavernous angiomas (BSCAs) is still challenging, past studies have reported that surgical extirpation decreased annual hemorrhagic rate. The goal of this study was to evaluate postoperative rebleeding risks (RR) and long term outcomes. A series of 25 patients (including 9 women, mean age 36.4 ± 11.0

years, mean follow-up 49.5 ± 33.4 months) who underwent resection at our institute from Jan. 2000 to Sep. 2014 were reviewed. All the patients had a history of hemorrhage and the locations of lesions included 9 midbrain, 12 pons and 4 medulla. Postoperative outcomes and prognostic factors were considered. Complete resection was achieved in 80 % and RR were 12.0 %. Neurological function was improved or preserved in 80 %. There were no factors significant relation to prognosis, but the pons lesion and distance from the brain surface were highly correlated factor with good outcome. Incomplete resection appeared to result in rebleeding. This study indicates that surgery for BSCAs can provide a lower RR and a better outcome than in the natural course. Surgical resection is recommended for hemorrhagic BSCAs but total resection must be attempted.

CS3-6-6 Yasargil highway in skull base

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My Teacher Professor Yaşargil, is very famous doctor, mentor, surgeon, lider, scientist, researcher, inventor and teacher of last Century, not only in Neurosurgery, but also in Neuroscience of the World.

His very important Neurosurgical Way and technique, the pterional transsylvian approach, I called as "YAŞARGIL HIGHWAY" is commonly employed in surgery of the anterior circulation and upper basilar artery aneurysms, as well as for the tumors of orbital, retroorbital, sellar, chiasmatic, subfrontal and prepontine areas and lesions around the sella especially for lesions behind the clivus. Also tumors arising from the medial sphenoid ridge, the superior orbital fissure, the anteromedial temporal surface, or the cavernous sinus region are approached through a pterional exposure.

The modification of surgical technique is based on the experience, training and observation of the neurosurgeon. One technique is not necessarily more better than the another. Regardless of the surgical technique, the end results depend on a rigorous, methodical, systematic, and step by-step approach to the target, securing it with minimal injury to surrounding structures.

CS3-7-1 Surgical treatment of parasagittal and falcian meningiomas

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CS3-7-2 Surgical strategy for meningioma invading venous system. How to reconstruct the venous sinus?

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A meningioma is a benign tumor, and radical cure is provided by total resection by the operation.

But in case of invading venous system, the treatment becomes very difficult. If the patient is asymptomatic, waiting the operation until the venous sinus is completely occluded and the collateral pathway is developed is best option. Or the partial extraction that let a tumor around the venous sinus remain is often chosen. However, the patient has symptom due to the venous perfusion disorder or if the tumor is malignant, it is necessary to perform resection combined with reconstruction of the venous sinus. The reconstruction of the venous sinus itself is very difficult, but a method to make graft between bridging vein (V-V bridge bypass) is few risks, and effective. We describe these surgical procedures with a video presentation.

CS3-7-3 Meningiomas invading the venous sinuses: Resection preserving the sinuses

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Management of sinuses invaded by meningiomas requires identification of the grade of sinus occlusion. If tumor invades the external layer of sinus wall, this layer can be laminated with tumor. If the entire lateral wall is involved, the sinus can be partially resected and primarily closed/grafted. If more than one wall are involved, a piece of tumor can be left attached or the sinus can be resected and reconstructed/grafted. An occluded sinus can be safely resected with the tumor.

115 meningiomas invading sinuses, 82 in the SSS, were treated (1984-2013). Age: 14-84 years-old. Mean follow-up: 87 months. No sinus resection/

grafting was done except for tumor in the SSS anterior 1/3. 93 patients had grade I, 17 grade II, and 5 grade III tumors. Total resection: 80%; subtotal: 16%; partial: 3.5%. Global mortality was 14.3%; operative mortality was 1.8%. Recurrence occurred in 20.4%, most in grades II/III. The RFS were 79% and 75% at 5- and 10-years. The RFS curves were better for grade I and for patients with more extensive resection. In conclusion, recurrence and mortality/morbidity rates indicated that total/subtotal resection without sinus resection is adequate for these patients.

CS3-7-4 Removal of cavernous meningioma with high flow bypass

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Objective: Meningiomas or solitary fibrous tumors (SFTs) arising from the cavernous sinus (CS) are usually treated with radiosurgery to control growth. Surgical removal of cavernous tumors is indicated only for tumors extending outside the CS. However, even after adequate treatment, the tumor may exhibit recurrence and/or malignant transformation. We report a treatment option for recurrent meningeal tumors of the CS. **Methods:** Four patients with CS tumors that exhibited regrowth after multiple operations and radiosurgery were treated with radical removal in combination with high-flow bypass, and a vascularized muscle flap was used for reconstruction. One patient had a radiation-induced atypical meningioma, two had transformed atypical meningiomas, and one had a frequently recurring SFT. **Results:** No local recurrence was observed in any patients in follow-ups of 13–41 months. In all patients, a Karnofsky performance score of over 80 upon admission was maintained at over 70 at the final follow up. **Conclusion:** Radical removal in combination with high-flow bypass provides favorable results and maintains quality of life in patients with recurrent CS meningeal tumors.

CS3-7-5 Cerebral revascularization for skull base tumors

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Objective: We aimed to evaluate a recent series of

patients who required prophylactic cerebral bypasses as a treatment strategy for skull base tumors. **Patients and Methods:** Patients with cerebral revascularization was selected based on the following preoperative radiological findings: 1) a major vessel engulfed by benign tumor showed narrowing or elongation on the angiogram, 2) a major vessel is invaded by malignant tumor, and 3) poor collateral blood supply is presumed when affected vessel is interrupted. **Results:** Five superficial temporal artery to middle cerebral artery bypasses and one occipital artery to posterior inferior cerebellar artery bypass were performed. Two patients harbored WHO grade I meningioma at the medial sphenoid ridge and two patients had high-grade meningioma in the cavernous sinus. Tumors with chondrosarcoma and metastatic malignant tumor at the craniovertebral junction involved the internal carotid artery and vertebral artery respectively. There were no acute perioperative stroke or surgical complication attributed to the bypass procedure. **Conclusion:** Cerebral revascularization has a definitive benefit for selective patients with skull base tumors.

CS3-7-6 Surgery of the pineal region

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Since the early 20th century, pineal tumors have been a tremendous challenge to neurosurgeons. Continuous advances in microsurgical, minimally invasive and endoscopic approaches have improved the surgical outcome and minimized morbidity. Tissue diagnosis has become a prerequisite in the management of pineal tumors. Biopsy techniques can be either endoscopic or stereotactic. The location of the tumor in relation to the deep veins dictates the surgical approach. The supracerebellar infratentorial approach is the traditional approach to pineal tumors. The occipital interhemispheric transtentorial and the combined supra-infratentorial approaches provide wider exposure and can be used for extensive tumors or tumors located above the deep veins. Modern endoscopic and endoscopic assisted keyhole approaches are a new addition to pineal region and can be definitive.

CS3-7-7 Extensive parasellar meningiomas: Operative strategies

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Surgery for extensive parasellar meningiomas is challenging due to their close vicinity to cavernous sinus, optic nerve/chiasma, internal carotid artery, trigeminal nerve, pituitary gland/ infundibulum, and hypothalamus. These lesions may arise from middle fossa base, cavernous sinus, sellar region (extending laterally), and medial sphenoidal/orbitsphenoidal/clinoidal regions. Extensive multicompartamental tumors may occur. Tumor consistency, invasiveness, arachnoidal plane, perforator involvement, and adherence to neurovascular structures determine resectibility and prognostication. Anterior clinoidal drilling and wide Sylvian fissure dissection provides a good plane that defines ICA and its branches. Angiographic assessment of vessel displacement with cross flow/balloon test occlusion, and stereotactic radiosurgery are useful adjuncts. In this study, surgical nuances in management of extensive parasellar meningiomas are discussed.

CS3-8-1 Long-term recurrence data on radical and "maximal safe" removal of cranial base meningiomas

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CS3-8-2 Surgical management of petroclival tumors: Discussion of outcome measurement

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Petroclival tumors remain one of the most challenging skull base tumors. Surgical management of these tumors is associated with morbidity for cranial nerves (CN).

Methods. Between 2000 and 2015, 37 patients underwent surgical treatment for petroclival tumors (32 meningiomas, 5 trigeminal schwannomas). Retrosigmoid (RS) approach and RS with tentoriotomy was performed in 25 cases, suprameatal extension was used in 7. In 5 cases RS

approach was combined with subtemporal approach. Karnofsky performance scale (KPS) was used for general functional status assessment, petroclival meningioma impairment scale (PCMIS) for cranial nerves function evaluation.

Results. Preop CN involvement: III – VI in 5 cases, V nerve in 12, VII nerve in 3. Gross-total resection was achieved in 14 (38%). New postoperative CN morbidity was observed in 14 cases and was presented III, IV, VI CN in 7 cases, V CN in 5, VII CN in 3, VIII CN in 4. In 6 cases, CN dysfunction was transient and 5 patients had permanent dysfunction.

Conclusion. Tendency for surgical radicality increases CN morbidity. CN morbidity remains the main cause of disability. PCMIS is an important and valuable instrument for outcome analysis.

CS3-8-3 Variation on surgical approaches to central skull base meningiomas

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Radiocal microsurgical resection of meningiomas remains the primary treatment option in our contemporary practice. The complex neurovascular structures at the central skull base and peri-sellar region may pose a major surgical challenge at the time of tumor resection. The evolution of modern neuroimaging, promotion of tailored surgical approaches and innovative neurosurgical techniques enhance surgical planning, navigation and lead to safe resection of complex skull-base tumors with improved patient's outcome. The welding of proper surgical approach with excellent microsurgical technique is of paramount value for excellent surgical outcome. The author will review important recommendation for step by step surgical removal of these meningiomas with focus on some other important surgical considerations. Representative cases from a large series of patient material will be selected to demonstrate the value of these recommendations.

CS3-8-4 Clinical analysis of meningiomas treated with anterior transpetrosal approach

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CS3-8-5 Intraventricular meningiomas -a clinopathologic study and review

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Intraventricular meningiomas are rare tumors. Origin of these tumors can be traced to embryological invagination of arachnoid cells with the choroid plexus. These tumors are slow growing, reaching large size prior to detection. Commonly seen in lateral ventricles, these have occurred in third and fourth ventricles as well. Presentation is in the form of raised intracranial pressure without any localizing features. Imaging studies are diagnostic and hydrocephalus is present due to obstruction to CSF pathways. Surgery is the only treatment, and surgical excision requires planning to avoid eloquent cortex incision, and early control of feeders from choroidal vessels. Total excision can be achieved. Histopathology is varied and most of the tumors in our study were angiomatous meningiomas. These tumors are no different histologically from those tumors that are dural in origin. No recurrences have been reported.

CS3-8-6 Feature of elderly meningioma in Japan - Surgical strategy and pitfalls

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Introduction: By OECD health data, Japan has best life expectancy and highest elderly rate in the world. Now, we investigated the feature, surgical strategy and pitfalls of elderly meningioma in Japan.

Subjects, Methods and Results: From 1999 to 2015, we experienced totally 42 surgeries of meningiomas in elderly patients over 75 year-old. The mean age was 78.8 year-old, 17 males and 25 females, involved 2 incidental cases. The mean size was 43.5mm in maximum diameter. There were 6 cases post operative deterioration due to various reasons. Pathologically investigation revealed high incident rate (45.2%) of Grade II and III.

Conclusions: We should take minimum surgical complication in elderly meningioma. It is important to decide the best surgical timing and method after close follow up.

CS3-8-7 Meningioma surgery in the elderly: Do skull base meningiomas pose a real risk for adverse outcome?

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Skull-base involvement was found to be an independent risk factor in meningioma surgery in the elderly. We retrospectively assessed 254 patients aged 65 or older surgically treated for intracranial meningioma from 1996 to 2010. Data collected contained patients' characteristics (gender, age, ASA etc.), tumor locations, pre- and postoperative symptoms and signs, preoperative KPS, Histology, Simpson Grade, operative complications and operative outcome at follow-up (KPS and GOS). Patients were divided into 2 groups: skull-base (SB) and other intracranial location (OL). Outcome dependence on tumor location was assessed using Fischer's Exact Test. 125 and 128 patients harbored meningiomas of the SB or OL, respectively. Seventeen patients died due to operative complications (9 patients in the OL group and 8 in the SB group). SB was not related to adverse outcome, neither on Karnofsky score (p=0.956) nor Glasgow outcome scale (p=0.428). Median Karnofsky score improved in both groups from 80 preoperatively to 90 postoperatively. In contrast to both proposed classifications, tumor location in the skull base was not a risk factor for adverse outcome in the elderly.

CS3-9-1 Meningiomas of the anterior visual pathway: Evolution of diagnosis and treatment

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CS3-9-2 Surgical management of anterior cranial fossa meningiomas involving optic nerves. surgical techniques and results

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Introduction Optic nerves could be involved in anterior skull base meningiomas by either compression or direct infiltration. The aim of this study is to discuss the different surgical techniques and results. Methods 80 patients with different

anterior skull base meningiomas were involved in this study. Different surgical corridors were utilized. Frontolateral minicraniotomy, pterional craniotomy, COZ, and bifrontal craniotomy. Results Total removal with optic nerve decompression was achieved in 76.2%. Subtotal removal was achieved in 23.8%. Improvement of vision was achieved in 48 cases (60%), stationary in 24 cases (30%), while deteriorated in 8 cases (10%). Recurrence occurred in 10 cases in the subtotal group (10 out of 19 cases 52.6% - 12.5% in total). Conclusion Optic nerve infiltration, duration of visual symptoms, and degree of removal were found to be the most important factors determining the visual outcome and recurrence.

CS3-9-3 Anterior clinoidal meningiomas: Clinicoradiological features and surgical outcome

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Object: The purpose of this study was to analyze our clinical experience with anterior clinoidal meningiomas (ACP) in our hospital. Methods: Fifty nine consecutive cases of ACP operated (1993-2015) were retrospectively analyzed. The mean tumor size was 4.1cm (range, 1.2~8.0). The mean of follow-up period was 54.1 (1-210) months. Results: Simpson's grade II was achieved in 38 cases (64.4%). Simpson's grade III/IV was performed mainly because of invasion into CS or loss of dissection plane from neurovascular structures. Twelve patients (20.3%) developed postoperative permanent complications. Large size and old age were independent factors for occurrence of complication. Progression of tumor (recurrence or regrowth) was found in 11 cases (18.6%). Incomplete resection, non-benign pathology, presence of internal feeder, severe preoperative symptom were related with the progression of tumor after resection. Conclusion: Although our results showed relatively low morbidity, mortality and recurrence rates, and good surgical resection compare to the results of past, ACP meningioma still have been a challenge for neurosurgeon because of their close to critical vascular and nerves structure.

CS3-9-4 Classification of tuberculum sellae meningiomas and outcomes based on scoring and surgical approach

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CS3-9-5 Surgical outcomes of clinoidal meningioma

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Objective: In this study, we retrospectively analyzed our data to evaluate the result of clinoidal meningioma in a consecutive series of patients treated with microsurgically for clinoidal meningioma specifically focusing on our skull base technique. Patients and Methods: Clinical data from the consecutive series of 23 patients who received surgical treatment for the clinoidal meningioma between 2000 and 2014 were analyzed. The main presenting symptoms were visual impairment in 47.8% and seizure in 13.0%. On physical examination, visual acuity was decreased in 34.8% and visual field defect was found in 21.7%. We adopted extradural clinoidectomy with optic nerve decompression for ensuing sufficient space. Results: Simpson grade I or II resection were achieved in 52.1%, III in 30.4% and IV in 17.5%. Eight patients obtained visual symptom improvement, but 4 patients remained pre-operative status of visual function and 1 patient of visual function was deteriorated after surgery. Conclusion: Acceptable functional outcomes could be achieved via the extradural anterior clinoidectomy with optic nerve decompression.

CS3-9-6 Avoidance of serious complications in surgery for paraclinoid meningiomas

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Object: To refine the surgical strategy for paraclinoid meningiomas, we focus on the visual deficits and the serious vascular injury. Methods: We reviewed our surgical outcome for 14 paraclinoid meningiomas between April 2011 and January 2016. Results: Gross total resection was achieved in 13 cases while near total resection in one with severe invasion to the ICA wall. Vision

improved or was kept normal in all cases postoperatively. As for techniques, we followed the principle of the early optic canal decompression consisting of the extradural anterior clinoidectomy and optic canal unroofing before starting debulking the tumor. Surgical complications included temporary hemiparesis in one case due to the perforator infarction, hyposmia in one, and hemiparesis in one because of the ICA injury. Conclusions: Optic canal decompression should be achieved as early as possible during surgery especially for large tumors, making it easier to identify the paper-thin optic nerve and protect it. Vascular injury is the most critical complication. Surgeons should be aware of the locally invasive biological nature of meningiomas to the vessel wall even though they are usually considered as benign.

CS3-9-7 Tuberculum sellae meningiomas

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INTRODUCTION Meningiomas located at the planum sphenoidale, tuberculum sellae and sellar diaphragm are comprised under the term of Tuberculum Sellae Meningiomas (TSM). Their development gives rise to a symptomatology in which visual disturbances are the major complaint, along with headache.

METHODS Retrospective study on 81 TSM, out of 216 sellar and parasellar meningiomas, from a personal series of 929 operated intracranial meningiomas (887 new cases), in the last 15 years.

RESULTS TSM represent 9,1% of all meningiomas operated by the main author by intracranial approaches, Fronto-temporal (fronto-lateral variant) approach being the preferred route. In 96,3% a Simson grade I and II was achieved. The postoperative complications consisted in: transient visual alteration (4,8%), transient diabetes insipidus (4,8%), transient motor deficit (2,4%). No mortality was encountered.

CONCLUSIONS Most of TSM can be removed completely and safely at the first surgical attempt, through a fronto-lateral approach.

CS3-10-1 Strategy of petroclival meningioma: MEP monitoring and brainstem edema

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Object:One of the key elements for surgical management of petroclival meningiomas (PCMs) is whether to peel away tumor from the brainstem or not. The authors propose a prevention of intraoperative brainstem injury through evaluating both intraoperative MEP monitoring and the extent of Peritumoral Edema in the Brainstem (PTEB) preoperatively. **Methods:**24 patients with PCM were surgically treated under MEP monitoring. The extent of PTEB was divided into 5 grades; none (Grade 0), slight (Grade 1), moderate (Grade 2), more than half (Grade 3), extensive (Grade 4). **Results:**In Grade 0, all 10 patients had the tumor peeled away from the brainstem and remained with intact motor function. In Grade 1 and 2, 2 out of 8 patients it was difficult to peel away the tumor from the brainstem. One patient developed new motor paresis postoperatively. In Grade 3 and 4, all patients had abnormal MEP amplitudes before tumor excision and we couldn't peel away the tumors. 2 out of 6 patients had abnormal MEP amplitude and 3 patients got worse motor paresis postoperatively. **Conclusion:**In PTEB grade 3 and 4, we recommend not peel away the tumor from the brainstem to avoid postoperative complications.

CS3-10-2 Surgical treatment and prognostic analysis of petroclival meningiomas

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Objective : To analyze the long-term surgical outcomes and prognostic factors of petroclival meningiomas. **Methods :** Clinical data of 426 cases of petroclival meningiomas were retrospectively analyzed and followed-up to evaluate the prognostic factors of outcomes and long-term survival. The pre-and post-operative status of patient was evaluated by Karnofsky Performance Scale (KPS). **Results :** After a mean follow-up duration of 71.2 months, 314 patients(85 males and 229 females 1 were included in the recent study with a mean preoperative KPS of 72.9±10.5. Complete resection(Simpson Grade I or II)was achieved in 53.8%patients. and the surgical

mortality was 2.1%. Recurrence was found in 28 patients and 23 patients died during follow-up. Preoperative KPS, relationships between tumor and brain stem, vessels and nerves were independent prognostic factors of recent KPS and long-term survival. The overall survival rates were 93.0% at 5 years, 90.6% at 10 and 70.0% at 15 years. **Conclusions:** Surgical treatment was the first and the best option for petroclival meningiomas.

CS3-10-3 Petrous meningiomas: The impact of tumor location on clinical presentations and surgical outcome

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Introduction: Meningiomas based on the posterior surface of the petrous bone pose a great deal of surgical challenge primarily due to their vicinity to the cranial nerves and the brainstem. In this paper we present our experience with these tumors and analyze our results.

Material and methods: 25 patients of petrous meningiomas operated at our center over 5 years were divided into the anterior petrous (Group A, n=6), posterior petrous (Group P, n=14) and straddling group (Group S, n=5) with respect to the IAM. The groups were compared with respect to the clinical symptomatology and surgical outcome.

Results: Group A patients more commonly presented with cranial nerve dysfunction (n=3), while symptoms of cerebellar dysfunction (n= 12) and hydrocephalus (n= 8) were higher in the Group P. Group P patients underwent more complete excision (Grade 2 Simpson 85.7%) than Group A (50%) and Group S (40%). The spectrum of complications was also different in these subgroups.

Conclusion: Attachment of PM in relation to IAM has special implications. Extra caution needs to be exercised during surgery of PM especially those at or anterior to the IAM.

CS3-10-4 Surgical strategy for tentorial meningiomas

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Object: Surgical strategy for management of tentorial meningiomas(TM) determined mostly by site of their origin. Goal of investigation was to define optimal surgical approach for removing of TM

Methods: From 2009 to 2015 28 patients with TM

were operated on. Ratio F/M was 23/5, age ranged from 19 to 73. Tumors were distributed: medial "incisural"- 7(25,0%); peritorcular "torcular"- 4(14,3%); falcotentorial- 7(25,0%); paramedian "intermediate"- 2(7,1%); lateral tentorial- 8(28,6%). Tumor size ranged from 23 to 95mm in diameter, with a median at 54mm. Following approaches were applied: combined supra-infratentorial in diff. variants- 17(60,7 %); supracerebellar infratentorial- 7(25,0 %); suboccipital transtentorial- 2(7,1 %); subtemporal extradural with anterior petrosectomy- 2(7,1 %)

Results: Total 20(71,4%), subtotal 7(25,0%), and partial 1(3,6%) tumor removal had been spent. There were no lethal cases. The complication included 1 case of CSF leakage

Conclusion: Combination of sub- and supratentorial approaches, resection of the tentorium involved in TM provided Simpson I-II resection in most cases with minimal morbidity and long-term recurrence-free outcomes

CS3-10-5 Microsurgical management of primary jugular foramen meningiomas

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This study summarized clinical manifestations, surgical management, histological grading and long term outcome of jugular foramen meningiomas (JFMs). Retrospective study was performed in 22 consecutive patients with primary JFMs from January 2004 to October 2010, 10 male and 12 female with average age of 39.4). The tumor was classified into Type I (intracranial) in 1, Type II (intracranial) in 15, Type IV (intra-extracranial) in 6, no Type III (extracranial). The gross total resection was achieved in 15 cases and subtotal resection in 7. Fourteen patients (63.6%) developed new or worse neurological deficits immediate after operation, WHO Grade 2 was found in 4 cases (18.2%) and Grade 3 in one. One (Grade 3) died of tumor regrowth 20 months after surgery and radiosurgery. Five of 17 patients of Grade 1 developed tumor regrowth. Radiosurgery provide a good tumor control for tumor regrowth in Grade . In conclusion, JFMs has a favorable long term overall survival, however neurological preservation is still challenging

CS3-10-6 Strategy of preoperative embolization for skull base meningioma, view point of skull base anastomosis

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The control of bleeding form tumors have been a main factor for success of brain tumor surgery. Specially, in skull base surgery, bleeding is directly related with the result of surgeries, because of narrow and deep surgical field. So, the success of skull base meningioma surgery depends on preoperative embolization. In embolization for skull base tumors, knowledge of dangerous anastomosis is necessary. Especially, middle meningeal artery, recurrent meningeal artery, ascending pharyngeal artery, and OA-VA anastomosis are important. We present 22 case of skull base meningioma in all 70 cases of meningioma with preoperative embolization. Only one complication was visual acuity loss during 3 months in a case of sphenoidal meningioma. It was depended on recurrent meningeal artery. CP angle or clivus meningioma are often related with ascending pharyngeal artery which fed some cranial nerves. Embolization of such arteries are reported that very risky. However, we can use coil, liquid material, and particle. We present cases of sphenoidal, clivus, and CP angle meningioma, which are removed after embolization.

CS3-10-7 Safety and efficacy of preoperative embolization in patients with meningioma

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Objective: Preoperative embolization may be useful in surgery for meningioma. We investigated the therapeutic efficacy of preoperative embolization in terms of surgical results for patients with meningioma.

Methods: Patients who underwent tumor resection followed by preoperative embolization between October 2007 and December 2015 were identified. We retrospectively assessed the safety and efficacy of preoperative embolization in 53 patients and 57 procedures.

Results: Mean age was 62 years, and mean tumor volume was 45.5ml. The mean interval between

preoperative embolization and resection was 4.2 days. Mean operative time was 6.3 h. Mean blood loss during tumor removal was 257 ml. Postembolic complications were seen in 3 patients, as intratumoral hemorrhage in 2 and embolic minor stroke related to the procedure in 1. Emergency craniotomy was performed in 2 patients with postembolic intratumoral hemorrhage and both patients recovered well.

Conclusion: Preoperative embolization could give us an advantage in surgery for meningioma. However, we must pay attention to the possibility of embolic complications and keep prepared for emergency craniotomy.

CS3-11-1 Clinical features of otic capsule sparing temporal bone fractures

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Object: This study was designed for the evaluation of clinical and radiological aspect of otic capsule sparing temporal bone fracture, which was anticipated for good prognosis

Methods: The 188 temporal bones of the 173 patients who were diagnosed as otic capsule sparing temporal bone fracture by HRCT were reviewed in this study. Through a review of medical records, otoscopic findings and symptoms evaluated. Type of temporal bone fracture was classified with several radiological categories of traditional classification and regional analysis.

Results: 128 longitudinal type, 23 transverse type 37 mixed type fractures were classified among total 188 temporal bone fracture. 7 type I, 85 type II, 169 type III and 114 type IV classified using regional analysis. Seventeen cases from total showed facial paralysis of H-B(IV) or under.

Fourteen of follow-up cases were improve to H-B(II) or under about 57.6 day after initial evaluation.

Conclusion: Initial conservative treatment for facial paralysis or conductive hearing loss is possible in otic capsule sparing group under careful evaluation of clinical symptom and radiologic symptoms.

CS3-11-2 Preventing CSF leak after retromastoid suboccipital excision of CP angle tumors: Are fibrin sealants essential?

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Objective: To analyse the incidence of CSF leak after excision of CP angle tumors through a Retromastoid suboccipital craniotomy, to identify factors associated with post op CSF leaks and to address specific aspects of surgical techniques aimed at reducing CSF leaks

Methods: A retrospective study of 284 CP angle tumors operated in a single institute over 67 months was done from Jan 2010 to August 2015. All tumors were excised through a Retromastoid suboccipital craniotomy. A Musculo-Pericranial flap based on occipital artery was raised. Dural closure done tightly with over-layer fat graft. Mastoid air cells are packed with autologous fat graft. No artificial sealing agents were used. Musculo-pericranial flap carefully sutured while closure. Patients with hydrocephalus and papilledema underwent VP shunt before tumor excision. Multiple variables and their association with post op CSF leaks was studied.

Results: In the 284 patients operated for CP angle tumors, 8 (2.81 %) had post op CSF leak, 5 (1.76%) from the operative wound, 2(0.7%) developed CSF rhinorrhoea and 1 (0.35%) had otorrhoea. Leak rates are lesser or comparable to series in which artificial sealants are used. 5 out of 8 patients with leak had pre op hydrocephalus. In 3 patients CSF drainage done from Ommaya reservoir placed at the time of surgery. In rest of 5 patients CSF leak subsided after intermittent lumbar drainage. One patient required permanent VP shunt. None of the patient required re-exploration. Hospital stay extended by a mean of 8.6 ± 4.8 days due to CSF leak.

Conclusions: Good opening and closure technique aided by dural overlaying and mastoid packing of autologous fat graft results in reduced CSF leak and better cosmetic outcome, artificial sealants not essential. Addressing hydrocephalus pre operatively by VP shunt or EVD is necessary to minimise post op leaks.

CS3-11-3 Cause analysis and treatment of infected cutaneous fistula after craniotomy

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<Purpose> During craniotomy, the frontal sinus is opened and risks of infection are high. If wound infection occurs, treatment can be difficult. We examined four cases of infected cutaneous fistulas after craniotomy and reviewed their causes and treatment methods.

<Patients> We examined four post-craniotomy cases in which each patient had a cutaneous fistula in the frontal area and underwent skin flap transplantation. In all cases, the frontal sinus was opened, either during craniotomy or when the trauma occurred. The intervals to the onset of infection were 1, 3, 10 and 13 years. At the reconstruction, we removed the infected bones and artificial materials. We eliminated the dead space in the frontal sinus and created a drainage pathway to the nasal cavity. We used an antero-lateral thigh free flap to make a septum between the cranial cavity and sinus. No cranialization of the frontal sinus was performed.

<Conclusions> 1) The dead space in the frontal sinus formed by artificial materials is most likely the cause of infection. 2) At the reconstruction, we should eliminate the dead space and make a septum between the cranial cavity and sinus with a vascularized flap.

CS3-11-4 Own 23yr. experiences with skull base trauma - the controversies

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Our group have more than 400patients: the anterior skull base, middle, posterior open trauma. During anterior skull base reconstruction we protected the olfactory structures in 91%. Mortality v our series is 1,7%, morbidity posttraumatic 17%, postoperative 0,6%. Follow up in this series is 23 years.

In lecture author will be discussed about new anatomical aspect of skull base, the biomechanical aspect of dura mater, the technical notes of different approaches of reconstruction, problems of timing of reconstruction or the controversies between conservative and surgery treatment.

In our series we preferred acute operations and reconstructions of open skull base fracture with

very effective goal. In reconstruction method we preferred vascularized flaps for reconstruction of dura. Author discussed problems of acute and delay reconstruction, discussed mortality and morbidity. Authors have experiences 23 years with acuta operations and reconstructions, diagnostic technics, treatment and follow up of patients.

CS3-11-5 Penetrating traumatic brain injury in children

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Background: The incidence of severe head injuries complicated with different grades of cerebral contusion and intracranial hematomas is on the rise. Therefore, we availed ourselves the opportunity of dealing with such cases in 4Years period of intifada in Palestine. A thorough study of etiological factors, types, diagnostic tools including clinical criteria, methods of treatment, and prognosis is carried out.

Methods & Materials: No/140, Age 6/12-14 years, Duration 28/9/2000-28/9/2004. Male-119/ Female21. Head injury closes 49/ Open 39/ Multiple 52. causative agent 84Shrapnel, 44.Rubber, 12 Bomb explosion

Results: Neurological symptomatology in order of frequency were employed. Surgical intervention was indicated in 36 patients, 10 of them passed away. Out of the 140 patients 100 attained a good recovery. 19 patients got a moderate Disability.

Conclusion: Brain CT scan has proved itself invaluable in diagnosis of our patients as regards to the type, size, location of contusions and hematomas, as well as follow-up of further evolution.

CS3-11-6 Reconstruction of large skull defects after extensive removal of skull base tumors: Is bony reconstruction for skull base defects necessary to prevent brain herniation?

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Objectives: Resection of skull base tumors such as malignant tumors, chordomas or extensive meningiomas sometimes causes large skull base defects, which require reconstruction. Bony reconstruction is not usually performed for such defects in our institute. We discuss the validity of

our reconstruction in terms of brain herniation.

Patients and methods: During the past 25 years, we performed resection of the skull base with tumor in 172 patients. We analyzed our reconstruction methods retrospectively and performed long-term follow-up for possible brain herniation.

Results: We removed the anterior cranial base in 42 patients, the anterior and middle cranial base in 128, and the anterior and middle cranial base with the clivus in 2. In our early series, we performed bony reconstruction in 2, 1, and 1 of the 42, 128, and 2 patients, respectively. In the other patients, the skull base defects were reconstructed by using galeal or vascularized free musculocutaneous flaps without bone. None of the patients had brain herniation regardless of the size of the skull defects.

Conclusion: Bony skull base reconstruction is not necessary to prevent brain herniation even for large skull base defects.

CS3-12-1 Selective schwannomectomy for small acoustic neuromas: Beyond preserving hearing

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Recent developments in neuroimaging enable us to detect small acoustic neuromas (<1cm in extrameatal size) retaining not only hearing but also vestibular function. Theoretically, for such tumors, selective schwannomectomy (SS), removing the tumorized vestibular nerve (VN) and preserving the non-tumorized VN, can realize functional preservation of the latter, as well as of the facial and cochlear nerves. We will present 4 cases of such removal, in addition to the operative results of a total 43 small neuromas, all operated upon suboccipital-transmeatally.

Preoperatively, cases 1 and 2 both showed normal caloric response, while cases 3 and 4 indicated canal paresis and normal cervical vestibular evoked myogenic potential (cVEMP). The origin of the tumor was the inferior VN in cases 1 and 2, and the superior VN in cases 3 and 4. After SS, hearing was preserved within the same preoperative class in all 4 cases, and caloric response was well maintained in cases 1 and 2, and cVEMP in cases 3 and 4.

Postoperatively, these 4 patients barely experienced dizziness acutely and chronically. SS will be a new surgical goal for small neuromas retaining both hearing and vestibular function.

CS3-12-2 The management of internal auditory canal in acoustic neuroma surgery

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Objectives: We retrospectively evaluated the significance of properly drilling the posterosuperior wall of internal auditory canal in acoustic neuroma surgery during January 2006 to January 2015 in department of neurosurgery, the First Affiliated Hospital of Chongqing Medical University. **Results:** Among the 215 patients, 198 patients (92.1 %) were treated with total resection, 12 patients (5.6 %) with subtotal resection, and 5 patients (2.3 %) with partial resection. The facial nerve was anatomically preserved for 199 patients (92.6%). The facial nerve was functionally preserved for 128 patients (59.5%) (according to the House-Brackmann(HB): grade I-II, 22 cases (10.2%) and grade III, 106 (49.3%)). **Discussion:** To avoid complications of operation, high jugular bulb must be paid more attention to and drilling the posterosuperior wall of internal auditory canal was replaced by the guidance of neuroendoscope in these patients whose petrosal bone and posterior wall of internal auditory were high gasification. **Conclusion:** The appropriate management of the posterosuperior wall of internal auditory canal is very important for total resection of the tumor and preservation of the facial nerve.

CS3-12-3 A minimally invasive percutaneous transtubar middle fossa approach for acoustic neuromas

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Object: Use of a minimally invasive tubular retractor in the middle fossa approach (MFA) for small intracanalicular tumors may help mitigate the risk of postoperative complications by minimizing temporal retraction. We propose a minimally invasive microscopic and/or endoscopic percutaneous transtubar MFA for the management of these lesions.

Methods: Subtemporal keyhole craniectomies were performed on cadavers previously injected with synthetic tumor models. Extradural dissection of the internal auditory canal was performed using a minimally invasive instrumentation through the ViewSite™ Brain Access System (Vycor Medical). The intracanalicular tumors were removed and degree of resection was assessed.

Results: All approaches were successfully completed

through the tubular retractor with minimal retraction. Excellent intraoperative visualization was achieved. Of the 6 synthetic tumors, 5 gross total and 1 near total resections were achieved.

Conclusion: A percutaneous transtubar MFA is a minimally invasive option for resection of small intracanalicular tumors with preservation of auditory function, reduced temporal retraction, and enhanced protection of surrounding structures.

CS3-12-4 Retro-labyrinthine or retro-sigmoid approaches for vestibular neurectomy

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Objective: To describe and evaluate two major approaches for vestibular neurectomy. **Material and methods:** Retrospective study of 28 Meniere's disease cases. Of them, 13 performed retro-sigmoid approach (RS) and 15 retro-labyrinthine (RL). The operation time, approach duration, anatomical characters, outcomes and complications were collected. **Results:** The operation time of RS was about 2 hours, that time of RL was about 2 hours 20 mins. The distance from dura incision to cerebellopontine angle (CPA) or VII- VIII bundles was shorter in RL approach. The dura incision size was smaller in RL approach. The surgical outcomes and complications with both approaches were not different. **Conclusion:** The RL provided a shorter path and reduced the surgical time. The vision of CPA under RL was narrowed therefore it was not recommended for tumor resection. But RL did not need to press the cerebellum tissue to expose the CPA who maybe made the patient recovery more quickly after surgery, and it exposed better the nerve roots near brainstem.

CS3-12-5 Retromastoid approach. How I do it?

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CS3-12-6 Misdiagnosis of isolated IAC mass and intra-operative decision-make

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Objective: To report the misdiagnosis of intern auditory canal(IAC) mass, to review the therapeutic strategy for these mass, and discuss the intra-operative decision make.

Methods: Retrospective case review between 2002 and 2015.

Result: Totally, 5 patients involved the pre-operative misdiagnosis. The diagnosis of 2 patients was corrected from vestibular schwannoma (VS) to facial nerve schwannoma (FNS), and 3 other were corrected from FNS to hemangiomas (HEM). The pre-operative CT and MRI of these patients cannot provide a clear decision for differential diagnosis (Example, VS vs FNS, FNS vs HEM), so the initial diagnoses were made mainly on the basis of predominant symptoms. 2 FNS patients had no facial symptoms but presented audiological symptoms and 2 HEM patients presented mainly facial paralysis. The therapeutic strategy for these tumors was to keep the nerve function at maximum then to remove the tumor.

Conclusion: The misdiagnosis of intern auditory canal mass occurs when the mass was isolated and small with atypical symptoms. Sometimes, the correction of diagnosis might be made during the surgery and the nerve function should be considered and protected firstly.

CS3-12-7 Bilateral supratentorial extradural haematoma following VP shunt insertion & posterior fossa tumour excision- Case report, literature review and lesson learnt

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Introduction: Remote site haemorrhage following cranial surgery is a well-documented but rare complication, with high morbidity and mortality. We report the case of a child who survived this complication and discuss the relevant literature.

Case summary: This 16 year-old boy who presented with a two-month history of headache, blurred vision and ataxia was found to have a large, cystic cerebellar tumour causing obstructive

hydrocephalus. He underwent a VP shunt insertion and tumour excision. He remained unresponsive after reversal of anaesthesia and developed a unilateral dilated pupil. CT scan showed bilateral supratentorial extradural haematomas causing herniation. He underwent immediate bilateral craniotomies, evacuation of haematomas & shunt ligation, elective ventilation. The shunt had to be opened later. He was discharged with minimal neurological deficit. **Discussion:** Sudden decompression of chronically raised intracranial pressure and excessive CSF release is the likely cause of remote haemorrhage and has been documented following excision of posterior fossa lesions. Staging the procedure, considering ETV, gradual CSF release may prevent this complication.

CS3-13-1 Petroclival meningioma - Multidisciplinary approach

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Objective: Patients with large petroclival meningioma have been managed with surgical strategy to keep or improve QOL.

Patients and Methods: We have treated 25 patients with large petroclival meningioma compressing brainstem from 2003 to 2015. Radiosurgery was applied on the rest of tumor if growth was documented. KPS and cranial nerve deficits before and after surgery were retrospectively analyzed.

Results: 29 operations were done on 25 patients. KPS improved after surgery in 10 patients, was not affected in 13, and worsened in 2. Improvement was mainly owing to brainstem decompression and disappearance of neuralgia. New permanent deficit was observed frequently in VIII, IV, and VI cranial nerves. Radiosurgery was added in 9 patients after confirming growing tendency. Tumor has been well controlled in all cases except one case that had malignant meningioma.

Conclusion: Symptoms due to brainstem dysfunction will likely resolve after surgery contributing in improvement of KPS. Radiosurgery is useful adjunct but aggressive tumor and recurrent case are still problematic.

CS3-13-2 Anterior petrosal approach and its modification for petroclival tumors

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Based on the personal experiences with 209 operations using the anterior petrosal approach,

the modification to prevent the venous complications and to widen the operative field backward to the internal auditory meatus.

Many of the cerebral venous complications may occur unexpectedly and might be serious in some cases. It is almost impossible to determine whether we can safely sacrifice a certain vein during the operation, or not. To avoid the venous complications, we should preserve the veins as far as possible. Especially in cases of the epidural approaches to the cavernous sinus, Meckel's cave, the petroclival region and the infratemporal fossa, we should preserve the drainage route of the middle cerebral vein, which has some variation. The drainage route from the cavernous sinus is also important. I will present how to preserve the various venous drainage routes; such as the sphenobasal vein, the sphenopetrosal vein or sinus, the sphenoparietal sinus, the inferior cerebral veins, et al., when we access to the cavernous sinus and the petroclival region by using the appropriate epidural, subdural or combined epidural and subdural routes. In cases of CPA meningiomas with posterior extension belong the superior petrosal sinus, the addition of the partial mastoidectomy of Trautmann's triangle to anterior petrosal approach is simple and effective. These modification will be demonstrated.

CS3-13-3 Evolution of management strategy in petroclival meningiomas over 20 years

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Object: The study aimed to demonstrate evolution of management strategy in petroclival meningiomas (PCMs) in 5 periods over 20 years.

Methods: From February 1992 to February 2014, 616 cases of PCMs was surgical treated and clinical data were reviewed.

Results: Overall, presigmoid approach was the commonest used approach (n=325, 52.8%) followed by subtemporal transpetrosal approach (n=126, 20.5%). Before 1993, subtemporal approach (n=12, 80%) was the most common used approach. After then, presigmoid approach was the preferred during the following 3 periods: from 1993 to 1997 (n=33, 55.0%), from 1997 to 2003 (n=133, 76.4%), and from 2003 to 2011 (n=130, 50.2%). At the recent period (from 2011 to 2014), subtemporal transpetrosal approach became the dominant approach. Before 2011, we recommended observation after non-total resection. After then, radiotherapy was recommended for non-total resection or unbenign meningiomas soon after surgery.

Conclusion: We verified the overwhelming advantages of subtemporal transpetrosal approach

in resecting lesions predominantly in mid- and upper clival regions and medial to internal auditory meatus.

CS3-13-4 Petroclival meningiomas

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CS3-13-5 Treatment of petroclival meningiomas

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The surgical removal of petroclival meningiomas remains one of the greatest challenges in Neurosurgical practice with a significant risk of neurological morbidity.

The definition and classification of petroclival meningiomas and the different treatment options is described.

According to the primary attachment of the tumor and to get the best access to the tumor without fixed brain retraction, we have used different skull base approaches.

The results of the surgery for the last five years are presented

CS3-13-6 For small petrous apex meningiomas causing refractory trigeminal neuropathy, can surgery play a role in the minimally invasive era?

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CS3-13-7 Petroclival meningioma: Choosing the right approach

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Objectives: An understanding of the mechanism of formation of arachnoid fold around vestibular schwannoma is crucial in preserving the anatomical integrity of 7th nerve. **Methods:** The author, who has an operative experience of 784 cases of vestibular schwannomas, describes the technical pearls for preservation of facial nerve. The essential initial step is peeling of the double

layer of arachnoid from the posterior tumor surface. After reduction of the tumor volume, continued dissection of the arachnoid fold toward the brainstem can be achieved without opening the arachnoid over the fifth and lower cranial nerves, which are in separate cisterns. The key element in successful vestibular schwannoma is understanding that flattened facial and cochlear nerves do not have a arachnoid separating them from the tumor capsule which is essentially the compressed and attenuated perineurium of the vestibular nerve from which tumor has grown. If the tumor cannot be dissected from 7th nerve easily, a sub-perineural dissection is advised. **Result & Conclusion:** Acoustic neurinoma surgeons should strive to keep anatomical integrity of 7th nerve even in large acoustic tumors.

CS3-14-1 Grades II and III meningiomas: Experience in a public hospital in são paulo state, Brazil

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Objective: Atypical/malignant meningiomas are infrequent and their outcomes are poorer than benign tumors. We analyzed the factors influencing the outcome of patients with atypical/anaplastic meningiomas. **Method:** 52 patients WHO Grades II/III meningiomas. Age: 16-89 years-old; median follow-up = 44.50 months. 42 patients had grade II, and 9 had Grade III tumors. All patients were surgically treated and 20 underwent radiotherapy. Outcome was analyzed using survival and RFS curves and KPS score. **Results:** Grade III tumors predominated in older patients. Total, subtotal and partial resections were achieved in 60.8%, 35.3% and 3.9%. Survival was better for patients <60 years-old and for grade II tumors and RFS for patients with Grade II, with radical resection and for "de novo" tumors. Recurrence rate was 51% (39.2% Grade II, 66.7% Grade III). Operative mortality was 1.9%. Neurological deficits occurred in 21.6%, 9.8% transient. **Conclusions:** Our results were similar to recent publications. Age <60 and WHO grade II were predictors for better prognosis. Treatment of grades II/III meningiomas remains difficult and new therapeutic approaches are needed to improve their outcome.

CS3-14-2 Surgical approach for aggressive skull base meningiomas

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Objective: Skull base meningiomas occasionally show aggressive growth particularly when they recur. We analyze factors potentially affecting the long-term clinical outcome of aggressive recurrent meningiomas.

Patients: A total of 13 patients with recurrent meningiomas were reviewed. Based on the location of recurrence, these patients were divided into the peripheral (n = 6) and the central (n = 7) skull base types.

Results: The peripheral skull base type occasionally extended widely into craniofacial structures. Using a multivariate logistic regression model, an increased proliferative potential (odd ratio 3.7) was an independent variable predicting the deterioration of the long-term functional outcomes. Recurrence at the central skull base (odd ratio 2.5) was also a strong predictor of poor long-term outcome.

Conclusions: Highly proliferative potentials induced repeated recurrences, eventually leading to worsening of functional outcomes of central skull base meningiomas. In the peripheral skull base type, a relatively good performance status was maintained for several years even after repeated surgeries. Therefore, radical resection of the tumors should be planned for this type.

CS3-14-3 Surgical challenging for atypical and anaplastic meningiomas and its outcomes

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Atypical and anaplastic meningiomas display aggressive behavior and have high propensity for recurrence. Surgical resection alone cannot achieve radical cure. The goal of this study was to assess the postoperative outcomes and prognostic factors for recurrence. In this retrospective study, 47 patients (including 30 women, 11 anaplastic subtype, mean age 60.0 ± 16.0 years, mean follow-up 26.8 ± 19.0 months) who underwent resection with histologically proven atypical and anaplastic meningioma by current WHO criteria from 2011 to 2015 were reviewed. Postoperative outcomes and prognostic factors were considered. Simpson grade 1 and 2 resections were achieved only in 51.7 % and recurrent rate was 37.9 %. Neurological

function was improved or preserved in 70.4 %. Peritumoral brain edema (PTBE) on brain MRI was statistically significant relation to poor prognosis. Higher MIB-1 labelled index (LI) and Simpson grade were highly correlated factor with recurrence but not significant. Preoperative adjuvant therapy could not decrease postoperative recurrence. This study indicates that malignant meningiomas with PTBE highly recur. The lesion of PTBE might be involved tumor cell histologically.

CS3-14-4 Malignant meningioma of WHO Grade III at Shanghai Huashan Hospital from 2003 to 2008

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Malignant meningioma, as WHO grade III, is rare and fatal with 3 subtypes: anaplastic, rhabdoid and papillary meningioma. These cases from 2003 to 2008 were retrospectively reviewed. There were 63 anaplastic meningioma, 12 rhabdoid meningioma and 17 papillary meningioma. The mean follow-up time was 84.9 ± 19.7 months. Among 63 anaplastic meningioma, tumor recurred in 35 out of 63 (55.6%) patients. Thirty-three (52.4%) patients died at the most recent follow-up, and the median overall survival (OS) was 70.0 ± 9.7 months. The three-year and five-year survival rates were 68.3% and 54.7%, respectively. However, multivariate analysis identified radiotherapy as the only independent factor affecting PFS ($p = 0.007$). We found that (1) Preoperative KPS, extent of tumor resection, radiotherapy, tumor location and previous history of meningioma, were factors related to the patient's PFS. (2) MIB-1 proliferation index failed to identify a cut-off point to predict the prognosis of patients with anaplastic meningioma. This study provides an overview of the status quo for epidemiology and treatment of malignant meningioma in China with a large population.

CS3-14-5 Meningioma en plaque (WHO Grade I) with extensive osseous metaplasia

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Meningioma en plaque with osseous metaplasia is very rare. We present a rare case of a 40 year old female who complained of headache and dizziness for years. No seizures. On neurological

examination there were no neurological deficits. MRI of her head showed slight contrast enhancement in the right frontal and temporal convexity. There was no peritumoral edema. The size of the lesion was 4.6 cm and the second 2.6 cm. Intraoperatively we found three tumors of the frontal and temporal convexity. Neuropathology confirmed the diagnosis of meningioma en plaque (WHO Grade I) with extensive osseous metaplasia.

CS3-14-6 Lateral approach for management of ventrally located upper cervical meningioma

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Introduction: The upper cervical meningioma (C1-C3) is rare lesions. They form 60-80% of all intradural extramedullary tumors at that level. The lateral approach to ventrally located upper cervical meningioma is an alternative to more complicated anterior approaches, and has much less neurological complication in comparison with dorsal and dorsolateral approaches.

Methods: In the period between 2007 and 2014 13 patients with ventrally located upper cervical meningioma were operated using the lateral approach. The main presenting complaints were neck pain and gait disturbance.

Results: Total excision of the tumor was achieved in all cases. No significant complication except in one patient transient accessory nerve palsy developed postoperatively.

Conclusion: Lesions ventral to the spinal cord in the upper cervical region could be managed safely using the lateral approach in comparison with anterior or dorsolateral approaches.

CS3-14-7 Intradural extramedullary spinal meningioma: Personal series

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Spinal tumors are rare and comprise about 15% of all CNS tumors. More than half (55%) are extradural.

The remaining 45% are intradural spinal tumors-IST. Intradural spinal tumors are subdivided into intradural intramedullary spinal cord tumors-ILSCT (5%) and intradural extramedullary spinal cord tumors-IESCT (40%).

Among IESCT meningiomas and Schwannomas are most common. Meningiomas are more common in women and most commonly located in the thoracic region. Reported surgical series of intradural spinal

tumors are relatively rare and every publication provides an opportunity to gain insight into surgical treatment technique pearls, complications and outcomes.

Over the past 12 years we treated 13 patients with intradural extramedullary spinal meningiomas. There were 1 man and 12 women, with ages ranging from 24-89 years (mean 58 years). The length of hospital stay ranged from 2 to 8 days (mean 4 days), and mean follow-up was 41 months. All patients had radical tumor resection and no recurrences were noted during follow up. The neurological, operative, radiological, and outcomes features will be detailed.

The results of operative treatment of ISTs are generally good. Spinal meningiomas can be radically resected with minimal morbidity, minimal complication rate and no mortality.

CS3-15-1 New physiological vessel's quality - biomechanical study- brain veins

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The study of biomechanical characters of vessels a them modeling cause the new informations about behaviour this anatomical structures. Recently discovered vessel quality, angiosynizesis and selfexcitatio wall vessel vibration have an influence on behaviour understand part of cardiovascular system. Recently discovered biomechanical vessel duality have an influence on physilogy and pathophysiology vessel system in different anatomical systems of body, e.g. central nervous system area. We study physiological aspects and pathophysiological problems.

The conclusions: very small exchange of length (ca. 1%) about bridging brain veins can go to angiosynizesis, vibration of vessel wall during physiological state, facility beginning of angiosynizesis by propagation pulsing pressure wave, structural stability of bridging veins can be restore by adequate rise in pressure in given moment. The function of flow in thinwall venous system of brain is combination of angiosynizesis and "pulsing venous pump" of cavernous sinus, which follow into venous system pulsing flow.

CS3-15-2 Dural incision in the petrosal approach with preservation of the superior petrosal vein

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The petrosal approach has been applied for the treatment of many lesions in the posterior fossa, but the location and preservation of the superior petrosal veins (SPVs) during this approach are usually not particularly considered. The authors developed a technique of dural incision with special consideration of the location of the SPV to preserve venous flow during the petrosal approach. The authors describe technical details on how to cut the dura mater and superior petrosal sinus, with special attention to the location of SPV, so that the normal flow of the SPV to the lateral sinus can be preserved. Between July 2007 and March 2014, this technique was used in 45 patients, and no major complications were reported. The SPVs should be considered critical structures in the petrosal approach. Preoperative evaluation of the SPV anatomy should be performed in patients undergoing such surgical treatment, and the dural opening must be performed with special attention to the SPV to avoid intraoperative injury and postoperative complications.

CS3-15-3 Analysis of petrosal vein in surgery of petroclival meningiomas

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Object: Petroclival meningioma (PCM) sometimes involves the petrosal vein and its preservation during the resection has been an important issue. However, the precise risk of its sacrifice and the following venous complication via anterior transpetrosal approach (ATPA) has not been elucidated.

Methods: Using the technique of Computed Tomographic Venography (CTV), we retrospectively analyzed the petrosal vein pre- and postoperatively in 39 PCM patients. Venous complication during the operation in each patient was also examined.

Results: The petrosal vein and some tributaries were significantly less detected in PCM. CTV detected the petrosal vein in 71.8% of PCM patients preoperatively and the 64.3% of them was preserved. We didn't have any venous complication. The anastomosis between the petrosal vein and the basal vein via pontotrigeminal vein significantly developed in PCM compared to control.

Conclusion: Our study demonstrated anterior transpetrosal approach could be safely performed for petroclival meningioma from the point of view of the venous preservation. Preoperative CTV is important to assess the petrosal vein and its tributaries in order to perform safe operation.

CS3-15-4 Trigeminal neuralgia caused solely by vein: Diagnosis and management

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Object: We describe diagnosis and management of trigeminal neuralgia caused solely by vein.

Methods: Sixteen cases of trigeminal neuralgia (TGN) were retrospectively evaluated.

Results: TGN caused solely by vein was found in 16 out of 145 TGN cases (11.0%). The mean age at surgery was 54.9 years old with mean symptom duration of 4.7 years. Female was dominant (69%) and the right side was more affected (81%). The V2 was most commonly affected distribution (75%). Carbamazepine was effective in most cases. It is difficult to predict the involvement of veins only by clinical history. Transverse pontine veins were the most common vessel for the neurovascular compression in 12 case. The compression site on the nerve varied, not only REZ. More recurrence was noted in cases used transposition technique, division of the vein was preferred in later series. We present two cases of TGN with three-dimensional preoperative images.

Conclusion: TGN caused solely by vein is sometimes misdiagnosed if contrast enhanced study was not performed. The culprit vein should be divided if it is a small tributary of superior petrosal vein.

CS3-15-5 Ultrasound doppler for identification of venous sinuses

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Objective: To investigate the applicability of a micro-Doppler ultrasound probe to avoid injury to the transverse and the sigmoid sinus in the retrosigmoid approach.

Methods: In a series of 25 patients undergoing a surgery for lesions in the cerebello-pontine angle both image guidance and a micro-Doppler probe (16Mhz, Multi-Dop pro®, Compumedics, Germany) were applied during the surgical approach. The mean maximum error of the image guidance system (Kolibri®, Brainlab, Germany) was calculated.

Results: There were no accidental incisions of the transverse or sigmoid sinuses when both localizing

methods were combined. Image guidance was off-target by a mean of 2.64 mm (range 0-6mm, SD 1.55 mm).

The exact location of the transverse sinus was invisible in 7 cases, while the sigmoid sinus was visually undetectable in one case. Ultrasound Doppler indicated blood flow outside the visible borders of the sinuses in 5 cases.

Conclusion: Combined image-guidance and intra-operative micro-Doppler allow for precise location of the transverse and sigmoid sinus in retrosigmoid approaches to the posterior cranial fossa. The method can be applied in all craniotomies that border on a venous sinus.

CS3-15-6 Surgical treatment of tentorial and falcotentorial meningiomas

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CS3-15-7 Surgical strategy for intracranial meningioma involving major venous sinus

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Object: We analyzed our surgical results and discuss management strategy for intracranial meningiomas involving the MVS.

Methods: Between 1993 and 2011, 107 patients with intracranial meningiomas involving MVS underwent surgery in our institution.

Results: Simpson Grade I/II removal was achieved in 93 patients(87%). Partially or totally occluded MVS by their meningiomas was found in 39 patients(36%). Complete resection of involved sinus or sinus reconstruction after tumor removal was performed in 25 patients(23%). Recurrence rate was 12%. Sindou classification and KPS score 6 month after the surgery were predictive factors for recurrence in our study($p=0.044$ and $p=0.001$, respectively). The resection degree did not reach statistical significance($p=0.484$).

Conclusion: Complete tumor resection with sinus reconstruction did not significantly prevent tumor recurrence in intracranial meningioma involving MVS. Considering the complications from this procedure, the tumor should be removed as much as possible while leaving remnant portion with significant invasion of sinus or drainage vein. Following radiation therapy or GKRS for a remnant or recurred meningioma might then be justified.

CS3-16-1 Intraoperative assessment of the proliferative potential of meningioma cells

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Object: To accurately assess the proliferative ability of meningioma cells during surgery.

Methods. We calculated the ratio of aneuploid cells with abnormal number of chromosomes to whole cells in each specimen by the rapid intraoperative flow cytometry. The time needed for each calculation was 10 minutes.

Results: Forty-nine specimens from 20 patients with meningiomas were included. There was a significant correlation between MIB-1 labeling index and the ratio of aneuploid cells. Among 15 medium to large-sized tumors, 5 of 6 tumors with preoperative growth on serial images show a higher ratio of aneuploid cells in the tumor attachment while 2 of 9 tumors without the confirmation of preoperative growth were so ($p=0.033$). On the other hand, tumors causing peritumoral edema demonstrated more aneuploid cells near the surface contacting the brain tissue than the tumor without edema (80% vs 10%, $p=0.015$).

Conclusions: Our data showed the possible availability of the rapid intraoperative flow cytometry. Also, our quantitative data demonstrated the existence of intratumoral gradation of the cellular proliferative potential which is dependent on the biological characteristics of meningiomas.

CS3-16-2 Landscape of genomic alterations in high-grade meningioma

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OBJECT: We genomic characterized a large cohort of high-grade meningiomas to better understand their biological behavior. **METHODS:** Whole-genome or whole-exome sequencing was performed on 60 grade II and III meningiomas to identify somatic copy-number alterations, mutations, and rearrangements. Genomic aberrations were correlated with recurrence status, receipt of prior radiation, and *NF2* status. **RESULTS:** High-grade

meningiomas harbored an elevated rate of mutations, indels, and recurrent copy number alterations compared to grade I meningiomas. In particular, several recurrent mutations across the cohort suggest alteration of canonical pathways implicated in oncogenesis, including cell cycle genes. Complex chromosomal rearrangements, suggestive of chromothripsis and genomic instability, was also identified. Analysis of paired primary and recurrent high-grade meningiomas revealed distinct phylogenic patterns of tumor evolution. **CONCLUSIONS:** Genomic characterization of sporadic high-grade meningiomas reveals significant recurrent chromosomal copy number alterations and highly disrupted rearrangements.

CS3-16-3 Genomic alterations in skull base meningiomas

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Object: We prospectively characterized the chromosomal profile of a large cohort of skull base meningiomas to identify predictors of clinical behavior. **Methods:** Copy-number alterations (CNAs) of 144 skull-base meningiomas were analyzed by array-based comparative genomic hybridization and correlated with pathological and clinical parameters. **Results:** 144 skull-base meningiomas (83 grade I, 55 grade II, 6 grade III) from 137 patients (79F/58M) were profiled, including de novo and recurrent tumors, with and without prior radiation. Monosomy 22 was the most frequent CNA, followed by alterations of chromosome 1p, 6q, 7p, 10q, and 18q in high-grade meningiomas. The incidence of chromosomal loss correlated with location and recurrence risk. Pteroclavicular and sphenoid meningiomas, while planum sphenoidale/olfactory and tuberculum/clinoid meningiomas had few alterations. **Conclusion:** Systematic genomic characterization of a large series of skull-base meningiomas reveals distinct subsets of tumors, which may complement traditional histopathologic classifications in predicting natural history and adjuvant treatment decisions.

CS3-16-4 Microarray gene expression profiling of skull base invasive meningiomas

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Meningiomas are common adult brain tumors originating from meningeal coverings of the brain and spinal cord. While most World Health Organization (WHO) grade 1 meningiomas are slowly growing and surgically curative, some tumors clinically show invasive feature and behave aggressively.

Object: To detect the invasive features of different meningioma tumors through a genetic study and classification.

Method: Comprehensive analysis of gene expression was conducted on 32 meningioma cases.

Results: The cluster analysis of the gene expression profile demonstrated distinct clustering of invasive meningiomas. Either up-regulation or down-regulation of the expression was observed in certain genes when comparing gene expression profile between invasive and non-invasive meningioma.

Conclusion: Some of the genes expressed specifically in the invasive tumors can be utilized as genetic markers of invasive meningioma, predicting behavior of the tumors and prognosis of the patients, and thus, supporting to lead to appropriate therapeutic strategy.

CS3-16-5 Anatomical distribution and postoperative ischemia of perforators in clinoid meningiomas

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Clinoid meningioma (CM) is compartmentalized by arterial trunks, including the internal carotid artery (ICA), A1, and M1, causing involvement of their perforators. Impairment of perforators during CM surgery has not been well described in the previous literatures. We reviewed 23 CMs regarding anatomical patterns of compartmentalization and postoperative ischemia caused by perforator impairment. The

compartments were defined as medial (medial to ICA and inferior to A1), lateral (lateral to ICA and inferior to M1), and superior (superior to A1 and M1) based on the anatomical relationship with the carotid fork. Diameter of the CM was < 2cm in 1, 2 - 4cm in 9, and 4cm - in 13 cases. Medial, lateral, and superior compartments were found in 16, 10, and 8 of 23 CMs, in respectively. Postoperative ischemia was detected in 7 cases. Region of the ischemia was the A1 perforator area in 6, and ICA perforator area in 2 cases. Impaired perforators were not necessarily associated with the patterns of compartmentalization. This result cautioned that meticulous dissection is required to preserve perforators, A1 perforators, in particular, coursing on the deepest surface of the CM in surgical field.

CS3-16-6 Surgery of clinoidal meningiomas

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During the period of the past 8 years from 2008 to 2015, I treated surgically 625 patients with various types of brain tumor in my skullbase service at the Shinkomonji Hospital in Fukuoka. Of 625 brain tumors, there were 215 cases of meningioma (34.4%), and of them, skullbase meningiomas constituted 94 cases. In this presentation I want to discuss surgical technique and complication avoidance in 16 cases of clinoidal meningioma. The ages ranged from 30 to 80 with a mean of 59.5 years. There were 2 males and 14 females in this series. There were 4 cases with small tumor size less than 2 cm, 6 cases of medium size tumor between 2 cm to 4 cm, and 6 cases of large and giant meningioma over 4 cm size. Presenting symptoms were visual disturbances in 8 cases. The key points in surgery of clinoidal meningioma: firstly, internal carotid identification and preservation, and secondly, optic nerve identification and preservation. In this series there were no mortalities, no major complications. The key issue is separation and dissection of the optic nerve without manipulating it. The technique of dissection and resection of tumors will be presented with color pictures and videos.

CS3-16-7 Meningioma surgery (Myanmar experience)

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Our Neurosurgical Department in Myanmar was established in 1966 by three neurosurgeons, first trained in US from 1957 to 1960, second in UK, and

third in Japan. de Vilbiss bone channelling forceps and Gigli saw are widely used for Craniotomies up to mid-2013. With increased Health Budget, we can use powerdrills for craniotomy. Perviously tumour forceps, now CUSA can be used for resection of brain tumours. Various meningiomas were resected mostly total, sometimes near total, and partial in some cases. With newer available equipment, we can do more for patients in Myanmar.

CS3-17-1 Facial palsy in skull base trauma

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Trauma to the lateral skull base is commonly encountered in the major trauma unit at our institution. The cause is motor vehicle trauma most commonly then a range of other mechanisms. They may be isolated injuries but more frequently are associated with more extensive head, neck and other significant trauma.

The middle ear is always involved and the inner ear less commonly. Facial paralysis is seen in approximately 20% of cases with a small proportion of those due to disruption of the nerve. This paper will present our experience with more than 1300 cases of temporal bone trauma. The development and types of paralysis will be described. Our assessment strategy using modern imaging and electro-diagnostic protocols will be outlined. Management techniques both non-operative and surgical will be described. The results of treatment will also be presented.

The management of other cranio-cervical, major body and limb trauma take precedence but all patients with trauma to the temporal bone are seen early by the Otolary service. This allows timely assessment particularly of facial movement and better ability to manage the nerve injury appropriately leading to better patient outcomes.

CS3-17-2 Should surgery be the standard of care for facial paralysis secondary to temporal bone fracture

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Objective: to reevaluate the current treatment paradigm for undisplaced temporal bone fracture associated complete facial paralysis where surgical exploration is often recommended treatment.

Methods: Prospective Cohort. N= 28. Complete facial paralysis. Undisplaced temporal bone fracture in 25, no detected fracture in 3.

Initial treatment limited to Prednisolone (1mg/kg X 3 weeks) and physiotherapy. Ongoing electrophysiological monitoring for muscle denervation / degeneration. Surgical exploration limited by protocol to cases demonstrating electrophysiological motor end plate degeneration, or no clinical improvement at 18 weeks.

Results: Clinical recovery noted in 4/28 by 8 weeks, 23/28 by 12 weeks, 27/28 by 16 weeks, and in all 28/28 by 20 weeks. At 36 weeks 27/28 recovered to HB Grade I/II and 1/28 to Grade III.

Conclusion: Final recovery to Grade I/II can be anticipated in >95% of cases and is superior to historical reports of surgical treatment in the literature.

CS3-17-3 The pattern of temporal bone fracture in relation with imaging findings and peripheral facial nerve palsy

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Temporal bone fracture is one of the causes of peripheral facial nerve palsy. It is usually diagnosed based on clinical findings and imaging. Nevertheless, detail relationship between temporal bone fracture and peripheral facial nerve palsy has not been investigated.

We retrospectively studied 155 patients with post-traumatic otorrhea. We documented peripheral facial nerve involvement and findings on x ray or computed tomography (CT) scan.

As many as 76 (49,03%) patients have no visible fracture, 32 (20,64%) have remote visible fracture site (not in the temporal bone), and 47 (30,32%) have a visible ipsilateral temporal fracture. 20 (12,9%) have peripheral facial nerve palsy; out of 20 patients, 10 (6,45%) have a visible fracture either remotely or in the ipsilateral temporal bone, and the other 10 (6,45%) have no visible fracture on their imaging.

We conclude that in this study, most patients with post-traumatic otorrhea have no visible fracture on imaging, including those with facial nerve palsy. Further research with better and more detailed imaging quality is required.

CS3-17-4 Facial reanimation- meeting the different requirements of skull base patients

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CS3-17-5 Dynamic/static reconstructions for various type of facial paralysis

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CS3-18-1 Risk of rupture of small sized aneurysm?

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Object: The aim of this study was to determine the most common size of ruptured aneurysms in our patient population with ruptured intracranial aneurysms and whether there is a critical size and a specific location at which the incidence of rupture of intracranial aneurysm increases. **Method:** A retrospective analysis of patients with ruptured intracranial aneurysms between January 2011 and December 2014 was done. **Result:** Our review included 265 patients with ruptured intracranial aneurysms in which 324 aneurysms were identified. In this series, 87.10% (231/265) of the patients had ruptured aneurysms sized less than 10 mm, and 190 out of 265 patients (71.6%) had ruptured aneurysms which were less than 7 mm. Most ruptured aneurysms were found on the anterior communicating artery (39.6%). **Conclusion:** Our study suggested that we need to recommend surgical treatment for even small unruptured aneurysms with irregular shape, especially anterior circulation aneurysms. Most intracranial aneurysms that are located at the anterior communicating artery and middle cerebral artery bifurcation are small and have high chances of rupture and should be considered for treatment.

CS3-18-2 Factors affecting short and long term outcome in surgically managed multiple aneurysms

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Objective: To identify factors predictive of a poor outcome in patients with multiple intracranial aneurysms(MIA). **Methods:** Clinico-radiological features and outcome using Glasgow Outcome Score (GOS) of 63

patients of MIA were noted. Good H&H grade were grade 1 & 2 and remaining were labelled as poor and GOS was divided into two groups as Favourable: 4 & 5; unfavourable: 1-3. Significance was calculated by Pearson chi square test/fisher exact test, univariate logistic regression model and multivariate analysis was done with Forward method in Binary Logistic Regression model.

Results: The most common site was MCA bifurcation however, Acomm artery aneurysm was the most common site to rupture. The factors influencing patient outcome at discharge were age \geq 65years, H&H grade, Pcomm distribution of aneurysm, hypertension, infarct and hydrocephalus and at long term follow up (mean 14.3 months) were infarct and hydrocephalus.

Conclusion: A poor H&H grade, hypertension, Pcomm artery distribution, elderly, infarct and hydrocephalus each influence a poor outcome at discharge. However, only infarct and hydrocephalus were seen to influence the outcome at long term follow up.

CS3-18-3 A1- segment aneurysms: Management protocol based on a new classification

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Aims- Management dilemmas of A1 aneurysms were studied utilizing a new classification based upon their location on the longitudinal and circumferential axis of A1 segment. **Methods** -This is a retrospective analysis of 15 patients with A1 - segment aneurysms. Data included clinical features, angiographic findings, H&H grade, surgical steps and difficulties encountered. **Results:** Multiple aneurysms were present in 2 patients. 8 patients had IVH and 2 patients had frontal ICH. 6 patients had an anomalous ACA and Acom complex. 14 patients underwent clipping and in 1 wrapping was done. A1 aneurysms were classified as proximal, distal, mid-segment and anterior, posterior-inferior and posterior-superior. Follow-up (mean: 2.9 years) recovery assessed using mRS & correlated with preoperative status. 7 patients had favorable outcome (mRS 0-2) and in 8 patients outcome was unfavorable (mRS 3-6). 1 patient each from H &H grade III, IV and V died (mRS6) during treatment. **Conclusions-** A1 aneurysms have unique anatomic and angiographic properties, which present surgical difficulties. A new classification identifies surgical difficulties inherent in different sites of origin of A1 - aneurysms.

CS3-18-4 Surgical treatment and outcome for paraclinoid aneurysms

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Study about Surgical Treatment for Paraclinoid Aneurysms

Objective: Although advances in surgical technique of anterior skull base have improved, postoperative visual complications still occur.

Methods: 171 unruptured paraclinoid aneurysms cases are included.

Result: Aneurysm size: Mean 6.7mm (2.4-43.1mm). Postoperative visual impairment occurred in 50(29.3%), including visual loss in 15(8.8%), and visual field narrowing in 35 (20.5%). In these cases, the portion of the aneurysm were carotid cave in 24, anterior wall in 4 and superior hypophyseal(SHA) in 22. Postoperatively, the onset of visual symptoms was delayed by 12 to 48 h in all cases.

Discussion: Diameter of complicated cases were relatively small as 6.2mm(3.1-22.2mm). And many case were SHA and carotid cave which have to open distal dural ring circumferentially. It may cause shut off part of cavernous sinus and venous perfusion surround by optic nerve.

Conclusion: Severe vision complications occur due to the venous perfusion disorder caused by circumference opening of distal dural ring and along with the increase of internal pressure in the optic canal.

CS3-18-5 Skull base technique for complete neck clipping of basilar top aneurysm; Frequency and usefulness

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Introduction: Clipping of basilar top aneurysm is one of the most difficult neurosurgical procedures because of narrow and deep operative field and perforators. We report our experience of surgical results of basilar top aneurysm clipping.

Method Between 2012 and 2015, we performed 30 cases of basilar top aneurysm clipping. All procedures were used anterior temporal approach and evaluated their characteristics and approach.

Result: All of 30 cases, 28 cases were unruptured and 2 were ruptured. Male female ration was 1:9. Mean age was 59.6 years old(Range from 38 to 73).

Mean aneurysmal diameter was 5.14 mm (Range 2.4 to 10.0mm). We approached right side craniotomy 64%. The frequency of Anterior clinoidectomy, posterior clinoidectomy and zygometry was 6 of 30(20%), 5 of 30(17%), and 8 of 30(27%) respectively.

Conclusion: Although anterior clinoidectomy, posterior clinoidectomy and zygometry are less frequently used for the neck clipping of basilar top aneurysm, they are necessary technique to perform the complete neck clipping for anatomically difficult cases.

CS3-18-6 Extended endonasal endoscopic transclival clipping of basilar artery aneurysms

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Background and importance: Transcranial clipping of most of the posterior circulation aneurysms are one of the most difficult procedures with high morbidity and endovascular coiling is an alternative with less risk but is not devoid of complications and is not suitable for all aneurysms. Here we describe four cases of posterior circulation aneurysms clipped via extended endoscopic endonasal transclival route. To best of our knowledge this is the first report of basilar top and posterior cerebral artery aneurysms being clipped endonasally.

Clinical presentation: The age range was between 35 and 70 years. There were 2 males and 2 females. Three out of four patients had presented after the rupture of aneurysms and the other patient presented with sudden onset left hemiparesis probably due to thromboembolism from a large unruptured left posterior cerebral artery (PCA) aneurysm. On evaluation with 4 vessel digital subtraction angiography (DSA), 2 patients had basilar apex aneurysm, 1 patient had basilar trunk aneurysm and the other patient had posterior cerebral artery aneurysm. All the patients underwent extended endoscopic endonasal transclival clipping of the aneurysm. Post operatively two patients had good recovery. One patient with PCA aneurysm and the other patient with basilar apex aneurysm had fresh post-operative deficits. One patient developed post-operative CSF rhinorrhea. Another patient was reexplored because of malposition of clip.

Conclusion: Endoscopic extended transnasal surgery is an expanding field in neurosurgery with a steep learning curve. With improvement in techniques and instrumentation the use of this approach for clipping posterior circulation aneurysms can become an effective alternative in the treatment of aneurysms.

CS3-18-7 Development of a new high-resolution intraoperative imaging system to simultaneously visualize light and near-infrared fluorescence images of ICG

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Objective: Intraoperative ICG-videoangiography has been widely used with vessels clearly shown as white on a black background. We have developed a high-resolution intraoperative imaging system and a laser-light system to simultaneously visualize both light and near-infrared (NIR) fluorescence images from ICG.

Methods: The operative field was illuminated via an operating microscope by the laser-light system with wavelength of blue (464nm), green (532nm), red (640nm) and infrared (783nm). In the camera unit, visible light and NIR fluorescence emission light were filtered using a special sensor unit with an optical filter. Both images were simultaneously visualized on a single monitor.

Results: Our system clearly visualized the operative field together with fluorescence-enhanced blood flow. In aneurysm surgeries, we could confirm incomplete clipping with the neck remnant or with remnant flow into the aneurysm. In cases of arteriovenous malformation or arteriovenous fistula, feeding arteries and draining veins were easily distinguished.

Conclusions: This system allows observation of the operative field and enhanced blood flow and facilitates various types of neurovascular surgery.