



## 7th World Congress of Neuroendoscopy of the International Federation of Neuroendoscopy (IFNE) Jalisco, Puerto Vallarta, Mexico, 1-4 November 2015

### Oral Presentations

#### **International Infant Hydrocephalus Study: Initial results of a prospective, multicentre comparison of endoscopic third ventriculostomy (ETV) and shunt for infant hydrocephalus**

*Shlomi Constantini, Spyros Sgouros, Abhaya Kulkarni (Tel Aviv, Israel, Athens, Greece, Toronto, Canada) for the IIHS Investigators*

**Introduction:** The IIHS is an international, prospective, multicentre study to compare ETV and shunt in infants (<24 months old) with symptomatic triventricular hydrocephalus from aqueductal stenosis. It was started in 2004, under the aegis of the International Federation of Neuroendoscopy (formerly the International Study Group for Neuroendoscopy). Here, we present the first results of IIHS.

**Methods:** IIHS utilized a prospective comprehensive cohort design, which contained both a randomized and non-randomized arm. Patients received either an ETV or shunt, based on their randomization or parental preference. Patients were followed prospectively for time to treatment failure, defined as the need for repeat CSF diversion procedure (shunt or ETV) or death due to hydrocephalus. Survival analysis was used to compare time to failure for ETV versus shunt. The trial was registered at [clinicaltrials.gov](http://clinicaltrials.gov) (NCT00652470).

**Results:** A total of 158 patients met eligibility criteria (median age at surgery 3.6mths, IQR 1.6-6.6 mths) across 27 centres in 4 continents. Since only 52 patients (32.9%) were randomized, all 158 patients were analyzed together (115 ETV, 43 shunt). Actuarial success rates for ETV vs shunt at 3, 6, and 12 months were: 68% vs 95%, 66% vs 88%, and 66% vs 83%. The 6 month ETV success rate of 66% was slightly higher than would have been predicted by the ETV Success Score (57%). The hazard ratio for time to treatment failure favoured shunt over ETV (3.17, 95% CI 1.45-6.96,  $p=0.004$ ), after adjusting for age at surgery, history of previous hemorrhage or infection, continent, and randomization status. Patients younger than 6 months of age appeared to do relatively worse with ETV than older patients.

**Conclusions:** The IIHS has provided the first prospective direct comparison of ETV and shunt for infant hydrocephalus. These initial results suggest that shunting has a superior success rate compared to ETV, although the success rate for both was relatively high. This patient cohort continues to be followed in IIHS and we will await the results of the important primary outcome of health status at 5 years of age.

#### **The utility of Thulium laser in neuroendoscopy**

*Piero Andre Oppido (Rome, Italy)*

**Introduction:** Neuroendoscopy is presently considered a minimally invasive surgical approach. Despite wonderful magnification of the endoscope, due to the minimal surgical approach, bleeding control and tumor ablation are harmful by standard tools. Especially, in vascularized tumors and near vital structures the traditional electrosurgery can be ineffective and dangerous. In neuroendoscopy the ideal tool is one thin handpiece for easy coagulation, cutting and ablation by preserving healthy tissue. Since 2009, we are using the Tu diode pumped solid state (DPSS) laser (Revolix, LISA laser products) in neuroendoscopic procedures by thin microfibers through the endoscope's work channel.

**Methods:** In the Tu DPSS the active laser material is thulium (Tu), emitting light at wavelength of 2,0 micron, through one microfibre large 0,2 mm in diameter. Power range was from 1 to 8 Watts. The energy can be absorbed by water without side effects. This laser can hit the tumor in near contact or targeting from short distance with limited penetration. Tumor cutting and ablation is possible, too. The Tu DPSS laser works very well in water solution, as the CSF. We report our experience in 26 ventricular tumors, 16 in 3rd ventricle and 10 in the lateral ventricle. The histology was: 13 high-grade gliomas, 5 craniopharyngiomas, 2 PNET, 2 metastases, 4 colloid cysts. A flexible or rigid scope was used.

**Results:** in 17 neuroendoscopic biopsies the Tu DPSS laser microfibre was used for hemostasis and partial ablation. In 5 craniopharyngiomas wall ablation was performed. In 4 colloid cysts complete removal was possible. In one case 3rd ventricular nodule was totally removed by ablation with

the laser. ETV or tumour cyst fenestration or septostomy through infiltrated septum was successfully performed. It showed precise coagulation at low temperature without tissue sticking. In all surgical procedures bleeding control was easy and successful. During laser activation endoscopic vision was always clear. No side effects due to these instruments were observed.

Conclusions: We consider Tu DPSS laser extremely handy and safe. The laser is more efficient for coagulation and ablation of vascularized tumours.

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### **Influence factors on endoscopic third ventriculostomy – outcome analysis and comparison of two german neuroendoscopy centers**

*Sonja Vulcu, Ömer Bozcicek, Wolfgang Wagner, Michael R. Gaab, Joachim Oertel (Homburg/Saar, Mainz, Hannover, Germany)*

Introduction: Endoscopic third ventriculostomy presents the procedure of first choice in the therapy of obstructive hydrocephalus. There exists a stable and high success rate for this procedure; and the impact of age and etiology is notorious. Other influence factors are still under current debate.

Objective: The authors evaluated potential new influence factors on the outcome rate after ETV and compared the results of two German neuroendoscopy centers in a large patient series.

Material and Methods: The authors performed a retrospective analysis of 250 patients who underwent endoscopic third ventriculostomy between 2006 and 2008 either at department A or B. Evaluation was based on patient records, surgical records, telephone interviews and follow-up examination. Analyzed factors were age, underlying pathology, endoscopic system and surgical experience. Surgical success was defined by complication rate, revision rate and clinical/radiological outcome.

Results: One-hundred-seventeen patients received an ETV at department A and 133 patients at department B. The patient groups were slightly different with more infants at department B. Postoperative clinical success rate reached 79.3% at department A and 68.7% at department B. There was a significant influence on clinical success for age ( $p=0.031$ ) and underlying pathology ( $p=0.001$ ). Intraoperative complications occurred in 5.6% and postoperative complications in 9.2% of the patients. Age ( $p=0.026$ ) and surgical experience ( $p=0.029$ ) had a significant impact on intraoperative complication rate. Furthermore, there was a significant influence on the revision rate for the underlying pathology ( $p=0.037$ ). A revision surgery was performed in 12% of the patients. Surgical experience and endoscopic equipment had no significant impact on the clinical success rate.

Conclusions: The evaluation of these patient groups underlines the importance of impact factors like age and hydrocephalus etiology for clinical success. Surgical experience and persistence of surgical technique seem to play an important role to avoid intraoperative complications.

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### **Endoscopic third ventriculostomy in patients with a small prepontine distance**

*Waleed Azab (Kuwait, Kuwait)*

Introduction: A sufficient prepontine distance is required for fenestrating the third ventricular floor during endoscopic third ventriculostomy (ETV). The prepontine distance (PPD) may, however, be very small so that an ETV is considered technically impossible due to the high risk of injury to the basilar tip or its branches.

Objective: To present the clinical data, neuroradiological findings as well as operative technique of ETV performed in a series of patients with a small prepontine distance.

Materials and methods: ETV was performed in a series of 11 patients with a small prepontine distance via fenestrating the third ventricular floor at the dorsum sellae. The medical charts, neuroradiological and intraoperative findings in these patients were retrospectively reviewed. The PPD was defined as the distance between the basilar artery and the dorsum sellae on preoperative sagittal MR images and was measured in all patients. An ETV was considered successful when no further CSF diversion procedure was required.

Results: The measured PPD ranged from 0 to 3 mm, a fenestration of the tuber cinereum was achieved by initial application of pressure against the dorsum sellae using a blunt instrument. Third ventricular floor opening was then completed by negotiating a balloon catheter through the created opening and inflating it to enlarge the stoma. No intraoperative events or postoperative morbidity have taken place. ETV was successful in 8 patients (72%).

Conclusions: In patients with an obliterated or reduced PPD, an ETV can be safely done. The dorsum sellae is a key anatomical feature to perform the fenestration in these cases. The success rate of ETV in these patients is similar to the reported success rates in those with normal PPD.

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### **Neuroendoscopic coagulation of the choroid plexus in hydranencephaly: case report**

*Roberto Alexandre Dezena, Carlos Umberto Pereira (Uberaba-MG, Aracaju-SE, Brazil)*

Introduction: Hydranencephaly is a rare congenital disease defined as absence of cerebral hemispheres with intact thalamus, brain stem, and cerebellum, with the associated space filled with CSF. In some cases, occipital

lobes also remain intact. The prognosis of patients is very poor in result of various systemic complications. Due to continuous CSF production by the choroid plexus and poor absorption, many patients suffer from intracranial pressure and increasing head size. The standard treatment for CSF excess is a shunt system, but an excellent option is the neuroendoscopic choroid plexus coagulation (NCPC), to balance CSF production avoiding the use of a shunt device.

**Objectives:** to present a patient submitted to bilateral NCPC to control CSF production, highlighting the usefulness of this technique.

**Material and Methods:** this case is about a male newborn with a prenatal diagnosis of hydranencephaly by maternal ultrasound. After the birth a CT scan demonstrated a typical hydranencephaly and a NCPC was proposed.

**Results:** the patient was submitted to neuroendoscopic approach. A Gaab system 0° rigid neuroendoscope it was used, entering inside the skull, from Kocher point, visualizing the choroid plexus. Bipolar coagulation device was used, reaching all endoscopic visible portions of the choroid plexus, achieving a good cauterization, including the intrinsic vessels (demonstrated in video). No skull increasing was registered while child alive. 3D CT scan showed adequate control of CSF production. The child died of systemic complications after 3 months.

**Conclusions:** as in several case reports all over the world NCPC can be a good option in hydranencephalic patients, avoiding CSF shunt device.

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.

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### **Infundibular recess angle reduction after endoscopic third ventriculostomy: does it reflect clinical success?**

*Waleed Azab (Kuwait, Kuwait)*

**Introduction:** Although significant reductions of the ventricular size take place after an endoscopic third ventriculostomy (ETV) in the majority of successfully treated patients, ventricular size reduction is not always seen after a successful ETV. There still exists a need for practical and reliable radiological parameters to assess the clinical success of an ETV.

**Objective:** To evaluate the relevance of infundibular recess angle reduction to clinical success during the early postoperative period after ETV.

**Patients and Methods:** We retrieved the clinical and radiological data of patients who underwent an ETV.

Patients with the following criteria were included: (1) Preoperative MRI studies are available (2) Postoperative MRI studies are done within the first 2 postoperative weeks. (3) The infundibular recess is clearly seen on pre- and post-operative sagittal MR images. Pre- and post-operative measurements of the angle of the infundibular recess of the third ventricle were performed on midsagittal T1-weighted, T2-weighted, FIESTA or CISS images.

**Results:** The extent of reduction of the infundibular recess angle highly predicted the clinical outcome of ETV during the early postoperative period. The average reduction was about 48 % in successful versus only 15% in failed procedures.

**Conclusions:** The degree of reduction of the angle of the infundibular recess of the third ventricle correlated with the amount of third ventricular decompression after ETV. Most importantly, such a reduction was noted to occur during the early postoperative period when radiological changes are less pronounced. Infundibular recess angle measurement is practically easy and may prove very helpful in cases with no clear cut clinical evidence of success of ETV.

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### **Endoscopic ventricular lavage in preterm infants with post hemorrhagic hydrocephalus prevent complications associated to repeated CSF withdrawal**

*Jaime Torres-Corzo, Roberto Rodriguez-della Vecchia, Rolando Jiménez-Guerra (San Luis Potosi, Mexico City, Mexico)*

**Introduction:** Severe intraventricular hemorrhage (IVH) (Grades III and IV) occurs in 3%–20% of prematurely born infants with very low birth weight (VLBW). Repeated cerebrospinal fluid withdrawal, and continuous drainage via an external or subgaleal ventricular drain attempt to solve hydrocephalus temporally, until a permanent shunt can be inserted. Endoscopic ventricular lavage could theoretically decrease complications associated with intraventricular bleeding, including long term hydrocephalus.

**Objective:** To analyse the immediate effects of endoscopic ventricular lavage on mortality and morbidity, as well as endoscopic third ventriculostomy (ETV) long term success in this population (5 years follow up).

**Materials and methods:** Premature patients with grade III-IV post hemorrhagic hydrocephalus that were treated endoscopically by the authors from 2004 to 2011 where included in the study. Endoscopic lavage and clot removal were performed and an ETV was also performed when an obstruction was identified either endoscopically or in previous imaging.

**Results:** 17 premature patients were included in the analysis, being 35.3% of them VLBW. In all patients

an endoscopic lavage was performed while 15 of them required an ETV. 1 patient died 2 months after endoscopy from causes unrelated to the surgical procedure. 1 patient (6.2%) had a functional ETV until his last visit after 5 years follow up. The remaining patients were shunted between 1-2 months after endoscopy. No surgical infections were present. A previous study described a 58% need of shunting after an endoscopic lavage, while in our cases 88.2% were shunted.

Conclusions: Endoscopic ventricular lavage and ETV provide control temporarily, although not avoiding a shunt, but preventing the complications associated to repeated CSF withdrawal.

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### **Endoscopic treatment of suprasellar arachnoid cysts - is ETV always necessary?**

*Christoph Wiegand, Ali Akcocuk, Christoph Greiner, Niels Sörensen (Osnabrück, Würzburg, Germany)*

Introduction: Suprasellar cysts are intraventricular mass lesions leading to obstructive hydrocephalus in early childhood.

Objective: Retrospectively it was questioned whether endoscopic third ventriculostomy (ETV) is mandatory in the treatment of suprasellar arachnoid cysts.

Material and methods: We report a series of n= 15 children with suprasellar arachnoid cysts (SAC) presenting with obstructive hydrocephalus (HCP) from 2010 until present. The youngest baby was 3 months, the oldest girl was 14 yrs. old harboring a combined suprasellar and posterior fossa cyst, with a mean age index of 3,5 months. All children had preoperative ultrasound and/or MRI. Neuronavigational guidance or landmarks acquired through Osirix® were applied for optimum entry point. The lesion was removed purely endoscopic via a right sided transfrontal 12 mm burr hole, puncturing the ventricle with a peel away catheter (BBraun ®) 5,5 mm using a rigid 30 degree endoscope (Aesculap MINOP). Cysts were resected by monopolar diathermy onto the margins, finalizing the procedure with an ETV.

Results: All procedures were complication free (no meningitis / no bleeding from plexus / no occluding cyst remnant), except for 1 child needing a shunt for unknown reason. In all children post-operative transfontanelar ultrasound or MRI scan was done showing removal of the lesion at discharge, at 3 months and after 1 year.

Conclusion: The minimally invasive endoscopic access to SAC is superb for atraumatic removal, avoiding exceeding craniotomies and parenchymal damage providing excellent bleeding control and intraoperative visualisation. ETV is not mandatory when both foramen of Monro as well as the aqueduct are patent. ETV is an additional option as “double insurance” when anatomic relations after cyst

removal are not clearly understandable and there might be doubt of patent CSF pathways. So in any scenario of doubt we do an additional ETV at the end of procedure.

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### **Endoscopic treatment of suprasellar arachnoid cyst**

*Abelardo Cavero (Lima, Peru)*

Introduction: The arachnoid suprasellar cysts can compress the pituitary and hypothalamus, as well as the visual pathway, causing various degrees of hormonal and visual alterations. Thus, they must be recognized and treated early to prevent irreversible damages.

Objectives: To prove the functionality of the transcortical endoscopic approach for treatment of cysts on the suprasellar region.

Material and methods: 5 year old child with arachnoid suprasellar cyst of great magnitude which caused hormonal and visual alterations. Description of the medical procedures applied on the cerebral endoscope. Procedure initiated in the right transsylvian cerebral area, followed by a right frontal transcortical endoscopic approach.

Results: The transcortical approach allowed us to reach suprasellar cyst through the lateral ventricle and the right foramen of Monro. Thus, succeeding in the shifting of the arachnoid cyst towards the right lateral ventricle and the pontine cistern.

Conclusions: The transcortical endoscopic approach is an efficient surgical method for arachnoid suprasellar cysts treatment, especially for cysts of great magnitude which are easily accessible through the foramina of Monro.

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### **Complication avoidance in intraventricular endoscopy**

*Christoph Wiegand, Ali Akcocuk, Frank Möllmann, Christoph Greiner, Niels Sörensen (Osnabrück, Würzburg, Germany)*

Introduction: Complication avoidance in intraventricular endoscopy can be achieved by following the rules, knowing the anatomy and doing the right thing in a surgical complication.

Objective: In a mono-institutional series we looked into approximately 400 procedures pointing out different techniques taking into account potential and real complications.

Material and methods: We report a series of n=392 patients with intraventricular endoscopic procedures from 2008 until present. The youngest patient was 3 days old presenting with acute hydrocephalus and foramen of Monro stenosis, the oldest was 16 yrs. old with a cystic craniopharyngioma. All patients had preoperative MRI

scan or in severe emergencies regarding neonates we used high resolution ultrasound. We always apply pre-operative planning through Osirix® reassuring anatomical landmarks and neuronavigation where needed and technically possible. In all cases we use peel away catheter either 3 or 5.5 mm (BBraun®). Often we feel that 30 degree lenses are more versatile in intraventricular procedures except for septostomies where a 0 degree lens might be more straightforward. Finally all endoscopic procedures receive 5 mg vancomycin intraventricularly at the end of surgery.

Results: We did N=45 arachnoid cysts, N=59 endoscopic explorations for various reasons such as biopsies, looking for membranes and obstruction, N=19 septostomies, N=11 cystic craniopharyngiomas, N=143 ETVs, N=6 aqueductoplasties, N=9 foraminoplasties of Foramen of Monro, N=6 colloid cysts, N=9 intraventricular tumors, N= 2 intraventricular cavernomas mimicking SAH, N=11 endoscopic intraventricular biopsies, N=47 endoscopic assisted ventricular shunt placements, N=14 endoscopic lavage in neonates with posthemorrhagic hydrocephalus G III-IV. As complication we counted N=1 temporary diabetes insipidus after ETV, N=2 intraprocedural intraventricular bleeding from choroid plexus, N=4 postoperative bacterial meningitis, N=7 ETV failures with requiring VP shunt. N=4 CSF leakage from poor wound healing, N=3 babies suffering from fits after endoscopic lavage for post hemorrhagic HCP. Complication rate was around 1-2%. No death, no severe disability occurred.

Conclusion: For complication avoidance we recommend several strict preoperative and intraoperative rites: Know your patient, know your assisting colleague (“4 hands-one mind” strategy), know endoscopic indications and your endoscopic equipment. Get the best MRI scans available, as it is your road map through surgical anatomy. Choose the right technique for the right patient- “no intraventricular tourism” - this will redirect adequate indication. Move along the plexus choroideus if you get lost intraventricularly as the plexus of the sella media leads you the way to the foramen of Monro. Do the right thing in an intraoperative complication: Don` t take out the endoscope in a scenario of unexpected bleeding-often it is enough to rinse in venous bleedings, always use a peel away catheter to protect parenchyma e.g. covering the fornix. Don` t push things too far intraoperatively: if you can` t get it right it is no shame to come back this is far better than harming the patient. When closing up the wound – this applies especially to children-do as many layers as possible to prevent CSF leakage.

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### **Our experience of endoscopic approach to skull base tumors**

*Bagathsingh Karupannan (Madurai, India)*

Aim: To share our experience of treating skull base tumors by endoscopic endonasal approach.

Materials and method: 90 patients were operated irrespective of age & sex in the period between 2010 to 2014, which includes benign tumors of skull base like pituitary macroadenoma, planum sphenoidale meningioma, aneurysmal bone cyst of anterior clinoid process, craniopharyngioma, pituitary tuberculoma, clivus lesion, skull base metastases. In most of the cases total excision of tumor was done except in few cases of pituitary macroadenoma in which suprasellar and parasellar extension was left behind. All cases were operated by 4 hand surgical technique using rigid type endoscope. Repair of the bony & dural defect was done using nasal septal mucosal pedicle flap and nasal packing done in all cases.

Results: Morbidity with this approach was less as compared to craniotomy. 1 patient of pituitary macroadenoma died because of intraoperative vascular (carotid) injury during initial period of our practice. We noted complications like early postoperative CSF rhinorrhoea in 1 patient which was treated by therapeutic LP, meningitis in 6 patients which recovered in all patients. There was no postoperative hemorrhage in surgical site. Patients were followed up from 3 months to 4-year period after surgery.

Conclusion: Endoscopic approach using 4 hand surgical technique and rigid endoscope is safe and effective for skull base tumor surgeries.

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### **Endonasal rescue flap technique: approach for pituitary adenomas. Experience of “Dr. Jose Eleuterio Gonzalez” University Hospital**

*José Armando Díaz Martínez, Arturo Sotomayor González, Mauricio Arteaga Treviño, Samuel Pérez Cárdenas, Ángel Martínez Ponce de León (Nuevo Leon, Mexico)*

Introduction: The adoption of vascular pedicled flaps to reconstruct skull base defects following endoscopic endonasal skull base surgery is a significant milestone in the development of endoscopic endonasal approaches (EEAs). It has reduced postoperative cerebrospinal fluid (CSF) leaks to levels similar to open approaches. Rescue Flap Concept: In many cases, the surgeon does not know a priori if a nasoseptal flap will be needed for reconstruction, and to preserve the vascular pedicle, the flap must be raised prior to the sphenoidotomy. To decrease patient morbidity from unnecessary nasoseptal flap harvest, the nasoseptal “rescue” flap technique was devised to allow for partial harvest of the most superior and posterior aspect of the flap at the onset of the case. If a CSF leak is encountered or the resultant defect is larger than expected, the rescue flap can be fully harvested and used for reconstruction.

Material and methods: Describe the experience and

technique for approaching skull base pathologies using endonasal endoscopy. Reconstruction techniques, indications for harvesting a nasoseptal flap before access the tumor and indications for a nasoseptal flap harvested at the beginning of the procedure.

Results: Twenty patients were included in this series. First 11 patients were approached using the conventional approach and harvesting the nasoseptal flap in the following cases: a. Functional pituitary adenomas, b: Giant pituitary adenomas (more than 40 millimeters). Nine patients were approached using the “rescue flap” concept during the approach. Duration of the procedure was considerably less using the rescue flap technique. Only in two patients, it was needed to complete the flap harvesting secondary to CSF leak. In these patients, the flap was useful and reconstruction was satisfactory. Discharge time was shorter in the group of the rescue flap.

Conclusions: Rescue flap represents a useful technique that reduces morbidity, diminishes length of the procedure and can offer a satisfactory technique for dural repair in case of CSF leak. We adopted this technique as the usual procedure for the approach of our pituitary tumors at this tertiary referral center.

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### **Three-dimensional endonasal endoscopic approach for pituitary adenomas**

*Luis Alberto Ortega-Porcayo, Isaac Jair Palacios-Ortíz, Juan Barges-Coll, Juan Luis Gómez-Amador (Mexico City, Mexico)*

Introduction: Endoscopic endonasal pituitary surgery is an evolving specialty that requires detailed anatomical concepts and advanced endoscopic technical skills. From the technical perspective, the recent introduction of a three-dimensional (3D) endoscope overcomes the lack of stereoscopic vision from 2D endoscopes. Objective: Assess the efficacy and advantages of a HD three-dimensional (3D) endoscope (Visionsense 3D-HD/Philadelphia, PA, USA) for pituitary adenomas.

Aim: Examine the surgical technique, advantages, limitations, complications and outcome using this new 3D endoscope.

Aims of study: Analyze technical advantages for the neurosurgeon using the 3D endoscope during the resection of pituitary adenomas.

Material and methods: The study design was an analytic and retrospective case series at the National Institute of Neurology and Neurosurgery MVS, Mexico. Six consecutive patients with the diagnosis of pituitary adenoma were included. Charts were reviewed for patient gender and age, symptoms, tumor characteristics, surgical procedure, complications and outcome. Advantages and disadvantages were analyzed between two skull base surgeons and two

skull base fellows.

Results: Five patients had non-functional adenomas and one patient had a GH-secreting adenoma. Hardy classification was as follows: Two patients 4C, two patients 3B, one patient 3A and one patient 3E/Knosp 3A. Total resection was achieved in all patients including the patient with cavernous sinus extension and the GH-secreting adenoma. Visual improvement was achieved in 5 patients (83%). All tumors had a soft consistency and no complications were documented during surgery. Regarding postoperative surgical complications, 3 patients had transient diabetes insipidus and one patient permanent diabetes insipidus. Two patients experienced CSF leakage, the first one four days after surgery and the second one five days after surgery. Both were managed initially using a lumbar drain, one did not resolve and needed a second surgery to perform a new gasket seal reconstruction. New hormonal deficits occurred in three cases (50%). The follow up was between 1-6 months and none of them required a second pituitary resection surgery or stereotactic radiosurgery. There was no associated mortality. 3D Advantages and disadvantages: From our perspective, the new 3D system shows two main disadvantages. During the initial phase of the surgery, when the ENT surgeons are working in the narrow nasal spaces, the peripheral screen vision loses definition that needs more maneuverability needing frequent irrigation. Second, there is a minimal delay from the surgical movements on the 3D screen. The main advantages are the following: Surgical movements are greatly improved, depth perception is accurate and permits a better understating of the surgical anatomy, elucidating better the vascular structures and for the young fellows the depth perception improves their surgical confidence during the procedure.

Conclusions: The 3D endoscope improves anatomical understanding and provides a more precise maneuvering of the surgical instruments. Endoscopic endonasal approach is the main indication for this innovatory and efficient tool that overcomes the lack of depth perception during endonasal endoscopic surgeries.

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### **Endoscopic pituitary gland identification and its importance for preservation of hormonal function**

*Stefan Linsler, Renate Hero-Gross, Bettina Friesenhahn-Ochs, Frank Lammert, Joachim Oertel (Homburg/Saar, Germany)*

Objective: The endonasal endoscopic approach has been established for perisellar tumor surgery over the last decade. A higher resection rate and decreased complication rate is expected. Here, the authors analyzed their series of transnasal endoscopic perisellar surgery for identification of pituitary gland tissue and its role for postoperative

hormonal insufficiency.

**Methods:** Between January 2011 and August 2013, 60 patients with preoperative intact pituitary function received endoscopic endonasal transsphenoidal procedures for intrasellar pathologies. The patients were prospectively followed. Special attention was paid to intraoperative identification of gland tissue, surgical complications and radicality, hormonal insufficiency and medical substitution. **Results:** Thirteen percent (8 of 60 patients) showed a persisting pituitary insufficiency. In this patient cohort, five patients (62.5%) with new postoperative endocrinologic deficits had a partial pituitary insufficiency leading to substitution of thyroxin and hydrocortisone. Two patients were substituted with thyroxin, hydrocortisone and sexual hormones and one patient with thyroxin, hydrocortisone and ADH. In analysis with Fisher's exact test, there was a high significant correlation between the identification of the pituitary gland intraoperatively and normal pituitary function postoperatively ( $p < 0.005$ ). On follow up MRI, radical tumour resection was seen in 92% (55 of 60 patients).

**Conclusions:** The endoscopic technique has been shown to be safe in sellar lesions. A high radicality and only minor complications were observed. This study indicates that preservation of pituitary gland tissue is well possible in endoscopic transsphenoidal surgery. The intraoperative identification and preservation of gland tissue is a positive predictor of postoperative normal hormonal pituitary function.

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### **Minimally invasive resection of a large cervical spine neurenteric cyst**

*Ochoa-Plascencia MR, Muciño-Hernandez MI, Borrayo-Dorado SML, Nuñez-Velasco S, Mortola-Rodriguez F, Aguirre-Portillo LE (Guadalajara, Mexico)*

**Introduction:** We present the case of a large cervical spine neurenteric cyst, ventral to the spinal cord, resected with a minimally invasive microsurgical and endoscopic technique.

**Objective:** To present the advantages of both microsurgical and endoscopic techniques for the resection of a cystic lesion of the spine.

**Material and methods:** Male, 28 years old, with spasticity and weakness of the four limbs, since childhood. During the previous 12 to 18 months, had some walking impairment. After his evaluation, he had a mild spastic tetraparesis, with normal sphincteric control, and reduced posterior column sensations. He was able to walk with a cane and independent. The MRI showed a C2 to C6 intradural non enhancing cystic lesion ventral to the spinal cord that was flattening the cord and remodeling the vertebral bodies.

We planned a minimally invasive posterior approach, with neurophysiological monitoring. We performed a left C2/C3 hemilaminectomy. After opening the dura, we found a thin walled translucent non vascular cyst causing flattening and displacement of the spinal cord. After the dissection between two roots and ventrally to the spinal cord, the cyst was punctured and drained a clear dense mucinous material. The cyst walls were easily dissected from the nerves and spinal cord. We used rigid and flexible endoscopes to explore the interior of the cyst and the anterior aspect of the spinal cord. We dissected the cyst wall from the caudal and contralateral spinal cord, but a small portion adherent to the anterior spinal artery was left behind. Pathology reported a classical neurenteric cyst.

**Results:** In the postoperative period, the patient was stable. He reported sensibility improvement in the four limbs. The spasticity was unchanged. During the follow up, he complained about the limitation caused by spasticity, with minimal response to baclofen and physiotherapy. At the present, he is able to walk with spastic gait, is independent and has normal sphincter control. At 2 years the MRI shows some spinal cord atrophy, with the cyst remnant without changes or mass effect.

**Conclusion:** The removal of large cyst lesion in the spine is safe using minimally invasive techniques, assisted with microscopic and endoscopic views. Both techniques enhance the vision of the area, through small approaches, in a safe way with better result for the patient.

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### **The success of endoscopic third ventriculostomy in children: analysis of prognostic factors**

*Ricardo Santos De Oliveira (Sao Paulo, Brazil)*

**Objective:** The treatment of hydrocephalus in children with endoscopic third ventriculostomy (ETV) has particular features and is associated with different success rates (SR). The aim of this study was to identify putative factors that could influence the outcome of ETV in children.

**Methods:** Clinical data of 114 consecutive patients under 18 years of age who underwent 116 consecutive ETVs from January 2000 to January 2010 were reviewed. Data were analyzed with regards to clinical and radiological SR. The actual long-term SR was compared to that predicted by the ETV Success Score (ETVSS) model.

**Results:** The study group included 49 males (43%) and 65 females (57%) with a mean age of  $6.17 \pm 1.02$  years (ranging from 11 days to 18 years) at surgery. Concerning the etiology of hydrocephalus, tumors and aqueductal stenosis (AS) were the most frequently observed, with each occurring in 33 cases (29%), followed by malformations in 24 (21%), cystic lesions in 6 (5%) and other etiologies in 18 patients (16%). The overall SR at the first ETV attempt

was 80% (91/114), compared to 74.8% (variance 14.35, 95% CI 69.37– 78.22) predicted by the ETVSS. Regarding age, SR was 58% in patients under 6 months of age, 65% in children between 6 months and 1 year, and 86% in children older than 1 year. SR for AS and hydrocephalus associated with posterior fossa tumors were 88 and 90%, respectively. Unsatisfactory results were related to previous intraventricular hemorrhage and infection. The overall complication rate in this series was 13%. Conclusion: ETV is safe and effective in children. In this series, the age of the patient and etiology of hydrocephalus were related to SR. Also, the ETVSS was accurate to predict outcome. In a long-term follow-up, surgical experience was statistically significant in reducing complications.

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### **Neuroendoscopic procedures in the treatment of compartmentalized hydrocephalus in children**

*Flavio Giordano, Giacomo Peri, Barbara Spacca, Regina Mura, Federico Mussa, Massimiliano Sanzo, Elena Arcovio, Pierarturo Donati, Lorenzo Genitori (Firenze, Italy)*

**Introduction:** Compartmentalized hydrocephalus (CH), also known as complex or multiloculated hydrocephalus, is a rare disease usually observed in the pediatric age. It is characterized by presence of abnormal septa ad/ or obstruction that may lead to isolated compartments inside the ventricular system. CH may be congenital but is usually due to infection, hemorrhage or shunt surgery complication. It may be classified in: univentricular hydrocephalus, multicystic hydrocephalus, trapped fourth ventricle, trapped temporal ventricle.

**Aim:** Aim of the present retrospective study on 51 treated pediatric patients is showing the efficacy of Neuroendoscopy procedures in the management of CH in reducing the number of implanted shunts, their morbidity and number of revisions.

**Materials and methods:** Since 1994 to 2015 fifty-one patients affected by symptomatic CH due to various pathologies underwent to different neuroendoscopic procedures: septostomy and Monroe foraminoplasty, endoscopic third ventriculostomy (ETV), aqueductoplasty, multiple fenestrations, ventricular catheter lysis, choroid plexus coagulation. More than half children (39/51; 76,5%) have been previously operated for VP-shunt insertion (secondary CH), while 12 out 51 (23,5%) received neuroendoscopic procedures as first choice surgery (primitive CH). Surgical outcomes were evaluated according to number of patients shunt-free, number of shunt revisions and number of VP-shunt per patient.

**Results:** Fifty-one patients underwent to a total of 91 neuroendoscopic procedures for CH. There were 29 males,

22 females; mean age was 11,1 years (range 1 – 15 yrs). Surgeries were: septostomy and Monroe foraminoplasty (22), ETV (21) and redo-ETV (11), aqueductoplasty (18), multiple septa and cyst fenestration (16), ventricular catheter lysis (2), choroid plexus coagulation (1).

Mean follow up was 61,8 months (range 9 months – 18,3 years). All of them received a full neuroradiological work-up by means of CISS/CSF-drive MR both before and after surgery. Surgical mortality occurred in one patient (1,1%) with CH due to myelomeningocele. Morbidity accounted for 25,4% (13/51) because of infection (2/91; 3,0%), CSF-leakage (4/91; 7,8%), cranial nerve palsy (3/91; 5,8%), intraventricular hemorrhage (1/91; 1,9%). Three procedures (1,9%) were aborted because of distorted anatomy. At last follow-up 8 out of 27 patients carrying only one shunt before were shunt-free after surgery (29,6%) corresponding to an overall 15,7% of shunt-free children in the whole series. 70% (34/50) patients maintained only one shunt while 8/50 (18%) two or more after surgery. The average number of shunt revision after surgery was reduced from 2,82 to 1,51.

**Conclusions:** Neuroendoscopic procedures are efficacious in the management of primary and secondary CH, and may successfully reduce both the number of shunt revisions and the number of VP-shunt per patient. ETV should be considered as first choice for shunt failure every time the anatomy of hydrocephalus allows it.

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### **Endoscopic CSF fistula repair. Principles & techniques**

*Mohisn Qadeer, Salman Sharif (Karachi, Pakistan)*

**Introduction:** Endoscopic transnasal approaches to the skull base have changed the treatment of cerebrospinal fluid fistulae, making repair less invasive and as effective as craniotomy.

**Methods:** This study prospectively looked at the results of endoscopic repair of dural defects through endoscopes by using various graft material. Between January 2012 and 2015, 48 cases of anterior skull base CSF fistulae were treated endoscopically. Fistula closure was achieved by various kinds of grafts with fibrin glue.

**Results:** The etiology of the fistula was accidental trauma in 29 cases, iatrogenic in 8 and spontaneous in 11. The site of the defect was the sphenoid sinus in 15 patients, the cribriform plate in 14, the anterior ethmoid roof in 9, the posterior ethmoid roof in 8, and the posterior wall of the frontal sinus in 2. The success rate at first attempt was 94 %. In our hands, the success rate of endoscopic fistula repair was high, even in defects larger than 2 cm. Success may be further improved with accurate diagnosis of elevated intracranial pressure, a contributing factor to

the failure of spontaneous fistula repair.

Conclusion: Advances in endoscopic transnasal approaches to the skull base have revolutionized the treatment of CSF fistulae. Endoscopic surgery has become the method of choice in the repair of anterior skull base CSF leaks, though with limitations related to the site (posterior wall of the frontal sinus) and the size of the defect.

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### **Combined choroid plexus coagulation and endoscopic third ventriculostomy for the treatment of hydrocephalus, is it really useful?**

*Abhaya Kulkarni (Toronto, Canada)*

ETV+CPC has shown promising results in sub-Saharan Africa, but its efficacy and role in treating children in other settings is still being determined. A review of the history of ETV+CPC and the current state of knowledge about this procedure, including on-going and future planned studies is presented. The early evidence suggests that there might well be a useful role for ETV+CPC in some infants with hydrocephalus, but the exact group that will benefit most is yet to be defined.

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### **Imaging characteristics affecting the decision to perform ETV and predicting success**

*Spyros Sgouros (Athens, Greece)*

Introduction: There is increasing attention paid to radiological factors that may influence the outcome of ETV and hence could be used preoperatively as factors that may influence the decision to perform the procedure. Such factors may include the downward bowing of the floor of the third ventricle, the size of the third ventricle, the stretching of the roof of the third ventricle.

Material: Analysis of radiological data of children with aqueduct stenosis who had ETV by the author and review of the literature.

Results: In patients who had ETV and the preoperative MR scans were analysed there was a distinct difference in the anatomy of the third ventricle between patients where ETV was successful and those that it failed. In the success group the third ventricle was large, the floor bowing down and the roof stretched upwards. In the failure group the floor was not bowing down, the roof was not stretched upwards and overall the third ventricle was small. Several reports in the literature are increasingly identifying as a positive predisposing factor the downward bowing of the floor of the third ventricle as well as the stretching of its roof, as factors that may indicate that the walls of the third ventricle have a CSF propelling role.

Discussion: It may be possible to forecast which patient may benefit from ETV by observing the anatomy of the

third ventricle. Larger third ventricle with down-stretched floor and up-stretched roof may be associated with higher chance of success.

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### **Transventricular neuroendoscopic exploration and biopsy of the basal cisterns**

*Rolando Jiménez-Guerra (Mexico City, Mexico)*

While endoscopy is considered a diagnostic tool in several medical specialties, neurosurgery has relied on several other diagnostic procedures such as MRI and CT given the relative invasiveness of endoscopy. Diverse pathologies at the skull base and ventral pons not only cause obstructive hydrocephalus, but might be difficult to diagnose by conventional means. These lesions are difficult to biopsy with stereotactic puncture, and can be approached endoscopically through the floor of the third ventricle. Main indications for exploring subarachnoid space are: inflammatory process, parasite searching and extraction as well as tumor biopsies. There are also some cases when compartmentalization of cisterns requires release of pressure, and opening thickened arachnoid septa in hydrocephalus patients would theoretically increase flow into the spinal compartment or any other place where eventually cerebrospinal fluid will be absorbed. Several authors have proved that going beyond the third ventricle with a flexible neuroendoscope is safe. Arachnoid biopsy along with traditional brain cortex biopsy increases global accuracy diagnosis from 16 to 91% in cases with chronic meningitis. Using rigid lenses limits exploration into the interpeduncular and pre pontine cisterns, while flexible scopes are optimal when exploring the rest of the basal subarachnoid space. Infections related to sterilization protocols have been a concern among some surgeons, but no cases have been reported using flexible endoscopes. Exploring basal subarachnoid space is safe in experienced hands and should be part of the armamentarium of neurosurgeons dealing with central nervous system chronic inflammatory and infectious pathologies.

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### **“Make your own” endoscopy simulator for practicing hand – eye coordination for endonasal and skull base endoscopy**

*Adesh Shrivastava, Karan Singh (Bhopal, India)*

Introduction: The major challenges to skull base endoscopy is the visual training for depth perception on a two dimensional screen and the hand eye coordination. With more and more surgical procedures being subjected to endoscopic technique, simulation training for beginners is becoming essential. Such trainings have proven advantages and reduce complications & operative times as well

improve surgical outcomes. But due to limited availability and the highly restrictive costs of such simulators, not every endoscopic surgeon (especially beginners) gets to practice on them.

**Objective:** Here we try to solve this problem by a unique “make your own” simulator. This simulator can be made at home using easily available items and can be used as a personal device for practicing wherever and whenever needed.

**Material and methods:** Android mobile phone with automatic screen rotation (G-sensor), endoscopy simulator app (Endosimulator®) for android, pen for capacitive screen, MHL (HDMI video) cable compatible with the mobile being used, any display with HDMI input, a long pencil and a mobile handle. With the equipment in place, trainees with no or minimal experience in endonasal endoscopy were given an initial demonstration of proposed steps. Then predefined tasks were given which were objectively monitored with the app. With progressive practice the accuracy of hand-eye coordination was measured.

**Observations and results:** It was seen that with progressive practice the accuracy of hand eye coordination increased and this was objectively recorded on the app.

**Conclusions:** For beginners in endonasal & skullbase endoscopy, this trainer is a low cost practical simulator that can be easily assembled by the user and used at convenience even at home for practicing hand-eye coordination. With a variety of tasks on the app and different handle designs, the accuracy in maneuvering different endoscopic instruments can be improved substantially.

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### **Endoscope holders in cranial neurosurgery: technology, trends and implications**

*Dimitrios Paraskevopoulos, Jonathan Roth, Shlomi Constantini (London, United Kingdom, Tel Aviv, Israel)*

**Introduction:** Cranial neuroendoscopy may be used freehand or with endoscope holders (EH). Over the years, various companies and research groups have developed EH, claiming advantages such as the ability of a single surgeon to perform surgery, and a more steady visual view (potentially avoiding tissue damage). Despite these advantages, and for ill-defined reasons, EH are not widely used.

**Objectives/Aims:** Aim of this study is to summarize the evolution of EH and attempt an overview of currently available devices, their features and actual usage. The objective is to systematically review the current state of technology, identifying strengths and weaknesses, and focusing on feasibility of available systems, as well as surgeon’s preferences. In addition, we performed a survey among neurosurgeons regarding the use of EH.

Furthermore, an insight into the future is proposed, identifying trends, specifications and technological evolution.

**Methods:** A systematic review was conducted on Pubmed, OvidSP, EBSCO and Google Scholar. Targeted search through cross-references was also implemented, followed by personal contacts, interviews, company websites and operating manuals. An online survey was performed to acquire data on preferences and current state of usage. This was conducted by approaching surgeons from several countries via email and subsequently posted online, via a neurosurgical exchange forum.

**Results:** EH may be divided into manual and pneumatic. Use of micromanipulators is sometimes implemented. Different characteristics have been described, such as pneumatic, mechanical, friction, micromanipulator, robotic, hybrid, air-locking, and voice-control. An overview of systems and main features is provided.

Twenty-eight surgeons responded to the survey. The majority (75%) do not routinely use EH. The rest utilize holders mainly for intraventricular rather than skull base procedures. Nearly all surgeons (96%) stated using a second surgeon regularly. Reported weaknesses included: crude movements, downward drift, loss of depth perception, lack of flexibility, iatrogenic injury, cost, bulky construct, limited degrees of freedom, staining of endoscope tip requiring repeated release.

Features welcome in the future were: robotics, micromanipulators, stability, precision, automatic/remote control system, and easy unlocking/locking.

Despite the availability of several EH in the market, their use is not widely accepted. We suggest several reasons for their limited use, including those related to the endoscope’s role, and those related to the EH. Other reasons may be attributed to surgeons’ training or reluctance to implication of new technologies.

**Conclusion:** Although EH have a role in cranial neuroendoscopy, their use seems limited and their features are regarded as suboptimal. There are no clear indications regarding the procedures that should be performed using EH. Many factors affect the implication of EH, including safety, type of surgery, surgeon’s preference and mechanical properties. There is still potential for improvement and further technical evolution of EH, which could lead to a change of paradigm in the future.

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### **Endoscopic reconstruction of CSF pathway**

*Piero Andre Oppido (Rome, Italy)*

**Introduction:** Neuroendoscopy is presently considered a scarcely invasive surgical approach to expanding lesions bulging into the ventricle, as a relevant tool to perform bioptic procedures, discontinuation of cystic

walls or tumor removal in selected cases. Furthermore, the diffusion of neuro-imaging and the accurate follow-up of brain tumor patients have more frequently allowed documenting tumoral and pseudo-tumoural cystic areas causing the obstruction of cerebrospinal fluid pathways. Neuroendoscopic procedures enable fenestration of cystic lesions, in addition with third ventriculostomy or septostomy to restore CSF pathways.

**Methods:** We analyze our experience regarding 77 patients affected by brain tumors arising by the wall of the third or lateral ventricle. In all cases hydrocephalus or obstruction of CSF flow was present. By endoscopic technique septostomy, cystostomy, third ventriculostomy (ETV) tumor resection and were performed to control intracranial hypertension.

**Results:** in 53 patients with non-communicating hydrocephalus the ETV was realized. In 4 LG astrocytoma the ETV was the only surgical treatment, definitively. In 12 cystic tumours cystostomy and marsupialization into the ventricle solved a relevant mass effect with clinical intracranial hypertension syndrome. In 10 patients neuroendoscopic relief of CSF pathways by septostomy associated to Ommaya reservoir or one catheter shunt was possible. In 5 case colloid cyst and 2 cystic craniopharyngioma removal was possible, by restoring CSF flow without other procedures. After intracranial hypertension control, in 13 malignant gliomas and 5 leptomeningeal carcinomatosis allowed to continue tumor adjuvant therapy ameliorating the quality of life.

**Conclusion:** In this series the endoscopy was found to be safe and effective, avoiding major surgical approaches and without any relevant post-operative morbidity. Based on these results and on the increasing series described in the literature, the endoscopic techniques should be considered a selected approach to treat CSF obstructions by paraintraventricular tumors. This surgical procedure is not limited to relief of non-communicating hydrocephalus, but also it is useful for tumor removal or biopsies and evacuation of cystic lesions. In patients affected by malignant tumors, neuroendoscopy can be performed to control intracranial hypertension before starting adjuvant chemotherapy or radiotherapy.

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**Experience of the neuroendoscopy training program with simulation at the Garrahan Pediatric Hospital simulation center**

*Sebastián G. Jaimovich, Roberto Jaimovich, Marcela Bailez, Juan Carlos Vassallo, Susana Rodriguez (Buenos Aires, Argentina)*

**Introduction:** We are living a new era focused on patients' safety that requires the neurosurgeon to acquire technical skills before performing an actual surgery. With this goal

we have created the first neuroendoscopy training center with simulation in Argentina, within the framework of the Simulation Center and Experimental Surgery at "Prof. Dr. J. P. Garrahan" Pediatric Hospital.

**Objective:** To present the three years' experience of the neuroendoscopy training program with simulation developed at "Prof. Dr. J. P. Garrahan" Pediatric Hospital Simulation Center.

**Material and methods:** Over the past three years we have organized training courses in basic and advanced neuroendoscopy. Each course is based on a rigorously designed training program where trainees can learn and improve neuroendoscopy skills in an organized environment, progressive in complexity and supervised by our instructors in a personalized way. To perform the most complex intraventricular neuroendoscopic procedures we have developed different types of simulators, including non-anatomical and anatomical simulators, and simulation models in live animals, allowing trainees to perform endoscopic explorations, membranes fenestration, tumor resection, hemostasis, hematoma aspiration and direct placement and removal of catheters, among other procedures.

For validation proposes, during the courses we evaluated each trainee's basic and final skills for all the procedures in the program; and trainees answered a questionnaire on performance. We also acknowledged trainees' and instructors' opinion on simulators' realism.

**Results:** During this 3-years period 107 trainees neurosurgeons and residents participated to learn or improve their neuroendoscopy skills. The average trainees' basic skills for the program's procedures globally were poor (null/poor basal skills: 75% for membrane fenestration, 100% for tumor biopsy and resection, 100% for hemostasis, 100% for hematoma aspiration, and 100% for catheter placement and removal). After training, the final skills were adequate and very good globally (according to the mentioned procedures: 62%, 100%, 75%, 100%, 100% respectively). The deferred questionnaire on performance reported that all trainees gained confidence in neuroendoscopy procedures, and 83% applied the techniques learned. The opinion of realism on the different simulators was: 98% very good/excellent for non-anatomical simulators, 94% very good/excellent for anatomical simulators and 100% for animal models.

**Conclusion:** Through surveys and assessments we determined that a rigorously designed specific training program, with a supervised and progressive training, using different neuroendoscopy simulation models, allows trainees to improve and accelerate their learning curve with the goal of patient's safety.

### **The shuntscope - new technique for catheter placement in complex cases of hydrocephalus in pediatric neurosurgery**

*Stefan Linsler, Sebastian Antes, Mohamed Salah, Joachim Oertel (Homburg/ Saar, Germany)*

**Objective:** The long-term preserving of ventriculoperitoneal shunt function depends on the correct placement of the ventricle catheter. Nearly 4% of ventricular catheters are misplaced. There are already many tools to optimize the insertion, such as neuronavigation or stereotactic techniques.

**Methods:** We used the new semirigid ShuntScope (Karl Storz, Germany) for the catheter placement in cases of slit ventricles, pseudotumor cerebri, cystic lesions and in cases of aqueductoplasty. The study was carried on 33 patients (19 males, 14 females), mean age 40 (5 to 78 years, 7 children). 24 patients presented with slit ventricles or difficult anatomic ventricular configurations. The ShuntScope was used as diagnostic and therapeutic tool. The small outer diameter of 1mm allows to pass through the catheter under directly endoscopic view with a very good image resolution of 10 000 Pixels.

**Results:** The main value of this new technique was the ability to place the catheter tip accurately within distorted or small ventricles. Even controlled and guided placements in the fourth ventricle were possible in cases of aqueductoplasty. The semirigid endoscope allowed a safe intraoperative correction of the catheter placement due to a cover sheet function of the ventricular catheter. The postoperative neuroradiological imaging revealed the catheter tip placement analogous to the intraoperative findings and video recording analysis. No bleeding complications or infections occurred.

**Conclusion:** The ShuntScope is very useful for safe catheter placement in complex cases of hydrocephalus. With this new technique misplacements of shunt catheters are completely avoidable. The ShuntScope technique should be implemented in Pediatric Neurosurgery.

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### **Neuroendoscopy or microsurgery for plexectomy**

*Sebastian G. Jaimovich, Ma. Laura González, Roberto Jaimovich (Buenos Aires, Argentina)*

**Introduction:** Plexectomy and choroid plexus coagulation, as a treatment option to manage complex hydrocephalus, has been performed microscopically and endoscopically since the early 1900s, but recently it has become more popular.

**Objective:** To present our experience with different plexectomy techniques, from microsurgery to minimally invasive endoscopy, analyzing results and complications.

**Material and methods:** Through a retrospective

observational study we analyzed medical records and neuroimaging of patients admitted to our institution from 1990 to the present time, which underwent plexectomy as a primary or complementary procedure. We considered gender, age, underlying disease, indication, days of hospitalization, intraoperative and postoperative complications, evolution and surgical technique.

**Results:** A total of 25 plexectomies were performed in 14 pediatric patients: 18 microsurgical plexectomies, 3 pure endoscopic, 2 biportal endoscopic, and 2 endoscopically assisted plexectomies through an expandable port. The main indications for performing these procedures were infectious multiloculated hydrocephalus (10 patients), choroid plexus hyperplasia (2 patients) and nonfunctioning peritoneum with bilateral jugular thrombosis (2 patients). Combined procedures were performed in 12 cases (10 multiloculation fenestration and 2 third ventriculostomy). Microsurgical technique presented more complications: seizures / status epilepticus (7 patients), motor deficit (2 patients) and subdural collections (4 patients); but no need for CSF shunt in 50% treated of patients. Minimally invasive endoscopic plexectomy techniques (pure, biportal or endoscopically assisted through an expandable port) presented fewer complications, faster recovery with less hospitalization and significantly less brain damage; however, CSF shunt was required in all cases.

**Conclusions:** Plexectomy was used in different pathologies, from complex hydrocephalus to persistent pioventriculitis, as a last line treatment. The various minimally invasive endoscopic techniques should be of choice as they showed similar success treatment rates for persistent pioventriculitis and for most complex hydrocephalus, in comparison to microsurgical plexectomy; with the advantages of reducing associated complications morbidity and approach's brain damage.

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### **Trigeminal neuralgia endoscopic microvascular decompression - a procedure of choice**

*Tariq Salah Ud Din, Amir Aziz, Yaser Ud Din Hoti, Khurram Ishaque (Lahore, Pakistan)*

**Introduction:** Microvascular decompression has been widely used as the first choice in treating trigeminal neuralgia, but in a few patients the offending vessels by the microscope cannot be properly visualized as it gives only an anterior posterior view. By performing microvascular decompression with the help of endoscope, a panoramic view of the internal structures is obtained which helps in identifying structures not visible with conventional microscopic technique. We sought to clarify the important factors for good operative outcomes.

**Methods:** We reviewed 20 patients with trigeminal neuralgia treated by endoscopic microvascular decompression during

the period January 2013 to September 2015, including clinical presentation, operative findings, techniques, and outcomes. Neurovascular conflicts were divided into single contact, contact and indentation, single adhesion, adhesion and indentation, and trigeminal nerve atrophy. Operative outcomes were graded into immediate postoperative complete pain relief (excellent), delayed postoperative complete pain relief (better), significant pain relief (good), and no response to microvascular decompression (poor). Results: We found endoscopic MVD a better procedure in terms of short time of surgery, less complications and short hospital stay and better visualization of the anatomy.

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### **Acute aqueduct obstruction in young adult - neuro endoscopic management**

*Saikaran, Sanjay Bendalae, K. Bagathsingh, K. Selvamuthukumaran, V. Inbasekaran (Madurai, India)*

**Aim:** Acute CSF Follow obstruction at the level of superior aspect of Aqueduct in the posterior 3rd ventricle by infective cystic lesion is rare in our part of the country. So we want to discuss the case because of rarity and exclusive endoscopic management, in young adult.

**Materials and Methods:** A 29 years old gentleman presented with acute episode of altered sensorium since the evening. He was admitted to the local hospital in nearby town and referred to our hospital for further management. NCCT showed dought full lesion at third ventricle with acute obstructive hydrocephalus. MRI with contrast showed multiple intraparenchymal lesions with non-enhancing lesion at posterior 3rd ventricle obstructing the aqueduct at superior level, with acute obstructive hydrocephalus. At the level of the FM there was no obvious attachment. We planned to remove the obstruction by neuroendoscopic technique. Through standard right frontal endoscopic route, we removed the lesion causing obstruction. Patient was discharged on 6th POD.

**Conclusion:** Even though parenchymal neurocysticercosis is frequent, intraventricular cysticercosis with acute presentation is rare in our part of the country. Usually it presents as seizure disorder, it is rare to present as acute episode of altered sensorium in a previously normal patient. MRI is important in planning the neurosurgical intervention. Obstruction at the level superior Aqueduct is easy to manage endoscopically than other sites of CSF pathway obstruction.

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### **Flexible neuroendoscopy management of hydrocephalus secondary to intraventricular neurocysticercosis in pediatric patients**

*L Fernando Muruato-Araiza (San Luis Potosi, Mexico)*

**Introduction:** Neurocysticercosis is central nervous system (CNS) infection by the larval stage of the pork tapeworm (*Taenia solium*). It is the most common parasitic disease of the CNS and is considered a public health problem in developing countries. It is considered a rare disease in the pediatric patients compared with its frequency in adults. In pediatric patients represents 0.8 to 27.5% of cases in general, attributed to the long incubation period of the etiologic agent.

**Objective:** Demonstrate the utility of flexible neuroendoscopy to treat hydrocephalus secondary to intraventricular neurocysticercosis in the pediatric population.

**Methods:** We retrospectively reviewed patients under 18 years with neurocysticercosis requiring neuroendoscopy to solve hydrocephalus. Endoscopic findings, procedures, previous cerebrospinal fluid shunting, patient monitoring, resolution of hydrocephalus, preoperative functional outcome and outpatient follow-up were recorded.

**Results:** We included 7 patients, mean age 14.14 years ( $\pm 3.185$ ), the main cause of hydrocephalus was aqueductal stenosis (71.42%). All patients underwent endoscopic third ventriculostomy performing premammillary membrane fenestration, parasitic extraction in 4 patients, 4 aqueductoplasty, 3 septostomy 1 lamina terminalis fenestration, 1 shunt reinsertion and 1 shunt removal. The mean follow-up time was 414 days ( $\pm 246.5$ ). Six patients experienced successful resolution of hydrocephalus, we experienced frozen subarachnoid space in the patient with failure of the endoscopic procedure ( $p = 0.14$ ) nevertheless a second look neuroendoscopy was successfully performed. The mean preoperative Karnofsky score was 57.14 ( $\pm 7.55$ ), median after follow-up improved to 100 (range 80-100) ( $P = 0.0078$ ). Two patients with a past history of shunt placement did not fully recovered ( $P = 0.0476$ ).

**Conclusion:** Flexible neuroendoscopy for the management of hydrocephalus secondary to intraventricular neurocysticercosis in pediatric patients is a useful procedure solving hydrocephalus in 85.71% of the patients. The functional outcome of these patients increases after surgery.

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### **Prepontine cistern racemose neurocysticercosis resection by neuroendoscopic third ventriculostomy: an unexpected intraoperative diagnosis**

*Roberto Alexandre Dezena, Leopoldo Prézia de Araújo, Murillo Martins Correia, Wellington Márcio da Silva, Joyce Yuri Silvestre Yamamoto (Uberaba-MG, Brazil)*

**Introduction:** racemose neurocysticercosis refers to cysts in the cisterns of the subarachnoid space, which can occasionally grow into large lobulated masses compressing surrounding structures and causing hydrocephalus. Neuroendoscopic third ventriculostomy (NETV) opens

premamillary membrane and drains CSF from the third ventricle to prepontine cistern, allowing sometimes biopsies in this region.

**Objectives:** to present a case of a patient submitted to NETV during which there was an unexpected intraoperative diagnosis of racemose neurocysticercosis, and neuroendoscopic resection of the cysts was performed. **Material and Methods:** this case is about a 69-year-old man with a progressive gait ataxia and progressive cognitive decline. CT and MRI showed obstructive hydrocephalus. For this case a neuroendoscopic approach was proposed.

**Results:** the patient was submitted to neuroendoscopic approach, by a Gaab system 0° rigid neuroendoscope, entering the right lateral ventricle, from Kocher point, reaching the third ventricle. An NETV was performed opening premamillary membrane and surprisingly several racemose cysts were seen inside prepontine cistern, all being resected (demonstrated in video). Histopathology diagnosis showed racemose form of *Cysticercus cellulosae*. The patient improved gait ataxia and memory, and was discharged to neurological follow-up.

**Conclusions:** NETV proved a useful technique for this rare case.

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## **Craniotomy with neuroendoscopy assistance for treatment of multiple intracranial hydatid cysts.**

### **Case report of neurohydatidosis**

*Victor David Mosaja Alanya (Lima, Peru)*

Hydatid disease is caused by the parasite *Echinococcus Granulosus* that often involves lung and liver. However this may also affect the CNS producing Neurohydatidosis. Hydatid infestation of brain and spine is of paramount importance, especially in endemic areas. When it is located in brain parenchyma, cysternal space or skull base there is a risk of rupture during surgery and subsequent spread resulting in multiple neurohydatidosis. Reported here is the case of a 14-year-old woman who underwent surgery for intracranial cysts with resultant pathology in hydatid disease. In one year follow-up, MRI showed spread of multiple new cysts located deep in the skull base. Craniotomy was performed with endoscopic assistance to prevent rupture of cysts. Literature review was performed about pathology, imaging, options of treatment and intraoperative care. Endoscopic extraction can prevent rupture of deep cysts.

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## **Endoscopy in the treatment of intraventricular and subarachnoid space cysticercosis 2008 to 2014**

*William Martinez Diaz, Jorge Nuñez Manrique (Lima, Peru)*

Cysticercosis is a parasitic disease of humans and pigs caused by *Taenia solium*, which presents the adult parasite invaginated scolex in a vesicle.

The infection is acquired by ingesting eggs or gravid proglottids of the tapeworm, out with human feces infected with pork tapeworm, the definitive host and main risk factor. Oncospheres are released into the small intestine, invade the intestinal wall into the bloodstream and spread.

Because cysticerci modulate the immune response and immune suppression occurs as an escape mechanism, two forms of cysticercosis, cellulose and racemose are distinguished.

Those of the most common type cellulose are about 5-10 mm in length, are seen as yellowish-white, oval vesicles or rounded, with visible scolex inside, looking like a small white pellet. Racemose form larger, vesicular, lobed, often like a bunch of grapes (subarachnoid space, brain ventricles). Scolex is usually not visible, although in most cases, a comprehensive gross review allows the identification of the same or their remains. Neurocysticercosis is a pleomorphic disease, its clinical manifestations depend on the genetic diversity of parasites, their number, status (colloidal stage is generating increased inflammatory reaction), anatomical location (parenchyma - with the highest percentage, grooves, ventricles, subarachnoid, tanks, spinal less frequently), the host immune response and modulation thereof by the parasite.

The most severe clinical presentation is considered when the parasite is located in the subarachnoid space.

Signs and symptoms become apparent months or years after infection: seizures, partial with or without generalization, severe headaches, obstruction of CSF circulation with increased intracranial pressure - mainly by ventricular or cisternal location, secondary hydrocephalus, depression, dementia, focal neurological disorders, hyperactivity (in children). Often the presence of cysticerci in the CNS is asymptomatic.

Diagnosis requires imaging studies and identification of antibodies and antigens, due to its limited sensitivity and specificity.

Treatment includes Albendazole antiparasitic and praziquantel. The optimal treatment strategy of intraventricular cysticercosis and cerebral cisterns should be personalized with endoscopic surgery been preferred at our institution. Prevention and control can be achieved with i. *T. solium* Taeniasis is exclusively a human disease and this is solely responsible for the dispersal of adult parasite eggs, causing human and porcine cysticercosis; ii. The introduction of basic health infrastructure required for the proper disposal of excreta; iii. Health control of pork and illegal killing; iv. Confinement of pig to prevent coprophagy and adequate food, health inspection, seizure and registration of infected animals; v. Effective health surveillance programs.

**A comparison of the success rate of neuroendoscopic procedures in patients with obstructive hydrocephalus based on the patency of the subarachnoid space of the basal cisterns: our experience**

*Jaime G Torres Corzo, Roberto Rodriguez Della Vecchia, Juan Carlos Chalita Williams, Jose Juan Sanchez Rodriguez, Dominic Shelby Cervantes (San Luis Potosi, Mexico City, Mexico)*

**Introduction:** Neuroendoscopy has revolutionized the classic management of hydrocephalus which was previously limited to shunting. Endoscopic Third Ventriculostomy is the most frequently employed procedure in neuroendoscopy to treat obstructive hydrocephalus. Other procedures include: lamina terminalis fenestration, septostomy, aqueductoplasty and Magendie and Luschka foraminoplasty. Cerebrospinal fluid must circulate from the ventricles and must pass to the subarachnoid space in order to be absorbed. In our experience a patent subarachnoid space is a very important predictive factor to assess the success rate of neuroendoscopic procedures in obstructive hydrocephalus.

**Objective:** Our objective was to compare the success rate of flexible neuroendoscopy in obstructive hydrocephalus in patients with patent subarachnoid space versus those with a scarred subarachnoid space.

**Aim:** To compare the success rate of flexible neuroendoscopy in obstructive hydrocephalus in patients with patent subarachnoid space versus those with a scarred subarachnoid space over a five year period.

**Material and methods:** We performed a retrospective analytic cohort study of 150 patients randomly selected. The patients' files and surgical videos were analyzed. Patients were classified into two groups: those with a patent subarachnoid space and those with scarred subarachnoid space. The groups were compared and the success rate of resolution of hydrocephalus was analyzed.

**Results:** Patients with a patent subarachnoid space had a resolution rate of 69.54%. Those with a scarred subarachnoid space had a resolution rate of 32.55%. This was statistically significant ( $p < 0.0001$ ).

**Conclusions:** A patent subarachnoid space is an important factor in predicting success rate of neuroendoscopic procedures in patients with obstructive hydrocephalus. We highly recommend exploration of subarachnoid space to decipher its characteristics in order to identify patients at risk of recurrence of hydrocephalus.

**Transventricular neuroendoscopic cystic craniopharyngioma resection-how much is enough?**

*Christoph Wiegand, Ali Akcocuk, Frank Möllmann, Christoph Greiner, Niels Sörensen (Osnabrück, Würzburg, Germany)*

**Introduction:** Cystic craniopharyngiomas expanding into the ventricles are demanding tumors leading to obstructive hydrocephalus in childhood.

**Objective:** Retrospectively it was questioned in a mono-institutional series which type of craniopharyngioma fits best for endoscopic transventricular removal.

**Material and methods:** We report a series of n=11 children with cystic craniopharyngioma (CC) presenting with obstructive hydrocephalus (HCP) from 2010 until present. The youngest child was 3 yrs, the oldest 16 yrs old with a mean age of 6,8 years. All children had preoperative MRI and CT (detecting calcification) scan. Neuronavigational guidance and landmarks acquired through Osirix® were applied for optimum entry point. The cystic lesion was removed purely endoscopic via a right-sided transfrontal 12 mm burr hole, puncturing the ventricle with a peel away catheter 5,5 mm (BBraun ®) using a rigid 30 degree endoscope (Aesculap MINOP). Cysts were resected by monopolar/bipolar onto the solid margins of the tumor, whenever possible additional ETV to reinstall CSF drainage to the basal cisterns was done.

**Results:** All procedures were complication free (no sterile or bacterial meningitis / no bleeding from plexus / no occluding cyst remnant), except for 1 child needing a Rickham reservoir for serial puncture. No shunt was needed in the postoperative course of all patients. In all children post-operative MRI scan was done after 48 h showing removal or remarkable reduction of size of the lesion at discharge, at 3 months, 6 months and after 1 year. N=2 children needed a redo endoscopy for recurrent cysts. All children were included into the craniopharyngioma study at the German study center in Oldenburg/Germany.

**Conclusion:** The minimally invasive transventricular endoscopic access is superb for atraumatic removal of cystic portions of CC, avoiding extensive craniotomies and parenchymal damage providing bleeding control and intraoperative visualization. We feel that ETV can reestablish CSF pathways draining cyst fluid into basal cisterns. We think it is best advisable in small children at young age with space occupying cystic components of craniopharyngioma bulging into the ventricles. It is also a good option in children having undergone multiple procedures for CC resection depending on hormonal substitution. It is reasonable to rinse pressure controlled ringer solution to remove cyst liquid avoiding sterile meningitis.

## **Flexible neuroendoscopy as a diagnostic and therapeutic tool of craniopharyngiomas with ventricular invasion**

*L Fernando Muruato-Araiza (San Luis Potosi, Mexico)*

**Introduction:** Craniopharyngioma is thought to arise from ectodermally derived epithelial cell remnants of Rathke's pouch and the craniopharyngeal duct. They can occur along the craniopharyngeal duct however the most common location is the sellar and parasellar region in the central nervous system. This tumor is observed to have a bimodal distribution, with one peak in children between 5 to 14 years old and a second peak in adults 45 to 60 years old. Up to 50% of children will have obstructive hydrocephalus that may warrant rapid ventricular drainage. Solid and cystic components of craniopharyngioma have given rise to several management methods and treatment for the resolution of these tumors, some of them are surgical treatment with gross total or subtotal resection, stereotactic cyst aspiration, radiation therapy, cyst chemotherapy, systemic chemotherapy, radiotherapy and rigid or flexible neuroendoscopy.

**Objectives:** The aim of this work is to correlate the therapeutic effectiveness and clinical outcomes in patients with obstructive hydrocephalus associated with craniopharyngioma managed with flexible neuroendoscopy.

**Methodology:** Descriptive analysis was made of patient files with craniopharyngiomas in the department of neurosurgery of Hospital Central "Dr. Ignacio Morones Prieto" in San Luis Potosi through which were established the criteria for pre and post-operative analysis settled in patients undergoing Flexible Neuroendoscopy to evaluate the effectiveness of the surgical procedure as a diagnostic and therapeutic method using a descriptive statistical analysis.

**Results:** We studied 5 cases of craniopharyngiomas with ventricular extension, age range was between 8 to 58 years old, 3 patients were female, hospital stay of patients with a minimum of 3 days and maximum of 49 days, readmissions in shorter periods. The most significant improvement was presented after the first and sixth month postoperative ( $p=0.034$  and  $p=0.051$  respectively), nevertheless after the sixth month postoperatively, all patients had once again symptoms reflected in their Karnofsky score decrease.

**Conclusions:** Craniopharyngiomas are low incidence tumors with solid and cystic components causing hydrocephalus up to 50% and can be managed through Flexible Neuroendoscopy as a minimally invasive surgical tool. The main advantages allow having a diagnostic and therapeutic route, determining the tumor type and draining the cystic portion performing fenestration, significantly reducing the symptoms during the first 6 months.

## **Endoscopic ultrasonic aspiration for cystic intraventricular craniopharyngioma**

*Oscar Garcia-Gonzalez, Paola Hernandez-Ponce (Mexico City, Mexico)*

**Objective:** We report our experience in purely endoscopic excision of intraventricular craniopharyngiomas in pediatric patients with the minimally invasive ultrasonic aspirator Söring-Sonoca /GAAB neuroendoscope system.

**Methods:** Five patients with intraventricular craniopharyngioma were operated by a purely endoscopic approach using a GAAB rigid endoscope and the Söring-Sonoca ultrasonic aspiration system.

**Results:** One patient was operated 3 times and another patient two times. An Ommaya reservoir was placed into the cystic remaining cavity in the another five patients. The tumor size varied between 1.9 and 5.5 cm in the largest diameter. The cystic content of the tumor could be aspirated completely in all five patients. There were no long-term complications.

**Conclusion:** Ultrasonic aspiration can be applied safely and successfully in selected endoscopic procedures. The use of this technique could expand the indications for endoscopic approaches to include also solid intraventricular lesions. The Söring-Sonoca ultrasonic aspirator is a highly effective tumor decompression system that can be effectively used in a purely endoscopic approach to intraventricular craniopharyngiomas.

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## **Inside-out endoscopic fenestration of Blake's pouch cyst. An unsuccessful endoscopic third ventriculostomy led to a more appropriate treatment**

*Rolando Jiménez-Guerra, Jaime Torres-Corzo, Roberto Rodriguez-della Vecchia (Mexico City, San Luis Potosi, Mexico)*

**Introduction:** Blake's pouch (BP) represents an invagination of the romboencephalic roof, which gives origin to the foramen of Magendie during embryonic development. Failure to open leads to a late childhood, very slowly progressive hydrocephalus associated to a cystic posterior fossa malformation. It is considered within the Dandy-Walker spectrum. Although the standard surgical treatment of hydrocephalus associated with BP cyst has not yet been established, it is more commonly managed by endoscopic third ventriculostomy (ETV). In this case, an unsuccessful attempt to perform an optimal ETV led us to navigate through the ventricular system and communicate the cyst to the subarachnoid space in an inside-out manner with a flexible endoscope.

**Methods and Results:** Herein we describe a previously healthy 14-year-old male, who developed progressive cognitive decline over 2 years and papilledema. An apparently communicating hydrocephalus was identified on MRI associated to an enlarged cisterna magna and a Blake´s pouch cyst was diagnosed. An ETV was attempted through a pre coronal burr hole unsuccessfully due to a densely reticular interpeduncular cistern. Further visualization with a flexible neuroendoscope revealed a patent aqueduct, closed foramina of Luschka and an open foramen of Magendie communicating into a wide cisterna magna, enclosed by a fibrous opaque wall. We opened this membrane and successfully gained access into the spinal subarachnoid space. The patient recovered well with no hydrocephalus at follow up after one year.

**Conclusions:** Flexible neuroendoscopy is safe and can provide a more accurate diagnosis in cases of apparently communicating hydrocephalus. It also allows a physiologic and minimally invasive therapeutic choice, specifically when dealing with hydrocephalus associated to a Blake´s pouch cyst.

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### **Pineal tumours –endoscopic approach**

*Sergio Valenzuela, D Silva (Santiago, Chile)*

From 1996 until 2012 at the Instituto de Neurocirugía Asenjo in Santiago-Chile we have performed over 1000 cases of Neuroendoscopy for 575 children and 475 adults in order to solve a lot of diseases, mostly hydrocephalus with third ventriculostomy but also intracranial cysts, colloid cysts, craniopharyngiomas, multiloculated ventricles and intraventricular tumours.

A group of 43 patients with pineal tumours has been selected for this presentation studying the clinical features, neuroimages and surgical procedures as well as their results. We will go over the neuroendoscopic technique, indications, patient requirements, complications and disadvantages.

Our conclusions is that neuroendoscopy is a reliable and useful method to treat many diseases especially pineal tumours, providing a very good opportunity to avoid a craniotomy if germinomas are found, performing an endoscopic biopsy, resolving at the same time hydrocephalus by performing third ventriculostomy. This procedure may be done with low morbidity and without mortality, based in a mature experience from the operator and the right diagnosis and surgical tools.

Based on our experience from 43 patients as well as the neuroendoscopic literature, we recommend this technique to face this pathology in children and adults.

### **Efficacy of ETV in the treatment of hydrocephalus after removal of posterior fossa tumor in children**

*George Papaevangelou, Christos Chamilos, Spyros Sgouros (Athens, Greece)*

**Objective:** The purpose of this study was to analyze the efficacy of Endoscopic Third Ventriculostomy (ETV) in the management of hydrocephalus after posterior fossa tumor surgery in children.

**Materials and methods:** A retrospective review was performed of the management of hydrocephalus after 33 posterior fossa tumor resections in 29 patients performed by one surgeon between 2008-2015 (one patient had 4 operations and another 2 operations for recurrence). All patients had tumour excision as the first operation, regardless of the size of the ventricular system. Management of hydrocephalus was instituted after tumour excision when this became clinically necessary due to symptoms of intracranial hypertension in the presence of large ventricles, with or without pseudomeningocele.

**Results:** Hydrocephalus was present before tumour resection in 17 patients (51%). After tumour excision, 12 patients in total (36%) required permanent treatment for hydrocephalus, 2 of those did not have hydrocephalus at presentation, had laterally placed tumours but developed it after tumour resection. In 10 patients ETV was performed as first procedure; 8 of those required subsequent ventriculoperitoneal shunt. Hence the success rate of ETV was 20%. All patients that ETV failed had pseudomeningocele postoperatively. Of those who had ETV that failed, 2 patients had wound CSF leak postoperatively, and one of those developed frank CSF infection.

**Conclusion:** ETV when employed in the management of hydrocephalus after removal of a posterior fossa tumour in children has a poor success rate. Presence of pseudomeningocele is a negative predisposing factor for ETV success.

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### **Endoscopic management of non-shunt-related intra- and peri-ventricular cystic lesions**

*Waleed Azab (Kuwait, Kuwait)*

**Introduction:** Neuroendoscopic interventions are minimally invasive options that have recently proven greatly efficacious in the management of various intra- and peri-ventricular cystic lesions.

**Objective:** To retrospectively analyze the results of endoscopic treatment of these lesions in our center.

**Materials and methods:** Twenty one patients with intra- and peri-ventricular cysts endoscopically treated by the authors were included. Relevant clinical and radiological data was retrieved from patients' clinical records and the PACS system, respectively. All procedures were performed

using rigid 0 and 30 degrees endoscopes. All patients underwent CT imaging during the first postoperative week and MR imaging during the first 3 months postoperatively. Results: There were 9 male and 12 female patients; mean age 17.3 years. The cohort of patients included: 6 suprasellar arachnoid cysts, 3 quadrigeminal cistern arachnoid cysts, 5 colloid cysts of the third ventricle, 3 craniopharyngiomas, 3 Blake's pouch cysts and 1 third ventricular arachnoid cyst. Endoscopic management included: 6 ventriculocystocisternostomies (VCC), 4 cystoventriculostomies (CV), 3 cystoventriculostomies (CV) plus Ommaya reservoir insertion, 5 cyst excisions and 4 third ventriculostomies (ETV). At a mean follow-up of 12 months (3-36 months), a complete resolution of clinical symptoms and signs was recorded in 17 of 21 (80.9%) patients. Cyst reduction or disappearance was demonstrated in 13 of 21 patients (61.9%). No mortalities or permanent morbidities.

Conclusions: Endoscopic options for management of intra- and peri-ventricular cysts are highly effective alternatives to open surgery or shunting procedures. With their very low complication rates, endoscopic options should in our opinion be the first-line strategies of treating these lesions.

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### **The translaminar endoscopic lumbar discectomy**

*Alejandro Alfaro-Garibay (Leon, Mexico)*

Minimally invasive techniques, in particular endoscopic, have gained ground in the management of spinal pathology, particularly related degenerative disc disease and canal stenosis. These surgical approaches have shown benefits in reducing bleeding, tissue damage, infection rates, and the cost of the proceedings. Degenerative disc disease types include extrusion and contained herniated disc. These types can be handled efficiently with translaminar approach, as well as cases of spinal stenosis. There are several models of endoscopes available to perform this surgical procedure. The technique is described by Dr. Destandau, step by step, using a non-coaxial endoscope with a large working channel, allowing the use of bipolar forceps, Kerrison, electrodes, surgical high speed drills. A video describes the technique.

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### **Epiduroscopic laser neural decompression in lumbar pain**

*Andrea Sinagra (Buenos Aires, Argentina)*

Introduction: ELND has replaced conventional epiduroscopy in the treatment of herniated disc, spinal stenosis, failed back surgery syndrome and other conditions producing refractory low back pain.

Objective: to explore the efficacy of ELND in patients

suffering from intractable lumbar pain.

Aim: to add laser therapy as new tool in epiduroscopic approaches.

Aim of study: to prove that epiduroscopic laser decompression is a safe and effective approach for lumbar intractable pain.

Material and methods: 53 patients underwent ELND in the period from August 2014 to March 2015 to treat several conditions producing intractable lumbar pain. Transsacral epiduroscopy was the chosen approach. We used a flexible endoscope and a laser fiber of 1470-nm (15w) wavelength (Orlight). VAS was used to measure pain improvement.

Results: average VAS fell to 2.3 from 9.6 for radicular pain and to 3.2 for lumbar pain at 2 weeks after the procedure and persisted at 4 months after the procedure

Conclusion: ELND is an effective and safe novel treatment of conditions producing intractable back pain; allowing ambulatory treatment with quick return to previous activities.

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### **Selective endoscopic transforaminal lumbar discectomy**

*Alejandro Alfaro-Garibay (Leon, Mexico)*

Spine surgery today tends to be done with minimally invasive techniques, especially endoscopic. For the solution of painful conditions such as sciatica caused by degenerative disc disease. In cases of contained herniated disc, with special indication in cases of posterolateral and foraminal herniations especially, as well as in cases of discogenic pain type and foraminal stenosis. Using for this purpose, various types of endoscopes, with coaxial channel work, facilitating the use of working tools such as: curettes, radiofrequency electrodes, surgical laser and special drills, we can achieve the goal of relieving pain, decompression, disc modulation and radiofrequency remodeling, performing the procedure under local anesthesia. In this paper, the YESS technique is described in video, showing the different stages of the procedure.

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### **Endoscopic intraventricular anatomy**

*William Martinez Diaz, Jorge Nuñez Manrique (Lima, Peru)*

The flexible endoscope was used for carrying out tneuroendoscopy: Aesculap (Germany) 6mm OD and 1mm working channel with bending angle of 120 ° up and 90 ° down, incorporated camera source, high resolution screen and video recording equipment.

Surgery is started with a burr hole in front of the coronal suture, most of the times right after making an incision in the dura and after verifying its hemostasis catheter "Peel

Away” is introduced to reach the frontal horn of the lateral ventricle, the endoscope is inserted and the absence of bleeding and the optimal conditions for the procedure is verified.

Vision is usually the foramen of Monro which must comply with the characteristics of: choroid plexus backwards, septal vein and thalamo-striate vein. Then the endoscope is directed towards the lateral wall where the caudate nucleus is observed and under the roof of the frontal horn (underside of the corpus callosum), the endoscope is removed and goes back to observe the ventricular atrium where the abrupt change in direction of the ventricle going down and out which recognizes the choroid plexus, seen to come from the bottom up.

Mammillary bodies: When the endoscope is facing the foramen of Monro, guarding the anterior pillar of the fornix, it advances towards the floor of the third ventricle and goes forward to see the anterior aspect of the third ventricle, mammillary membrane (Tuber cinereum), infundibular recess trailing edge of the optic chiasm, lamina terminalis (lamina optica supra), anterior commissure and roof of the third ventricle (peak of the corpus callosum); backing the endoscope and doing a “low-flying” on the floor of the third ventricle or sometimes passing over the interthalamic adhesion heads back to look at the posterior aspect of the third ventricle and recognize top-down: habenular commissure, pineal recess, posterior commissure, subcommissural body and opening of the aqueduct.

The endoscope is inserted through the aqueduct and on the floor of the fourth ventricle can be recognized: funiculus teres eminence (second angle of the root of the facial nerve nucleus of the sixth cranial nerve), half groove, obex and ependyma.

On the roof of the fourth ventricle choroid plexus can be seen in its transverse portion toward the lateral recesses, and sometimes the vertical portion locus coeruleus, the foramen of Magendie, the inferior vermis and cerebellar tonsils.

Passing through the foramen of Magendie observe the cisterna magna dura and occipital; we observe working down tela-vel portion of the tonsil and tonsillar, PICA, back edge of the foramen magnum and posterior spinal vascular plexus, posterior spinal roots.

The endoscope then is removed very carefully from the fourth ventricle and the aqueduct to the third ventricle.

The flexible endoscope is directed toward the mammillary membrane and at its anterior half a fenestration is performed with a forceps clamp and then expanded by introducing the endoscope, to recognize: perforating arteries, basilar artery, posterior cerebral arteries, The endoscope is directed forward on the clivus, before the basilar and can recognize: anterior superior cerebellar artery, pontine arteries, sixth cranial nerve on the rise since the groove towards the pontine cavernous sinus, anterior inferior cerebellar artery and its parts, the seventh and

eighth nerves to the ear canal, moving down recognize the vertebral arteries with spinal branches and the formation of the anterior spinal artery, the entrance of the hypoglossal canal, anterior edge of the foramen magnum, premedullary vascular plexus, anterior and posterior cervical roots branches, dentate ligament.

You can add the visualisation of the anterior communicating complex bilateral A1 segment, the pituitary stalk, the pituitary gland, the Lillquist membrane, the trigeminal nerve, the basilar trunk cistern, the inferior colliculus and the occipital horn.

We must point out that especially in infectious diseases (neurocysticercosis, meningitis, arachnoiditis, etc.) sometimes it becomes difficult or impossible to recognize these structures, because the arachnoid has “stuffed” all the arteries and brain structures that should be recognized in endoscopy and Dr. Torres Corzo has described as “frozen subarachnoid space” because of its similarity, as viewed with the endoscope.

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### **Endoscopic cervical discectomy**

*Alejandro Alfaro-Garibay (Leon, Mexico)*

The cervical spine is not immune to current minimally invasive surgical techniques. With endoscopic access, both anterior cervical and translaminar approaches, we can resolve painful conditions related to degenerative disc disease. The surgical technique is percutaneous start with progressive tubular dilation. Avoiding vascular structures (carotid artery and jugular vein) and visceral (esophagus). An endoscope with coaxial working channel is used. The endoscope allows the use of graspers, laser and radiofrequency electrodes. This paper presents the surgical technique step by step and clinical results.

# Poster Presentations

## **Neuroendoscopic biopsy in a case of thalamic glioma: case report**

*Roberto Alexandre Dezena, Helisângela Alves de Oliveira, Laís Russo Carneiro, Kellen Cristina Kamimura Barbosa Silva, João Henrique Amaral e Silva (Uberaba, MG, Brazil)*

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## **Neuroendoscopic third ventriculostomy and neuroendoscopic biopsy in a diffuse intrinsic brainstem glioma: case report**

*Roberto Alexandre Dezena, Carlos Umberto Pereira, Joyce Yuri Silvestre Yamamoto, Helisângela Alves de Oliveira, Laís Russo Carneiro (Uberaba, MG, Brazil)*

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## **Endoscopic coagulation of choroid plexus in infants with hydranencephaly: safety and feasibility**

*Oscar Garcia-Gonzalez, Paola Hernandez-Ponce (Mexico City, Mexico)*

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## **Endoscopic ultrasonic aspiration for third ventricle colloid cyst**

*Paola Hernandez-Ponce, Oscar Garcia-Gonzalez (Mexico City, Mexico)*

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## **Endoscopic third-ventriculostomy (ETV) as part of the surgical treatment in hydrocephalus**

*Oscar H. Jimenez-Vazquez (Michoacan, Mexico)*

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## **Endoscopic findings in patients with intraventricular shunt malfunction. Preliminary report**

*Oscar H. Jimenez-Vazquez (Michoacan, Mexico)*

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## **Craniopharyngioma: subtotal resection and 12 years follow-up at the General Hospital of Mexico**

*Elizabeth Ogando-Rivas, Rolando Jiménez-Guerra, Jesús Quetzalcóatl Beltrán-Mendoza, José de Jesús Gutierrez-Cabrera (Mexico City, Mexico)*

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## **Specification analysis, design and prototyping of a burr hole endoscope stabilization device**

*Dimitrios Paraskevopoulos (London, United Kingdom)*

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## **Neuroendoscopy for neurocysticercosis**

*Perez, JM.*

## **Single-port endoscopic technique for the treatment of primary intracerebral hemorrhage**

*Juan Antonio Ponce-Gómez, Luis Alberto Ortega-Porcayo, Victor Alcocer-Barradas, Juan Barges-Coll, Juan Luis Gómez-Amador (Mexico City, Mexico)*

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## **Intraventricular hamartoma not linked to phacomatosis**

*Andrea Sinagra, Marisa Pérez (Buenos Aires, Argentina)*

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## **Communicating hydrocephalus, therapeutic diagnostic approach: A case report**

*Eduardo Flores Alvarez, Mauricio Armando Esqueda Liquidano, Kléber Eduardo González Echeverría, Erick Ariñez Barahona, Rodolfo Arellano Cervantes, Leoncio Tovar Romero (Mexico City, Mexico)*

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## **Intraventricular mixed neoplasm: Treatment and simultaneous diagnosis. Case Report**

*Eduardo Flores Álvarez, Mauricio Armando Esqueda Liquidano, Rodolfo Arellano Cervantes, Erick Ariñez Barahona, German Ballesteros Cuevas, Leoncio Alberto Tovar (Mexico City, Mexico)*

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## **Endoscopic Treatment of Intraventricular Tumors**

*Rodolfo Arellano Cervantes, Mauricio Armando Esqueda Liquidano, Erick Ariñez Barahona, Leoncio Alberto Tovar Romero, Eduardo Flores Álvarez (Mexico City, Mexico)*

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## **Endoscopic management of neurocysticercosis of the fourth ventricle**

*Erick Ariñez Barahona, Eduardo Flores Alvarez, Mauricio Esqueda Liquidano, Jenner Laredo Gomez, Kleber Gonzalez Echeverria, Rodolfo Arellano Cervantes (Mexico City, Mexico)*

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## **Anaplastic astrocytoma with right cerebellar brain stem extension and non-communicating hydrocephalus, therapeutic diagnostic approach: A case report.**

*Eduardo Flores Alvarez, Mauricio Armando Esqueda Liquidano, Kléber Eduardo González Echeverría, Erick Ariñez Barahona, Rodolfo Arellano Cervantes, Leoncio Tovar Romero (Mexico City, Mexico)*