ABSTRACTS

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Skull Base Surgery

Reconstruction for skull base surgery

Nishit Shah (Mumbai, India)

Skull base surgery consists of 3 parts. Exposure, tumour or lesion removal and reconstruction. Exposure must be wide and does not necessarily depend on the size of the pathology. Usually one spends double the time in getting a good exposure than in actual tumour removal. This is to make the excision safer and more complete. Another factor is that one has to think of reconstruction at the start of surgery, and the exposure must include planning the reconstruction. This might be the most important part of the surgery as reconstruction is often the most difficult part of the process. It may also be a factor in deciding the route of approach for surgery – endonasal as against transcranial. Prior to introduction of pedicled flaps, we traditionally repaired skull base defects using free material. The tissues used most often included cartilage, bone, fat and fascia lata. In cases where dural defects are small, one can plug defect with fat, either directly or as a bathplug technique. Fascia on top would provide additional cover. Larger dural defects could be closed using fascia as underlay and then fat on top. Bone or preferably cartilage could be used for additional bony reconstruction when required and covered by overlay fascia. We like to use tissue glue (Tisseel™ from Baxter) to reinforce the repair. We have now become reliant on the HB flap (Hadad-Bassagastugey), which is a pedicled vascularized flap, based on the septal branch of the spheno-palatine artery. Any transphenoidal surgery requiring reconstruction starts with elevation of HB flap prior to starting the exposure. Damage to mucosa or feeding vessel, the septal branch of spheno-palatine artery, will endanger the viability of the flap and make it non-vascularized. Having done about 1000 endoscopic transphenoidal surgeries, I will present our experience in the repair and reconstruction of closing skull base defects.

Endoscopic management of craniopharyngioma

Chandrashekhar Deopujari (Mumbai, India)

Introduction: The goals of treatment in craniopharyngioma surgery in childhood are: improving vision, decreasing intracranial hypertension, and cure from tumor preserving good functional status. Though an ideal treatment remains elusive, recently more conservative approaches are advocated and endoscopy is playing a greater role in surgical management.

Material and Methods: Endoscopy has been used in a personally operated series of 76 patients: for cyst drainage (+/- reservoir) in 15 cases, endoscope assisted transcranial excision in 9 cases, transnasal excision in 22 cases and combined approaches were performed in 11 cases. Combined approach was performed in patients presenting with intracranial hypertension with cystic tumor and hydrocephalus.

Results: In the transnasal endoscopic group, satisfactory excision was achieved in 12 / 14 cases intended for radical excision. One patient required transnasal surgery for large calcified chunk and one required a repeat procedure for CSF leak and residual tumor excision.

Conclusions: Combined endoscopic approach is advocated in children presenting with intracranial hypertension due to cystic tumor and hydrocephalus with significant improvement in neurological and endocrinological status, may obviate the need for permanent CSF diversion and reduces CSF leak.

Endonasal skull base surgery - initial institutional experience of PSGIMSR, Coimbatore, India

Rajkumar Raju (Coimbatore, India)

Introduction: To present initial difficulties in starting the endonasal skull base surgery and analyse surgical results of initial series of 28 cases.

Material and Methods: From July 2010 to July 2013, we had performed 28 cases of endoscopic skull base surgery, of which CSF leak repair in 8 cases, pituitary adenoma surgery in 19 cases and craniopharyngioma surgery in 1 case. Team consists of ENT, Plastic surgeon and Neurosurgeon. All the procedures are confined to sella, sphenoid and ethmoid sinuses. No extended skull base procedure was done.

Results: Adenoma removal total – 16 cases, subtotal - 3 cases, craniopharyngioma partial removal-1. CSF leak repair - no recurrence, vision improvement in all 12 patients with visual deficits. No Post op CSF leak and meningitis. Hyponatremia in one patient.

Conclusions: Endonasal skullbase surgery is the standard

procedure for surgical treatment pituitary macroadenomas and skull base CSF leaks. Sellar, sphenoid and ethmoid sinuses surgery is safer and easy for the beginning endoscopic skull base team.

Endo-nasal, transphenoidal approach - skull base lesions

Venkataramanaa N. K, Shailesh A V Rao, N.B. Phahalad (Bangalore, India)

Introduction: The introduction of endoscopy to transphenoidal surgery, with its improved illumination and wider field of view, has added significant potential for the resection and repair of a variety of cranial base lesions. We review our experience with the expanded endoscopic endonasal approach in a series of 39 patients with anterior cranial base pathology.
Material and Methods: In the last 3 years, the expanded endoscopic endonasal approach was used in 39 patients with the following pathologies: 3 giant pituitary macroadenomas, 5 craniopharyngiomas, 1 esthesioneuroblastoma, 8 sphenoid CSF rhinorrhoea, 3 posterior ethmoids CSF leak, 3 suprasellar Rathke's pouch cysts, 5 clival chordomas, 1 cavernous haemangioma, 1 suprasellar meningioma, 1 suprasellar arachnoid cyst, 1 foramen magnum meningioma, 1 sellar meningioma, 1 sphenoid meningioma, 1 sellar SOL, 1 sellar / suprasellar mass, 1 prepontine cystic lesion, 1 nasal angiofibromas, 1 cavernous malformation.
Results: Gross total tumor removal, as assessed by postoperative magnetic resonance imaging, was possible in the majority.
Complications: There was no operative mortality. One patient had temporary quadriparesis and other had major CSF leak requiring repair.
Conclusions: The expanded endoscopic endonasal approach is a promising minimally invasive alternative to open transcranial approaches for selective lesions of the midline anterior cranial base. The avoidance of craniotomy and brain retraction and reduced neurovascular manipulation with less morbidity are potential advantages. Major complications have been few, but there are also limitations with this technique. This multi-disciplinary approach should be included in the armamentarium of cranial base surgeons and considered as an option in the management of selected patients with these complex pathologies.

Paediatric skull base aneurysmal bone cyst - endoscopic approach

Bagathsingh Karuppanan, Nageshwaran, K Selvamuthukumaran, Paul Gardner, Carl Snyderman (Madurai, India)

Objective: to present a rare case of skull base tumor. A 12 yrs old boy presented with swelling over the right side of scalp over the right eyebrow. He also had right complete ophthalmoplegia with right optic atrophy. CT and MRI was done which showed a bony lesion in right frontal skull bone. He was operated for endoscopic and supraorbital craniotomy, but because of bleeding only biopsy could be taken. Later, as it was vascular tumor, it was embolised and then endoscopically transnasal excision was done by world known skull base surgeons. Final biopsy was reported as aneurysmal bone cyst.

Surgical management of Rathke's cleft cysts

Vishwaraj Rath, Deopujari C E , Shah N J, Karmarkar V S, Kendre B (Mumbai, India)

Introduction: Though diagnosis of Rathke's Cleft cysts (RCC) has increased due to the improvements in imaging techniques, symptomatic cases are uncommon and accurate preoperative diagnosis may sometimes be difficult. Indications of surgery are not clear and management is controversial.
Material and Methods: A retrospective analysis (2003-2013) of 46 consecutive cases with RCC seen in a surgical unit is presented. Eighteen surgically treated symptomatic RCCs were further evaluated for their clinical presentation, imaging characteristics, surgical approaches as well as intra-operative findings.
Results: Headache was the most common presenting complaint and was seen in almost all patients while 4 patients presented with visual deficit as the chief complaint. Hormonal abnormality was observed in 4 patients. The cyst had suprasellar extension in 4 patients. The cyst content showed hyper intense MRI signal in T1W as well as T2W images. Transphenoidal or extended surgery for cyst excision was performed in all 18 patients. Pituitary stalk and the normal gland were preserved in all cases. Radical excision of cyst wall was not possible in 3 cases. Relief from headaches and visual deficits improved but preoperative hormonal deficiencies did not improve and new deficits were not observed.
Conclusions: Rathke's cleft cysts are an uncommon pathology with a wide spectrum of clinical and radiological features. Rathke's cleft cysts are typically benign, asymptomatic lesions that can be monitored. In selected patients, transphenoidal surgery provides excellent improvement in clinical symptoms and long term cyst resolution.

Extended endoscopic approach to the CV junction
Vikram Karmarkar, C. Deopujari, Nishit Shah (Mumbai, India)

Introduction: Extended Endonasal Endoscopic techniques have matured. We examine the application of these to ventral pathology at the CV junction.
Material and Methods: All extended procedures involve planning, preparation, exposure, lesion management and reconstruction. We have used an inverted U nasopharyngeal flap for access apart from nasoseptal flaps required for reconstruction. Also the optimum use of the nasal and oral corridors is described. We have used this technique in patients with chordoma, meningioma and ventral surgery for CV junction anomalies.
Results: Judicious use of the technique seems to reduce some of the morbidity associated with the traditional transoral technique.
Conclusions: These techniques are useful in managing certain ventral CVJ pathology.

Spontaneous CSF rhinorrhea from primary empty sellar syndrome
Sandip Chatterjee, Ranjan Raychowdhury (Kolkata, India)

Introduction: Primary empty sella refers to herniation of an arachnoid diverticulum into the sella turcica, displacing the pituitary gland. This sac can further function as a one way valve, increase the intrasellar pressure and erode the thin sella floor. The CSF leak that ensues can be a troublesome problem.
Material and Methods: We report on our experience of 21 cases of spontaneous CSF rhinorrhoea due to this condition. In 5 cases, patients suffered from bacterial meningitis prior to diagnosis. 9 patients were male, and 12 were female. No patient had any history of trauma, radiation or surgery to the sellar area. CSF was confirmed by measuring the glucose and beta-transferrin levels. MR scan was used to establish that the site of leakage was in the sellar floor. Seven cases also underwent CT cisternography.
Results: Nine patients underwent microscopic trans-nasal repair using fascia lata and tissue glue, whereas 12 had an endoscopic repair, in keeping with the change in our practice. In 3 cases the leak persisted, necessitating permanent lumbo-peritoneal shunt. Temporary lumbar drain was used in these 3 patients, and additionally in 4 patients.
Conclusions: The aim of the presentation is to highlight this rather uncommon cause of spontaneous CSF rhinorrhoea which, if not picked up early, may lead to life threatening meningitis.

Endoscopic endonasal transphenoidal approach to sellar lesions: a detailed account of our technique
Stefan Linsler, Michael Robert Gaab, Joachim Oertel (Homburg, Germany)

Introduction: The endonasal endoscopic approach is currently under investigation for perisellar tumour surgery. A higher resection rate is to be expected and nasal complications should be minimized. Here, the authors report their technique of transnasal endoscopic neurosurgery after 218 procedures.
Material and Methods: Between October 2000 and September 2011, 210 patients received endoscopic endonasal transpenoidal procedures for perisellar lesions. Procedures were video recorded. These cases were prospectively followed. The surgical technique was carefully analyzed.
Results: Standard technique was mononostril approach with 0° optics. 30° and – after availability - 45° optics were used for assessment of radical resection. On follow up MRI revealed radical tumour resection in 125 out of 138 cases (90.1%). Recurrent tumour growth was observed in five younger patients (2.3%). There was no mortality. There were three cases of meningitis (1.4%) and 7 cases of CSF leakage (3.2%). One case required subsequent surgical closure of the fistula (0.5%). Three patients (1.4%) complained postoperatively of nasal congestion or reduced nasal air flow, however no complaints were considered to be severe.
Conclusions: In comparison with other literature reports, the results are comparable or even better with respect to surgical radicality. But, the very low rate of nasal complains is particularly remarkable. The technique has been shown to be safe and successful with a high radicality and only minor complications. In contrast to microsurgery, the various optics allow a look “around the corner” to allow a radical tumor removal.

Transphenoidal pituitary surgery in the elderly
Erlick Pereira, L James Livermore, Ashley Grossman, Simon A Cudlip, Puneet Plaha (Oxford, UK)

Introduction: With an increasingly ageing population, the number of elderly people diagnosed with pituitary tumours continues to rise. There is concern that with increasing age and comorbidities, there is higher anaesthetic risk, as well as perioperative morbidity and mortality from pituitary surgery. This study aimed to audit the benefits and complications of transphenoidal surgery performed in a large pituitary centre in elderly patients.
Materials and Methods: Data on all elderly patients (age ≥ 70 years) undergoing transphenoidal surgery at a large tertiary referral centre between November 2003 and

August 2012 were collected retrospectively.
Results: A total of 104 operations were performed on 102 patients during 106 months. Median age was 75.2 years (range 70-94) and 63 (61%) of the patients were male. Median follow-up was 15.2 months (range 2.3-84.4). The majority presented with either peripheral visual field defects (26.4%) or pituitary hormone deficits (17.9%). A significant number (21.7%) of tumours were incidental radiological findings while investigating other diagnoses like stroke and dementia. 48.1% of operations were undertaken microscopically and the remaining 51.9% were endoscopic. Median hospital stay was 4 days (range 3-18). Intra-operative complications included hypotension (1.9%) and blood loss requiring transfusion (2.9%). The 30 days complications included transient diabetes insipidus (9.6%), syndrome of inappropriate anti-diuretic hormone secretion (8.7%), delayed cerebrospinal fluid leak requiring lumbar drainage (0.9%) with no patient requiring formal repair. There were no peri-operative deaths. Long-term assessment suggested 79% had improved or stable endocrine function with 7% achieving biochemical cure and 91% showed improved or stable visual fields.
Conclusions: Pituitary surgery in the elderly, whether microscopic or endoscopic, has low morbidity and mortality and is a safe and effective intervention for both symptom control and functional outcomes.

Endoscopic endonasal transphenoidal excision of pituitary tumours, experience at Jinnah Hospital, Lahore

Kashif Ali Sultan, Zafar Iqbal (Lahore, Pakistan)

Introduction: Endoscopic transphenoidal adenectomy carries the possibility of new pituitary failure, recovery and improvement of visual field and hormonal levels.
Material and Methods: It is retrospective study performed on consecutive patients who underwent endoscopy assisted endonasal transphenoidal adenoma removal over a 2-years period at the department of neurosurgery, AIMC, Jinnah Hospital Lahore. Pre and postoperative visual status and hormonal levels were determined and correlated with clinical parameters using a multivariate statistical model.
Results: Of 23 patients (11 female and 12 male) with 22 patients (95.65%) having macro adenoma and 1 9 (4.3%) patient with micro adenomas, 12 patients had functional (52.17%) and 11 were nonfunctional (47.82%) type of adenomas. Vision abnormalities were present in about 18 patients (78.26%). Of the functional adenomas 4 patients had prolactinoma (17.3%), 7 had Acromegaly (30.43%), 1 had Cushing disease (4.34%), study showed that 55% of the patients with hormonal dysfunction improved and of the remaining 45% patients none of them developed hypo pituitary function. Visual field defects improved in 84% of patients, complete blindness of the 50% of patients improved. One patient had recurrent pituitary adenoma and there was no mortality among all 23 operated patients.
Conclusions: Visual field defects improved in 84% of patients, complete blindness of the 50% of patients improved, whereas improved hormonal function occurs in 55% of patients. The likelihood of new hormonal and visual loss or recovery appears to depend on several factors.

Outcome after endoscopic transnasal transphenoidal removal of pituitary adenomas

Mohana Rao Patibandla, Manas Kumar Panigrahi (Hyderabad, India)

Introduction: To evaluate outcome of the patients with pituitary adenomas following endoscopic transnasal transphenoidal surgery.
Material and Methods: One hundred and eighty eight patients with pituitary adenoma were operated through endoscopic transnasal transphenoidal approach by senior author between May 2000 and Jan 2012. They were evaluated with ophthalmological examination, MRI and/or CT scan brain, hormonal evaluation. Only the patients who were operated through transphenoidal resection by using endoscope were included. Patients were evaluated for visual, hormonal outcomes and mortality rates. These patients had a follow up range of 12 months to 12 years 4 months.
Results: The mean age of the patients was 43.48 yrs (range 12 – 78). The overall mortality rate was 2.65% (5/188). Visual improvement was noted in 75.6% of the patients, unchanged in 18%. Improvement in terms of hormonal assessment was noted in 76.9%. Complications like CSF rhinorrhea, temporary DI, permanent DI, anterior pituitary deficiency, hematoma, 3rd nerve paresis, and meningitis noted in 11.5%, 13.6%, 7.82%, 10.9%, 3.14%, 1.57% and 2.09% respectively.
Conclusions: Visual symptoms of less than 1 year and adenomas of less than 37.25 mm size have better visual outcome. Complications are comparable with other studies. Firm adenomas are special entity need to diagnose pre operatively because they are difficult to excise and create more complications.

Study of endoscopic transphenoidal approach to pituitary tumours over 10 years

Bhaskar Kendre, C. E. Deopujari, Nishit Shah, Vikram Karmarkar, Vishwaraj Rath (Mumbai, India)

Introduction: To confirm the efficacy and safety of the endoscopic endonasal transphenoidal approach in the treatment of pituitary lesions

Material and Methods: 350 consecutive patients with pituitary tumour operated by transnasal endoscopic route over 10 years by a surgical team at a tertiary care centre hospital were evaluated. Patients treated conservatively by hormonal therapy, radiosurgery/ radiotherapy and transcranial surgery were excluded. Modes of presentations, intraoperative findings & postoperative outcomes were studied. Uninostril approach was used in first 5 years while binostril approach was used in all cases from 2008 onwards.
Results: Visual complaints were the commonest mode of presentation, followed by raised ICT. Adverse effects observed during surgery were: intraoperative CSF leak in 36 (10.28%) patients, which was repaired with fat, fascia & glue. Major bleeding occurred on 4 occasions. Residual lesion was seen in 29 patients & 11 patients showed recurrence on follow up scans. Of these, 13 underwent repeat surgery, 10 repeat endoscopic procedure & 5 transcranial excisions. Postoperative CSF leak was seen in 10 (2.85%) patients and a surgical repair was required in 5 (1.42%). Hormonal cure was obtained in 68 (83.95%) of 81 functional tumours and postoperative new hormonal deficiency was observed in 10 (2.85%).
Conclusions: Endoscopic transnasal approach achieves better tumour clearance, fewer complications and better preservation of pituitary function.

Endonasal endoscopic repair of CSF leaks: our experience

Neelam Krishnan Venkataramanaa, Shailesh A V Rao, Prahalad NB, Pradeep Hosamani (Bangalore, India)

Introduction: CSF leaks from anterior skull base present as rhinorrhea and headache with a potential risk of complications like meningitis. A variety of techniques have been described in literature from transcranial, extracranial (external ethmoidectomy, frontal sinusotomy) to transnasal as treatment options.
Material and Methods: We present the retrosprectice analysis of our data at Global Institute of Neurosciences, Bangalore. We retrospectively reviewed the clinical data of CSF leaks (spontaneous, traumatic, post-surgical and iatrogenic) between January 2011 and June 2013. All were treated endoscopically with either a binostril / uninostril technique.
Results: 20 patients were included in the study, with the duration of CSF leaks ranging from 1 week to 2 years. Among them 6 (30%) were females, 14 (70%) were males with age ranging from 14 to 75 years. The leak was spontaneous in 5 (25%), traumatic in 8 (40%), post-surgical (skull base SOL) in 6 (30%) and iatrogenic in 1 (5%). Two cases (10%) were recurrences from previous transcranial surgeries. Successful closure of the leak was achieved in 20 (100%) in first attempt. With a follow up of 3 – 6 months (ranging from 3 to 30 months), no recurrence was seen.
Conclusions: Endoscopic endonasal closure of CSF leaks is a good approach for CSF leaks of any etiology. The approach has a good surgical success rate with least morbidity

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Functional Endoscopic Pituitary Surgery (FEPS)

Azmi Alias, Narizan Ariffin, Mohammed Saffari Mohammed Haspani (Kuala Lumpur, Malaysia)

The endoscopic transphenoidal technique allows a direct optical visualization of surgical corridor through the natural pathway of nasal cavity, assessment of critical anatomy of the sphenoid sinus and intrasellar area with the possibility to differentiate normal pituitary gland from abnormal pathology.
This provides an opportunity to preserve the physiological function of the surgical corridor (nasal cavity) and target lesion (pituitary) especially in patients with preoperative normal pituitary hormones through a selective opening and tumour resection. Our aim of surgery is emphasizing on selective removal of pathology, reversal of visual symptoms and preserving the function of normal pituitary glands thus avoiding long term postoperative hormonal replacement dependency.
Every attempt is made to preserve the potentially functioning pituitary gland while removing the pathological lesions and the surgical opening is limited to anterior sphenoidotomy and posterior septostomy for the purpose of intra sellar approach.
A total of 150 endoscopic transphenoidal surgery procedures involving various Functioning and Nonfunctioning Pituitary Adenoma were performed at the Department of Neurosurgery, Hospital Kuala Lumpur, Malaysia from July 2005 until August 2013 through a combined Neurosurgeon-Otorhinolaryngologist with binostrils - 4 hands techniques.
Depending on the position of the pituitary gland and tumour, which can be predicted from the preoperative MRI, we performed intracapsular dissection first with the initial step to curette the tumour inferiorly towards clivus first and preserving the superior capsule as it may represent the compressed normal pituitary gland. A plane between potentially normal gland and tumour were created. Image Guided system was used especially in lateralized tumour and recurrence. Selected cases will be presented to illustrate the surgical technique and functional outcome.

Visual outcome after endoscopic transphenoidal approach for pituitary adenoma

Ali Ayyad, Jens Conrad, Alf Giese, Martin Mayer (Mainz, Germany)

Introduction: The transphenoidal route is a direct and rapid extracerebral approach to the sellar region, and therefore, it is the most widely used technique for the processes involving this area. Since its introduction in 1907 it has been subjected to tremendous developments. The endoscope is the latest innovation in the field of optical instrumentation; it allows the 'surgeon's eye' to penetrate the depth and width of the access route. Visual symptoms including decreased visual acuity, visual field defects and ocular motility disturbance are the most common presenting symptoms in patients with pituitary adenoma. One of the goals of pituitary surgery is to improve such deficits. We reported here the visual outcome after endoscopic transphenoidal surgery for pituitary adenoma.
Material and Methods: From 2004 till 2011 we have operated 287 pituitary adenoma using pure endoscopic transphenoidal approach. 123 patients presented with visual field defect or decreased visual acuity, 31 patients had diplopia due to 3rd, 4th or 6th cranial neuropathy.
Results: In the group of 123 patients with visual field defects or decreased visual acuity 94 patients improved postoperatively, 29 patients remained the same and no patient deteriorated. In the group of diplopia 30 patients improved, 1 patient remained the same. No patient deteriorated.
Conclusions: The minimum traumatization of the nasal cavity without nasal retractor, the optical advantages of the endoscopic visualization in anatomical orientation and tumor removal and the early postoperative improvement of the patients without nasal packing are obvious advantages of the endoscopic binostril technique. This approach is effective in improving the visual symptoms in comparison with other approaches or techniques.

Usefulness of the angled-endoscope for the inferior approach to the treatment for the symptomatic Rathke's cleft cyst

Yasuhiko Hayashi, Daisuke Kita, Issei Fukui, Masahiro Oishi, Jun-ichiro Hamada (Kanazawa City, Japan)

In the transphenoidal surgery for the Rathke Cleft Cysts (RCCs), the incision of the anterior lobe of the pituitary gland is required for the aspiration of the cyst content because they arise from the pars medialis. However, with the use of angled-endoscope, it is possible to incise the inferior aspect of the cyst accurately (inferior approach), which can be observed by the MRI T1 weighted image with contrast enhancement and is usually considered to cover with the thinnest part of the anterior lobe. 21 cases of RCC were treated with this described procedure to avoid excess incision of the anterior lobe and subsequent postoperative hypopituitarism.
Anterior and posterior pituitary functions were evaluated in all the 21 patients treated endoscopically and compared with the 38 patients who treated with microscope previously and required the incision of the anterior lobe from the anterior aspect (anterior approach). Among the typical symptoms caused by the RCCs, the difference in headache and visual disturbance could not be found between both approaches, but the endocrinological symptoms were significantly recognized to recover in the inferior approach than in the anterior approach. The evaluation of the anterior pituitary functions was well preserved in the inferior approach than in the anterior approach. The posterior pituitary function did not show significant difference between two approaches postoperatively. The postoperative recurrence rate of RCC had lower tendency in the inferior approach than in the anterior approach. Usefulness of the inferior approach of the treatment for RCC is clearly demonstrated in our cases.

Endoscopic findings of unusual hypophysitis: three case reports

Masahiro Oishi, Yasuhiko Hayashi, Issei Fukui, Daisuke Kita, Jun-ichiro Hamada (Kanazawa City, Japan)

Hypophysitis is a chronic inflammatory change affecting the pituitary gland that comprises an increasingly complex clinicopathological spectrum. Histologically, hypophysitis includes mainly three different subtypes: lymphocytic, granulomatous and xanthomatous. Additionally, newer variants have recently been reported. We describe three cases of unusual hypophysitis to assess clinical process, neuroradiological imaging, macroscopic appearance and pathological findings.
First, we present a 69-year-old female with lymphocytic neurohypophysitis caused by rupture of Rathke's cleft cyst (RCC). She manifested sudden headache and subsequent diabetes insipidus without impairment of anterior pituitary function. MR imaging revealed RCC, swollen pituitary gland and disappearance of posterior lobe hyper-intensity on T1-weighted images. With an endoscopic transphenoidal biopsy, the specimen revealed massive lymphocytic invasion on the posterior lobe only. Although lymphocytic hypophysitis is the most popular among the three hypophysitis subtypes, it is very rare that from rupture of RCC arises hypophysitis.
Secondly, we present with a 72-year-old female with xanthomatous hypophysitis associated with polyuria, polydipsia, fatigue and fever. MR imaging showed pituitary stalk thickening with cystic mass and no evidence of posterior lobe hyper-intensity on T1-weighted images. Endoscopic transphenoidal biopsy yielded a soft yellow cystic lesion macroscopically and many histiocytes affection microscopically. Xanthomatous hypophysitis is an extremely uncommon form of hypophysitis and have

been described only 15 cases since the first case report in 1998.
Finally, we present with a 59-year-old male with IgG4-related hypophysitis. He manifested diabetes insipidus and diplopia. MR imaging revealed an enlargement of pituitary gland, a homogeneous contrast enhancement without detection of posterior lobe hyper-intensity on T1-weighted images. Endoscopic transphenoidal biopsy revealed that the anterior lobe turned to be firm and gray. IgG4-related hypophysitis is one of the new variants and associated with the systemic organs involvement.

Reconstruction technique of pituitary sellar floor by using silicon plate under endoscopy

Kidoguchi Masamune, Ryuhei Kitai, Norichika Hashimoto, Hiroyuki Neishi, Kenichiro Kikuta (Fukui, Japan)

Introduction: Endoscopic transphenoidal surgery (eTSS) is widely used for pituitary lesions. The rigid reconstruction of sellar floor is important step for CSF leakage. We have been using silicon plate as the material of alternative bone. Reconstruction under surgical microscope was not difficult due to bi-hands technique and wide surgical field. However, in this endonasal approach under endoscopic, the instruments interfered with inserted materials of sellar floor. We are going to show our new techniques to repair.
Material and Methods: A soft silicon plate was cut from the block. According to the bone defect, the thin silicon plate was prepared. Typical case was approximately 1.5 cm in diameter. This thin plate was fixed by metal forks with spike and put 3-0 silk thread at the corner. It looked like flying kite. Under direct visualization by endoscopy, the plate was inserted into nasal cavity that named as "Flying kite technique". Reaching to the sellar floor, the plate was detouched. The plate was pulled by the thread and pushed by metal bar, that named as "Counter force technique".
Result: We adopted this method for 35 eTSS cases. The insertion procedure was easy, suitable and quick. There were no CSF leakages requiring additional surgery. There was a case that silicon plate dropped spontaneously and the patient brought the material.
Conclusions: eTSS has been widely used, but not easy. Rigid reconstruction is important step due to CSF leakage. At the end of surgery, the reconstruction has to be done securely. This present technique make it easier and certainty.

Endoscopic binostril transphenoidal pituitary surgery

Venkataramanaa N. K. (Bangalore, India)

Endoscopic approaches to the pituitary have undergone numerous refinements over the last few years. Technical advancements, optics, instrumentation and navigation have revolutionized this procedure. To begin with we used mononostril endoscopic technique, later we switched over to a team approach wherein use of two nostrils, four hands has increased the efficacy and safety of this approach.
We have operated 77 pituitary tumors by this approach in the last 5 years. The initial part of the surgery is done by the ENT surgeon creating a surgical corridor and also raising naso-septal or turbinate flaps for reconstruction. Then the Neurosurgeons will take over from the floor of the sella. The floor will be gently removed to provide maximum possible access. Navigation will help to define the boundaries of the floor. It is important to have the full opening of the dura to excise the tumor. After dural opening the tumor is gently separated from the lateral margins and then anterior and posterior margins. In macroadenomas a clear plane will be seen in majority through which we can remove the adenoma totally. Larger adenomas require debulking. The co-ordination of the team is essential to achieve the best results. 76 were pituitary adenomas and 1 was a cavernous hemangioma occupying the sella. We had one mortality due to vascular injury. Three had CSF leak, two of them required repeat repair of the floor. The technical details and challenges faced in the recurrent adenomas will be presented.

Surgical simulator for complex skull base endoscopy

Vicknes Waran, Vairavan Narayanan, Ravindran Karuppiah, Prepageran Narayanan (Kuala Lumpur, Malaysia)

Introduction: Endonasal endoscopic neurosurgery extends from excision of pituitary tumours to more extensive skull base procedures. These operations are challenging and the learning curve is long. While skills to perform endoscopic pituitary surgery can be developed rapidly due to the larger case load, experience to surgically manage skull base pathology is more difficult as the cases are less frequent and usually performed only in specialized units.
Surgeons performing these procedures have to be accustomed to using a variety of tools and techniques in an area confined by both bony and soft tissue structures. Utilising a 3D printer we created a model of a patient with cranial migration of the odontoid peg. This model allows surgeons to practice techniques like navigation, drilling in confined spaces and learning a difficult procedure by repetitive and standardised learning steps.
Material and Methods: A model was created using the CT and MRI imaging data of an actual patient with cranial migration of the odontoid peg causing myelopathy who subsequently underwent transnasal endoscopic resection of the peg.

This model was tested by three experienced endoscopic skull base surgeons (two Neurosurgeons and an ENT surgeon).
Results: All three surgeons found the model very useful. While the intra nasal structures were absent the anatomy of the naso-pharynx was accurate. The "tissue" handling was similar but certain processes like using diathermy was not possible. However the entire process of removing the peg and additional calcified ligaments was possible and fairly realistic.
Discussion: Custom biomodels created using 3D printing technology form an excellent supplement to conventional cadaveric skull base endoscopic training by providing realistic training for less frequent and difficult problems.

Extended approach for clival chordoma
Dinesh Rattnani, Rana Patir (New Delhi, India)

Introduction: With increase in familiarity with endoscopic instruments and endoscopic anatomy it is now possible to remove the skull base tumours from anterior skull base to odontoid
Material and Methods: A middle aged man presented with complaints of headache with no apparent deficit. His brain MRI revealed mixed intensity mass involving sellar, suprasellar region extending to clivus. Patient was taken for surgery and endoscopic transphenoidal removal was done. Tumour was eroding the clivus. Whole of basilar artery was visualised. There was CSF leak during surgery. Closure was done with fat and fascia and fibrin glue supported by Haddad's flap.
Results: Patient tolerated the procedure well. There was no CSF leak after removal of lumbar drain and there was no other complication.
Conclusions: With proper selection of patient tumor from anterior skull base to odontoid can be safely removed.

Flip sphenoid mucosa flap reconstruction in endoscopic transphenoidal surgery
Azmi Alias, Narizan Ariffin, Mohammed Saffari Mohammed Haspani (Kuala Lumpur, Malaysia)

Endoscopic transphenoidal approach involves removal of sellar floor and opening of dura prior to removal of intrasellar lesions and in certain cases resulted in CSF leakage. Reconstruction of the sellar floor is the most critical step to form a permanent barrier, separating the contaminated nasal from intracranial cavity. Various material has been used to reconstruct small defect in the sellar floor such as subcutaneous fat, fascia lata, surgicel and tisseel glue which proved to be effective.
We described our technique in utilizing a flip sphenoid mucosa flap as an additional construct in selected cases of endoscopic transphenoidal surgery due to its potential ability to promote healing and early recovery. The surgical technique and operative video will be presented by the first author. Attempt is made to preserve the sphenoid mucosa as much as possible following posterior septostomy and anterior sphenoidotomy. The sphenoid mucosa over sellar floor and upper clivus on one side is raised carefully from intrasphenoidal septum at midline and kept in place laterally with cottonoid and similar technique repeated on the other side. Following removal of intrasellar lesions and initial repair of sellar defect, the intact flip sphenoid mucosa from both side is returned back to its original position and keep in placed with thin layer of surgicel. Tisseel glue is applied in selected cases with intraoperative CSF leak. Endoscopic examination and cleaning of the nasal cavity is done at 2 and 6 weeks at the ENT clinic as part of our routine postoperative assessment.

Purely endoscopic transcranial repair of transfrontalsinus CSF rhinorrhoea – A novel technique & an early experience
Ajit Sinha, Sumit Goyal (New Delhi, India)

Transfrontal sinus CSF leak (post-traumatic) has always been challenging and nearly impossible to treat transnasally (endoscopic). Literature is full of repair procedures done transcranially doing frontal craniotomies (bifrontal or unilateral frontal) with its associated problems of large incisions, cosmetic deformity, skin anesthesia and frontal lobe retraction. We have successfully done 5 cases of purely transfrontal CSF leak repair using transcranial extra-dural route by 4mm endoscope over last 1 year. All were males with history of trauma in the past. One case was 6 years old child, other cases were young adults (age range 25-45 years). One case was bilateral frontal sinus fracture. Average postoperative hospital stay was three days. Follow-up range is from 2 months to 12 months, with no case of recurrence seen. No other complication including post-op added anosmia was encountered. We conclude that by this novel purely endoscopic transcranial extra-dural technique, repair of CSF leaks through the frontal sinus fracture is safe and effective.

Invasive pituitary adenomas
Sbeih Ibrahim (Amman, Jordan)

Pituitary adenomas are the second most common benign intracranial tumor after meningiomas. Some adenomas are typical but others may be invasive, aggressive, premetastatic or carcinomatous. Invasive adenomas can infiltrate bone, dura, nasal sinuses, cranial nerves and venous sinuses. The

goal of surgery in the invasive nonsecretory adenomas is gross total resection, followed by radiotherapy, radiosurgery or conservative follow up. In the invasive secretory group, surgery is followed by medical treatment, radiotherapy or radiosurgery.

We are presenting our experience with giant invasive pituitary adenoma in the period between 1990 – 2011. 56 patients were encountered: 33 males and 23 females. 36 patients were non secreting adenomas, 16 prolactin secreting, 2 ACTH and 2 GH secreting. 50 patients needed transcranial and 8 patients needed transnasal surgical excision. Indication of surgery in nonfunctioning adenoma was neurosurgical deterioration. In the secretory group indication was deterioration of neurological condition in spite of medical treatment. Transcranial surgery was needed where invasive adenoma extended to posterior, middle or anterior fossa. One preferred surgical approach by us is transbasal subfrontal, among other approaches. The aim of surgery was gross total resection whenever possible. Postoperative adjuvant therapy was needed for all patients: radiotherapy in 54 patients, Gamma radiosurgery in 12 patients and drug therapy in 12 patients. The dose in Gamma Knife varying between 14 – 22 gray. Follow up in our patients ranged from 20 – 154 months with mean follow up period of 58.2 months. Mortality in this series occurred in 2 patients: one patient died of meningitis after major CSF leak and one died of pulmonary embolism. No carcinomatous change was seen in any of our patients.

We believe that surgical cure is not possible for all invasive secretory and nonsecretory adenomas. Invasiveness is an issue decided by radiological, histological, and operative findings. Most invasive adenomas are giant ones.

Hydrocephalus and CSF Disorders

Endoscopic surgery for suprasellar arachnoid cyst - the lessons learned

Jagath Lal Gangadharan, Dhaval Shukla, Dhananjay I Bhat, Sampath Somanna, Indiradevi B (Bangalore, India)

Introduction: Endoscopic surgery is presently the gold standard for management of suprasellar arachnoid cysts. However, complications like hemorrhage or failure of the procedure requiring CSF diversion can occur. Studies defining the steps to avoid complications and improving outcome are rare.

Materials and Methods: Consecutive cases of suprasellar arachnoid cysts (SAC) managed using endoscope in this tertiary care institute for the last 18 years were analysed in relation to surgical procedure performed and operative complications. Steps of surgery that might have contributed to development of complications were identified. Cases were followed up for long term outcome.

Results: 19 patients had undergone endoscopic management for SAC. Majority were of the pediatric age group (mean age 9 years), two were in their third decade. Raised intracranial pressure was the commonest presentation (15 cases). Classical Bobble head doll syndrome was seen in three cases. Developmental delay with regression of milestones was the presentation in seven cases, four patients had seizures. Ventriculocystostomy (VC - 3 cases), ventriculocystocisternostomy (VCC – 15 cases) and endoscopic transphenoidal decompression (1 case) were performed. Intraoperative hemorrhage was the commonest complication seen in three cases. One patient expired due to hypothalamic injury. CSF rhinorrhoea occurred in the patient who underwent transphenoidal surgery. With a mean follow up of 34 months (3 months to 120 months), majority of the patients were found to improve symptomatically. Two cases required ventriculo-peritoneal shunt. Endocrine dysfunction (hypothalamic) was seen in four patients.

Conclusions: Endoscopic management is recommended in the treatment of SAC, with a similar outcome following VC and VCC. Techniques to avoid peroperative hemorrhage like anterior fenestration of the basal cyst wall against the dorsum sella or clivus is demonstrated. Endocrine dysfunction has to be diagnosed and treated for optimum outcome.

Management of hydrocephalus in children: ETV or Shunt

Milind Sankhe (Mumbai, India)

ETV has been extremely successful in children above 2 years with obstructive hydrocephalus. The role of ETV in children less than one year of age with obstructive hydrocephalus has been debatable due to inconsistent results. The efficacy of ETV in infants with hydrocephalus is dependent on factors other than etiology.

The factors which may indirectly contribute to this outcome are:

a) Lack of pressure gradient between the intraventricular and the subarachnoid compartment due to lack of rigidity of the cranium.

b) The arachnoid granulations which are responsible for CSF absorption are poorly developed as yet.

c) Large head size in comparison to poorly developed neck and delayed head holding causes constant jugular pressure. This reflects intracranially in intravenous pressure reducing

the CSF absorption.
The insertion of V-P shunt is associated with complications of blockage, infection and revisions. Though shunts do need revisions and there are associated complications; shunts do have a role in management of hydrocephalus.
We compare the results and complications and suggest guidelines to the use of two procedures using the data available in the literature.

Endoscopic approach to the third ventricular colloid cyst located behind the foramen of Monro

Carlos Gagliardi, Cuello Luis Mariano, Viera Vanina, Escalada Guillermo A (La Plata, Argentina)

Introduction: The aim of this communication is to introduce a variation to the standard technique when approaching colloid cysts located posterior to the foramina of Monro, which has shown to be successful. As known the endoscopic approach to the third ventricular colloid cyst located behind the foramen of Monro is difficult because these lesions, attached to the tela choroidea of the ventricular roof, are virtually invisible through conventional approaches and attempts to reach them involve risk of injury to the fornices and other structures.
Clinical Case: We were consulted by a 42-year old male having seizures and headache. The patient has history of a failed transcallosal microsurgical approach as an attempt to remove a colloid cyst located behind the foramina of Monro, The brain CT scan revealed the presence of a homogeneously hyperdense round mass in the topography corresponding to the third ventricle. The MRI showed signs of a microsurgical transcallosal approach and a round, homogeneous intraventricular lesion attached to the tela choroidea, in the middle third of the roof of the third ventricle.

Choroid plexus coagulation: is it useful?

Jose Aloysio Filho, Leopoldo Mandic Furtado (Nova Lima, Brazil)

Introduction: The aim of this study was to analyse the different benefits of choroid plexus coagulation in various etiologies of hydrocephalus.
Methods: In this prospective study, choroid plexus coagulation was performed in patients between January of 2011 and December of 2012. The inclusion criterion was the presence of large ventricular dilatation with septum pellucidum agenesis on brain MRI: considered a predictor of choroid plexus bilateral visualization during neuroendoscopy – a must in order to coagulate the entire choroid plexus of the lateral ventricles. In this study we analyzed the following variables: patient distribution by age, gender, hydrocephalus etiology, procedure duration, length of hospital stay and mortality rate. As far as benefits are concerned, we considered the following: time without valve, hydrocephalus definitive treatment and head shape after the valve.
Results: Choroid plexus coagulation was performed in nine patients, three girls and six boys (67%). Among the hydrocephalus etiologies there were: Dandy-Walker syndrome in 1 case (0.11%), type II Chiari in 2 cases (0.22%), hydroanencephaly (0.11%), semilobar holoprosencephaly (0.33 %), and aqueduct stenosis with extreme hydrocephalus (0.22%). We had to implant the valve in all the cases of this series, and the mean time without the valve was 3 months.
Conclusions: The choroid plexus coagulation was effective for the temporary control of hydrocephalus, time gain until valve implant and better cranial cosmetic results after the valve implant.

Septal vein symmetry. Implications for endoscopic septum pellucidotomy

Jonathan Roth, Adelou Olasunkanmi, Kalman Rubinson, Jeffrey H. Wisoff (Tel Aviv, Israel)

Objective: Endosopic septum pellucidotomy is used for treating unilateral and certain types of bilateral hydrocephalus. The ideal location for the septostomy is controversial; however, an avascular region is preferred. As the septal veins (SV) are viewed only from one side, we studied the symmetry of the SV to try and define a safe area for a septostomy.
Methods: Sixteen cadaver brains were dissected. The septum pellucidum was exposed bilaterally, and was divided into three regions. SV of both sides were evaluated according to number, size, distribution, and location relative to common markers on both sides.
Results: Each side included 1-7 large veins (mean 2.3 ± SD 1.4), 0-3 small veins (2.05±1.73), and a total of 2-7 veins (4.35±1.53). 88% of the large veins were located in the anterior septal region (anterior to the foramen of Monro). Among the 10 brains that were extensively dissected, 90% had asymmetric septal veins (either in the number of large veins, or in the existence of any veins) in at least one of the septal regions. 50% of brains had asymmetric septal veins in the anterior region.
Conclusions: Distribution of the SV is asymmetric in most cases. We recommend performing a septostomy at the anterior area of the middle septal region, at the level of the foramen of Monro, mid-height between the corpus callosum and fornix. Careful evaluation of preoperative imaging, as well as thorough coagulation at the septostomy site are essential in preventing injury to a contralateral large septal vein.

Brain endoscopy as a primary treatment modality in hydrocephalus: an institutional experience

Charitesh Gupta (Dehradun, India)

Objective: The best option of therapeutic management of hydrocephalous is not always obvious. The neuroendoscopy has evolved and refined over past few decades and its sole role has replaced traditional shunts insertion in most of obstructive and non-obstructive hydrocephalus. The different endoscopic procedures were carried out to assess the therapeutic role of intracranial endoscopy.
Methods: Intracranial endoscopy was performed in 85 patients (55 male and 30 female patients) of varied etiology of hydrocephalus, over a period of 10 yrs. Mean age was 26 yrs (range 2 months-72 years). Their clinical, radiological and follow up data were studied retrospectively. The follow up of these patients ranged from 8 months to 7 yrs. Therapeutic outcome, complications and failure to alternate method were analyzed to validate results.
Results: Congenital hydrocephalus was most common etiology followed by chronic or post-meningitis pathology. Endoscopic third ventriculostomy (ETV) was carried out as a basic therapeutic technique together with adjunctive procedures like aqueductoplasty, choroid plexus cauterization, cyst or tumour removal etc. Only 8 patients did not respond to the endoscopic therapy hence ventriculo-peritoneal shunts (VPS) were inserted as an alternative. Transient intra and postoperative complications observed in 6 patients without any mortality.
Conclusion: ETV is very safe and reliable minimally invasive therapeutic option for all obstructive and most of communicating hydrocephalus. It should be considered as procedure of choice to restore cerebrospinal circulation. However, due high failure in patients younger than 6 months, shunt insertion may be opted at the initial outset.

Surgical simulator for intra-ventricular endoscopy

Vicknes Waran, Vairavan Narayanana, Ravindran Karuppiah (Kuala Lumpur, Malaysia)

Introduction: Endoscopy within the ventricular system has been increasing over the last 2 decades. It is a complex process requiring extensive training, both in time and resources. Ventricular neuroendoscopy, currently lacks an adequate simulation system to function as a surrogate to real time intraoperative learning. An ideal surrogate system should be anatomically and physically realistic. It should also allow the training of intraoperative procedures like navigation, fenestration and biopsy. Presently, the closest surrogate system widely available is cadavers. Unfortunately, learning endoscopy via cadavers is less than ideal due to the consistency as well as the inherent anatomical distortions of the cadaveric brain. Utilising a 3D printer, we have been able to create an accurate cranial-ventricular model based on actual patient data. In addition to allowing neuronavigation registration, the model allows access to a variety of neuroendoscopic procedure training like 3rd ventriculostomies and biopsies.
Aim: The aim of this study is to introduce the ventricular simulation system that we have developed and the experience of 3 neurosurgeons with this system.
Method: 3 customised models of a single patient with hydrocephalus were created via 3D rapid prototyping technique. The models were assessed for accuracy of registration and planning, tissue handling, anatomical accuracy, tactile feedback during a third ventriculostomy and overall experience by 3 experienced neurosurgeons.
Results: All 3 assessors found the cranial-ventricular simulation system very useful and an improvement on currently available teaching techniques. There were some concerns on tissue handling.
Discussion: The simulation system and results will be presented.

Endoscopic excision of colloid cysts: A 12 years institutional experience and description of a new technique

Sarat Chandra (New Delhi, India)

Context: The operative approaches for colloid cyst excision are varied with open microsurgical excision still considered the “gold standard”. Endoscopic removal of these cysts is gaining in popularity. We describe our experience with this technique in 79 patients treated over a period of 9 years at our centre and also describe a 2 port technique for gross total excision.
Aims: To document the efficacy and safety of the endoscope for colloid cyst excision.
Settings and Design: A retrospective study of all the subjects who underwent endoscopic colloid cyst excision at our centre between January 2000 and March 2012.
Material and methods: Patient records, radiological images and operative notes of endoscopically treated cases of colloid cysts were assessed. Follow up data for these cases including clinical and radiological details were retrieved.
Results: 59 cases underwent endoscopic surgery. Gross total excision of cyst (with small residual nubbin) could be achieved in 46 (78%) cases. Others underwent near total excision (15), partial excision (4) and cyst aspiration (1). A 2-port technique for achieving excision was used in 28 cases. There was 1 mortality due to fulminant meningitis. No recurrence was noted in our series (follow up till 99 months). 2 patients required VP shunt due to persistent hydrocephalus.
Conclusions: Endoscopic excision is a safe and efficacious,

minimally invasive method for colloid cyst removal. Even a subtotal excision of these slow growing cysts may be acceptable when experience with the endoscope is limited.

Development and content validation of performance assessments for Endoscopic Third Ventriculostomy (ETV)

Gerben Breimer, Faizal Haji, Eelco Hoving, Abhaya Kulkarni, James Drake (Toronto, Canada)

Introduction: With increasing expectations to objectively assess technical competence during residency, there is a clear need for standardized methods to teach and evaluate neuroendoscopic skills. Procedural checklists and global rating scales (GRS) are widely accepted methods for assessing surgical skill and enable evaluators to highlight tasks to be targeted during subsequent training. We describe the methodology for our development and content validation of multiple tools for evaluating performance of neurosurgical trainees on the ETV procedure.

Materials and Methods: The important aspects of ETV were identified through review of current literature, ETV videos, and discussion with senior pediatric neurosurgeons, fellows and residents. A procedural checklist was created, divided into Setup, Exposure, Navigation, Ventriculostomy, and Closure. A checklist of potential errors and a GRS were also developed. Nineteen recognized experts in ETV from various countries identified during literature review agreed to participate in an electronic Delphi survey, to establish content validity of these assessment tools by iterative consensus.

Results: Seventeen experts responded and graded each ETV step, error and GRS item using a Likert scale. The first Delphi iteration is complete. A rapidly emerging consensus has been noted, along with important additions, clarifications and suggestions for improvement. The second iteration is underway, with the expectation that consensus on all items will emerge within three rounds.

Conclusions: Following establishment of content validity, the assessment tools will be evaluated on a standardized ETV simulator to determine if they can distinguish trainees of different levels and skill. Ultimately an assessment tool for ETV training, evaluation and potentially certification will result.

Fidelity study of a new synthetic simulator for endoscopic third ventriculostomy

Gerben Breimer, Vivek Bodani, James Drake (Toronto, Canada)

Introduction: Endoscopic third ventriculostomy (ETV) is an effective but technically demanding procedure with significant risk. Current simulators including human cadavers, animal models and virtual reality systems are expensive, relatively inaccessible and can lack realistic sensory feedback. We have constructed a realistic low cost, reusable brain simulator for ETV and evaluated it for fidelity.

Materials & Methods: A brain silicone replica mimicking normal mechanical properties of a 4-month-old child with hydrocephalus was constructed, encased in the replicated skull and immersed in water. Realistic intraventricular landmarks included the choroid plexus, veins, mammillary bodies, infundibular recess, and basilar artery. The thinned out third ventricle floor which dissects appropriately, is quickly replaceable. Standard neuro-endoscopic equipment including irrigation is used. Bleeding scenarios and tumor biopsies are also incorporated. The simulator was tested for fidelity by means of questionnaires (5-point Likert-type items) with 16 neurosurgical trainees (PGY 1-6) and 9 pediatric and adult neurosurgeons.

Results: The simulator is portable, robust, and sets up in minutes. Over 95 % of participants agreed or strongly agreed that the simulator's anatomical features, tissue properties and bleeding scenarios were a realistic representation of that seen during an ETV. Participants stated that the simulator helped develop the required hand-eye coordination and camera skills, and was a valuable training exercise.

Conclusion: A low-cost reusable silicone-based ETV simulator realistically represents the surgical procedure to trainees and neurosurgeons. It can develop the technical and cognitive skills for ETV including dealing with complications.

Insertion technique for small ventricle using new endoscopic sheath and stereotactic frame

Ryuhei Kitai, Masamune Kidoguchi, Takahiro Yamauchi, Kenichiro Kikuta, Hidetaka Arishima (Fukui, Japan)

Introduction: Endoscopic surgery in cases involving small ventricles is difficult. A neuroendoscopic sheath that has been improved to make it suitable for use with a Leksell stereotactic frame, which enabled us accurately insert a stereotactic needle into the small ventricle and provided an adequate surgical corridor.

Methods: A commercially available peel-off transparent sheath (Neurosheath; Medikit, Japan) was improved. The original sheath was composed of a thin polypropylene outer tube and an obturator. The obturator contained a pore of 1 mm in diameter and was widened to fit the Leksell stereotactic needle. We adopted this new endoscopic sheath for 3 patients that was, one was lymphoma in the third ventricle, 2 were pineal germ cell tumor without hydrocephalus.

Result: Leksell stereotactic frame and an intraoperative

CT scan could be ensured that the neuroendoscopic sheath was precisely cannulated. The trajectory should follow a line composed of three points: the target area of the lesion, the space under the massa intermedia, and the center of the foramen of Monro, and this line was extended to obtain the entry point at the level of the skull. An accurate transcortical intraventricular puncture was performed according to the direction indicated by the stereotactic frame. Biopsies of those tumors were diagnostic. There were no complications during procedure.
Discussion: Using this optimized system, this co-axial cannula could be introduced like a conventional brain needle, using stereotactic techniques to reach the targeted small ventricle accurately. It was essential that the rigid-rod endoscope was straight when they were introduced into the third ventricle through the transparent endoscopic sheath that had been passed through the narrow foramen of Monro. We are confident that the use of this stereotactic neuroendoscopic positioning system is safer for cases involving small ventricles.

Colloid cysts

Si Saber Mohamed, Bouyoucef Kheireddine (Blida, Algeria)

Introduction: The colloid cyst of the third ventricle is histologically benign tumor. The contrast between its benign histology and risk of morbidity, mortality and open surgical exploration of the intervention of its resection, has led many surgeons to opt for minimally invasive surgical approaches.
Materiel & Methods: From July 1994 to March 2012, 45 patients underwent surgery for colloid cysts by endoscopic approach in first intention. Neuronavigation is used whenever the ventricular system is small.
Results: They were 45 patients, 34 males and 11 females, their ages ranged between 13 and 74 years (mean age: 37 years).The most common symptom was headache in 37 patients (82%), nausea and / or vomiting (20%), impaired eye fundus with decreased visual acuity (51%) and convulsive seizures. Resection was complete in 37 (82%). Morbidity was observed in 6 patients (13%), 2 meningitis and 4 patients had transient memory disorders. There was no mortality.
Discussion: The use of endoscopy is recommended due to a reduction in the operative time, the low rate of complications related to a smaller cortical incision, and a lower risk of a seizure disorder, and therefore a shorter hospital stay and reduced cost. As for the quality of total or near-total resection in different series of the literature, it seems that is possible (64.9% of evaluable cases).
Conclusion: Endoscopic resection of colloid cysts of the third ventricle allows the total possible ablation with a very low permanent morbidity and no mortality.

Endoscopic interventions in pediatric intracranial cystic lesions

SS Dhandapani (Chandigarh, India)

Introduction: Endoscopic interventions though much successful in adults have mixed results in children with intracranial cystic lesions. This was to evaluate our initial experience with 19 cases of cranial endoscopy in children with various cystic lesions.
Materials and Methods: Children with intracranial cystic lesions who underwent various endoscopic procedures were studied in relation to clinico-radiological profile, surgical method employed, intra-op findings, post-op course and complications.
Results: Of the 19 cases, 10 had intraventricular cysts, 6 had Dandy Walker cysts, 3 had arachnoid cysts. The various procedures adopted in these patients, prognostic factors and their outcome will be discussed. Most had satisfactory recovery, 4 had persistent arrested hydrocephalus not requiring any treatment, 2 required shunt, 1 developed asymptomatic external hydrocephalus, 1 developed subdural hygroma which improved with repeat tappings, 1 developed meningitis which improved with antibiotics, and 1 had third nerve paresis.
Conclusions: Endoscopic interventions in pediatric intracranial cystic lesions is challenging with good results. Post-op clinical improvement is more important than near normal imaging.

Flexible neuroendoscopy an useful adjunct to rigid neuroendoscopy in management of hydrocephalus

Subodh Raju (Hyderabad, India)

Introduction: The conventional rigid neuroendoscope though most widely used for management of hydrocephalus has its limitation in areas which is not in straight line of the operative field. A flexible endoscope in the armamentarium renders an added advantage in management of hydrocephalus due to its manouverability into areas where rigid endoscope cannot be passed.
Material and Methods: A retrospective analysis was done for the period 2007 to 2013 for 210 cases which underwent neuroendoscopy for the management of hydrocephalus. Flexible neuroendoscope was used as an adjunct in 18 cases and was considered useful.
Results: Flexible neuroendoscope was used for performing transforaminal translaminaterminalis 3rd ventriculostomy in 8 cases of hydrocephalus where it was not feasible to perform the same through the floor of the 3rd ventricle due to various pathologies. Out of these 8 cases, 6 were successful. Transaqueductal decompression of 4th ventricular arachnoid cyst by cystoventriculostomy/

cystocisternostomy was performed in 5 cases. Two cases of trapped 4th ventricle were also dealt with in a similar fashion. In 3 cases of multiseptate hydrocephalus, multiple septostomies were possible due to the use of flexible endoscope and then a shunt was placed. There were no major intraoperative or postoperative complications except a minor contusion at fornix in case of translaminaterminalis 3rd ventriculostomy.
Conclusion: Flexible endoscope is a useful adjunct in selected cases of hydrocephalus not amenable to rigid endoscopy where in the manoeuvrability of the same for reaching the target causes minimum collateral damage as compared to rigid endoscope. This also can be used through the same sheath and same burr hole.

Endoscopic intraventricular surgery: a beginner's perspective of first 20 cases
Madhukar Nayak (Mangalore, India)

Introduction: Intraventricular neuroendoscopy is rapidly emerging as a safe, effective and viable alternative to conventional CSF diversion procedures like shunt tube placement. Technical challanges and learning curve are major issues from a beginner's perspective in intraventricular neuroendoscopy, the safety profile of which has been analysed by the author.
Materials and Methods: The author presents his experience of first 20 cases of Intraventricular Neuroendoscopy which included aqueductal stenosis [4], X - linked congenital hydrocephalus [1], post-meningitic hydrocephalus [4], intraventricular arachnoid cyst [1], frontal arachnoid cyst [1], pineal tumour with hydrocephalus [1], aneurysmal rupture with IVH [1], Primary Neonatal IVH [1], Hypertensive IVH with Hydrocephalus [1], cerebellar infarct with hydrocephalus [1], cerebellar metastasis with IVH [1], shunt malfunctioning with hydrocephalus [1], post-traumatic SAH with hydrocephalus [2].
Results: Patient outcome was evaluated in terms of improvement in sensorium, motor power, Ant fontanelle tension, Head circumference, postop imaging [CT- reduction in ventricular size, MRI - Flow voids at the floor of 3rd ventricle on T2 Sag images].
Conclusion: Intraventricular Neuroendoscopy is a safe, effective and viable alternative to conventional shunt and other open procedures. From a beginner's perspective, thorough understanding of anatomy, technical aspects and meticulous execution of every step especially a watertight closure and regular followup is essential in providing a good outcome.

Preoperative Endoscopic Third Ventriculostomy in children with posterior fossa tumors: an institution experience
Waleed Azab, Tarek Mohammed Al-Sheikh, Ahmed Yahia Abdelrahman (Kuwait)

Objective: To assess the effectiveness and safety of pre-resection endoscopic third ventriculostomy (ETV) in permanently relieving hydrocephalus in children with posterior fossa tumors.
Methods: 17 pediatric patients with posterior fossa tumors and associated triventricular obstructive hydrocephalus underwent ETV before definitive tumor resection, and ETV was repeated after tumor resection if hydrocephalus with increased intracranial pressure persisted or recurred. The medical records, operative notes and imaging studies were retrospectively reviewed.
Results: 18 ETV procedures were performed in 17 patients, 11 males and 6 females, age range (1.5 to 13 years; mean 6±3.86). Follow up periods ranged from 6 to 23 months (mean follow up 13.9±5.4). ETV was successful in relieving hydrocephalus during the follow up period in 15 out of 17 patients (88.2%). Prior to surgical excision of the posterior fossa tumors, no failures of ETV were detected and all of the 17 patients showed marked clinical improvement and radiological disappearance of signs of active hydrocephalus.
Conclusions: Preoperative ETV is a highly effective long term CSF diversion procedure for treatment of hydrocephalus associated with posterior fossa tumors in children. In experienced hands, ETV has a very low complication rate.

Long-term results of endoscopic third ventriculostomy: An outcome analysis
Sonja Vulcu, Leonie Eickele, Giuseppe Cinalli, Joachim Oertel (Homburg, Germany)

Background: The endoscopic third ventriculostomy (ETV) presents the procedure of first choice in the therapy of obstructive hydrocephalus. The excellent clinical and radiological success rates are notorious.
Objective: Nevertheless, big patient series regarding the long-term outcome are lacking. The authors present a large case series with 113 patients undergoing 126 endoscopic third ventriculostomies and highlight the initial postoperative outcome after three month and long-term follow-up with an average of seven years.
Methods: All patients which received ETV at the department of neurosurgery in Mainz between 1993 and 1999, were evaluated. Obstructive hydrocephalus was the causative pathology in all cases.
Results: Initial clinical success rate was 82% and decreased slightly to 78% during long-term follow-up. Overall, ETV

failed in 31 patients. This collective received second ETV or shunting. A positive impact on long-term success was seen for age older than six month, obstruction due to cysts, tumor or benign aqueductal stenosis and a high preoperative Karnofsky-Index. The complication rate reached 9%. All complications were transient.
Conclusion: The high clinical success rate in short-term and long-term follow-up confirms the ETV's status as gold standard in obstructive hydrocephalus, especially for distinct pathologies. The patient's age, underlying pathology and Karnofsky-Index may influence the outcome and they should be considered carefully by the surgeon.

The value of endoscopic reventriculostomy in obstructive hydrocephalus

Sonja Vulcu, Leonie Eickele, Joachim Oertel (Homburg, Germany)

Background: The endoscopic third ventriculostomy (ETV) is the gold standard in the therapy of obstructive hydrocephalus. The initial excellent clinical and radiological outcome rate is notorious. Under current controversial discussion is the need and effectiveness of reventriculostomy.
Objective: The authors evaluated a large patient series focussing on the effectiveness of reventriculostomy and highlight the inital and very long term outcome.
Methods: One-hundred-thirteen patients underwent a total of 126 ETVs at the department of neurosurgery in Mainz between 1993 and 1999. Obstructive hydrocephalus was the causative pathology in all cases.
Results: Thirty-one events of failure after ETV occurred during short and long term follow up. Thirteen patients underwent reventriculostomy, i.e. three patients during the first three months, other ten patients after 7 to 78 months (mean 33 months). Other 18 patients received shunt implantation. All reventriculostomies were performed without any complications. Long term evaluation after successful reventriculostomy ranged from 2 months up to 14 years (average 7 years). Long term success rate of successful reventriculostomy after 3 months yielded 80%.
Conclusion: Regarding these statistics it can be advocated that reventriculostomy in a careful patient selection is of value and furthermore effective. The choice to perform re-ETV or implant a shunt system is based on surgeon's preference and of course on the radiological findings.

Endoscopic treatment of arachnoid cyst of the fourth ventricle. First case report

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Introduction: Arachnoid cysts occurrence within the fourth ventricle is particularly uncommon. In a recent review eleven cases have been reported. Shunting procedures were performed, but did not afford long-term improvement of symptoms. Definitive treatment consisted of open resection of the cyst-wall. To the best of author's knoweledge till to date no pure endoscopic treatment is reported.
Materials & Method: a 72-year-old woman with a large arachnoid cyst within the fourth ventricle was admitted at the Neurosurgery-Neurotraumatology Unit of University Hospital of Parma, Italy. A six-months history of psycotic dysfunction was reported, with onset of progressive cerebellar signs three months before admission. A MRI showed massive enlargement of the fourth ventricle by an intraventricular arachnoid cyst, mild enlargement of ventricles with signs of transependymal absorption visible as high T2 signal on MRI or low density. The MRI analysis of cerebrospinal fluid flow velocities showed absence of flow void at the aqueduct, enlarged at the T2 w sequences. The patient underwent one right frontal burr hole for two-steps endoscopic approach, with magnetic neuronavigation technique. The first step was an endoscopic third ventriculostomy, then a transaqueductal cyst fenestration, with diode laser was performed.
Results and Conclusions: One month postoperative CT scan showed a reduction of ventricles and cyst diameters. The patient showed a partial recovery of the cerebellar signs, with reduction of psychotic dysfunction. This reported case is the first pure endoscopic treatment of a fourth ventricle arachnoid cyst. The enlargement of the aqueduct may allow a safe and effective fenestration of the superior wall of cyst. The third ventriculostomy enable the CSF outflow in the basal cysterns. The neuronavigation could be useful to tailor the best approach to reach two targets with one entry-point. This treatment could be an alternative choice to the complete excision of the cyst.

Endoscopic intraventricular surgery in infants and toddlers a beginner's perspective of first 6 cases

Madhukar Nayak (Mangalore, India)

Introduction: Intraventricular neuroendoscopy in Infants is a unique challenge in itself not only due to the technical aspects but also considering the unique and fragile hemodynamics of an infant/ toddler.
Materials and Methods: The author presents his operative video clips of initial experience [4 infants, 2 toddlers] of intraventricular neuroendoscopy for various indications like aqueductal stenosis [3], post-meningitic hydrocephalus [2] and primary intraventricular hemorrhage [1]. He demonstrates the small but significant details like multilayered pedicled flap opening and closure, postop

management and follow up.
Results: 5 out of 6 [4 infants, 1 toddler] had a favorable outcome in terms of reduced head circumference, improved psychomotor milestones and stoma patency on postop imaging
Conclusion: Intraventricular neuroendoscopy is a safe, effective and valuable tool for treatment of CSF pathway obstruction in infants and toddlers, even in the initial part of the learning curve. Thorough understanding of the fragile hemodynamics in infants/toddlers, technical aspects of surgery with meticulous execution of every step especially a good watertight closure, and a good team support from a Paediatrician/ Neonatologist/ Paediatric Nurse is essential for good overall outcome.

Endoscopic Third Ventriculostomy (ETV) with Choroid Plexus Cauterization (CPC) in Infants with Hydrocephalus: a retrospective Hydrocephalus Clinical Research Network (HCRN) study

Abhaya Kulkarni, Jay Riva-Cambrin, Samuel Browd, James Drake, Richard Holubkov, John Kestle, David Limbrick, Arlene Rozzelle, Tamara Simon, Mandeep Tamber, John Wellons III, William Whitehead for the HCRN (Toronto, Canada)

Introduction: The use of ETV with CPC has been advocated as an alternative to CSF shunt in infants with hydrocephalus. There are limited reports of this procedure in the North American population, however. We provide a retrospective review of the ETV+CPC experience within the HCRN.
Methods: All children (<2 years old) who underwent an ETV+CPC at one of 7 HCRN centers before November 2012 were included. Data was collected retrospectively through review of hospital records and the HCRN registry.
Results: Thirty-six patients were included (13 with previous shunt). The etiologies of hydrocephalus were: 9 intraventricular hemorrhage of prematurity, 8 aqueductal stenosis, 4 myelomeningocele, and 15 other. There were no major intra-operative or early post-operative complications. There were 2 post-operative CSF infections. There were 2 deaths unrelated to hydrocephalus and 1 death from seizure. A total of 18 patients failed ETV+CPC at a median time of 30 days after surgery (range 4-484 days). The actuarial 3, 6, and 12 month success for ETV+CPC was 58%, 52%, and 52%. Near-complete CPC (>90%) was achieved in 11 cases (31%) overall, but in 50% (10/20) of cases in 2012 versus 6% (1/16) cases before 2012 (p=0.005). Failure was higher in children with <90% of the choroid plexus cauterized (hazard ratio=4.39, 95% CI=0.999 to 19.2, p=0.0501).
Conclusions: Our early North American multicenter experience with ETV+CPC in infants demonstrates that the procedure has reasonable safety and efficacy in selected cases. The degree of CPC achieved might be associated with a surgeon learning curve and appears to affect success.

Endoscopic Third Ventriculostomy: Analysis of factors associated with failure of the procedure

Carlos Gagliardi, Luis Mariano Cuello, Vanina Viera, Guillermo Escalada (La Plata, Argentina)

Introduction: Endoscopic third ventriculostomy (ETV) has become the procedure of choice for the treatment of obstructive hydrocephalus. Nevertheless, success rates vary significantly among different reports. Ventriculostomy failure has been defined as the necessity for a subsequent surgical procedure due to persistence or recurrence of symptoms of intracranial hypertension.
Material and Methods: Fifty-five publications concerning failure rates for ETV and physiopathological issues were reviewed. Risk factors were listed and analyzed.
Results: Age < 6 months, specially < 1 month, and prematurity were recognized as predictors of poor results; this was attributed to the immaturity of the LCR absorption mechanisms and insufficient development of arachnoid granulations. Patients with Chiari malformation were good candidates for ETV for treatment of hydrocephalus, but the resolution of syringomyelia seemed to require permeability of the subarachnoid space (SAS) dorsal and ventral to the brainstem. Myelomeningocele was associated with high failure rates when ETV was performed in newborns because of incomplete development of the SAS. Intracranial hemorrhage and infection were strong predictors of poor results in the few months following the event, but not later. Secondary neoplastic compromise of the CNS was associated with failure of the procedure, presumably because of reactive or infiltrative changes in the SAS. Technical issues, such as ostomy size and presence of secondary membranes are discussed.
Conclusions: The success of ETV for the resolution of hydrocephalus resides in the correct diagnosis of pure obstructive hydrocephalus, and the presence of a well-developed SAS. Advances in the knowledge of CSF production, circulation and absorption will lead to better selection of surgical candidates.

Management of hydrocephalus in posterior fossa tumors. When is ETV indicated? Is it safe? Is it easy?

C. E. Gagliardi, L. M. Cuello, V. Viera, G. A. Escalada (La Plata, Argentina)

Introduction: Treatment of hydrocephalus in posterior fossa tumors is still a matter of controversy and different centers have their own protocols. Patients with increased ICP

associated with posterior fossa tumors may be considered to have two different diseases: hydrocephalus and the tumor itself. The management of such hydrocephalus may be done by preoperative drainage or ETV. Other possibility is to perform the extirpation of the tumor, making the hydrocephalus treatment only in the patients with persistent hydrocephalus.
Material and Methods: We analyzed our experience and complications in the management of hydrocephalus in patients with posterior fossa tumors, and compared it with the publications of different authors.
Results: One of the more important facts is that all the consulted information concludes that nearly 80% of the patients operated for extirpation of posterior fossa tumors are free of shunt, and that a number of the shunted patients had malresorptive hydrocephalus related with hemorrhage and other circumstances that affects the normal CSF reabsorption. In addition, ETV in these patients has many technical difficulties, for instance, the basilar artery and its branches usually is pressed against the clivus and the ventricular floor, increasing the risk of vascular damage, we operated a patient in whom the basilar artery was herniated through the ventriculostomy due to posterior fossa hypertension.
Conclusion: We conclude that in the patients in condition to be operated, direct tumor extirpation is the best alternative, followed if necessary of shunt placement or ETV when indicated. When ICP is very high and complications related with hydrocephalus are predicted, ventricular drainage is a safer technique than ETV before the tumor resection.

Role of neuroendoscopy in the comprehensive management of hydrocephalus
Ramesh Teegala (Eluru, India)

Introduction: Endoscopic third ventriculostomy (ETV) has gained popularity and widespread acceptance during the past few years. Along with the ETV other endoscopic procedure like aqueductoplasty, septostomy, cysto-ventriculostomy, endoscopic guided stenting play a role in complex intraventricular pathologies causing the hydrocephalus. Despite of best efforts, overall success rates of ETV in unselected hydrocephalus fall below the 60%. Role of Neuroendoscopy and other CSF diversion procedures were discussed.
Material and Methods: All the cases of hydrocephalus presented to our department over last six years where neuroendoscopy was used at least once in the management were included in this study. Hydrocephalus was managed according to the departmental protocol. Along with ETV many other endoscopic and open procedures like VPS (Ventriculo-Peritoneal Shunt), VSG (Ventriculo-subgaleal) Shunt, Omaya chamber placement.
Results: Between December 2006 and June, 2013, a total of 152 Neuroendoscopy procedures were carried out. The ages of the patients ranged from one month to 62 years and the average follow-up period was 15 months. Primary ETV was done in 87 patients as a first procedure. In 30 cases ETV was done as a second procedure after the failed VP shunt. In 10 cases, ETV was done following the VSG (Ventriculo-subgaleal) shunt which was done as intermediate procedure in infected newborn hydrocephalus. In 11 cases, redo ETV was done following the failed primary ETV. In 3 cases, along with ETV, aqueductal stenting was done for trapped fourth ventricle. Other procedures were carried in 11 cases.
Conclusions: The results indicate that ETV is a most effective treatment in cases of obstructive hydrocephalus. In complicated hydrocephalus, endoscopy has significant role. Most of ETV failures occur within 3-4 months after surgery.

Reversing the third ventriculostomy
Milind Sankhe (Mumbai, India)

Endoscopic Third Ventriculostomy (ETV) has become the standard of care for patients with obstructive hydrocephalus. The procedure allows the cerebrospinal fluid (CSF) to bypass the obstruction at the third ventricular outlet or the fourth ventricular outlet. The aim is to allow the CSF to flow freely in the subarachnoid space (SAS) and eventually get absorbed. We present a concept of diverting the flow of CSF into the SAS by placing a simple catheter allowing communication between the third ventricle and the cranial SAS.

Neuroendoscopy applied magnetic neuronavigation in the treatment of complex hydrocephalus and intracranial cysts in a prospective study with 14 patients
Jose Aloysio Filho, Leopoldo Mandic Furtado (Nova Lima, Brazil)

Introduction: Conventional endoscopic navigation in complex hydrocephalus is very difficult due to distortion of the normal anatomy and the neurosurgeon's difficulty in recognizing the structures. Magnetic neuronavigation could be a valuable tool helping the procedure.
Material and Methods: In this prospective study of patients operated from January 2011 to December 2012 we analyzed all complex hydrocephalus and intracranial cysts operated with neuronavigation coupled with neuroendoscopy. We evaluated the following variables: patient distribution in age, gender, hydrocephalus etiology, type of endoscopic procedure employed, morbidity rate, surgery duration and mean hospital stay. We took off this study all those patients

submitted to conventional neuroendoscopy.
Results: We performed 21 surgical procedures in 14 patients. They had the same gender distribution and mean age of 7 years. The isolated fourth ventricle was observed in 2 patients (14.3%); complex hydrocephalus in 8 cases (57%); Dandy Walker syndrome in 2 cases (14.3%) and arachnoid cyst in 2 cases (14.3%). Brain shift impacted the efficacy in a procedure (0.2%). There was no mortality.
Conclusions: Magnetic neuronavigation associated with neuroendoscopy seems to have increased the efficacy and safety of endoscopic procedures in the population studied.

Outcome of Endoscopic Third Ventriculostomy in a paediatric population

Vivek Josan, Poxon J, Ramirez R, Thorne J
(Manchester, UK)

Introduction: We evaluated the results of ETV in a paediatric population, with specific focus on success rates in different etiologies of childhood hydrocephalus and at different ages.
Methods: A retrospective analysis of 81 ETVs performed in 73 paediatric patients from January 2008 to May 2013 was carried out. We recorded the etiology of the hydrocephalus, success rate, and the patients' age. Success was defined as no further need of a CSF diversion.
Results: Ages ranged from 6 weeks to 17 years. ETV was successful in 62% cases. The three most common etilogies were intracranial tumours (38%), aqueductal stenosis (13%) and IVH (12%). Their success rates were 58%, 82% and 60% respectively. Patients under the age of 1 had the lowest success rate by age at 40%. The majority of failures occurred within the first month after the procedure (60%). No deaths resulted from the procedure. There were 5 complications, 2 abscesses along ETV tract, 1 haemorrhage, 1 internal capsule injury and 1 cerebral peduncular injury.
Conclusion: This study found no statistically significant variance in success rates with regards to either cause of hydrocephalus or age of patient. The study suggests that there may be no need for a lower age limit for ETV procedures. With a 62% success rate and a low complication rate of 6.1%, the benefits of a minimally invasive procedure suggest ETV is a suitable first line treatment in the management of hydrocephalus in the paediatric population.

Initial learning curve in Endoscopic Third Ventriculostomy: First year experience

Vijay Parihar, YR Yadav, Yatin Kher, Shailendra Ratre
(Jabalpur, India)

Aim: To present the first year experience of endoscopic third ventriculostomy (ETV) by young faculty.
Material and Methods: Author starts doing independent neuroendoscopic surgery in same institute after working with an experienced senior neurosurgeon for three years. The Institute is a tertiary care hospital well known for its neuroendoscopic training. Twenty eight (28) patients (age rages from 1 month to 40 years) with hydrocephalus of various etiologies were treated with standard ETV with one year follow up.
Results: 19 patient relieved their symptoms, 2 required revision, 3 patient converted to EVD intraoperative due to not able to make perforation in third ventricle floor later converted to shunt, one patient died due to intraoperative fatal bleed and one died of meningitis.
Conclusion: The learning curve for endoscopic third ventriculostomy can be reduced with training and experience. The surgeon can achieve better outcomes, reduced morbidity and mortality after careful selection of cases depending upon his experience.

ETV as a first treatment for hydrocephalus post posterior fossa tumors

Hassan Kadri (Dubai)

22 patients suffering from hydrocephalus due to an obstruction of the fourth ventricle by a posterior fossa tumor on the midline have undergone an ETV as a first procedure. The age ranged between 10 months and 11 years. The follow up were between 3 and 15 months. All patients had a brain CT and MRI before surgery, a CT after ETV and an MRI after tumor removal. The efficacy of the ETV was estimated clinically (disappearance of headaches, vomiting, VI nerve palsy) and radiologically (reappearance of cerebral sulci and the Sylvian fissure disregarding the ventricular volume). One patient (10 months old) died suddenly after the ETV due to a probable upward herniation. One patient had a hemorrhage during the ETV and received a temporary external drainage. The removal of the tumor was achieved completely in 20 patients and one patient died from other complications. The ETV was considered successful in 16 patients. 4 out of the 20 alive patients (20%) received a V.P. shunt after both ETV and Craniotomy. Compared with a group of 9 patients treated immediately by craniotomy {1 death from acute hydrocephalus, 2 V.P. Shunts inserted urgently (22%) } we think that the ETV should be performed in all patients suffering from non communicating hydrocephalus due to midline posterior fossa tumors, but surprisingly this procedure has no significant superiority in term of success rate term the VPS.

Endoscopic third ventriculostomy (ETV) in the management of CSF shunt dysfunction in hydrocephalus. Surgical outcomes in 127 patients with different etiologies

Flavio Giordano, Barbara Spacca, Federico Mussa, Pierarturo Donati, Lorenzo Genitori (Firenze, Italy)

Introduction: Despite many reports advocating ETV for CSF shunt dysfunction, its efficacy is still debated and the frequent abnormal anatomy makes it sometimes worrisome. Surgical results and technical notes are discussed in this presentation.
Materials and Methods: Since 1994 to 2012, 127 patients were admitted for VP shunt dysfunction: 61 females, 66 males; mean age 12 years. Average age at previous shunt surgery was 4,2 years. 109 out of 127 patients underwent ETV (85,8%), coupled with EVD in 15 cases (11,8%). Two and one cases respectively had redo-ETV after previous attempts (1,6%) and ETV plus cyst fenestration with (0,8%). VP-shunt were always removed whenever possible. In two cases ETV was aborted and converted to VP-shunt revision surgery due to distorted anatomy (1,6%). In the post-operative period 16 patients underwent ETV revision (12,6%) followed by definitive VP shunt in five cases while 34 subjects had directly a new VP shunt (26,8%). Lumbar puncture and cranial expansion were performed in 18 (14,2%) and 3 (2,4%) cases respectively. Surgical mortality occurred in one child with spina bifida due to acute hydrocephalus at admittance (0,8%). Morbidity accounted for 5.7% due to intraoperative bleeding (3), aborted ETV (2), wrong trajectories (2) with brainstem damage in one patient without permanent neurological sequelae. Average follow-up was 3,5 years (8 mos - 13,2 yrs). At last control 89 out of 127 patients were shunt-free (70,1%); best results were achieved in aqueductal stenosis (88,9%) and myelomeningocele (82,1%).
Conclusions: ETV may be a safe tool to manage VP shunt dysfunction with significant number of shunt-free patients (70,1%). The abnormal anatomy due to long-lasting VP shunting requires an adequate learning curve to avoid potentially fatal morbidity.

Endoscopic third ventriculostomy for the management of adult communicating hydrocephalus

Madoka Nakajima, Masakazu Miyajima, Hajime Arai (Tokyo, Japan)

Objective: This study aimed to assess our experience in communicating hydrocephalus (CH) cases treated by ETV and try to define categories of patients for which ETV might be useful.
Methods: Our criteria for surgery were as follows: MRI showing ballooning of the floor of the third ventricle and presenting with headache or the so-called NPH-like symptoms such as impaired walking, impaired torso balance, and cognitive function decline. Twenty patients (aged 40–75 years) with communicating hydrocephalus underwent ETV; The CSF dynamics of the prepontine cistern and cerebral aqueduct were checked using Time Slip before and after the ETV; in all patients with poor CSF flow in the prepontine cistern, the trabeculae there were also exposed and penetrated during the ETV.
Results: ETV was successful in all patients without major complications. Image findings showed that the main types of CH for which ETV was useful were (1) types with suspected functional cerebral aqueduct stenosis in which the lateral ventricle was significantly expanded and (2) types where the cerebrospinal fluid spaces of the posterior cranial fossa were expanded and the prepontine cistern had apparently poor CSF dynamics. The symptoms were successfully improved in at least 90% of patients, but in 2 patients, even though the symptoms improved after ETV, NPH-symptoms reappeared despite the confirmation of ample fenestration during follow-up. In such cases, CSF shunting succeeded in improving the symptoms.
Conclusion: Although ETV has positive effect on the ventricular / cisternal pressure gap, caution must be exercised when the procedure is considered as the treatment for CH, because ETV provided only temporary effect on symptoms, and NPH-like symptoms re-appeared over time.

Ventricular anatomical variations as a determinant of successful Endoscopic Third Ventriculostomy in childhood hydrocephalus

Mahmood Qureshi, David Oluoch-Olunya, Ben Okanga (Nairobi, Kenya)

Introduction: Successful ETV for childhood hydrocephalus remains a desired goal. However there remains uncertainty regarding its efficacy when childhood hydrocephalus is being treated in children below the age of 6 months. Conclusions have been drawn suggesting that ETV should not be considered in children below the age of six months.
Materials and Methods: The presentation outlines the variations encountered in a series of 32 children with hydrocephalus who underwent neuroendoscopic ventriculostomy. The varieties resulted in shorter operative times in children with no variant findings and prolonged times in children with variant endoscopic findings. This translated into increasing difficulties in successfully performing the ventriculostomy.
Results: There is evidence that ETV is successful in children even below the age of six months. Given the variations encountered, a Grading system is proposed, referred to as

the African Federation of Neurosurgical Societies (AFNS) Grading system graded between Grade 1 to Grade 5. There is a relationship between a lower Grade, shorter operating time and successful ETV, with higher Grades taking longer and more likely not to be successful.
Conclusions: Age below 6 months may therefore not necessarily be a contraindication to treatment with ETV. The AFNS Grade of hydrocephalus, reflecting the worsening ventricular anatomical variations, is likely to determine success of ETV in childhood hydrocephalus.

The role of endoscopic third ventriculostomy in the treatment of hydrocephalus in adult and pediatric patients; analysis of 283 cases
Hemant Bhartiya, Vivek Kumar Vaid (Jaipur, India)

Introduction: Endoscopic third ventriculostomy, when indicated and applicable, is the preferred minimally invasive alternate treatment to shunt surgery for the management of hydrocephalus. The results are fairly good and predictable and avoid insertion of foreign material in the brain with its related complications. This procedure is also readily acceptable to the patients and their attendants.
Material and Methods: A total of 283 patients, of both adult and pediatric age group, suffering from hydrocephalus, undergoing endoscopic third ventriculostomy, over a period from April 2000 to July 2013 were retrospectively analyzed. These included patients with congenital hydrocephalus, post infectious hydrocephalus, hydrocephalus due of posterior fossa lesions, or posterior third ventricular and thalamic lesions, normal pressure hydrocephalus and other miscellaneous causes.
A thorough analysis of their clinical and radiological features with particular emphasis on surgical aspects as well as complications faced was done.
Results: It was observed that the results were good and predictable in posterior third ventricular lesions, posterior fossa lesions, and congenital aqueductal stenosis. In post infectious and post hemorrhagic, the results were less favorable with successful outcome in approximately 20 percent. In children below the age of one, again the results were unfavorable and unpredictable probably due to altered CSF circulation and absorption.
Conclusions: Endoscopic third ventriculostomy essentially normalizes the CSF dynamics in patients with non-communicating hydrocephalus. Even in select patients with communicating hydrocephalus, the results are predictable and favorable. This procedure is minimally invasive with minimal complications and in experienced hands with good patient selection, the results are very encouraging. More so it is readily acceptable to the patients and should be offered as the first line of management to all the patients with hydrocephalus.

Normal pressure hydrocephalus: selection criteria for neuroendoscopic management
Michele Naddeo, Nikolaos Paidakakos, Barbara Massa Micon, Silvana Borgarello (Turin, Italy)

Introduction: Both our personal experience and the review of the literature confirm the difficulty in identifying diagnostic and prognostic tests with high predictive value and accuracy for normal pressure hydrocephalus (NPH). The aim was to assess and propose a selection algorithm that identified probable endoscopie third ventriculostomy (ETV) responders, thus allowing for endoscopie management of NPH,and shunt independency.
Materials and Methods: 44 NPH patients (21 male, 23 female, mean age 72). Tap test, infusion testing, Hauser Ambukatory test annd MMS were performed. Technique selection was made according to the gradient between lumbar and ventricular Rout values, following the proposed diagnostic algorithm.
Results: 68.2% of patients presented a favorable outcome. Similar qualitative results were obtained by both shunt surgery and ETV,after careful patient selection.
Conclusions: ELD is an invaluable tool for selecting probable responders, regardless of type of treatment. It should be administered in every NPH patient, in order to piace an indication for surgery in the first piace. Outflow resistance testing can be exploited to identify candidates for endoscopie management. Its use is based on the pressure gradient formed between the ventricles and the lumbar theca, but the hydrodynamic principles behind it stili need to be cleared, and cannot be explained by the old bulk flow theory. Instead, if we consider communicating hydrocephalus as a defect of intracranial compliance, ETV would reverse this phenomenon by reducing intraventricular pulse pressure and transmantle pressure gradient.

Hydrocephalus: Personal recommendations
Si Saber Mohamed, K.A.Bouyoucef (Blida, Algeria)

Hydrocephalus is a condition with multiple aspects, scalability is capricious and its surgical treatment is not always easy. The goal treatment for hydrocephalus is standardization of the disturbed CSF dynamics, resulting in a state of ''Arrested hydrocephalus". Typically neuroendoscopic ventriculostomy is indicated for treatment of hydrocephalus in cases of non-communicating hydrocephalus", involving hydrocephalus due to a blockage located in the CSF. However, in some cases, especially in children, secondary hydrocephalus caused by infection, hemorrhage & spina bifida; ETV is controversial. During the period 1994-2013 almost two thousand endoscopic procedures (1903) were performed in our department, among which 1110 ETV;

will be discussed the usual & unusual indications for ETV in the treatment of hydrocephalus and the complications, risks and pitfalls to avoid. We report the analysis of results obtained by the treatment of hydrocephalus by ETV associated with coagulation of the choroid plexus (396 cases) that we regard as an alternative, waiting the futures studies and a better understanding of hydrocephalus and the CSF dynamics will help us to create protocols to treat specific forms of hydrocephalus.

Subgaleal ventricular-subarachnoid stenting in newborns with posthemorrhagic hydrocephalus

Oleg Volkodav, S. Zinchenko (Simferopol, Ukraine)

Pediatric neurosurgery actual task is the liquoro-dynamic correction due to secondary post-hemorrhagic hydrocephalus combined non-traumatic (spontaneous intraventricular-subarachnoid hemorrhage) and traumatic genesis. Newborn post-hemorrhagic hydrocephalus neurosurgical treatment method was suggested and special ventricular-subarachnoid stent was invented and proved (Certificate in Copyright Law, pattern № 45865 from 02.10.2012, Ukraine). Eighteen emergency neurosurgical operations to newborns with post-hemorrhagic hydrocephalus were performed with minimal gestation 25-26 weeks. It's algorithm including subgaleal (subcutaneous) ventricular-subarachnoid drainage with following shunting via ventricular-subarachnoid stent to restore the physiological liquor circulation. Post-operative quantity criteria include: neurological anamnesis, ophhtalmoscopy, enolase (S-100 protein) laboratory blood figures, neuro-imaging (neurosonography, brain CT-scan and MRI). Subgaleal ventricular-subarachnoid drainage (Certificate in Copyright Law, pattern № 34523 from 11.08.2010, Ukraine) via ventricular-subarachnoid stent support primary effective liquor purification from blood (simultaneous ventricles and subarachnoid space). Following ventricular-subarachnoid shunting (Certificate in Copyright Law, pattern № 38061,20.04.2011, Ukraine) support effective liquor outflow from lateral ventricles to subarachnoid space for it physiological reabsorption. Subgaleal ventricular-subarachnoid stenting let to reduce the need for ventricular-peritoneal shunting with shunt-dependend condition and high risk of dysfunction and decrease time of recovery treatment.

Ventricular-subarachnoid stent for intracerebral hemorrhage treatment in newborns

Oleg Volkodav, Zinchenko S.A., Onitchenko Z.V., Namirovskaya A.A. (Simferopol, Ukraine)

Newborn intra-cerebral hemorrhage high fibrinolytic activity with altered spontaneous hemostasis in the hematoma region lead sometime to it invasion with lateral ventricle and subarachnoid space communication (i.e. porencephalus). Newborn intracerebral hematoma surgical treatment method was suggested and proved (Certificate in Copyright Law, patent № 38063, 20.04.2011, Ukraine). It's algorithm including porencephalus model after hematoma removal with simultaneous effective purification from blood ventricles and subarachnoid space and further physiological liquor circulation via invented ventricular-subarachnoid stent (Certificate in Copyright Law, patent № 45865 from 02.10.2012, Ukraine). Ten emergency neurosurgical operations were performed to the newborns with intra-cerebral hematomas. Indications to the surgery are: rough hemisphere compression by the hematoma with midbrain dislocation more than 5mm, basal cistern deformation, homo-lateral ventricle compression with contra-lateral hydrocephalus. Neuro-imaging: neurosonography, brain CT-scan and MRI. After adequate intra-cerebral hematoma decompression special drainage from ventricular-subarachnoid stent input to hematoma cavity for external liquor purification hematoma remnant and it communication with ventricles and subarachnoid space. Following ventricular-subarachnoid shunting pure liquor from the hematoma cavity after external drainage removal let to reduce the multifocal occlusive hydrocephalus risk and improve newborns rehabilitation.

MRI morphometric measurements of the third ventricle in children with hydrocephalus due to aqueductal stenosis treated with ETV

Vassilios Tsitouras, Spyros Sgouros (Athens, Greece)

Introduction: Aqueduct stenosis causing hydrocephalus represents the clearest model of an obstructed third ventricle, without any other confounding anatomical factors, not-withstanding the age issue. The purpose of this study was to examine possibly significant differences of specific MRI measurements of the third ventricle in patients with hydrocephalus due to aqueduct stenosis.

Materials and Methods: We examined the immediate preoperative MRI scans of 8 patients that underwent an ETV procedure for aqueductal obstruction. A DICOM image analysis software was utilized and five measurements were chosen. The distance from the floor of the third ventricle to the anterior commisure (dI) and the upper most point of the forniceal curvature (dII), the total area of the 3rd ventricle on a midline sagittal view (mm^2), the volume of the ventricle as examined in the same view (cm^3) and the width of the 3rd ventricle on an axial cut.

Results: Five patients had aqueductal stenosis, two had midbrain tumors and one had a thrombosed vein of Galen

malformation (VGM). The ETV was successful in six children and failed in two. The median age of the children that failed was 2,5 months and for the successfully treated was 57,5 months. The mean values of four measurements (dI, dII, volume and area) were higher in the cases of successful ETV with the area difference reaching statistical significance (p: 0,018). Interestingly, the mean width of the third ventricle was higher in the patients with failed ETV (p: 0,264).
Conclusions: The morphology of the third ventricle in children with hydrocephalus due to obstruction of the aqueduct and successful ETV treatment seems to be different from those in whom ETV failed. The larger the area of the third ventricle in a mid-sagittal MR image the higher the chance of success.

Increased failure rates of ETV for persistent hydrocephalus after posterior fossa tumor removal in children. Preliminary results and possibly contributing factors

Vassilios Tsitouras, Georgia Papaioannou, Spyros Sgouros (Athens, Greece)

Introduction: Endoscopic third ventriculostomy is a recognized treatment option for hydrocephalus due to a posterior fossa tumor. Hydrocephalus after tumour removal represents a different model from aqueduct stenosis from the point of view of ETV, as the obstruction has been removed. The purpose of this study was to examine differences of specific MRI measurements of the third ventricle in such patients.
Materials & Methods: Several parameters of patients that underwent an ETV for hydrocephalus after posterior fossa tumour removal were examined: the failure rate (need for VP shunt), sex, age, tumor type (high grade – low grade), tumor location (midline – lateral), degree of hydrocephalus (mild – moderate – severe) and measurements of the third ventricle on MRI scans (area on a midline sagittal view and the width on an axial view).
Results: The median age of the cohort was 40,5 months (7months – 14 years). Seven of the ten (70%) patients who had ETV eventually needed a VP shunt, within two weeks from ETV. In these 7 failures, 5 were female, 5 had a high grade tumor, and in 5 the tumor had a midline location. In addition, all the 5 patients with severe hydrocephalus failed. The mean age of the failed group was 45,3 months and of the success group was 81,3 months (p: 0,167). The mean area and the mean width of the third ventricle were higher the failed group than in the success group (683,4 mm2 vs 529,8 mm2 – p: 0,092 and 18,1 mm vs 7,1 mm – p: 0,001 respectively).
Conclusions: High failure rates of ETV were encountered in children treated for persistent hydrocephalus after PFT resection. No significant contributing factors were found in this small group but high grade tumors with midline location were more suspicious. ETVs in patients with larger third ventricles tended to fail more frequently.

Bilateral endoscopic intraventricular lavage : improving survival and shunt independence among infants with pyogenic ventriculitis

Azmi Alias, Mohammed Saffari, Mohammed Haspani (Kuala Lumpur, Malaysia)

Introduction: Pyogenic ventricultis is a rare manifestation of severe intracranial infection and associated with high mortality.
Objectives: To describe endoscopic treatment and outcome of 8 infants (14 days to 12 months old) with pyogenic ventriculitis who underwent bilateral endoscopic transfrontal intraventricular lavage at Department of Neurosurgery, Hospital Kuala Lumpur, Malaysia from August 2008 to September 2011. Typical radiological features of pyogenic ventriculitis such as dilated ventricles, presence of ventricular debris and contrast enhancing ependyma were present.
Technique: Bilateral transfrontal inventricular approach was done using rigid, 0 degree, 6.4mm diameter endoscope from Aesculap (MINOP). An Inverted U-flap incision is made to accommodate a burr hole placed at precoronal-midpupillary position, started on the side with most dilated lateral ventricle. Endoscopic examination of the lateral ventricle is done followed by intermittent aspiration of the pus and debris using a modified infant feeding catheter. Similar procedure is repeated on the opposite side. An average of 3L of Ringer's Lactate solution is used for irrigation via gravity feed until clear return. Attempt made to remove the intraventricular debris as much as possible under endoscopic visualization with precaution not to damage the underlying ependyma. Either Ommaya reservoir or External Ventricular Drainage is inserted into one side of the lateral ventricle at the end of procedure and all infants received 4 – 6 weeks of intravenous antibiotics.
Results: All infants survived and recovered well. Four (50%) remained shunt independent while another 4 (50%) subsequently underwent VP shunt. No specific complication related to the procedure.
Conclusion: Bilateral endoscopic transcranial transventricular lavage is safe and effective in treating selected infants with pyogenic ventriculitis. It promotes faster recovery and improves outcome by immediate clearance of the CSF, minimize future risk of adhesions / septations and reduced shunt dependency.

Change in optic nerve sheath diameter is a sensitive radiological marker of ETV outcome

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(Cape Town, South Africa)

Introduction: The clinical response of pediatric patients after an ETV to treat non-communicating hydrocephalus, remains quite varied. Various radiological features correlating with ETV outcome have been described, but there remains a distinct group of patients with subtle clinical symptoms, in which the outcome of the procedure remains uncertain.
Methods: We performed a retrospective review to identify whether a change in the optic nerve sheath diameter (ONSD) as measured on T2 axial imaging provided a useful radiological marker of ETV outcome. Pre-operative and post-operative imaging (acquired within 3 months of the procedure) was available for all subjects included in the study. The ONSD in both eyes was measured and the average of the two was compared with other imaging features of ETV outcome, viz. change in ventricular size, morphology of the third ventricular floor, change in subarachnoid CSF volume around the cortex, patency of the stoma and CSF flow across the stoma. These were then correlated with clinical assessment of ETV outcome.
Results: The MRI imaging in 25 patients was adequate to measure and compare the ONSD with ETV outcome. The mean change in ONSD in the successful ETV group was 1.38 ± 0.3, compared with a mean change in ONSD of 0.9 ±0.32 in the ETV failure group (p=0.002).
Conclusion: Change in ONSD is a sensitive independent radiological marker for ETV outcome, and appears more useful when combined with traditionally accepted radiological features of ETV outcome.

Efficacy of non-contrast-enhanced Time-Spatial Labeling Inversion Pulse (time-SLIP) method in treatment of congenital central nervous system anomalies

Osamu Akiyama, Madoka Nakajima, Kazuaki Shimoji, Masakazu Miyajima, Hajime Arai (Tokyo, Japan)

Background: Recently, non-contrast Time Spatial Labeling Inversion Pulse (time-SLIP) method, a new sequence of magnetic resonance (MR) imaging has been developed to investigate the movement of cerebrospinal fluid (CSF). We have applied this imaging method to evaluate surgical indications and postoperative assessment in congenital anomalies relating in CSF circulation disorders.
Methods: We reviewed patients who had been treated for CSF circulation disorder and evaluate with time-SLIP between 2010 and 2012.
Results: During this period, 10 hydrocephalus, 3 Chari type 1 malformations, 3 arachnoid cysts, and 1 craniosynostosis were treated. In hydrocephalus, we had focused on those who underwent endoscopic third ventriclostomy (ETV). It is well known that T2 heavy weighted image is important to evaluate the patency of the stoma. Time SLIP method could add a dynamic image of the movement of the CSF going back and forth through the stoma. In Chiari type 1 malformation, it was possible to visualize the improved CSF movement around the cisterna magna. In arachnoid cysts, this method was able to visualize the CSF movement between the cistern and the cyst through the fenestration performed with the neuroendoscope.
Conclusions: In each case time SLIP method was able to visualize dynamic flow of the CSF and provided important information. This method is a less invasive examination which can repeatedly be used without contrast enhancement media. This Time-SLIP method is an efficient way to evaluate children with CSF circulation disorders.

Intraventricular neuroendoscopic lavage aka as brain wash in neonates presenting with posthemorrhagic hydrocephalus. What it is and for whom is it for?

Christoph Wiegand, Christoph Greiner, Niels Sörensen
(Osnabrück and Würzburg, Germany)

Material and Methods: We report a series of n= 15 children with occlusive and / or posthemorrhagic hydrocephalus from 2010 to present having undergone post partal neuroendoscopic lavage. All children had previous serial ultrasound and / or MRI scan. Posthemorrhagic hydrocephalus ranged from matrix bleeding grade II-IV. The youngest was 2 days, the oldest 4 months old. We used a rigid Minop 30 degrees endoscope with a big peel away catheter, irrigating 37 degrees Celsius warm ringer solution using monitor controlled irrigation pressure between 10 to 20 mmHg. Frontal ventricles were localised via ultrasound and punctured transfontanellar by a 5 mm peel away catheter (Braun/Melsungen). As the intraventricular approach was either left or right frontal all of them received a Rickham device at the end of surgery for emergency tapping. In all procedures septostomy was done as well as potentially obstructive membranes were perforated such as foramen of Monro obstruction and/or aqueductal stenosis when endoscopically accessible. A partial both sided choroid plexus coagulation was done when feasible. A major amount of blood and cell detritus was removed reducing CSF protein amount as well. All procedures were complication free (no infection / no bleeding from plexus) from the technical point of view. Otherwise all children even so under very careful pediatric anaesthetic monitoring woke up in delayed fashion, 5 of them with seizures lasting

until the following day. All grade III-IV posthemorrhagic children needed a VP shunt as suspected but were ready to be shunted the following postoperative week; 3 children suffering from grade II posthemorrhagic HCP made a shut free recovery.
Conclusion: This minimally invasive technique to clean the CSF is secure and easy to perform but needing an experienced team of neurosurgeons and intensivists/ anaethetists. The substitution of CSF by irrigation with Ringer's solution is not yet precise enough as these small children suffer from electrolyte changes ranging from postoperative seizures and pathologic eye movements. Of course not all them become shunt free in the clinical setting, but are much more early able to be shunted. We therefore encourage an international study for neonates with brain wash.

The accuracy of endoscopically assisted ventricular catheter placement in children
Wiegand Christoph, Christoph Greiner, Niels Sörensen (Osnabrück and Würzburg, Germany)

Material and Methods: We report a series of n= 43 patients with non-occlusive hydrocephalus from 2008 to 2010. The youngest was 2 months, the oldest 14 years old. Most of the catheters were placed occipitally, a minor rate was done from Kocher`s point. Only a few of them received Rickham devices for posthaemorrhagic or chemotherapeutic reasons. Occipital or frontal ventricles were localised via ultrasound and punctured by a 3 mm peel away catheter (Braun/ Melsungen). When intraventricular the inner tube of the catheter was removed and a 2 mm 30 degree optic (Aesculap Minop 2) was introduced and the outer layer was then endoscopically guided either to Foramen of Monro (frontal route) or forwarded to the frontal horn entering the ventricle from Frazier`s burr hole. All procedures were complication free (no infection / no bleeding from plexus). All catheters were controlled postoperatively either with ultrasound or CT scan and showed high accuracy with no malpositioning.
Conclusion: In conclusion this minimally invasive technique is secure and easy to perform, showing the point of entry as well as the final catheter position avoiding intraventricular lesion by guiding the peel away catheter endoscopically above the plexus choiroideus. In general terms even postoperative CT scan can be withdrawn avoiding obsolete radiation for children. In difficult Chiari scenarios were ventricular catheter placement with slit ventricles might be difficult and tricky this is a precise procedure under accurate endoscopic visualisation.

An unusual case of third ventriculostomy failure
Corrado Iaccarino, Antonio Romano, Vania Ramponi, Edoardo Viaroli, Franco Servadei (Parma, Italy)

Introduction: As the number of endoscopic third ventriculostomy procedures increase, new rare complications are encountered. The authors present a complication caused by absorbable haemostatic gelatin sponge that migrated into the third ventricle. In literature two cases of bone particles and one case of gelfoam migration has been reported.
Matherials & Methods: A 48-year-old man was admitted at the Neurosurgery-Neurotraumatology Unit of University Hospital of Parma with a 2-month history of progressive headache. Brain computed tomography (CT) scan and magnetic resonance imaging revealed an obstructive hydrocephalus due to aqueductal stenosis. The patient underwent endoscopic third ventriculostomy with no intraoperative complications. A thickened Lillequist's membrane was observed. As usual, at the end of endoscopic approach a strip of absorbable haemostatic gelatin sponge is placed along the superficial intraparenchymal path of the endoscope. No bone particles are left in the burr hole. Postoperative CT scan demonstrated a slight reduction of ventricles size with no other pathological findings. Because of a postoperative fever, several lumbar punctures were performed after the brain CT scan to eliminate meningitis as a differential diagnosis. After the lumbar punctures, the patient complained of severe headache and depression of consciousness. An urgent reexplorative endoscopic procedure was performed, and an obstruction of the stoma of the third ventricle floor by the absorbable haemostatic gelatin sponge was observed.
Results and Conclusion: The sponge was removed and the patient recovered with complete resolution of the previous symptoms after surgery. It is thought that the negative pressure gradient generated after the lumbar puncture might have been transmitted through the cerebrospinal fluid pathway, resulting in a suction effect and migration of the gelatine sponge from the intraparenchymal endoscopic path to the ventricle. After this case the authors suggest to avoid usage of gelatine sponge for hemostatic purpose and sealing of intraparenchymal endoscopic path.

Endoscopic third ventriculostomy (ETV)
Madoka Nakajima (Tokyo, Japan)

Objective: Endoscopic third ventriculostomy (ETV) is established as the treatment of choice in cases of non-communicating hydrocephalus. Further, in recent years, ETV has been successfully used for mitigating symptoms of communicating hydrocephalus in a number of cases. However, no clearly defined criteria are available for

selection of such cases in which ETV might be useful, and this has been a topic of debate. This study aimed to assess our experience in communicating hydrocephalus cases treated by ETV and try to define categories of patients for which ETV might be useful.
Methods: Our criteria for surgery were as follows: sagittal MRI showing downward displacement (ballooning) of the floor of the third ventricle and presenting with headache or the so-called normal pressure hydrocephalus (NPH)-like symptoms such as impaired walking, impaired torso balance, and cognitive function decline. Twenty patients (aged 40–75 years) with communicating hydrocephalus underwent ETV; a VISERA ventricular videoscope (OLYMPUS VEF TYPE V) was used to perform the procedure. The CSF fluid dynamics of the prepontine cistern and cerebral aqueduct were checked using Time Slip before and after the ETV; in all patients with poor CSF flow in the prepontine cistern, the trabeculae there were also exposed and penetrated during the ETV.
Results: ETV was successful in all patients without major complications. Image findings showed that the main types of communicating hydrocephalus for which ETV was useful were (1) types with suspected functional cerebral aqueduct stenosis in which the lateral ventricle was significantly expanded and (2) types where the cerebrospinal fluid spaces of the posterior cranial fossa were expanded and the prepontine cistern had apparently poor CSF dynamics. The symptoms were successfully improved in at least 90% of patients, but in 2 patients, even though the symptoms improved after ETV, NPH-symptoms such as impaired walking reappeared despite the confirmation of ample fenestration during follow-up. In such cases, cerebrospinal fluid shunting succeeded in improving the symptoms.
Conclusion: Although ETV has positive effect on the ventricular/cisternal pressure gap, caution must be exercised when the procedure is considered as the treatment for adult communicating hydrocephalus, because ETV provided only temporary effect on symptoms, and NPH-like symptoms re-appeared over time.

Endoscopic third-ventriculostomy. Review of 100 cases

Jamil Farhat Neto, Américo Rubens Leite dos Santos, José Carlos Esteves Veiga (Sao Paulo, Brazil)

Introduction: The neuroendoscope is currently used for the treatment of various conditions, and its main indication is the treatment of obstructive hydrocephalus by endoscopic third-ventriculostomy (ETV).
Material and Methods: A retrospective study of 100 patients who underwent ETV in the period of May 2004 to July 2011.
Results: Of 100 patients, 52 were male and 48 were female. The age ranged from 1 month to 83 years of life (average of 24years and 6 months). More than 50% of patients had obstruction at the level of the cerebral aqueduct(aqueductalstenosis,tumorsofthebrainstem).The procedure was successful, without the need for new approaches to the use of the shunt system ventricular in 88.3%. All patients had ventriculostomy patency in the study of flow of magnetic resonance. The postoperative complications occurred in 15 patients due to meningitis and / or cerebrospinal fluid leak associated with a mortality of 4%, and 2 patients already had meningitis prior to surgery.
Conclusions: The Third ventriculostomy has been increasingly established as the method of choice in cases of obstructive hydrocephalus, especially in cases where the obstruction site is easily identified on MRI. ETV in the patients studied showed to be a surgical minimally invasive and maximally effective treatment of obstructive hydrocephalus.

Endoscopic intervention for the fourth ventricular neurocysticercal cyst – What should be the optimum therapeutic approach?

Manish Ranjan, Subhas Kanti Konar, Sampath S, B Indira Devi, B A Chandramouli (Bangalore, India)

Objective: Fourth ventricular neurocysticercal cyst (FVNCC) usually presents with acute hydrocephalus, requiring surgery. Though endoscopic intervention is preferable, there is no consensus on the method and/or the extent of endoscopic intervention. We share our experience of endoscopic intervention for FVNCC and propose an algorithm of management.
Method: We reviewed the clinicoradiological details of consecutive patients, who underwent endoscopic intervention for the FVNCC at our institute from 1998-2009. Details of cyst excision, endoscopic intervention(s), CSF diversion (internal and external), complications and the outcome were analyzed.
Results: There were twenty one patients. Cyst could be totally excised in thirteen patients, while two patients had only partial excision of cyst. Excision of cyst could not be done in five patients due to ependymitis/adhesion, IVH and poor visibility of CSF due to hazy CSF. These patients underwent only ETV. Three patients had only cyst excision, as the sole endoscopic intervention, while 12 patients underwent ETV along with excision. Two patients had symptomatic periaqueductal injury with partial recovery (one each with rigid and flexible scope). The mean available follow up was 22 months. Shunt was avoided in 90% of patients. All patients who are available for follow up are asymptomatic, irrespective of the type of endoscopic intervention and extent of cyst excision status.

Conclusion: Relieving the acute symptomatic hydrocephalus by endoscopic internal CSF diversion (ETV) should be the primary therapeutic goal. Cyst excision (partial or total) should be attempted, only where feasible. The rigid scope is safe and satisfactory for the endoscopic intervention for FVNCC.

Quadrigeminal arachnoid cyst: How good is endoscopy?

Vivek Tandon, Ashish Suri, P. Sarat Chandra, Rajinder Kumar, Bhawani Shankar Sharma (New Delhi, India)

Background: Surgical management options for rare lesions like quadrigeminal arachnoid cysts (QAC) include craniotomy and cyst excision or fenestration, cystocisternostomy (CC), ventriculocisternostomy (VC) and cystoperitoneal shunt (CP). Similar procedures can be performed endoscopically and successful treatment of QAC has been reported through this procedure as well. However, there is no consensus about the treatment of choice for such rare group of patients.
Methods: We retrospectively analysed 18 cases of QAC treated at our institute between 2002 and 2012. Age ranged from 29 days to 50 years. All the patients underwent CT and MRI of the brain. Cysts were classified into 3 subtypes based on MRI findings. Surgical intervention was carried out in all the patients.
Observations: Two patients (type 1) underwent endoscopic third ventriculostomy (ETV) (alone) and 4 patients underwent ventriculoperitoneal shunt placement primarily. Craniotomy and cyst wall excision along with VC and CC was done in 3 patients with type 2 cysts. Endoscopic fenestration of cysts was done in 7 patients with type 3 cysts. Two patients with type 3 cysts underwent only endoscopic VC and CC without ETV. In 4/11 (36%) cases where endoscopy was primarily attempted procedure related morbidity was observed. In comparison to this morbidity was higher in craniotomy and shunt group [2/3 (66%) and 2/4 (50%) respectively]. There was no mortality in our series. The follow up period ranged from 6 months to 48 months.
Conclusions: We believe that endoscopic fenestration of cyst with cystocisternostomy or cystoventriculostomy when combined with third ventriculostomy is the procedure of choice for such patients. We do not recommend placement of solitary ventriculoperitoneal shunt. Operative re-exploration should be planned only after proper clinico-radiological correlation and not on the basis of imaging findings alone, as sometimes the cysts fail to regress but symptoms improve.

Neuroendoscopy primary treatment modality for hydrocephalus- early experience

Bagathsingh Karuppanan (Madurai, India)

Aim and objectives: The best option of therapeutic management of hydrocephalus is not always obvious. Neuroendoscopy has evolved and redefined over the past few decades and its sole role has replaced traditional shunt insertion for obstructive and most of the non-obstructive hydrocephalus. The different endoscopic procedures were carried out to assess the therapeutic role of intracranial endoscopy.
Materials and Methods: Intracranial neuroendoscopy was performed in 25 patients (20 are male, 5 are female), of varied etiology of hydrocephalus over a period of 1 ½ years. Mean age was 27 years (range from months – 72 years). Their clinical, radiological and follow up data were studied prospectively. The follow up of these patients range from 1 month to 1 ½ years. Therapeutic outcome, complications, failure to alternate methods were analysed to validate the results.
Results: Congenital hydrocephalus was common etiology followed by posterior circulation infarct and hydrocephalus. Endoscopic Third Ventriculostomy (ETV) was carried out as basic therapeutic procedure together with adjunctive cyst removal, tumour removal, aqueductoplasty etc. Only 4 patients did not respond to endoscopic treatment hence ventriculoperitoneal shunt (VPS) was inserted as an alterative therapy. No intraoperative complication was observed. Transient postoperative complication was observed in one patient without any mortality.
Conclusion: ETV is very safe and reliable minimally invasive therapeutic option for all obstructive and most of the communicating hydrocephalus. It should be considered as procedure of choice to restore the cerebrospinal CSF circulation. However, failure in some patients younger than 6 months, multiloculated hydrocephalus, severe infection with altered third ventricle anatomy, for these cases shunt insertion may be opted at the outset.

Third endoscopic ventriculostomy: complications

Michele Naddeo, Nikolaos Paidakakos, Silvana Borgarello, Barbara Massa Micon (Turin, Italy)

Introduction: ETV is an established treatment for obstructive hydrocephalus. The aim of this study was to perform a systematic review of ETV complications.
Materials and Methods: A literature review was performed. The PubMed database was queried for the search terms “complications” and “outcome” and “ETV” and “neuroendoscopy”.
Results: The overall complication rate ranged from 6 to 20%. Overall failure rate was 10-50%, but long term

reliability is not adequately assessed in the literature. Most commonly encountered complications were: CSF leakage 1-6%, meningitis 1-5%, cranial neuropathies 1-2%, hemorrhage 1-3.6% (including intraventricular bleeding, postoperative hematoma, and basilar artery injury), seizures 0-1%, bradycardia and/or pressure instability 0-1%, fornix contusion 0-2% (confusion, memory deficits), wound infection 1-1.5%, various medical complications 2-9%. Hypothalamic injury and dysfunction (pathologic weight gain, diabetes insipidus, amenorrhea, and precocious puberty) ranged from 0-2%, but could be underestimated. Various case reports were also found that reported unusual complications (eg. Terson syndrome).Total mortality rates nevertheless ranged from 0 to 2%. Finally, a higher overall complication rate is reported for previously shunted patients.
Conclusions: The real incidence of complications is very difficult to estimate. Variation in rates among the various studies can be attributed to the different underlying hydrocephalus etiologies, indications for ETV, patient comorbidities, surgeon experience (complication rate decreases with surgical experience), and of course, as mentioned above, vigilance in reporting. Although the surgical risk of the procedure appears higher than that of shunt placement, the mid and long term complication rate of ETV is clearly lower.

Intraventricular Neoplasms

Endoscopic resection of intra-parenchymal brain tumours – a prospective study of a novel, bimanual, fully endoscopic technique

Laurent James Livermore, Erlick Pereira, Nicola Voets, Simon Cudlip, Puneet Plaha (Oxford, UK)

Introduction: Endoscopic resection of intra-parenchymal tumours has scarcely been reported. We present our prospective single centre study of fully endoscopic, bimanual resection of intra-parenchymal brain tumours.
Materials and Methods: Over a 21 month period (Dec. 2011-Aug. 2013), 49 endoscopic intra-parenchymal tumour resections were carried out on 47 patients (24F:23M). Data on peri-operative stay including surgical complications and neurological deficits and post-operative follow up was collected. Post-operative MRI or CT was performed to assess for residual tumour.
Using image guidance a 2cm mini-craniotomy and a 1-1.5cm cortical access corridor, lined with surgical patties, was created down to the tumour. A 30° Karl Storz endoscope was used to visualise the tumour cavity and bimanual resection was performed using standard microsurgical techniques.
Results: Mean patient age was 54 years (range: 23-75). 41 tumors were supra-tentorial (20 frontal, 15 temporal, 3 occipital, 1 parietal and 2 parafalcine) and 8 infra-tentorial. The mean tumor size was 44mm. There were 13 metastases, 23 glioblastomas, 8 WHO grade II – III gliomas, 3 meningiomas and 2 haemangioblastomas. Complete resection was achieved in 77% of metastases with >97% resection achieved in the remainder. Greater than 95% resection was achieved in 65% of glioblastomas and 75% of grade II – III gliomas. Complete resection was achieved in both haemangioblastomas. Only one patient had new post-operative neurological deficit, which has subsequently resolved. 57% of patients were discharged by day 2 post-operatively.
Conclusions: This is the largest series of fully endoscopic intra-parenchymal tumour resection published in the literature. The technique is unique compared to microscopic and other reported endoscopic techniques due to the lack of a rigid access corridor and the utilization of the 30° endoscope to allow maximal tumour resection through a minimally invasive approach. Our experience demonstrates that this endoscopic technique is feasible, safe and achieves good tumour resection.

Combined open microsurgical and endoscopic resection of hypothalamic hamartomas: technical note

Jonathan Roth, Marian M. Bercu, Shlomi Constantini (Tel Aviv, Israel)

Hypothalamic hamartomas (HH) are typically located within the vicinity of the third ventricle. They can be attached to the walls of the 3rd ventricle, within the inter-peduncular cistern (3rd V floor), and/or attached to the mamillary bodies and hypothalamus. Depending on their location, resection is performed either through the third ventricle, approaching from above, or via a fronto-temporal craniotomy (i.e. pterional or fronto-orbital), approaching from below. “Above” approaches typically include the transcallosal-anterior interforniceal approach, and recently, purely endoscopic approaches performed transforaminally.
We hereby present a combined open and endoscopic approach for resection of HH located within the third ventricle in two young girls with relatively small lateral and third ventricles. Following an inter-hemispheric, transcallosal approach and exposure of the right foramen of monro (FM), an endoscope was inserted through the FM, which enabled safe resection of the HH.
The main advantage of the combined approach is when the lateral and third ventricles are relatively small, making a

purely endoscopic approach more challenging and possibly riskier.

Aqueductal tumors – a unique entity
Jonathan Roth, Shlomi Constantini (Tel Aviv, Israel)

Background and aims: Pure aqueductal tumors differ from pineal region and tectal tumors, as they are epicentered within the aqueduct. However, these tumors are rarely described as a separate group, and are often gathered with pineal region and tectal tumors. We describe our experience treating patients with purely aqueductal tumors.
Methods: Data was retrospectively collected, and included presenting symptoms, treatment paradigm, surgical approaches, and outcome.
Results: Between January 2011 and January 2013 we treated 5 patients with aqueductal tumors. Ages at presentation were 11-35 years old. Four patients presented with hydrocephalic related symptoms, and one was incidentally found in an NF2 patient. All patients underwent an endoscopic third ventriculostomy, two undergoing a concomitant endoscopic biopsy. Two patients underwent resection, both via a trans fourth ventricular approach. Overall, pathologies were available for 4 patients: 2 ependymoma grade II, 1 GBM, and 1 low-grade glial tumor.
Conclusions: Aqueductal tumors are located within the aqueduct, and typically present with obstructive hydrocephalus. The primary treatment often includes an endoscopic third ventriculostomy combined with an endoscopic biopsy. Tumor resection may be done from below (through the fourth ventricle), or above (transchoroidal approach). Routine approaches to the pineal region (interhemispheric transplenial, occipital transtentorial, and supracerebellar infratentorial) may risk the tectal plate and may pose additional risk as opposed to approaches through the aqueductal openings.

Supra interthalamic adhesion approach to the pineal tumor
Nobuhito Morota (Tokyo, Japan)

Objective: A modified neuroendoscopic approach for pineal tumors was introduced.
Methods: A flexible neuroendoscope was inserted into the third ventricle following the standard procedure. ETV, if hydrocephalus was present, was performed in routine fashion before tumor biopsy. The scope was flexed and advanced into the space formed by the roof of the third ventricle and the interthalamic adhesion (ITA) (the massa intermedia). Surgical views of the tumor were compared with the standard infra-ITA approach.
Results: The supra-ITA approach was introduced in January 2013 and applied for three consecutive children with a pineal tumor by the end of June 2013. Under this new approach, the pineal tumor came in front of the neuroendoscopic surgical view and sufficient tumor specimen was obtained without difficulty in two children. Bleeding from the biopsy site fell on the floor of the third ventricle and the procedure was unaffected. No complications were observed after the surgery. Suboptimal ventricular entry of the neuroendoscope prevented application of the supra-ITA approach in one child, in whom the pineal tumor was biopsied using the standard infra-IHA approach.
Conclusion: The supra-ITA approach to pineal tumors appears technically feasible and provides a better neuroendoscopic surgical view compared with the standard approach.

The current status of therapeutic neuroendoscopy for paraventricular tumor in Japan
Masakazu Miyajima and Study Group for the current status of therapeutic neuroendoscopy for ventricular and paraventricular tumoristic lesions in Japan (Tokyo, Japan)

One hundred twenty three tumors of thalamus and basal ganglia (average age: 39.6, female: 56, male: 67) were analyzed retrospectively, selected from the 191 cases of paraventricular region tumor which underwent endoscopic surgery from 2005 to 2009. Tumor sizes were less than 2 cm; 13 cases (11%), 2 to 4 cm; 62 cases (50%), and more than 4 cm; 46 cases (37%). Tumor locations were subependymal; 66 cases (54%), destruction of ependyma; 28 cases (23%), and unknown; 26 cases (21%). Sites of biopsy were lateral ventricle; 69 cases, third ventricle; 43 cases, and thalamus; 31 cases. Preoperative MRI findings demonstrated heterogeneous intensity; 72 cases (59%) and homogeneous intensity; 48 cases (39%), then detected contrast enhancement; 99 cases (80%), vascular flow void sign ; 13 cases (11%), intratumoral hemorrhage; 8 cases (6%), and CSF dissemination; 12 cases (10%). 107 cases (87%) were able to be histological diagnosed. Histological diagnosis were impossible in 9 cases, and the 7 of the 9 cases were covered with ependyma. Histological diagnosis were in order of glioma; 78 cases (63%), malignant lymphoma; 17 cases (14%), germinoma; 8 cases (7%), and unknown histology; 15 cases (12%). 74 cases (60%) were complicated by hydrocephalus. As a treatment, ETV; 49 cases (66%), septostomy; 13 cases (18%), and shunt; 11 cases (15%) were carried out, and ETV were efficacious in 47 cases (96%). As for perioperative complications, intratumoral hemorrhage and intraventricular hemorrhage were detected in 8 cases. These preoperative MRI findings were all heterogeneous intensity, and contrast enhancement were detected in 7 cases. Histological diagnosis were anaplastic astrocytoma;

3 cases, astrocytoma; 2 cases, and unknown histological diagnosis; 3 cases. In these cases, DSA was carried out in 5 cases, and tumor stains were detected in 3 cases. ADL was decreased after surgery in 9 cases (7%), and the histological diagnosis, intratumoral hemorrhage, onset of new hydrocephalus, and dissemination were involved as causative factors.

Endoscopic management of intra and paraventricular tumors

Carlos Gagliardi, Luis Mariano Cuello, Vanina Viera, Guillermo Escalada (La Plata, Argentina)

Introduction: Intra and paraventricular tumors historically have been a formidable challenge for neurosurgery, related with their deep location, surrounded by eloquent brain areas. Endoscopic good visualization is possible due to their location inside the CSF ventricular system; the often-associated obstruction of the CSF pathway and ventricular enlargement offer the possibility of working in large spaces.
Material and Methods: From August 1995 to December 2012 we performed 987 endoscopic procedures in the ventricular system. From them, 334 were related with intra and paraventricular tumors.
Results: We performed ETV in 278 patients, with partial tumor resection and or biopsy. We achieved complete resection in 56 patients, including 42 colloid cysts.
Discussion and conclusions: While it is true that endoscopy does not allow complete resection of these tumors in all cases, we consider it a useful tool in the management of concomitant hydrocephalus and biopsies that can reach to histological diagnosis in order to define the need for other complementary treatments.

Complications of neuroendoscopic tumor biopsy

Yusuf Ersahin (Izmir, Turkey)

Introduction: Endoscopic tumor biopsy has being increasingly used in the management of intra-paraventricular tumors. Hydrocephalus associated with tumor can also be endoscopically treated, when possible. The aim of this study is to review the complications of the endoscopic tumor biopsy.
Materials and Methods: All patients who had undergone endoscopic tumor biopsy were retrospectively reviewed in terms of age, gender, tumor location and complications. All patients had hydrocephalus in varying degrees and magnetic resonance imaging (MR) scans prior to the surgery.
Results: Neuroendoscopic biopsy was performed in 79 patients ranging in age from 4.5 months to 70 years (mean 15.6 years). There were 29 female and 49 male patients. In 2 patients, endoscopic biopsy was non-diagnostic. In 2 of 20 patients who underwent open surgery following biopsy, histopathological diagnosis differed significantly from the first one. Intraoperative tumor bleeding, upward gaze palsy, diplopia, tumor bleeding and hemiparesis, somnolence, oculomotor nerve paresis, asymptomatic epidural hematoma, high fever and delayed tumor bleeding developed in 9, 3, 2, 1, 1, 1, 1, 1 and 1 patient, respectively. Intra and postoperative complications developed in 20 patients (25.3%). One of the patients (1.3%) died due to tumor hemorrhage 11 days after endoscopic tumor biopsy. Almost all postoperative neurological deficits were transient except for hemiparesis.
Conclusions: Neuroendoscopic biopsy can be performed in patients with intraventricular and paraventricular tumors with an acceptable morbidity and mortality. Obtaining biopsy specimens from different parts of the tumor may decrease the false pathological diagnosis.

Is endoscopic excision of colloid cyst a myth or reality?

Anand Balasubramaniam (Mumbai, India)

Objective: To analyse the clinical profile, complication and outcome of endoscopic excision of colloid cysts.
Materials and Methods: 30 patients with colloid cysts who underwent endoscopic excision from 2000-12 were analysed. Clinical presentation, intraoperative complications, postoperative complications and outcome of the procedure was analysed. Mean average follow up period was 60 months with a 70% follow up rate.
Results: Age group ranged from 11-51years (Mean: 31 yrs). Majority of patients had presented with raised ICP (82%), 14% had seizures with raised ICP with average duration of symptoms being 18.5 months. 2 patients (6%) had peroperative complication in the form of brisk hemorrhage. 2 patients had motor neurological deficit following injury due to procedure which improved later. 80% patients recovered without any post op complications. 20% had complications in the form of CSF leak, CNS infection. Success rate of the procedure was 94%. No recurrences have been encountered till date in the followed patients.
Conclusion: Endoscopic excision of colloid cysts has a good success rate with minimal complications.

Endocopic management of central neurocytomas of the posterior third ventricle

Soner Duru, Erhan Turkoglu, Askın Seker, Ibrahim Ziyal, Zeki Sekerci (Duzce, Turkey)

Introduction: Central neurocytomas (CN) are rare benign tumors of the central nervous system those are typically located in the lateral ventricles. CN occurs mostly in young adults around the 3rd decade of life. Posterior 3rd ventricular location is extremely rare event. Since they are typically intraventricular, these tumors tend to present clinically with hydrocephalus. Currently, surgical removal with a gross-total resection of these tumors is the treatment of choice. Endoscopic procedures can be useful remove intraventricular lesions.
Material and Methods: A 30 year-old man presented with headache attacks and blurry vision. His neurological examination was normal except slight papilledema. MRI revealed a tumor located in the posterior part of the 3rd ventricle and caused obstruction of the aqueduct. Endoscopic approach performed to the posterior part of the 3rd ventricle and subtotal resection of the tumor was done.
Results: Histopathological examination of the tumor revealed CN. Patient underwent gamma knife stereotactic radiosurgery due to residual part of the tumor. In the first postoperative year, patient was still doing well, and MRI revealed no hydrocephalus and minimal residual tumor.
Conclusions: The benign nature of these tumors tends to offer a favorable outcome for most patients; however, recurrence rates are relatively high and tumors with high-grade features or extra ventricular location tend to have a less favorable prognosis. Gamma knife stereotactic radiosurgery has been shown to be useful in cases of residual tumor after sub-total resection and tumor recurrence. Endoscopic approach to posterior 3rd ventricle provides maximum efficiency to remove the tumor with minimum invasiveness. Endoscope was utilized to provide better visualization of the tumor borders, neurovascular structures, and the feeding arteries of the tumor. Posterior third ventricle central neurocytomas are relatively benign tumors that can be successfully removed using a minimally invasive approach, thereby avoiding the morbidity related to conventional open craniotomy.

Endoscopic aspiration of a cystic midbrain tumour through the fourth ventricle

Spyros Sgouros, Vasilios Tsitouras (Athens, Greece)

Introduction: Cystic tumours of the midbrain can cause significant symptoms, and often cyst decompression is challenging. Endoscopic techniques can prove valuable.
Case Report: A 10-year-old boy presented with headaches, restriction of upward gaze, slurred speech and unsteady gait. At MR scan he had a well circumscribed midbrain tumour with a large solid part anteriorly protruding to the posterior 3rd ventricle, and a cystic part posteriorly, compressing the aqueduct and causing hydrocephalus. An endoscopic third ventriculostomy was carried out and a biopsy was taken from the part of the tumour protruding in to the posterior 3rd ventricle. The biopsy was not diagnostic. He was treated for a presumptive diagnosis of low grade astrocytomawith a LGG chemotherapy regime. Six months later the cystic part of the tumour enlarged posteriorly, protruding in to the cavity of the 4th ventricle, stretching its floor, causing deterioration of his symptoms. An endoscopic fenestration of the tumour cyst was performed through the 4th ventricle. Through an occipital burr hole the Storz flexible endoscope was advanced in to the cavity of the 4th ventricle. The bulging floor was perforated at the midlineand tumour cyst fluid emerged. The procedure was uncomplicated. A MR scan5 months after the aspiration the tumour cyst was significantly smaller. The solid part of the tumour had reduced in size somewhat.
Discussion: Endoscopic fenestration of cystic tumours protruding in to the 4th ventricle can be performed safely. Paying attention to remain at the midline, the risks of causing neurological damage remain low.

Minimally invasive endoscopic resection of intraparenchymal brain tumors - a prospective study of a novel, bimanual, endoscopic technique

Puneet Plaha, Laurent James Livermore, Nicola Voets, Stacey R, Simon Cudlip (Oxford, UK)

Introduction: Endoscopic resection of intraparenchymal tumors has scarcely been reported. The authors report an endoscopic minimally invasive, non-tubular technique to resect intraparenchymal brain tumors and assess the feasibility, safety and surgical resection margins achievable by this novel technique.
Methods: Over a 21 month period, 50 consecutive fully endoscopic intraparenchymal tumor resections were carried out on 48 patients. Data on surgical morbidity and mortality and length of stay was collected prospectively. Percentage of surgical resection and residual tumor volumes were calculated using pre- and post-operative volume CT or MR imaging. All tumors were resected through a 2 cm mini-craniotomy using an HD Karl Storz rigid endoscope with a 30 degree viewing angle. Bimanual resection was performed using standard microsurgical technique.
Results: Mean patient age was 53 years. 42 tumors were supra-tentorial (19 frontal, 17 temporal, 3 occipital, 1 parietal and 2 parafalcine) and 8 infra-tentorial. Mean tumor volume was 41cm3. There were 12 metastases, 24 glioblastomas, 4 WHO grade III gliomas, 5 WHO grade I–II gliomas, 3 meningiomas and 2 haemangioblastomas. On volumetric analysis the overall mean percent resection was 96%. Over 95% resection was achieved in 70% of cases with total resection being achieved in 48% of cases. There was one new post-operative neurological deficit and no

deaths at 30 days post-operatively.
Conclusion: This is the largest series of endoscopic intra-parenchymal tumour resection published in the literature. The technique is unique compared to microscopic and other reported endoscopic techniques due to the lack of a rigid access corridor and the utilization of the 30° endoscope to allow maximal tumour resection through a minimally invasive approach. Our experience demonstrates that this endoscopic technique is feasible, safe and achieves good tumour resection.

Clinical and neuroimaging outcomes of surgically treated intracranial cysts in 110 children
Kuhyun Yang, Eungung Lee (Korea, Seoul)

Objective: The indications and optimal surgical treatments for intracranial cysts are controversial. In the present study, we describe long-term clinical and neuroimaging results of surgically treated intracranial cysts in children. The goal of this study is to contribute to the discussion of the debate.
Methods: This study included 110 pediatric patients that underwent surgeries to treat intracranial cysts. Endoscopic cyst fenestrations were performed in 71 cases, while craniotomies and cyst excisions (with or without fenestrations) were performed in 30 patients. Cystoperitoneal shunts were necessary for 9 patients. Long-term results were retrospectively assessed with medical and neuroimaging records.
Results: Clinical and radiological improvement was reported in 87.3% and 92.8% of cases, respectively, after endoscopic neurosurgery, and in 93.3% and 100% using open microsurgery whereas 88.9% and 85.7% after shunt operation. There were no statistical differences in clinical outcomes (p=0.710) or volume reductions (p=0.177) among the different surgeries. There were no mortalities or permanent morbidities, but complications such as shunt malfunctions, infections, and subdural hematomas were observed in 56% of the patients that had shunt operations. A total of 13 patients (11.8%) underwent additional surgeries due to recurrences or treatment failures. The type of surgery performed did not influence the recurrence rate (p=0.662) or the failure rate (p=0.247).
Conclusion: Endoscopic neurosurgeries are less invasive than microsurgeries and are at least as effective as open surgeries. Thus, given the advantages and complications of these surgical techniques, we suggest that endoscopic fenestration should be the first treatment attempted in children with intracranial cysts.

Combined open microsurgical and endoscopic resection of hypothalamic hamartomas: technical note
Jonathan Roth, Marian M. Bercu, Shlomi Constantini (Tel-Aviv, Israel)

Hypothalamic hamartomas (HH) are typically located within the vicinity of the third ventricle. They can be attached to the walls of the 3rd ventricle, within the inter-peduncular cistern (3rd V floor), and/or attached to the mamillary bodies and hypothalamus. Depending on their location, resection is performed either through the third ventricle, approaching from above, or via a fronto-temporal craniotomy (i.e. pterional or fronto-orbital), approaching from below. “Above” approaches typically include the transcallosal-anterior interforniceal approach, and recently, purely endoscopic approaches performed transforaminally. We hereby present a combined open and endoscopic approach for resection of HH located within the third ventricle in two young girls with relatively small lateral and third ventricles. Following an inter-hemispheric, transcallosal approach and exposure of the right Foramen of Monro (FM), an endoscope was inserted through the FM, which enabled safe resection of the HH. The main advantage of the combined approach is when the lateral and third ventricles are relatively small, making a purely endoscopic approach more challenging and possibly riskier.

Endoscopically complete removal of intraventricular cavernoma mimicking SAH
Christoph Wiegand, Christoph Greiner, Niels Sörensen (Osnabrück and Würzburg, Germany)

Material and methods: We report a “mini-series” of 2 patients with intraventricular cavernoma presenting as SAH and sudden headache. Pat. no. 1 was an 28 ys. old lady with sudden onset of SAH like headache. MRT and MRA scan showed a right sided cavernoma occluding foramen of Monro. Under ultrasound guidance the lesion was removed pure endoscopicqally. Clinically she made a full revovery. The 2nd pat, 67 ys. Old male, presented with headache and blurred vision, showing a left sided cavernoma having bled, being located under the roof of the cella media. This cavernoma was completely removed using a semisitting position and image guidance of the peel away catheter to ensure an accurate entry point from the occipital horn. All procedures were complication free (no infection / no bleeding from plexus), in both patients postoperative MRI scan were performed showing complete removal of the lesion.
Conclusion: The minimally invasive access to the ventricles is superb for minimally invasive removal,

atraumatic endoscopic handling avoiding big incisions and parenchymal damage providing excellent bleeding control and intraoperative visualisation.

Neuroendoscopy diagnostic tool for TBM

Bagathsingh Karuppanan (Madurai, India)

Background: Tuberculous Meningitis (TBM) pauses a diagnostic challenge because of inconsistent clinical presentation and also lack of rapid, sensitive and specific tests. The mortality is less than 20% in early stage and approximately 70% in late stage.
Objective: The definitive criteria include biopsy of brain with clinical features of TBM. Getting an accurate diagnosis in the form of tissue biopsy is another challenge. Here we are presenting a case of tuberculous meningitits confirmed by neuroendoscopic ventricular examination and ventricular biopsy.
Case Presentation: 17 year old lady presented with 4 months history of fever, weight loss and meningism. She had inconclusive lumbar puncture and was started on antituberculous treatment empirically. She continued to deteriorate and presented to neurosurgery team with low consciousness, hydrocephalus with trapped 4th ventricle. She underwent neuroendoscopy for vp shunt and during the procedure a ventricular examination and biopsy of the ventricular wall. The histopathological examination confirmed the diagnosis. She recovered well after the procedure. The antituberculous treatment was modified as she developed abnormal liver function tests with deranged INR.
Conculsion: This is an interesting case where endoscopy has helped to confirm diagnosis of tuberculous meningitis. Literature searches reveals case series of neuroendoscopy procedures done to treat tuberculous meningitis with hydrocephalus in late stage but this is one of the few cases in the literature where ventricular biopsy has been used to yield early diagnosis of tuberculous meningitis. This procedure has so far zero mortality and has been performed as a day procedure.

Endoscopic interventions in pediatric intracranial cystic lesions

SS Dhandapani (Chandigarh, India)

Introduction: Endoscopic interventions though much successful in adults have mixed results in children with intracranial cystic lesions. This was to evaluate our initial experience with 19 cases of cranial endoscopy in children with various cystic lesions.
Materials & Methods: Children with intracranial cystic lesions who underwent various endoscopic procedures were studied in relation to clinico-radiological profile, surgical method employed, intra-op findings, post-op course and complications.
Results: Of the 19 cases, 10 had intraventricular cysts, 6 had dandy walker cysts, 3 had arachnoid cysts. The various procedures adopted in these patients, prognostic factors and their outcome will be discussed. Most had satisfactory recovery, 4 had persistent arrested hydrocephalus not requiring any treatment, 2 required shunt, 1 developed asymptomatic external hydrocephalus, 1 developed subdural hygroma which improved with repeat tappings, 1 developed meningitis which improved with antibiotics, and 1 had third nerve paresis.
Conclusions: Endoscopic interventions in pediatric intracranial cystic lesions is challenging with good results. Post-op clinical improvement is more important than near normal imaging.

Endoscopic double fenestration of suprasellar and third ventricular cystic tumors with obstructive hydrocephalus

Rajnikant Sahu; Sanjay Behari, A K Jaiswal, Kuntal Kanti Das; Kamlesh Kumar Bhaisora (Lucknow, India)

Introduction: Endoscopic fenestration of cystic tumors of supra-sellar and third ventricular region causing obstructive hydrocephalus is a minimally invasive procedure that decompresses tumor, relieves hydrocephalus and obtains histological diagnosis. Performing an additional fenestration of inferior-most part of tumor capsule, communicating cystic cavity with suprasellar and interpeduncular cisterns, encourages continuous, gravity-dependent drainage of its content bringing lasting decompression.
Methods: 11 patients with cystic suprasellar and ventricular craniopharyngioma or intraventricular low grade astrocytoma were endocopically operated via a frontal burr-hole, transcortical, transventricular, trans-foraminal approach. Inclusion criteria included predominantly cystic lesion reaching up to and obstructing the foramen of Monro with lateral ventricular dilatation. Cyst was merged with the surrounding structures and could not be completely separated from it. Cyst underwent double fenestration with inferior part of capsule communicated with interpeduncular cistern.
Results: Cyst was adequately decompressed and biopsy taken either from the cyst wall or its solid component. There were no postoperative complications except development of pseudomeningocoele in two patients. Main difficulties encountered were delayed visualization of inferior aspect of capsule due to its opacified cystic contents and solid component with small calcification on the inferior aspect. Patients received radiotherapy and there was no cyst recurrence at follow up of between 6 months to three years.

Conclusion: Endoscopic double fenestration is an effective way of achieving decompression of cystic suprasellar and intra-third ventricular lesions reaching up to the foramen of Monro. An adequate communication of inferior capsule of cyst with interpeduncular cistern achieves a gravity dependent drainage. Subdural hygroma, pseudomeningocoele formation, thickened inferior wall leading to inadequate communication with cisterna magna and, lack of proper visualization due to opaque cyst content endangering the choroid plexus, thalamostriate vein and forniceal pillars at foramen of Monro are likely complications.

Technical note: Endoscopic transchoroidal fissure approach to the posterior part of the third ventricle and the fourth ventricle

Si Saber Mohamed (Blida, Algeria)

Objective: Beyond endoscopic third ventriculostomy and thanks to the evolution of endoscopic techniques, almost all the intra-ventricular lesions became accessible, including those located in the posterior fossa. The safety and feasibility of transchoroidal fissure or interforniceal endoscopic approach will be described as well as the arguments in favor of the choice of this new approach. Also, a new therapeutic strategy for medulloblastoma is proposed with analysis of the first results obtained.
Materials and methods: since1994 to2012 more than one thousand and six hundred endoscopic procedures were performed in our department, among which 160 related to the posterior compartment (113 post V3 & 47 post fossa). 17 patients profited from an endoscopic transchoroidal fissure approach for tumors of the posterior wall of V3 after treatment of hydrocephalus. The others were operated by traditional way via the foramen of Monro, including 4 via the stoma for the brainstem tumors and 39 via aqueduct of Sylvius for tumors of V4.
Results: The histological nature of the tumors was found for all the patients, among which 18 medulloblastomas. Morbidity was observed among three patients: 2 trauma of the massa intermedia without neurological expression, 1 trauma of the periaqueductal gray at the origin of a transient bilateral ophthalmoplegia, whereas mortality is null. The 17 endoscopic procedures via the choroidal fissure were carried out successfully. For the 18 cases of medulloblastoma diagnosed by endoscopic biopsy via aqueduct and after chemo and radiotherapy, we observed a complete remission after a follow-up going from 6 months to 5 years.
Conclusion: The endoscopic transchoroidal fissure approach or interforniceal constitutes a better alternative technique to reach the tumors of the posterior part of V3 and posterior cranial fossa. The new strategy for the medulloblastoma seems very interesting and should be the subject of a multicentre study.

Neuroendoscopy and multimodal treatment of third ventricle cystic craniopharyngiomas

Piero Andrea Oppido, Fabio Cattani, Carmine Maria Carapella, Alfredo Pompili (Rome, Italy)

Introduction: Craniopharyngiomas are histologically benign lesions that may develop at any point along the pituitary-hypothalamus axis, even in the third ventricle. Microsurgical treatment of these lesions remains among the most challenging for neurosurgeons because of their relationships with vital neural and vascular structures. Cystic craniopharyngioma can be treated by intracavitary chemotherapy or radiotherapy, in absence of intracranial hypertension due to CSF block and hydrocephalus. Neuroendoscopy is a safe and mininvasive technique performing tumor biopsy, CSF restore and cyst fenestration in only one procedure.
Method: By neuroendoscopy 5 cystic craniopharyngiomas with hydrocephalus were operated on. In 2 recurrences after microsurgical removal, a septostomy and an Ommaya reservoir positioning for subsequent bleomycine therapy were performed. In 2 patients presenting papilledema and endocrine deficits neuroendoscopic biopsy and cyst fenestration for diagnosis and CSF circulation restoration were performed prior to open microsurgery. In another elderly patient (75 yrs) affected by metabolic disorders the debulking of the solid core and tumor cyst was tempted by Tu laser only in neuroendoscopy.
Results: In all patients intracranial hypertension was successfully treated by restoring CSF pathways with only the neuroendoscopic procedure. No postoperative complications were observed. At follow-up after 7 years, in two patients treated with intracavitary bleomycine the MRI showed volume tumor reduction and no CSF obstruction. At follow-up after one and four years in the 2 patients operated on by microsurgery no tumor recurrence is detected at MRI. No tumor growth at the follow-up MRI can be observed in the patient undergone neuroendoscopic laser debulking.
Conclusions: Our retrospective experience confirms that in selected patients presenting cystic craniopharyngioma the neuroendoscopic procedure can be safe and without complications, even in case of intracranial hypertension. Neuroendoscopy is the minimally invasive approach to obtain diagnosis and restore CSF circulation, prior to microsurgical removing or radiochemotherapy.

Endoscopic management of third ventricular colloid cysts : An 12 years institutional experience and description of a new technique.
Chandra PS, Sharma BS (New Delhi, India)

Context: The operative approaches for colloid cyst excision are varied with open microsurgical excision still considered the "gold standard". Endoscopic removal of these cysts is gaining in popularity. We describe our experience with this technique in 79 patients treated over a period of 9 years at our centre and also describe a 2 port technique for gross total excision.
Aims: To document the efficacy and safety of the endoscope for colloid cyst excision.
Settings and Design: A retrospective study of all the subjects who underwent endoscopic colloid cyst excision at our centre between January 2000 and March 2012.
Material and Methods: Patient records, radiological images and operative notes of endoscopically treated cases of colloid cysts were assessed. Follow up data for these cases including clinical and radiological details were retrieved.
Results: 59 cases underwent endoscopic surgery. Gross total excision of cyst (with small residual nubbin) could be achieved in 46 (78%) cases. Others underwent near total excision (15), partial excision (4) and cyst aspiration (1). A 2-port technique for achieving excision was used in 28 cases. There was 1 mortality due to fulminant meningitis. No recurrence was noted in our series (follow up till 99 months). 2 patients required VP shunt due to persistent hydrocephalus.
Conclusions: Endoscopic excision is a safe and efficacious, minimally invasive method for colloid cyst removal. Even a subtotal excision of these slow growing cysts may be acceptable when experience with the endoscope is limited.

Endoscopic intervention for the fourth ventricular neurocysticercal cyst – What should be the optimum therapeutic approach?
Manish Ranjan, Subhas Kanti Konar, Sampath S, B Indira Devi, B A Chandramouli (Bangalore, India)

Objective: Fourth ventricular neurocysticercal cyst (FVNCC) usually presents with acute hydrocephalus, requiring surgery. Though endoscopic intervention is preferable; there is no consensus on the method and/or the extent of endoscopic intervention. We share our experience of endoscopic intervention for FVNCC and propose an algorithm of management.
Method: We reviewed the clinicoradiological details of consecutive patients, who underwent endoscopic intervention for the FVNCC at our institute from 1998-2009. Details of cyst excision, endoscopic interventions, CSF diversion (internal and external), complications and the outcome were analyzed.
Results: There were twenty one patients. Cyst could be totally excised in thirteen patients, while two patients had only partial excision of cyst. Excision of cyst could not be done in five patients due to ependymitis/adhesion, IVH and poor visibility of CSF due to hazy CSF. These patients underwent only ETV. Three patients had only cyst excision, as the sole endoscopic intervention, while 12 patients underwent ETV along with excision. Two patients had symptomatic periaqueductal injury with partial recovery (one each with rigid and flexible scope). The mean available follow up was 22 months. Shunt was avoided in 90% of patients. All patients who are available for follow up are asymptomatic, irrespective of the type of endoscopic intervention and extent of cyst excision status.
Conclusion: Relieving the acute symptomatic hydrocephalus by endoscopic internal CSF diversion (ETV) should be the primary therapeutic goal. Cyst excision (partial or total) should be attempted, only where feasible. The rigid scope is safe and satisfactory for the endoscopic intervention for FVNCC.

Endoscopic approach of intraseller arachnoid cyst: The Tunisian experience
Mohamed Ladib, E. Guassab, M. Bouchaala, H. Krifa (Sousse, Tunisia)

Intrasellar arachnoid cysts (IAC) are a rare pathology and only few cases were reported in literature. Different hypothesis were proposed to clarify their physiopathology, still unknown. The differential diagnosis with other cystic sellar lesions is sometimes difficult. Given the increased use of the endoscope in transphenoidal surgery, we exposed our technical procedure and its benefits in the treatment of these lesions. We report three cases of intrasellar arachnoid cysts that were fenestrated surgically using transphenoidal endoscopic procedure. Two patients had preoperative visual disturbances and one patient had hormonal status disturbances. All patients did not developed postoperative cerebrospinal rhinorrhea with visual improvement.

Spinal Surgery

Ultrasonic bone dissector in endoscopic spine surgery
Shrinivas Rohidas (Kolhapur, India)

Introduction: Ultrasonic bone dissectors can be used to

scrape bone in narrow corrridors.
Material and methods: From March 2009 to March 2012, we operated 55 spinal degenerative cases by using Sonoca 300, an endoscopic ultrasonic bone dissector (UBD). In lumbar region out of 371 cases UBD was used in 30 cases. In cervical region out of 25 cases approached anteriorly UBD was used in 10 cases and out of 25 cases approached posteriorly UBD was used in 15 cases. UBD was was not having any spinning parts like high speed drill and the risk of grabbing cotton pledget and damaging normal tissue accidently was thereby avoided.
Results: In this series, there were no iatrogenically induced injuries like for example, direct or heat damage to surrounding tissues, including nerves, spinal cord, dura mater, and vessels.
Conclusions: UBD is safe, versatile, and efficient in endoscopic spine surgery to remove bone near nerve, dura, cord and vessels.

Endospine in endoscopic anterior cervical microforaminotomy discectomy and cord decompression. An initial clinical experience
Shrinivas Rohidas, Jean Destandau (Kolhapur, India)

Objective: After 11 years experience in using endospine in the lumbar spine, I have used it to decompress the cervical spinal cord and roots.
Methods: We used Jho's technique in the anterior approach in 35 patients. Mobility of endospine along with angulation helps to approach narrow corridors in front of cervical cord.
Results: 32 patients had excellent results, 2 good results and 1 fair result, One patient had a dural tear that was sealed with fibrin glue. Two patients had vocal cord paresis which recovered in 2 and 8 weeks.
Conclusion: Endospine is helpful in surgery. Caution: it needs to be used by an experienced surgeon.

The role of endoscopy in recurrent lumbar disk
Omar Yusef Hammad (Cairo, Egypt)

Introduction: To evaluate the use of endoscopy as a minimally invasive surgery, in patients with recurrent lumbar disc.
Material and Methods: From 2005 to 2010, out of 1000 of patients with lumbar spine radiculopathy, 140 patients with recurrent lumbar spine radiculopathy underwent spinal endoscopy procedures, recurrent disc (n=120), and recurrent lateral recess stenosis (n=20), included 80 males and 60 females with age ranged between 25-74 years. All patients underwent preoperative plain films (A-P, lateral and dynamic views), MRI and CT scan spine in selected patients. Follow up period ranged between 6 – 60 months.
Results: 2 patients (1.4%) showed motor deficit, 120 patients (85.7%) reported sciatica free, 120 patients (85,7%) showed excellent outcome. Small dural tears occurred in 10 patients (7.1%) with no postop CSF leak. Two patients (1.4%) recorded superficial wound infection.
Conclusions: Spinal endoscopy is an effective minimally invasive surgery. It is a real practice rather than imagination. It could be a good alternative to standard open surgery in recurrent lumbar spine radiculopathy. It offers less tissue destruction. It obviates the need of implants, less hospital stay, and early return to work. Complications are comparable for those occurring in standard surgery.

Uniportal endoscopy in double level lumbar spine radiculopathy
Omar Yusef Hammad (Cairo, Egypt)

Introduction: To evaluate the use of endoscopy as a minimally invasive surgery, through a uniportal route in patients with double level lumbar spine radiculopathy.
Material and Methods: From 2005 to 2010, out of 1000 of patients with lumbar spine radiculopathy, 225 patients underwent spinal endoscopy procedures, double level lumbar disc (n=200), double level lateral recess stenosis (n=15), and bilateral double level lumbar lateral recess stenosis (n=10). Included 100 males and 125 females with age ranged between 25-55 years. All patients underwent preoperative plain films (A-P, lateral and dynamic views), MRI and CT scan spine in selected patients. Follow up period ranged between 6 – 60 months.
Results: 200 patients (88.9%) reported sciatica free, 200 patients (88,9%) showed excellent outcome. Small dural tears occurred in 5 patients (2.2%) with no postop CSF leak. Two patients (0.9%) recorded superficial wound infection.
Conclusions: Spinal endoscopy is an effective minimally invasive surgery. It is a real practice rather than imagination. It could be a good alternative to standard open surgery in double lumbar spine radiculopathy through a uniportal route. It offers less tissue destruction, it obviates the need for implants, less hospital stay, and early return to work. Complications are comparable for those occurred in standard surgery.

Patient position for Endoscopic Lumbar Discectomy—Vajrasana or Namaj position
Shrinivas Rohidas (Kolhapur, India)

Introduction: We report usefulness of a different easy knee chest position used for endoscopic lumbar discectomy and canal decompression with Endospine.
Materials & Methods: Till now total 945 patients with

different lumbar spinal lesions were operated from Sept 2002. The pathologies include simple disc hernia, disc hernia with canal stenosis. We used a different knee chest position using a special pillow under the chest and upper abdomen. The knees and hips are totally flexed with two small support pillows, one in between thigh and calf and another below ankle. Out of 945 cases in 895 patients we used this position. In 50 cases we used prone position because these patients had severe osteoarthritis of one or both knees.
Results: We used this particular position in 895 cases. No position related complication was noticed. The only contraindication is osteoarthritis of knee joints and hip joint surgery which prevents flexion at these two joints. Because the operative area is at higher level than heart significantly less epidural venous oozing is noticed. The abdomen is totally lax in between two thighs. There is interspinous distraction with lax abdomen which helps in severe lumbar canal stenosis surgery. This position can be used for obese, heavy weight patients, with additional support is necessary.
Conclusions: This new knee chest position is very simple, easy and does not require costly gadgets like frame or supports.

Endoscopic approach to the thoraco-lumbar spine – An initial experience
Dwarakanath Srinivas, Sampath S (Bangalore, India)

Introduction: Endoscopic approaches to the dorso-lumbar spine has been gaining popularity in part to the potential lower hospital stay, smaller incisions and lesser dissection thus decreasing the postoperative pain with comparable outcomes to conventional surgery. Here we present our initial experience with endoscopic approaches to the dorso-lumbar spine.
Material and Methods: A total of 7 patients underwent endoscopic surgery for the dorso-lumbar spine at our institute over the last 1 year.
Results: The average age was 32 yrs. 4 of them had Koch's spine, 1 had a metastasis and 2 had traumatic fractures. Outcomes with a short video presentation will be discussed.
Conclusion: Endoscopic spine surgery has a steep learning curve. It provides excellent visualisation with respect to conventional surgery.

Endoscope for lumbar spine: Percutaneous Endoscopic Lumbar Discectomy (PELD) or posterior endoscopy (Destandau/easygo)
I.C. Premsagar, Sri Balaji (New Delhi, India)

Introduction: With the increasing demand for minimally invasive techniques for spine more and more surgeons are replacing microscope with endoscope. But for lumbar spine two different endoscopic approaches can be used with equally satisfying results in experienced hands; Percutaneous Endoscopic Lumbar Discectomy (PELD) and standard posterior endoscopic approach was popularised by Jean Destandau and Joachim Oertel.
Material and Methods: 15 patients of lateral disc prolapse were operated by PELD technique and 21 patients were operated by posterior endoscopic approach. PELD was done in 10 patients at L4/5, 4 at L5/S1 and 1 at L3/2. Standard endoscopic approach was used in 24 patients; 7 PIVD at L4/5, 9 PIVD at L5/S1, 3 lumbar canal stenosis, 1 Pott's spine at L4/5, 2 ant. Cervical (cv) disc, 1 post cv disc and 1 cv canal stenosis.
Results: Time spent in both approaches ranged from 50 to 90 minutes. Incision size was 10mm in PELD and 25mm in standard approach. In PELD group 12 patients were pain free while 3 initial patients had some residual pain after surgery. In standard group all patients had significant relief. First patient developed foot drop due to excessive root retraction and one patient had dural tear.
Conclusions: The standard posterior approach is easier for surgeons who are already doing microdiscectomy as learning curve is less steep. It is just changing the scope in the same territory. It can also be used in cervical spine both posterior and anterior. But for PELD one must have unfailing ability to put the scope in the disc space through intervertebral foramen in awake patient. Though both techniques are equally good for pain relief.

Endoscope Assisted Microsurgery

Endoscopic-assisted microvascular decompression of the posterior fossa cranial nerves
Ramesh Teegala (Eluru, India)

Introduction: The purpose of this study was to evaluate the technique of endoscope as an adjunct to a retrosigmoid craniotomy for microvascular decompression (MVD) of trigeminal neuralgia and hemifacial spasm. Magnetic Resonance Imaging (MRI) findings were correlated with the operative observations.
Material and Methods: In last six years, 45 micro vascular decompression procedures were carried for diagnosed cases

of Trigeminal Neuralgia (TN), Hemi facial spasm (HFS) and Glossopharyneal Neuralgia (GN). All the procedures were carried with retromastoid craniectomy under endoscopic assistance.
Results: Among the 45 microvascular decompression procedures, MRI findings were very well correlated with intraoperative findings. There were 38 TN, 5 facial nerve and 2 cases of glossopharyngeal nerve decompression. In five cases, there were extra venous loops, which were causing severe compression over the 5th nerve REZ (root entry zone). In two cases, the vascular structure was passing through and through the 5th nerve complex. There were no procedure related complications. In 4 cases, endoscope was unable to be used due to narrow working space in the posterior fossa.
Conclusions: Traditionally, MVD is ably performed with the microscope. However, addition of an endoscope improves visualization of the entire nerve complex and ensures adequate decompression with less retraction. In properly selected cases the MVD is a definitive treatment with less morbidity and long term pain free period.

Endoscope assisted microsurgical removal of complex intracranial epidermoids
Suresh Dugani (Hubli, India)

Introduction: Intracranial epidermoids are epithelially derived lesions, which may present many challenges for the surgical treatment. Often encasing vital neurovascular structures and extend to multiple cisterns and compartments, making surgical resection difficult. We aim to treat these lesions with help of endoscope, neuronavigation along with microscope for the better outcome.
Material and Methods: At our institute over last 20 yrs we have surgically treated 144 patients with these lesions at various locations in the brain and skull base. Earlier we treated only with microsurgically. Since 2009 32 cases we started applying endoscope and since 2010 neuronavigation. Initially endoscope was used for visualization later it is used for guided dissection and removal.
Results: All cases had postoperative C.T/MRI scans, complete removal was done in 22 cases, remaining 10 patients had near total removal. One patient had postoperative meningitis. There were no deaths. 8 patients had transient various cranial nerve deficits. 2 patients had transient hemiparesis.
Conclusions: Endoscope assisted microsurgical removal of epidermoids increases the total resection rate, reduces surgical trauma, brain retraction and trauma to neurovascular structures and achieves complete cure with excellent functional recovery.

Endoscopic assisted microsurgical technique for management of anterior cranial fossa lesions using the key hole supraorbital approach
Ali Ayyad (Mainz, Germany)

Introduction: The priority in contemporary neurosurgery is to achieve the greatest therapeutic effect while causing the least iatrogenic injury.
The concept of keyhole surgery is based on the careful preoperative study of diagnostic images to determine the anatomic windows that provide access to the pathological processes, taking into consideration the individual pathoanatomic situation of the patient. The supraorbital subfrontal approach expose the suprasellar anatomic structures free for surgical dissection. The endoscope is the latest innovation in the field of optical instrumentation; it allows the 'surgeon's eye' to penetrate the depth and width of the access route. Using different angled endoscopes will be very helpful to extend further the surgical fields, visualize hidden parts and even control tumor removal which improves the surgical outcome. Here we describe the endoscopic assisted microsurgical technique in combination with supraorbital key hole craniotomy, for management of ant. cranial fossa lesions.
Material and Methods: During a 17 year period between 1995 till 2012 we have performed endoscope assisted microsurgical procedures for anterior skull base lesions including: aneurysm (274), anterior cranial fossa meningioma (137), craniopharyngiomas (68), arachnoid cysts (42), astrocytoma (24), epidermoids/dermoid (39), pituitary adenoma (58), germinoma (8), teratoma (11), hamartoma (5).
Results: The postoperative complications associated with approach were: supraorbital hypesthesia (17 patients), permanent palsy of the frontal muscle (12 cases), permanent hyposmia (24 patients), wound healing disturbances (3 cases), subcutaneous CSF collection & leak (11 patients).
Conclusions: The supraorbital craniotomy allows a wide exposure for deep-seated intracranial areas, it offers equal surgical possibilities with less approach-related morbidity. The optical advantages of the endoscopic visualization in anatomical orientation and tumor removal improve the surgical outcome. All these factors contribute to improve the postoperative due to reduction in the complications with pleasing cosmetic outcome.

Endoscopic assisted microvascular decompression of the trigeminal and facial nerve
Ali Ayyad, Martin Glaser (Mainz, Germany)

Introduction: Microscopic vascular decompression became the gold standard for surgical treatment of neurovascular compression syndromes in the posterior fossa since it

has been introduced by Jannetta. The introduction of the endoscope in neurosurgical procedures has brought a further new dimension into the field of intraoperative visualization. It provides, in contrast to the microscope, a panoramic view of the cerebellopontine angle (CPA) anatomy (especially with angled endoscopes) and shows exactly the differences between the pathological and the normal anatomy.
Material and Methods: We performed 67 surgeries in 65 patients with symptomatic trigeminal and facial nerve compression syndromes. The diagnosis was made mainly on the basis of clinical history, examination, and magnetic resonance imaging scans. Surgery was performed in all cases under endoscope-assisted keyhole conditions. The follow-up was 1 week postoperatively, 6 months and then yearly up to 7 years. All 34 patients with trigeminal neuralgia received preoperative medication treatment and experienced failure with it. Eighteen patients out of 30 with hemifacial spasm had been previously treated with botulinum toxin injections. One patient suffered from both trigeminal neuralgia and facial spasm, because of a megadolichobasilar and vertebral artery with compression of both cranial nerves.
Results: Sixty-four of the 65 patients became symptom free after surgical treatment; one revision surgery was necessary because of disappearance of the decompression muscle piece. No mortalities or minor morbidities were observed in this series.
Conclusions: A precise planned keyhole craniotomy and the simultaneous use of the microscope and the endoscope render the procedure of the decompression less traumatic and improve the outcome.

Endoscopic vascular decompression of the trigeminal nerve

Yad Ram Yadav, V Parihar, S Ratre, Y Kher, P R Bhatele (Jabalpur, India)

Introduction: Microvascular decompression is an effective method of treatment in trigeminal neuralgia especially when there is a vascular conflict. Surgery may fail if a compressing vessel is overlooked during surgery. The endoscope is better than a microscope in visualizing such conflict.
Materials and Methods: This is a prospective study of 75 patients. Preoperative computed tomography and magnetic resonance imaging scans were performed in all the cases. A 4 – 5 cm retroauricular skin incision was used and an about 3 cm craniectomy was performed. A zero degree 4 mm telescope supported by the holder was used after the dural opening. A Karl Storz 30 ° telescope was used for the visualization of the trigeminal nerve from the pons to Meckel's cave and dissection of the anterior conflict. Small pieces of dura patch were interposed between the nerve and the vessel. The microscope was not used at any stage. The follow-up period ranged from 12 to 84 months with an average of 48 months.
Results: There was no mortality. The duration of stay ranged from 3 to 10 days with an average of 4 days. The pain was relieved in 67 patients.
Conclusions: Endoscopic vascular decompression is an effective and safe alternative to endoscopic assisted microvascular decompression in trigeminal neuralgia.

Nasal – paranasal meningocele (meningoencephalocele). What approach?

Andriy Huk, Orest Palamar (Kyiv, Ukraine)

Introduction: Nasal-paranasal meningocele are not common. They might be iatrogenic, congenital or postraumatic.
Materials and Methods: We present 6 cases with meningocele and 1 case with meningoencephalocele. According to location: 4 patients presented meningocele in nasal cavity (cribriform plate defect), 2 patients with meningocele in sphenoid sinus (one of them with meningoencephalocele) and 1 patient with meningocele in nasopharynx. In 2 cases there was planum sphenoidale bone defect, the lateral wall defect of the sphenoid sinus in the other patient, cribriform plate defect in 3 cases and clival defect in the other patient. According to origin: in 3 cases meningocele was congenital, in 1 case postraumatic and in 3 cases iatrogenic.
Results: We used the bifrontal procedure in 1 case, subcranial approach (via frontal sinus) in 2 cases and endoscopy endonasal procedure in 4 cases. Dural defect was reconstructed with free fascia lata graft in all cases. Bone defect was reconstructed in 4 cases with autobone. No failures nor complications were observed in our series.
Conclusion: Meningocele closure successfully achieved with any approach. Endoscopy endonasal approach would be less traumatic.

Surgery of cerebello-pontine angle tumors: endoscopic possibilities

Orest Palamar, Andriy Huk (Kyiv, Ukraine)

Background: Tumors of the cerebello-pontine angle (acoustic neuromas, meningiomas) are widely treated pathology. What are the further possibilities in improving surgical care?
Matherial and Methods: In 7 cases we used the key hole approach (miniinvasive retrosigmoid suboccipital approach) with pure use of endoscopy. In this we use key hole retrosigmoid trephanation (up to 2 cm). Tumors sized from 2.5 to 3.5 cm. No postoperative mortality.

Results: Acoustic and facial nerves preserved at the preoperative levels. Function to the acoustic and facial nerves preserved at the preoperative level in all but 1 case. Function to the acoustic nerve preserved at the preoperative level in 4 cases and improved in 1 case. Function to the facial nerve preserved at the preoperative level. Patients after the surgery admitted to the ward, no need in admittance to the ICU unit and discharged on the 4-th day.
Conclusion: Key hole retrosigmoid approach over cerebello-pontine angle tumors is the surgical procedure associated with less trauma to the brain, preservation of facial and acoustic and is acceptable for smaller tumors, till 3.5 cm. This method can be used by neurosurgeon in addition to microneurosurgical technique for further optimization on cerebello-pontine tumors surgery.

Cholesterol granulomas
Sbeih Ibrahim (Amman, Jordan)

Cholesterol granulomas represent a foreign body giant – cell reaction to cholesterol deposits which are caused by loss of normal aeration and drainage of temporal bone air cells due to blockage and transudation of blood products in the air cells. We are here presenting our experience in 29 patients who presented with cholesterol granuloma of petrous bone in the period between Jan 1990 – Jan 2011. Eight patients were lost for follow up. Only 21 patients were followed up, of which 18 were males and 3 were females, with age ranging between 26-70 years with average age of 45 years. Presentation in our patients included headaches, facial numbness, facial palsy, facial spasm, gait imbalance, double vision and dizziness. Surgical approaches of these lesions vary according to location of these granulomas along petrous bone, which depends in turn on the amount of aeration within temporal bone. These approaches include extradural middle fossa approaches, presegmoid approach, retrosegmoid approach and others. We used the above three approaches; middle fossa in 5 patients, presegmoid in 6 patients and retrosegmoid in 5 patients and combined approaches in 5 cases. follow up ranges from 25 months – 264 months with average follow up of 115 months. Recurrence occurred in two patients in which we used retrosegmoid approach. We had no mortality in our series. Morbidity included CSF leak in two patients, wound dehiscence in 1, worst hearing in 1, and worse facial nerve function in another patient. We recommend an extradural approach for such lesions, unless dictated by other factors.

Expedient approaches for craniopharyngioma surgery: micro & endoscopic hybrid surgery
Hidehiro Oka, Kuniaki Nakahara, Hiroyuki Koizumi, Koji Kondo, Toshihiro Kumabe (Sagamihara, Japan)

Introduction: We describe our surgical strategy for craniopharyngioma and hybrid surgery using microscope and neuroendoscope.
Materials and Methods: Ninety one patients with craniopharynigoma were treated our Hospital (38 patients operated by only microscope from 1974 to 2000, 53 patients operated by hybrid surgery using microscope and endoscope from 2011 to 2012). We analyzed recurrence rate of only microscopic surgery (1974-2000) vs. hybrid surgery.
Result: Samii's grade of 91 patients was as follows: Grade I-1, II-16, III-37, IV-31, V-6. Expedient surgical approaches were 40 pterional/subfrontal, 30 interhemispheric, 16 transphenoidal approaches. Eight (21%) in 38 patients were recognized tumor recurrence from 1974 to 2000 by only microscopic surgery. On the other hand, 5 (9.4%) in 53 patients recognized tumor recurrence from 2001 to 2012 operated by hybrid surgery using microscope and neuroendoscope. Advantage of hybrid surgery is as follows; wide and clear view, fit to deep-seated tumors, ordinary instruments can use, microscopic surgical education to junior Neurosurgeon can do, and residual tumor of dead space for example under optic chiasm by hybrid surgery. On the other hand, disadvantage of this surgery is as follows; 2D, special practice is needed, narrow space, adhesion, ossified tumor, or vascular tumor.
Conclusion: We introduce expedient approaches and our hybrid surgery using microscope and neuroendoscope for craniopharyngioma. This procedure is useful to do conventional microneurosurgery for surgical education, moreover, it can remove residual tumor by hybrid surgery.

Lamina terminalis approach for craniopharyngiomas
Sbeih Ibrahim (Amman, Jordan)

Introduction: Third Ventricular tumors are the most difficult to expose and remove. Many neurosurgical approaches are being utilized.
Material and Methods: I operated upon 161 third ventricular tumors using various surgical approaches. I used lamina terminalis approach in 102 patients in the period between 1990-2011. This includes 55 patients with craniopharyngiomas in addition to 47 patient with other various pathologies that include: Gliomas, Ependymomas, Hamartomas etc.
Results: We present here the result of surgical excision of 55 craniopharyngiomas using Lamina Terminalis Approach. 32/55 patients had tumor size of more than 4cm in diameter. 18/55 had solid lesion, 6/55 had cystic lesions and 31/55 had mixed solid/cystic lesions. Gross total resection was achieved in 43 out of 55 patients (76%) with recurrence in 6 cases (15%). There was one mortality

in this group. Subtotal resection was achieved in 12 patients (22%) with recurrence in 10 patients (83%). We also encountered one mortality in this group. Endocrinological worsening and obesity were among the main morbidity issues but both usually improve within 2-3 years from surgery. We also encountered worsening of vision in two patients and confusional state in 5 patients, among other complications.
Conclusions: This approach has the advantages of allowing: radical excision of the lesion, neurovascular structures preservation, exposure of retroseller area, preservation of pituitary stalk and most importantly decreasing the misery associated with recurrence and its management, among other advantages. The factors that favor recurrence are large size of tumor, brain invasion, high Ki-67 index, adamantinoma histological type and incomplete surgical excision. We believe that incomplete resection is a virtual guarantee of recurrence. However this view should be taken on the background of risks of hypothalamic damage and other complication if total excision is pursued no matter what.

Application of neuroendoscopic techniques in neurosurgery

Awadhesh Jaiswal, Rajan Kumar, Anant Mehrotra, Arun Srivastava, Rabi Narayan Sahu, Sanjay Behari (Lucknow, India)

Introduction: In the modern era of neurosurgical practice, scope of cranial neuroendoscopy is rapidly advancing. As the attention has focused the development of minimally invasive surgical methods, neuroendoscopy has advanced both as an independent treatment modality for various neurological disorders and as an adjunct to microneurosurgery.
Objective: To analyze the application of neuroendoscopic techniques in in the diagnosis and treatment of various neurosurgical diseases.
Material and methods: The study was performed by retrospectively reviewing the medical records of patients operated by cranial neuroendoscopic techniques over last one and half year.
Results: We treated 50 patients with different neurosurgical diseases by performing endoscopic neurosurgery and endoscope-assisted microneurosurgery. Among 50 patients, 44 were treated with pure endoscopic neurosurgery [endoscopic third ventriculostomy (ETV) 10 cases; ETV with biopsy 5 cases; colloid cyst 2 cases; endoscopic pituitary adenoma excision 8 cases; fenestration and biopsy of craniopharyngioma 6 cases; tumor cyst fenestration 3 cases, arachnoid cyst and porencephalic cyst fenestration 1 case each and endoscopic CSF leak repair 8 cases] and 6 were endoscope-assisted microneurosurgery (epidermoid cyst excision 3 cases; posterior communicating artery aneurysm 2 cases and microvascular decompression for trigeminal neuralgia 1 case). In all the cases endoscope was found to be useful, however, 5 cases of ETV required another form of CSF diversion procedure and in one case of endoscopic biopsy, the report was inconclusive.
Conclusions: Neuroendoscope can be utilized in a variety of neurosurgical conditions. It decreases the morbidity caused by pure open surgery operation and helps in visualizing the areas usually not seen by microscope. It is also helpful to enhance surgical quality and to reduce the complications.

Endoscopic treatment for sagittal synostosis – Is a helmet necessary? A preliminary report

Rathnasabapathy Murali (Coimbatore, India)

Introduction: Endoscopic repair for craniosynostosis is now reported more commonly. Wearing of a helmet post-op is advised in nearly all cases.
Material and Methods: I am reporting a case of sagittal synostosis in a 3 month–old infant treated with endoscopic sagittal suturectomy. However no post–op helmet was used.
Results: One and a half years later child is doing well, with good skull shape. So the question whether a costly helmet (not available in India) is really necessary is raised.
Conclusion: While a single case is not conclusive, more studies are needed to establish this. If proven unnecessary, it would remove a costly, cumbersome and irritating ornamentation for the child.

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