ETV
Endoscopic Third Ventriculostomy
With the aim of minimizing surgical trauma, the so-called minimally invasive neurosurgical procedures have gained in popularity. In the past years neuroendoscopy has undergone a renaissance following the development of suitable rigid endoscopes and flexible, steerable fiberscopes. The refinement of auxiliary instruments, such as forceps, scissors, dissectors, electro-surgery or laser technology has opened a new spectrum for neuroendoscopic interventions, both in intracranial and intraspinal spaces.

The ventricular system as a preformed intracranial space is predestined for neuroendoscopic interventions. The operative indications now are well-defined and standardized. Obstructive hydrocephalus, intracranial cysts and intraventricular tumours are typical pathologies which can be diagnosed and cured using neuroendoscopical techniques.

1. Occlusive Hydrocephalus

Occlusive hydrocephalus can be caused by congenital aqueduct stenosis, cystic or solid intra- and periventricular space occupying lesions or haematoma. Conventional therapy is the placement of a CSF-shunt system. The advantage of shunt systems is the rapid reduction of clinical symptoms related to raised intracranial pressure. In general, there are low peri- and postoperative complication rates, however, complications in the long-term follow-up after shunt-placement such as shunt dysfunction, over-drainage or slit ventricle syndrome, are frequent.

To avoid these complications neuroendoscopic interventions with so-called “inner shunting techniques” such as endoscopic third ventriculostomy (ETV), cysto-ventriculostomy and cysto-ventriculo-cisternostomy have recently been used with good results. ETV is the method of choice in the treatment of occlusive hydrocephalus.

Operative Technique

Both rigid and flexible endoscopes can be used. In rare cases with distorted anatomical landmarks, it is advisable to plan the approach with the help of neuronavigation. After precoronar burr-hole trepanation, the endoscope is guided through the foramen of Monro to the floor of the third ventricle. The floor is opened in blunt technique or with the help of electro-coagulation devices. The artificial stoma is widened using a balloon catheter. Once the ventriculostoma is created (diameter approximately 6 mm), the fossa interpeduncularis is inspected and if present, the membrane of Liliequist has to be opened to guarantee free CSF-circulation.

Results

The operative success rate of ETV (shunt independence) is around 80%, operative morbidity 6% and operative mortality below 1%. In rare cases (2%) the ventriculostoma can occlude again, which is an indication to repeat ETV (1).

2. Intraventricular Cystic Lesions

Neuroendoscopic techniques enable neurosurgeons to manage intraventricular cystic lesions in a minimally invasive technique. This group of space-occupying processes includes colloid cysts, arachnoid cysts, porencephalic cysts, pineal cysts, Rathke’s cleft cyst, cystic craniopharyngiomas and malignant tumors with cystic components. Considering operative morbidity and mortality of stereotactic approaches to the lesions, endoscopic surgery provides the safer outcome due to direct inspection of the vascularization of the cyst membrane and the consistence of contents. Either definite or palliative treatment could be achieved using neuroendoscopic techniques, depending on the histopathological diagnosis and the aim of the therapeutic intervention. In contrast to the benign parenchymal cysts (colloid cyst, arachnoid cyst, pineal cyst, Rathke’s cleft cyst), volume reduction of cystic anaplastic astrocytomas and glioblastomas as well as metastases can be accomplished using endoscopic procedures in combination with reservoir systems.

Operative Technique

Pre- and intraoperative neuronavigational planning is essential. With the aid of frame-based stereotactic guidance or a neuronavigation system, access to the lesion can be gained rapidly and with high accuracy. The endoscope is navigated through a simple burr hole approach to the cyst.
of the surface of the lesion, small vessels are coagulated; the membrane is opened using a multipurpose bipolar forceps. The contents are aspirated and the remaining cyst capsule is vaporized. In cases of pineal cysts, where the cyst is located in the posterior part of the third ventricle, a flexible endoscope is useful for approaching the lesion. Using the same approach, the obstructed CSF pathways can be restored and consequently the increased intracranial pressure diminishes.

Results
140 patients with intracerebral cystic space occupying lesions were operated on using stereotactic frame-based or frameless neuroendoscopic techniques. The operative morbidity was 3.1%, there was no operative mortality (2,3).

3. Solid Intraventricular Tumours
Solid intraventricular tumours are suitable for neuroendoscopic interventions. Endoscopic biopsy of histopathologically unclarified space occupying should be preferred instead of “blind” stereotactic puncture. Especially around the foramen of Monro and in the pineal region endoscopic biopsy has some striking advantages. Using the endoscopic approach ventricular vessels and functional important structures (fornix, posterior commissure) can be spared. Furthermore postbiopitic haemorrhages can be recognized directly, which allows immediate haemostasis. Intraoperative macroscopical differentiation between normal and pathological brain tissue is possible, which raises the reliability of histopathological diagnosis.

In rare cases of intraventricular tumors with a size of less than 2 cm in diameter it is possible to perform a complete resection.

Operative Technique
The operative technique for endoscopic resection or biopsy of intraventricular tumours is quite the same as described before.

Results
The operative mortality is 1%, operative mortality below 1%. The reliability of histopathological diagnosis is 92% (4).

Conclusion
In conclusion, the combination of neuroendoscopy and neuronavigation, especially the adaption to robotic technology, will lead to further progress in intraventricular neuroendoscopy. At the moment virtual ventriculoscopy is in its beginnings, for the future it will help to simplify preoperative planning and the performance of neuroendoscopic interventions.

References
Intraventricular Neuroendoscopy
Dieter Hellwig M.D., Ph.D.

With the aim of minimizing surgical trauma, the so-called minimally invasive neurosurgical procedures have gained in popularity. In the past years neuroendoscopy has undergone a renaissance following the development of suitable rigid endoscopes and flexible, steerable fiberscopes. The refinement of auxiliary instruments, such as forceps, scissors, dissectors, electro-surgery or laser technology has opened a new spectrum for neuroendoscopic interventions, both in intracranial and intraspinal spaces.

The ventricular system as a preformed intracranial space is predestined for neuroendoscopic interventions. The operative indications now are well-defined and standardized. Obstructive hydrocephalus, intracranial cysts and intraventricular tumours are typical pathologies which can be diagnosed and cured using neuroendoscopic techniques.

1. Occlusive Hydrocephalus

Occlusive hydrocephalus can be caused by congenital aqueduct stenosis, cystic or solid intra- and periventricular space occupying lesions or haematoma. Conventional therapy is the placement of a CSF-shunt system. The advantage of shunt systems is the rapid reduction of clinical symptoms related to raised intracranial pressure. In general, there are low peri- and postoperative complication rates, however, complications in the long-term follow-up after shunt placement such as shunt dysfunction, over-drainage or slit ventricle syndrome, are frequent.

To avoid these complications neuroendoscopic interventions with so-called “inner shunting techniques” such as endoscopic third ventriculostomy (ETV), cysto–ventriculostomy and cysto–ventriculo–cisternostomy have recently been used with good results. ETV is the method of choice in the treatment of occlusive hydrocephalus.

Operative Technique

Both rigid and flexible endoscopes can be used. In rare cases with distorted anatomical landmarks, it is advisable to plan the approach with the help of neuronavigation. After precoronar burr-hole trepanation, the endoscope is guided through the foramen of Monro to the floor of the third ventricle. The floor is opened in blunt technique or with the help of electro-coagulation devices. The artificial stoma is widened using a balloon catheter. Once the ventriculostoma is created (diameter approximately 6 mm), the fossa interpeduncularis is inspected and if present, the membrane of Liliequist has to be opened to guarantee free CSF-circulation.

Results

The operative success rate of ETV (shunt independence) is around 80%, operative morbidity 6% and operative mortality below 1%. In rare cases (2%) the ventriculostoma can occlude again, which is an indication to repeat ETV (1).

2. Intraventricular Cystic Lesions

Neuroendoscopic techniques enable neurosurgeons to manage intraventricular cystic lesions in a minimally invasive technique. This group of space-occupying processes includes colloid cysts, arachnoid cysts, porencephalic cysts, pineal cysts, Rathke’s cleft cyst, cystic craniopharyngiomas and malignant tumors with cystic components. Considering operative morbidity and mortality of stereotactic approaches to the lesions, endoscopic surgery provides the safer outcome due to direct inspection of the vascularization of the cyst membrane and the consistence of contents. Either definite or palliative treatment could be achieved using neuroendoscopic techniques, depending on the histopathological diagnosis and the aim of the therapeutic intervention. In contrast to the benign parenchymal cysts (colloid cyst, arachnoid cyst, pineal cyst, Rathke’s cleft cyst), volume reduction of cystic anaplastic astrocytomas and glioblastomas as well as metastases can be accomplished using endoscopic procedures in combination with reservoir systems.

Operative Technique

Pre- and intraoperative neuronavigational planning is essential. With the aid of frame-based stereotactic guidance or a neuronavigation system, access to the lesion can be gained rapidly and with high accuracy. The endoscope is navigated through a simple burr hole approach to the cyst. After exposure
of the surface of the lesion, small vessels are coagulated; the membrane is opened using a multipurpose bipolar forceps. The contents are aspirated and the remaining cyst capsule is vaporized. In cases of pineal cysts, where the cyst is located in the posterior part of the third ventricle, a flexible endoscope is useful for approaching the lesion. Using the same approach, the obstructed CSF pathways can be restored and consequently the increased intracranial pressure diminishes.

Results

140 patients with intracerebral cystic space occupying lesions were operated on using stereotactic frame-based or frameless neuroendoscopic techniques. The operative morbidity was 3.1%, there was no operative mortality (2,3).

3. Solid Intraventricular Tumours

Solid intraventricular tumours are suitable for neuroendoscopic interventions. Endoscopic biopsy of histopathologically unclarified space occupying should be preferred instead of “blind” stereotactic puncture. Especially around the foramen of Monro and in the pineal region endoscopic biopsy has some striking advantages. Using the endoscopic approach ventricular vessels and functional important structures (fornix, posterior commissure) can be spared. Furthermore postbiotopic haemorrhages can be recognized directly, which allows immediate haemostasis. Intraoperative macroscopical differentiation between normal and pathological brain tissue is possible, which raises the reliability of histopathological diagnosis.

In rare cases of intraventricular tumors with a size of less than 2 cm in diameter it is possible to perform a complete resection.

Operative Technique

The operative technique for endoscopic resection or biopsy of intra- or periventricular tumours is quite the same as described before.

Results

The operative mortality is 1%, operative mortality below 1%. The reliability of histopathological diagnosis is 92% (4).

Conclusion

In conclusion, the combination of neuroendoscopy and neuronavigation, especially the adaption to robotic technology, will lead to further progress in intraventricular neuroendoscopy. At the moment virtual ventriculoscopy is in its beginnings, for the future it will help to simplify preoperative planning and the performance of neuroendoscopic interventions.

References

Endoskopisches Ventrikulostomie-Set
für Erwachsene

*VENTRIKULOSKOP* nach Hellwig, mit 1 Arbeits-, 1 Spül-*, 1 Absaugkanal*
*VENTRICULOSCOPE* according to Hellwig with 1 working-, 1 irrigation-*, 1 suction channel*

*kann auch für flexible Instrumente bis Durchmesser 1,3 mm verwendet werden
*can be used for flexible instruments up to 1.3 mm as well*

<table>
<thead>
<tr>
<th>Proximales Ende</th>
<th>Nutzlänge (NL) Working length (WL)</th>
<th>Ø</th>
<th>Kennfarbe Colour code</th>
<th>Blickrichtung Direction of view</th>
<th>Kanaldurchmesser Channel diameter</th>
<th>Bestell-Nr. Ordering number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>180 mm 6,5 mm grün green 5°</td>
<td>1 x 2,8 mm 2 x 1,4 mm</td>
<td>NS200-001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>① Seitlicher Einblick Oblique insight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>160 mm 7,6 mm</td>
<td>NS200-910</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventrikuloskopschaft Ventriculoscope sheath</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>6,9 mm</td>
<td>NS200-911</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obturator für Ventrikuloskopschaft Obturator for ventriculoscope sheath</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Detachable and rotatable ETV Instruments

**GRIFF, allein – HANDLE only**
- **without ratchet**
- **Ordering number**: NS200-290

<table>
<thead>
<tr>
<th><strong>AUFSATZ, allein</strong></th>
<th><strong>ZANGEN / SCHERE, komplett</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INSERT only</strong></td>
<td><strong>FORCEPS / SCISSORS, complete</strong></td>
</tr>
<tr>
<td><strong>Länge</strong></td>
<td><strong>Bestell-Nr.</strong></td>
</tr>
<tr>
<td><strong>Length</strong></td>
<td><strong>Ordering number</strong></td>
</tr>
</tbody>
</table>

- **Fasszange, doppelmeglich, Ø 1,6 mm**
  - **Grasping forceps, double action, Ø 1.6 mm**
  - **Length**: 312 mm
  - **Ordering number**: NS200-251 NS200-201

- **Probeexzisionszange, doppelmeglich, Ø 1,6 mm**
  - **Biopsy forceps, double action, Ø 1.6 mm**
  - **Length**: 312 mm
  - **Ordering number**: NS200-252 NS200-202

- **Schere, gerade, einfach beweglich, Ø 1,6 mm**
  - **Scissors, straight, single action, Ø 1.6 mm**
  - **Length**: 312 mm
  - **Ordering number**: NS200-253 NS200-203
## Neuro-SpiNe

### Nirvana ETV

**Bipolare Mikropinzette**  
Fassen, Koagulieren, Spreizen und Präparieren  
*Bipolar Micro Forceps*  
Grasping, Coagulate, Dilate and Dissect

<table>
<thead>
<tr>
<th>Diameter (Durchmesser)</th>
<th>Working Length (Nutzlänge)</th>
<th>Max. Operation Voltage</th>
<th>Ordering Number (Bestell-Nr.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 mm</td>
<td>360 mm</td>
<td>200 Vp</td>
<td>NS191-401</td>
</tr>
</tbody>
</table>

**Griff** mit Bipolarstecker, Kabel 4 m  
*HANDLE with bipolar plug, cable 4 m*

**Spüladapter** für Mikropinzetten  
*IRRIGATION ADAPTER for Micro forceps*

**Schauch** für Spüladapter  
*TUBE for irrigation adaptor*

Adapter für den Griff NS191-407 mit Bipolarstecker (Nicht im ETV-Set, Seite 9 enthalten. Bitte separat bestellen!)  
Adaptors for the handle NS191-407 with bipolar plug (Not included in the ETV Set, pg. 9. Please order separately!)
**Container**

**KUNSTSTOFFBEHÄLTERT** für die Sterilisation und Aufbewahrung des ETV-Sets

PLASTIC CONTAINER for the sterilization and storage of ETV-Sets

<table>
<thead>
<tr>
<th>Abmessungen (L x B x H)</th>
<th>Bestell-Nr.</th>
<th>Ordering number</th>
</tr>
</thead>
<tbody>
<tr>
<td>502 x 239 x 102 mm</td>
<td>Kunststoffbehälter allein</td>
<td>NS201-000</td>
</tr>
<tr>
<td></td>
<td>Plastic container only</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kunststoffbehälter mit komplettem ETV-Set*</td>
<td>NS153-000</td>
</tr>
<tr>
<td></td>
<td>Plastic container with complete ETV-Set*</td>
<td></td>
</tr>
</tbody>
</table>

* Kunststoffbehälter komplett (mit Endoskop und Instrumenten) und mit Endoskop–Halterung

Plastic container complete (with endoscope, instruments) and with instrument holder

**ENDOSKOP–HALTERUNG**, isoliert

- Instrumentenhalter 0–18 / Ø 4–18 mm
- Gelenkarm, Aktionsradius 400 mm
- L-Säule 450 x 100 mm, Höhe verstellbar
- isolierter Schienensockel, HF-geprüft

für die HF–Chirurgie, Laparoskopie, minimal invasive Chirurgie (MIC), allgemeine Chirurgie und Neurochirurgie. Stabile Montage an den verschiedenen OP–Tisch–Schienen.

ENDOSCOPE HOLDER, insulated

- Instrument holder 0–18 / Ø 4–18 mm
- Articulated arm, action radius 400 mm
- L column, 450 x 100 mm, height–adjustable
- Insulated rails clamping base, HF–tested

for High–Frequency (HF) Surgery, Laparoscopy, Minimal Invasive Surgery (MIS), General Surgery and Neurosurgery. Can be attached firmly to various rails on the operating tables.

<table>
<thead>
<tr>
<th>Bestell-Nr.</th>
<th>Ordering number</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS150–900</td>
<td></td>
</tr>
</tbody>
</table>