Ahmed ZOHDI

BRAIN ENDOSCOPY IN HYDROCEPHALUS
The Role of Intracranial Endoscopy in the Management of Hydrocephalus
Dos and Don’ts – Doable or Not?
Brain Endoscopy in Hydrocephalus

The role of intracranial Endoscopy in the Management of Hydrocephalus
do's and don'ts (doable or not?)

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1.0 Introduction: Why Brain Endoscopy?

After more than a decade of experience in brain endoscopy the **DOS** and **DON’TS** are becoming more apparent.

The indications of endoscopic interventions are clearer and the suggested procedure more precisely tailored, with pretreatment work-up and preoperative strategy planning playing an increasingly important role.

The learning curve in terms of **KNOW HOW** and anatomy together with the advances in neuroimaging technology largely account for the tremendous progress in this field.

Even though neuroimages may show similarities, the highly variable and complex nature of the abnormal cerebral anatomy is clearly a major challenge during intracranial neuroendoscopic procedures. The ventricular system may be distorted due to infection and haemorrhage or congenitally dysplastic and dysmorphic.

The limitations, though minimized, can be attributed to the inadequacy of the available tools and the unpredictability of the surgical outcome.

In spite of the tubular, two-dimensional vision, intracranial endoscopy globalizes the neurosurgeons’ scope, and should definitely be incorporated in their residency program and implemented in their armamentarium.

2.0 Aim: What to Do and How to Do?

The aim of this book is to address the problems and simplify their complexities to assist in guiding the beginner in neuroendoscopy out of the ordeal of failure into the real salvation of a successful operation.

The suggested morphological classification of hydrocephalus is based on the changes in the ventricular system. The data obtained from preoperative neuroimages were the keystone for the tailored approach.

This definite management protocol provides confidence to the neurosurgeon and, on the other hand, helps to define the limitations of intracranial neuroendoscopic procedures. In other words, what is **DOABLE** and what is **NOT**. Furthermore, what should you expect from a neuroendoscopic procedure? A definitive or an adjuvant solution?

The algorithm together with the ability to develop a realistic plan for your neuroendoscopy will help you to keep enthusiasm high and minimize any possible frustration.

An additional challenge is the distorted or dysmorphic anatomy. The command of this kind of dysplastic abnormalities mandates a wide exposure. One of the crucial factors associated with the surgical team’s level of experience and technical skills is **HOW** to deal with these variations and **HOW** to complete the intended procedure without aftermaths, in short, **HOW TO DO IT** without unpleasant surprises. This structured, systematic approach has proven to be immensely helpful in decreasing the tedious learning curve of brain endoscopy and reducing its duration.

Even well-trained and highly prepared neurosurgeons can still find difficulty in post-infectious, post-haemorrhagic hydrocephalus and equally with a congenital anomaly. Exchange of knowledge and conveyance of experience are the main objectives of this book.

There is no ceiling for the amount of possible variants in neuroendoscopy. The vast experience is gained by a good command of the anatomical anomalies and the constant application of an algorithm that is based on the available neuroimages.

This will also increase the number of neurosurgeons doing endoscopic procedures. It will make them more familiar and ready for the challenge. For those who have started, it will help the dedicated reader to gain a better footing and provide a brief guide to the field of intracranial neuroendoscopic procedures.
### 3.0 Current Neuroendoscopic Procedures

**Table 1: Current Neuroendoscopic Procedures**

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fenestration</td>
<td></td>
</tr>
<tr>
<td>Endoscopic Third Ventriculocisternostomy (ETV)</td>
<td></td>
</tr>
<tr>
<td>Cysts</td>
<td></td>
</tr>
<tr>
<td>Septa</td>
<td></td>
</tr>
<tr>
<td>Restoration</td>
<td></td>
</tr>
<tr>
<td>Foraminoplasty</td>
<td></td>
</tr>
<tr>
<td>Aqueductoplasty</td>
<td></td>
</tr>
<tr>
<td>Excision and Biopsy</td>
<td></td>
</tr>
<tr>
<td>Endoscopic Shunt Procedures</td>
<td></td>
</tr>
</tbody>
</table>

**Tables 2–7** present detailed data on the number of patients who underwent which procedure.

**Table 2: Endoscopic Third Ventriculocisternostomy**

<table>
<thead>
<tr>
<th>Lesions</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third ventricular lesions</td>
<td>98</td>
</tr>
<tr>
<td>Aqueductal stenosis</td>
<td>154</td>
</tr>
<tr>
<td>Fourth foraminal outlet obstruction</td>
<td>73</td>
</tr>
<tr>
<td>Fourth ventricular lesions</td>
<td>162</td>
</tr>
<tr>
<td>Proximal intracisternal obstructive hydrocephalus and non-obstructive, non-communicating hydrocephalus</td>
<td>12</td>
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<tr>
<td>Total</td>
<td>487</td>
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</tbody>
</table>

**Table 3: Arachnoid Cysts**

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventriculocisternostomy</td>
<td>28</td>
</tr>
<tr>
<td>Ventriculocystostomy</td>
<td>22</td>
</tr>
<tr>
<td>Cystocisternostomy</td>
<td>29</td>
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<tr>
<td>Total</td>
<td>79</td>
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**Table 4: Septostomy**

<table>
<thead>
<tr>
<th>Septa</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intraventricular septa</td>
<td>129</td>
</tr>
<tr>
<td>Septum pellucidum</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>213</td>
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</table>

**Table 5: Restoration**

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foraminoplasty</td>
<td>17</td>
</tr>
<tr>
<td>Aqueductoplasty</td>
<td>21</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
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**Table 6: Excision/Biopsy**

<table>
<thead>
<tr>
<th>Biopsy</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tumors</td>
<td>34</td>
</tr>
<tr>
<td>Cysts (colloid 17, choroid 5)</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>56</td>
</tr>
</tbody>
</table>

**Table 7: Endoscopic Shunt Procedures**

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unclogging</td>
<td>16</td>
</tr>
<tr>
<td>Retrieval</td>
<td>9</td>
</tr>
<tr>
<td>Redirection</td>
<td>36</td>
</tr>
<tr>
<td>Refashioning and replacement</td>
<td>93</td>
</tr>
<tr>
<td>Total</td>
<td>154</td>
</tr>
</tbody>
</table>
4.0 Descriptive Anatomy and Anatomical Guidelines

In neuroendoscopy, the reduced visual range of the lens mandates profound anatomical knowledge. In more than 50% of cases, (sometimes up to a ratio of 2:1 and even 3:1) the surgeon must be prepared for variations along the surgical trajectory.

The foramen of Monro (Fig. 1) is the compass (Fig. 2), that guides the surgeon to the target area. The venous drainage in and around is variable (Figs. 3–6). The choroid plexus may be abundant, scarce, medially or laterally displaced, (Figs. 7–10). The thickness of the fornix changes with the chronicity and the degree of hydrocephalus (Figs. 11–14). The inclination of the foramen of Monro reverses with the ballooning of the third ventricle from superolateral to superomedial (Figs. 15–18).

Endoscopic view of the foramen of Monro.

Thv = Thalamostriate vein; CP = Choroid plexus; Chv = Choroid vein; Cv = Caudate vein; DS = Dorsum sellae; TC = Tuber cinereum; Ba = Basilar artery; F = Cerebral fornix; Sv = Septal vein; MB = Mamillary body;
The configuration and shape of the foramen of Monro are variable, glued (Figs. 19, 20), veiled (Figs. 21, 22), obstructed (Fig. 23), plugged (Fig. 24), coapted (Fig. 25), crescentic (Fig. 26), fenestrated or septated (Figs. 27–29).

The size could be pinpoint, small and just permitting passage of the endoscope or dilated (Figs. 30–32).
The boundaries of the foramen of Monro may be faint (Figs. 33, 34), even without any landmarks (Figs. 35, 36), just an evident choroid plexus (Figs. 37, 38), aberrant veins (Fig. 39) or aberrant artery (Fig. 40).

The septum pellucidum may be bulging (Fig. 41) or displayed (Fig. 42), perforated posteriorly or anteriorly (Figs. 43, 44), fenestrated partially or almost totally (Figs. 45, 46), with a cavum (Fig. 47), or even absent, as shown in Figs. 48–50.
5.0 Endoscopic Management of Various Shapes and Levels of Hydrocephalus

The shape and level of hydrocephalus dictates the type of the neuroendoscopic intervention (Table 8).

The classification of hydrocephalus, as suggested by the author, is based on both the level of obstruction and the shapes assumed by the ventricular system. The use of these criteria is reflected in Table 8.

In this way, the endoscopic management and the preoperative work-up and choice of the planned procedures are facilitated.

<table>
<thead>
<tr>
<th>Table 8: Endoscopic Management of Various Shapes and Levels of Hydrocephalus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Univentricular Hydrocephalus</td>
</tr>
<tr>
<td>Biventricular Hydrocephalus</td>
</tr>
<tr>
<td>Triventricular Hydrocephalus</td>
</tr>
<tr>
<td>Tetraventricular Hydrocephalus</td>
</tr>
<tr>
<td>Bilocular Hydrocephalus</td>
</tr>
<tr>
<td>Multilocular Hydrocephalus</td>
</tr>
<tr>
<td>Multilocular Complex Hydrocephalus</td>
</tr>
<tr>
<td>Proximal Intracisternal Obstructive Hydrocephalus and non-obstructive, non-communicating Hydrocephalus</td>
</tr>
</tbody>
</table>

5.1 Univentricular Hydrocephalus

Univentricular Hydrocephalus is due to adhesions obstructing one foramen of Monro (Figs. 51, 52), whether posthaemorrhagic or postinfectious.

Foraminoplasty and/or pellucidotomy should be attempted in conjunction with ETV, if needed.

If the obstruction of the foramen of Monro is caused by a cavernoma, endoscopic excision will solve the problem (Figs. 53–56).
Pellucidotomy, foraminoplasty and/or ETV should provide a solution for a right lateral extreme ventricular dilatation (Figs. 57–60).

Foraminoplasty with a balloon-cather performed at the level of the right foramen of Monro.

Endoscopic view after foraminoplasty and ETV.
Septum pellucidotomy (Figs. 61–63) is indicated whenever communication should be established between two lateral ventricles, as is the case in univentricular hydrocephalus or an isolated lateral ventricle.

The site of pellucidotomy should be either in the anterosuperior or superoposterior aspect of the foramen of Monro, away from the fornix and the septal veins, in the thinnest and most transparent part of the septum pellucidum.

While creating the fenestration, the depth of the puncture should be guarded to prevent contralateral injury to a partially collapsed lateral ventricle.
5.2 Biventricular Hydrocephalus

Biventricular hydrocephalus is a condition in which the lateral ventricles are symmetrically dilated, with both foramina of Monro congenitally obliterated or adherent after an infection (Fig. 64).

If the third ventricle is found to be collapsed, successful foraminoplasty and subsequent third ventriculocisternostomy won’t be doable. An endoscopic pellucidotomy followed by insertion of a shunt would be optimum result.

As shown in (Figs. 65, 66), a choroid cyst is obstructing both the third ventricle and the foramen of Monro. Excision of the cyst will restore the shape of the foramen.

Variations in the morbid anatomy of colloid cysts (Figs. 67, 68) have an impact on the choice of an endoscopic approach through a single right pre-coronal burr hole at Kocher’s point.

The anatomical variations of the cyst and the foramen of Monro dictate the use of the transforaminal approach, the transseptal interforniceal approach or a combination of both. Several endoscopic maneuvers can be performed. These include aspiration of the cyst contents or its piecemeal removal, combined balloon squeeze and aspiration, foraminoplasty, pellucidotomy, coagulation of the cyst capsule and endoscopic third ventriculocisternostomy (Fig. 69). The choice of the appropriate approach is largely dependent on the location of the cyst and the shape of the foramen of Monro1.
5.3 Triventricular Hydrocephalus

Triventricular hydrocephalus is a condition where both lateral ventricles and the third ventricle are dilated – as is the case with tumors of the pineal region (Fig. 70) – and, in most cases, also involves an obstruction of the fourth ventricle (Fig. 71).

Endoscopic third ventriculocisternostomy is recommended (Figs. 72–77).

![Tumor of the pineal region obstructing the posterior part of the 3rd ventricle.](image1)

![Obstruction of the fourth ventricle.](image2)

![Tight space.](image3)

![Endoscopic view after fenestration.](image4)

![Narrow space.](image5)

![Endoscopic view after fenestration.](image6)

![Endoscopic view after fenestration.](image7)

![Absence of anatomical landmarks.](image8)
In posterior fossa lesions, the brain stem can be displaced upward and forward to varying degrees, thus affecting the target area (Figs. 78–83), but still making third ventriculocisternostomy doable. Figs. 84 and 85 show an extremely narrow space and pronounced forward displacement of the brain stem making endoscopic third ventriculocisternostomy hazardous and placing the basilar bifurcation at risk.

For more than a decade the suggested algorithm for the management of posterior fossa lesions concomitant with hydrocephalus has been adopted and applied in 247 cases. In tumors of the fourth ventricle (162) endoscopic third ventriculocisternostomy was performed successfully prior to the definitive surgery. Three endoscopic third ventriculocisternostomies were performed for the clinical entity of proximal intracisternal obstructive hydrocephalus.

The overall success rate of endoscopic third ventriculocisternostomy, even after definitive surgery, was 72.1% (119/165) depending more on the handling and fine definitive posterior fossa surgery than on the pathology of the lesion.

In the presence of extra-axial posterior fossa tumors, a live-saving internal cerebrospinal fluid diversion, a ventriculositygaleal drainage VSG (a prolonged temporary aseptic technique) or an external ventricular drain EVD (for shorter periods) were performed.
A good view of the floor of the third ventricle with all anatomical landmarks present and clearly visible (Figs. 86, 87) is a real salvation for endoscopic third ventriculocisternostomy.

A redundant floor, as shown in Fig. 88, can obscure vision. Ample irrigation restores visibility of the target area. In Figs. 89–91, the floor will appear opaque, thickened or a combination of both, and may have more than one layer for fenestration.
The level of the third ventricular floor may be elevated and dome-shaped, as shown in Fig. 92. A downward slanted or even steep target area may also be found (Figs. 93, 94). In the event of a distorted and inconspicuous floor (Figs. 95, 96) it is highly advisable to recall the importance of the most constant anatomical landmarks, namely the dorsum sellae and the pulsating basilar artery. If you are faced with lack of space for your tools to create the stoma, as shown in Fig. 97, release of the cerebrospinal fluid will reshape the area. A congested or vascular floor, as shown in Figs. 98, 99, will call for either profuse irrigation or balloon tamponade after fenestration.

The ventricular floor may be splitted by a band, either anteroposterioly (Fig. 100), or from side to side (Fig. 101). A poorly circumscribed floor as in Fig. 102 can be very frustrating and may require that the procedure be terminated.
An optimum radiological outcome after endoscopic third ventriculocisternostomy is shown in Figs. 103, 104.

The distorted anatomy of the dilated third ventricular floor dictates the selection of the target area. The optimal site for perforation is the translucent and most thinned out part of the tuber cinereum or the stretched premamillary recess.

The size of the endoscopic third ventriculocisternostomy need not always be as large as 5 mm in diameter. Openings of smaller size in a taut floor will serve the same purpose as will bigger fenestrations in a redundant area.
A wide variation exists in the endoscopic appearance of the infundibular recess (Figs. 105–116). The structure is one of the most important anatomical landmarks and should be visible at the anterior border of your endoscope while performing a third ventriculocisternostomy.

Figs. 117–119 show varying degrees of stretching to the infundibulum itself.
Anatomical variations of the massa intermedia (Fig. 120) and the presence of interthalamic septations/adhesions can cause inconvenience during endoscopy. This can be particularly significant in the case of anteriorly located adhesions (Fig. 121) presenting with a filamentous (Fig. 122), or sheet-like appearance (Fig. 123). If the septations/adhesions are filmy (Fig. 124) or extended (Fig. 125), they can be easily divided. The massa intermedia (Fig. 126) may also be absent. Anatomical variations of mamillary bodies are shown in Figs. 127–131.
Figs. 127–131
Anatomical variations of mamillary bodies.
Triventricular hydrocephalus, as in cases of aqueductal stenosis (Fig. 132), may benefit from an aqueductoplasty (Figs. 133–138). Although not the author's first treatment option, if aqueductoplasty fails, proceed with an endoscopic third ventriculocisternostomy.
Aqueduct of Sylvius. The anatomical variations of the Sylvian aqueduct encountered on endoscopy, may involve the shape, (Figs. 140–143) which can be dilated, wide, slitlike or just pinhole.

The obstruction of the aqueduct may also be subject to variation. It may be forked (Fig. 144), covered by a membrane (Fig. 145), blocked (Fig. 146), or totally veiled (Fig. 147).
5.4 Tetraventricular Hydrocephalus

Tetraventricular hydrocephalus (Fig. 148), as in the fourth ventricle, foraminal obliteration of Lushka and Magendi, Chiari II, and basal adhesions can benefit from an endoscopic third ventriculocisternostomy (Figs. 149–151).

5.5 Bilocular Hydrocephalus

Bilocular hydrocephalus (Fig. 152) is caused by an intraventricular arachnoid cyst (Fig. 153).

Possibly, a cyst of the velum interpositum may push it's way through the choroidal fissure into the lateral ventricle.

An endoscopic ventriculocystostomy should suffice, followed by a septum pellucidotomy, if needed.
5.6 Multilocular Hydrocephalus

Suprasellar intraventricular arachnoid cyst is an invagination of a ballooned interpeduncular cistern into the third ventricle and beyond, causing multilocular hydrocephalus (Figs. 154–157).

Endoscopic view from within a suprasellar intraventricular arachnoid cyst.

Preoperative MRI scan of an intraventricular arachnoid cyst.

Postoperative MRI scan after endoscopic ventriculocystocisternostomy.
Ventriculocystocisternostomy is the preferred endoscopic method for the treatment of multilocular hydrocephalus (Figs. 158–164).
Liliequist's membrane (Fig. 165) is the most striking trabecular arachnoid membrane.
It is formed mainly by two sheets, a thicker diencephalic (Figs. 166–169), and a thinner incomplete mesencephalic leaf, with the interpeduncular cistern interposed.
The multilayered floor of the third ventricle (Figs. 170–173) may be due to repeated infections or haemorrhage.

The loose cuff around the basilar artery and the ostia (Figs. 174–177) might be sufficient for cerebrospinal fluid drainage.

Yet, additional surgical manipulations and fenestrations (Figs. 178–181), may be useful to free the circulation of CSF flow.
The arachnoid trabeculae may be reduced in number (Figs. 182–185) and may be even less as shown in Figs. 186–189, which should not pose an obstacle.

Figs. 190–193 show the optimum endoscopic appearance for confirmation of the anticipated successful outcome of endoscopic third ventriculocisternostomy.
5.7 Multilocular Complex Hydrocephalus

Multilocular complex hydrocephalus (Figs. 194–197) is the most difficult of all to manage successfully, however, the condition is associated with a less favourable prognosis, probably as a result of repeated attacks of infection or haemorrhage.

Endoscopic shunt refashioning or new shunt placement with fenestration of the septa, with or without endoscopic third ventriculocisternostomy and optional redirection and replacement of the shunt system can help.

The objective in such a situation is to minimize the number of surgeries (endoscopic/shunt procedures), to maintain sufficient drainage of the ventricular compartements. This is achieved by highly accurate diagnostic work-up and adequate treatment planning, flexibility of tactics, and a clear decision which of the treatment options available should be translated into reality and which should not.

Further endoscopic procedures may be performed in the presence of a proximal or intraventricular shunt, as shown in Figs. 198–203.

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MRI scan of a typical multilocular complex hydrocephalus.

Intraventricular septa and adhesions.

Fenestration done with widening.

Connecting the ventricular compartments with the subarachnoid space.
Brain Endoscopy in Hydrocephalus

Unclogging of a shunt.

Refashioning of the shunt tube and replacement for adequate CSF drainage.

Redirection of the shunt tip.

Redirection of the shunt tip into another ventricular compartment or cyst.

A shunt plugged by the choroid plexus.

The shunt is retrieved under endoscopic vision.
5.8 Proximal Intracisternal Obstructive Hydrocephalus

In proximal intracisternal obstructive hydrocephalus, Figs. 204 and 205, with a typically downward bulging third ventricular floor, enlarged ventricles and cisterna magna, after posterior fossa surgery, endoscopic third ventriculocisternostomy is advised.

6.0 Complications of Brain Endoscopy

The overall complication rate associated with brain endoscopy is 4.7%, and involves iatrogenic injury to the structures along and around the trajectory of the endoscope on its course to the target area.

The rate of infectious complications following neuroendoscopic surgical procedures does not differ from those related to the general patient population, and there is no evidence of an increased risk.

Haemorrhage from the premamillary artery, plexus or major arteries are dealt with by ample irrigation, balloon tamponade and coagulation.

The mortality rate of this series of cases was subject to the disease and not an aftermath of endoscopy.

The complications can be categorized according to their onset, as immediate, early or delayed, according to the course of postoperative symptoms, as cured, stabilized, ameliorated or aggravated, being all related to the procedure and not disease-dependent.

The occurrence and duration of postoperative symptoms may be transient, like hyperthermia, or temporary as in cerebrospinal fluid leakage or in the case of a resolving subdural fluid collection. Postoperative symptoms may also persist for a long time with various degrees of severity. The procedure may be a single one, multiple or staged, which do not necessarily occur due to recurrence, but may rather be planned from the beginning.
7.0 Repeat Surgery

A definitive assessment of the outcome can only be made after a 3-month interval which should be the minimum follow-up period for patients treated with the endoscopic technique.

During redo surgery (Figs. 206–211), the ostium can be found to be patent, with no actual need to be reopened. Most of the failures after endoscopic third ventriculocisternostomy occur in the first postoperative year and rarely thereafter.

In the presence of a second floor for puncture, a redo surgery can be of great benefit. If there are multiple strands of adhesions, try with your endoscope to cut them through or enlarge, yet ultimately the patient will need a shunt.
8.0 Doable or Not?

An example for that motto would be the comparison between the following two cases.

The target area was amenable in the first case (Fig. 212), the procedure was performed successfully (Fig. 213).

The procedure was aborted in the second patient (Fig. 214), and instead, a ventriculostubgaleal drainage was done for this case of medulloblastoma grade IV with metastatic mass, to avoid further peritoneal spread.

Seeding overlying the floor of the third ventricle yet sparing a possibility.
Appearance after endoscopic third ventriculocisternostomy.
Metastatic mass leaving no space for endoscopic third ventriculocisternostomy.

9.0 Conclusions

This booklet is a concise summary of experiences of more than one decade of neuroendoscopy designed for educational purposes and written with the intention of serving neurosurgeons as a practical guide through the current endoscopic procedures. Both the indications and contraindications are relative in this field and can only be valid for selective cases. Each individual patient must be assessed according to the management algorithm. The successful outcome of surgery is considerably determined by the surgeon’s level of experience and technical skills, good knowledge of the morbid endoscopic anatomy, and last but not least, the medical instrumentation available.

The complications of brain endoscopy, whether injury, haemorrhage or infection are well-known to the expert community, the aim is to minimize them and be able to adequately deal with their aftermaths.

Defining success in neuroendoscopy is a staged process. First, you have to accomplish the mission. The ongoing clinical improvement of your patient is a must and comes thereafter. Finally, you should optimally document and prove your success by control neuroimages.

The neurosurgeon should keep his/her enthusiasm without any frustrations or high expectations.

The DOS and DON'TS in brain endoscopy are after all DOABLES or NOT.
10.0 References


Neuro-Endoscopy – Intracranial Surgery
GAAB Recommended Set
Neuro-Endoscopy – Intracranial Surgery
GAAB Recommended Set

Telescopes and Sheaths

1. 28096 AGA  
   **HOPKINS® Wide Angle Straight Forward Telescope 6°**, angled eyepiece, length 15 cm, autoclavable, with fiber optic light transmission and working channel diameter 3 mm incorporated, robust version, color code: green

2. 28162 BS  
   **Operating Sheath**, graduated, outer diameter 6.5 mm, working length 13 cm, with lateral stopcock and catheter port

3. 28162 BO  
   **Obturator**, for use with Operating Sheath 28162 BS

Instruments

4. 28162 U  
   **Grasping Forceps**, single action jaws, diameter 2.7 mm, working length 30 cm

5. 28162 ZE  
   **Biopsy Forceps**, single action jaws, diameter 2.7 mm, working length 30 cm

6. 28162 EP  
   **Scissors**, pointed, single action jaws, diameter 2.7 mm, working length 30 cm

7. 28162 EM  
   **Scissors**, pointed, slightly curved, double action jaws, diameter 1.7 mm, working length 30 cm

8. 28162 Z  
   **Biopsy Forceps**, double action jaws, diameter 1.7 mm, working length 30 cm

9. 28160 TyX  
   **Forceps**, for ventriculostomy, double action jaws, diameter 1.7 mm, working length 30 cm

10. 28162 BDL  
    **TAKE-APART® Bipolar Forceps**, with flat jaws, size 2.4 mm, working length 24 cm
    including:
    - **Bipolar Ring Handle**
    - **Outer Sheath**
    - **Working Insert**, for single use, package of 5

11. 28762 KB  
    **Bipolar Coagulation Electrode**, diameter 1.7 mm, working length 30 cm

12. 28762 K  
    **Coagulation Electrode**, unipolar, semiflexible, diameter 1.7 mm, working length 30 cm

13. 28160 SF  
    **Suction Catheter**, flexible, for single use, diameter 2.5 mm, working length 45 cm

14. 28162 SN  
    **Irrigation Tube**, autoclavable, with LUER-Lock connector

15. 533 TVA  
    **Adaptor**, autoclavable, permits telescope changing under sterile conditions

Holding System

16. 28272 KKA  
    **Holding System**, autoclavable
    including:
    - **Socket**, to clamp to the OR table
    - **Articulated Stand**, straight
    - **Clamping Jaw**, metal, with axial uptake

Optional

28162 BB  
- **Obturator**, with central hole 2 mm for stereotactic positioning, for use with Operating Sheath 28162 BS

28162 BD  
- **Optical Obturator**, for positioning Operating Sheath 28162 BS under visual control, for use with HOPKINS® Telescope 28018 AA

28018 AA  
- **HOPKINS® Straight Forward Telescope 0°**, diameter 2.7 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: green

28161 LD  
- **Deflecting Mechanism**, for LASER probes, with bend protection, with adjustment wheel, with ring-grip handle, inner diameter 2.5 mm, outer diameter 2.8 mm, working length 38 cm

For Diagnosis

28132 AA  
- **HOPKINS® Straight Forward Telescope 0°**, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: green

28132 BWA  
- **HOPKINS® Wide Angle Forward-Oblique Telescope 30°**, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: red

28132 FA  
- **HOPKINS® Forward-Oblique Telescope 45°**, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: black

28162 EA  
- **Telescope Bridge**, for use with HOPKINS® Telescope 28132 AA through Operating Sheath 28162 BS

28162 E  
- **Telescope Bridge**, for use with HOPKINS® Telescope 28132 BA/BWA/CA/FA through Operating Sheath 28162 BS

Recommended containers for sterilization:

Telescopes: 39301 A (3x)
Angled eyepiece: 39314 G
Instruments: 39360 BK

Please note:

The use of Balloon Catheter 28162 GB with diameter 1 mm is also recommended.

It is recommended to check the suitability of the product for the intended procedure prior to use.
Neuro-Endoscopy – Intracranial Surgery

DECO Recommended Set
# Neuro-Endoscopy – Intracranial Surgery

**DECO Recommended Set**

## Telescopes and Sheaths

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>28160 BA</td>
<td><strong>HOPKINS</strong> Forward-Oblique Telescope 30°, diameter 2.9 mm, length 30 cm, autoclavable, fiber optic light transmission incorporated, color code: red</td>
<td></td>
</tr>
<tr>
<td>28160 GK</td>
<td>Operating Sheath, small, oval, exterior 3.5 x 4.7 mm, working length 14 cm, with blunt obturator, with stopcock, for use with operating instruments size 1 mm in conjunction with Working Insert 28160 GE</td>
<td></td>
</tr>
<tr>
<td>28160 GM</td>
<td>Operating Sheath, medium, oval, exterior 3.5 x 5.2 mm, working length 14 cm, with blunt obturator, with stopcock, for use with operating instruments size 1.7 mm in conjunction with Working Insert 28160 GE</td>
<td></td>
</tr>
<tr>
<td>28160 G</td>
<td>Operating Sheath, large, oval, exterior 4 x 7 mm, working length 14 cm, with blunt obturator, with stopcock, for use with operating instruments size 2.5 mm in conjunction with Working Insert 28160 GE</td>
<td></td>
</tr>
<tr>
<td>28160 GE</td>
<td>Working Insert, with two working channels, with stopcock, for use with Operating Sheaths 28160 G/GK/GM</td>
<td></td>
</tr>
</tbody>
</table>

## Instruments for Operating Sheaths, small – size 3.5 x 4.7 mm

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>28160 TV</td>
<td>Forceps, for ventriculostomy, flexible, double action jaws, diameter 1 mm, working length 30 cm</td>
<td></td>
</tr>
<tr>
<td>28160 ZJ</td>
<td>Biopsy Forceps, flexible, double action jaws, diameter 1 mm, working length 30 cm</td>
<td></td>
</tr>
<tr>
<td>28160 TJ</td>
<td>Grasping Forceps, flexible, double action jaws, diameter 1 mm, working length 30 cm</td>
<td></td>
</tr>
<tr>
<td>28160 SE</td>
<td>Suction Catheter, flexible, for single use, diameter 1 mm, working length 45 cm</td>
<td></td>
</tr>
<tr>
<td>28160 KS</td>
<td>Spatula Electrode, unipolar, flexible, diameter 1 mm, working length 45 cm</td>
<td></td>
</tr>
<tr>
<td>28160 KA</td>
<td>Coagulation Electrode, unipolar, flexible, diameter 1 mm, length 53 cm</td>
<td></td>
</tr>
</tbody>
</table>

## Instruments for Operating Sheaths, medium – size 3.5 x 5.2 mm

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>28162 FL</td>
<td>Biopsy Forceps, double action jaws, diameter 1.3 mm, working length 30 cm</td>
<td></td>
</tr>
<tr>
<td>28160 EK</td>
<td>Scissors, single action jaws, diameter 1.3 mm, working length 34 cm</td>
<td></td>
</tr>
<tr>
<td>28160 SB</td>
<td>Suction Catheter, flexible, for single use, diameter 1.5 mm, working length 45 cm</td>
<td></td>
</tr>
<tr>
<td>28160 KM</td>
<td>Bipolar Coagulation Electrode, semirigid, diameter 1.3 mm, working length 35 cm</td>
<td></td>
</tr>
<tr>
<td>28160 KC</td>
<td>Ball Electrode, unipolar, flexible, diameter 1.7 mm, working length 45 cm</td>
<td></td>
</tr>
</tbody>
</table>

## Instruments for Operating Sheaths, large – size 4 x 7 mm

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>28160 ZG</td>
<td>Biopsy Forceps, flexible, double action jaws, diameter 2.3 mm, working length 40 cm</td>
<td></td>
</tr>
<tr>
<td>28160 TG</td>
<td>Grasping Forceps, flexible, double action jaws, diameter 2.3 mm, working length 40 cm</td>
<td></td>
</tr>
<tr>
<td>28160 KD</td>
<td>Bipolar Coagulation Electrode, flexible, diameter 2 mm, working length 35 cm</td>
<td></td>
</tr>
</tbody>
</table>

## Holding System

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>28272 RKB</td>
<td>Holding System, autoclavable</td>
<td></td>
</tr>
</tbody>
</table>

including:
- **Socket**, to clamp to the OR table
- **Articulated Stand**, L-shaped
- **Clamping Jaw**, metal, with axial intake

---

**Recommended containers for sterilization:**

39360 BK, 39301 B

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**Please note:**
The use of Balloon Catheter 28162 GB with diameter 1 mm is also recommended.
Neuroscope
Operating Sheath, outer diameter 6.5 mm

GAAB Recommended Set

- For diagnostic orientation in the ventricular system, the cerebellopontine angle, basal cisterns, for arachnoidal cysts, for cystic intracranial tumors
- For therapeutic ventriculostomy, catheterization of the aquaeductus and removal of cysts, tumors and other occlusions in the ventricular region

28096 AGA
HOPKINS® Wide Angle Straight Forward Telescope 6°, angled eyepiece, length 15 cm, autoclavable, with fiber optic light transmission and working channel diameter 3 mm incorporated, robust version, color code: green

28162 BS
Operating Sheath, outer diameter 6.5 mm, working length 13 cm, graduated, with lateral stopcock and catheter port

28162 BB
Obturator, for 28162 BS, with central hole 2 mm for stereotactic positioning

28162 BD
Optical Obturator, for positioning Operating Sheath 28162 BS under visual control, for use with HOPKINS® Telescope 28018 AA

28162 BO
Obturator, for 28162 BS

28018 AA
HOPKINS® Straight Forward Telescope 0°, diameter 2.7 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: green
Operating Instruments

GAAB Recommended Set,
for use with HOPKINS® Telescope 28096 AGA and Operating Sheath 28162 BS

Diameter 2.7 mm, working length 30 cm

28162 EP

28162 EP  **Scissors**, pointed, single action jaws, diameter 2.7 mm, working length 30 cm

28162 EH  **Hook Scissors**, single action jaws, diameter 2.7 mm, working length 30 cm

28162 DH  **Biopsy Punch Forceps**, through-cutting, single action jaws, diameter 2.7 mm, working length 30 cm

28162 U  **Grasping Forceps**, single action jaws, diameter 2.7 mm, working length 30 cm

28162 ZE  **Biopsy Forceps**, single action jaws, diameter 2.7 mm, working length 30 cm

Size 2.4 mm, working length 24 cm

28162 BDL

28162 BDL  **TAKE-APART® Bipolar Forceps**, with flat jaws, size 2.4 mm, working length 24 cm

including:

- **Bipolar Ring Handle**
- **Outer Sheath**
- **Working Insert**, for single use, package of 5
Operating Instruments

GAAB Recommended Set, for use with HOPKINS® Telescope 28096 AGA and Operating Sheath 28162 BS

Diameter 1.7 mm, working length 30 cm

- **28160 TVX** Forceps, for ventriculostomy, flexible, diameter 1.7 mm, working length 30 cm
- **28162 F** Grasping Forceps, double action jaws, diameter 1.7 mm, working length 30 cm
- **28162 Z** Biopsy Forceps, double action jaws, diameter 1.7 mm, working length 30 cm
- **28162 EM** Scissors, pointed, slightly curved jaws, double action jaws, diameter 1.7 mm, working length 30 cm
- **28162 EK** Scissors, pointed/blunt, single action jaws, diameter 1.7 mm, working length 30 cm
- **28162 ES** Scissors, blunt/blunt, single action jaws, diameter 1.7 mm, working length 30 cm
- **28762 K** Coagulating Electrode, unipolar, semiflexible, diameter 1.7 mm, working length 30 cm
- **28762 KB** Bipolar Coagulating Electrode, diameter 1.7 mm, working length 30 cm
- **28162 SN** Irrigation Tube, autoclavable, with LUER-Lock connection
- **28162 GB** Balloon Catheter, volume 0.20 ml, diameter 1 mm, length 40 cm, sterile, for single use, package of 10
Diagnostic Telescopes for Neuro-Endoscope
HOPKINS® Telescopes, Telescope Bridges

GAAB Recommended Set for use with Operating Sheath 28162 BS

Diameter 4 mm, length 18 cm

- **28132 AA**
  - **HOPKINS® Straight Forward Telescope 0°**, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: green

- **28162 EA**
  - **Telescope Bridge**, for use with HOPKINS® Telescope 28132 AA through Operating Sheath 28162 BS

- **28132 BWA**
  - **HOPKINS® Wide Angle Forward-Oblique Telescope 30°**, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: red

- **28132 FA**
  - **HOPKINS® Forward-Oblique Telescope 45°**, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: black

- **28132 CA**
  - **HOPKINS® Lateral Telescope 70°**, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: yellow

- **28162 E**
  - **Telescope Bridge**, for use with HOPKINS® Telescope 28132 BA/BWA/CA/FA through Operating Sheath 28162 BS

- **533 TVA**
  - **Adaptor**, autoclavable, permits telescope changing under sterile conditions
Intracranial Neuroendoscopy
Recommended Sets for Neuroendoscopy acc. to GAAB

28272 RKA  **Holding System, autoclavable,**
with quick release coupling KSLOCK,
including:
**Rotation Socket,** to clamp to the OR table,
for European and US standard rails,
with lateral clamp for height and angle
adjustment of the articulated stand
**Articulated Stand,** reinforced version, straight,
with one mechanical central clamp for all five
joint functions, height 30 cm, swivel range 37 cm,
with quick release coupling KSLOCK (female)
**Clamping Jaw,** metal, clamping range 4.8 up to
12.5 mm, with quick release coupling KSLOCK (male),
for use with instrument and telescope sheaths
Neuro-Endoscope
Operating Sheath, size 4 x 7 mm

DECQ Recommended Set

- 28160 BA: HOPKINS® Forward-Oblique Telescope 30°, diameter 2.9 mm, length 30 cm, autoclavable, fiber optic light transmission incorporated, color code: red
- 28160 G: Operating Sheath, large, oval, exterior 4 x 7 mm, working length 14 cm, with blunt obturator, with stopcock, for use with operating instruments size 2.5 mm in conjunction with Working Insert 28160 GE
- 28160 GE: Working Insert, with 2 working channels, with stopcock, for use with Operating Sheath 28160 G/GK/GM
- 28160 GL: Optical Obturator, concave, with channel, for use with Operating Sheath 28160 G

Operating Instruments for Operating Sheath size 4 x 7 mm

- 28160 ZG: Biopsy Forceps, flexible, double action jaws, diameter 2.3 mm, working length 40 cm
- 28160 TG: Grasping Forceps, flexible, double action jaws, diameter 2.3 mm, working length 40 cm
- 28160 SF: Suction Catheter, flexible, for single use, diameter 2.5 mm, working length 45 cm
- 28160 KD: Bipolar Coagulation Electrode, flexible, diameter 2 mm, working length 35 cm

Please note: The use of Balloon Catheter 28162 GB with diameter 1 mm is also recommended.
Neuro-Endoscope
Operating Sheath, 3.5 x 5.2 mm

**DECQ Recommended Set**

28160 BA  **HOPKINS® Forward-Oblique Telescope 30°**, diameter 2.9 mm, length 30 cm, autoclavable, fiber optic light transmission incorporated, color code: red

28160 GM  **Operating Sheath**, medium, oval, exterior 3.5 x 5.2 mm, working length 14 cm, with blunt obturator, with stopcock, for use with operating instruments size 1.7 mm in conjunction with Working Insert 28160 GE

28160 GML  **Optical Obturator**, concave, with channel, for use with Operating Sheath 28160 GM

28160 GE  **Working Insert**, with 2 working channels, with stopcock, for use with Operating Sheath 28160 G/GK/GM

**Operating Instruments for Operating Sheath size 3.5 x 5.2 mm**

28160 EK  **Scissors**, single action jaws, diameter 1.3 mm, working length 34 cm

28162 FL  **Biopsy Forceps**, double action jaws, diameter 1.3 mm, working length 30 cm

28162 FK  **Grasping Forceps**, semirigid, double action jaws, diameter 1.3 mm, working length 30 cm

28160 SB  **Suction Catheter**, flexible, for single use, diameter 1.5 mm, working length 45 cm

28160 KC  **Ball Electrode**, unipolar, flexible, diameter 1.7 mm, working length 45 cm

28160 KM  **Bipolar Coagulation Electrode**, semirigid, diameter 1.3 mm, working length 35 cm

**Please note:** The use of Balloon Catheter 28162 SB with diameter 0.7 mm is also recommended.
Brain Endoscopy in Hydrocephalus

Neuro-Endoscope
Operating Sheath, 3.5 x 4.7 mm

**DECQ Recommended Set**

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>28160 BA</td>
<td><strong>HOPKINS® Forward-Oblique Telescope 30°</strong>, diameter 2.9 mm, length 30 cm, autoclavable, fiber optic light transmission incorporated, color code: red</td>
</tr>
<tr>
<td>28160 GK</td>
<td>Operating Sheath, small, oval, exterior 3.5 x 4.7 mm, working length 14 cm, with blunt obturator, with stopcock, for use with operating instruments size 1 mm in conjunction with Working Insert 28160 GE</td>
</tr>
<tr>
<td>28160 GKL</td>
<td>Optical Obturator, concave, with channel, for use with Operating Sheath 28160 GK</td>
</tr>
<tr>
<td>28160 GE</td>
<td>Working Insert, with 2 working channels, with stopcock, for use with Operating Sheath 28160 G/GK/GM</td>
</tr>
</tbody>
</table>

**Operating Instruments for Operating Sheath size 3.5 x 4.7 mm**

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>28160 ZJ</td>
<td>Biopsy Forceps, flexible, double action jaws, diameter 1 mm, working length 30 cm</td>
</tr>
<tr>
<td>28160 TJ</td>
<td>Grasping Forceps, flexible, double action jaws, diameter 1 mm, working length 30 cm</td>
</tr>
<tr>
<td>28160 TV</td>
<td>Forceps, for ventriculostomy, flexible, double action jaws, diameter 1 mm, working length 30 cm</td>
</tr>
<tr>
<td>28160 SE</td>
<td>Suction Catheter, flexible, for single use, diameter 1 mm, working length 45 cm</td>
</tr>
<tr>
<td>28160 KA</td>
<td>Coagulation Electrode, unipolar, flexible, diameter 1 mm, length 53 cm</td>
</tr>
<tr>
<td>28160 KS</td>
<td>Spatula Electrode, unipolar, flexible, diameter 1 mm, working length 45 cm</td>
</tr>
</tbody>
</table>

**Please note:** The use of Balloon Catheter 28162 SB with diameter 0.7 mm is also recommended.
Intracranial Neuroendoscopy
Recommended Sets for Neuroendoscopy acc. to DECQ

28272 RKB  Holding System, autoclavable,
with quick release coupling KSLOCK
including:
  Rotation Socket, to clamp to the OR table,
  for European and US standard rails,
  with lateral clamp for height and angle adjustment
  of the articulated stand 28272 HB Articulated Stand,
  reinforced version, L-shaped,
  with one central clamp for all five joint functions,
  height 48 cm, swivel range 52 cm,
  with quick release coupling KSLOCK (female)
  Clamping Jaw, metal,
  clamping range 4.8 up to 12.5 mm,
  with quick release coupling KSLOCK (male),
  for use with instrument and telescope sheaths
**Neuro-Fiberscope, 2.8 mm**

**Working length 40 cm, Outer Diameter 2.8 mm, steerable**

Movements of the distal tip:
- **up:** 120°
- **down:** 170°
- **Angle of view:** 65°

Application Range – Indications
- For direct examination of all cerebral ventricles from caudal to cranial or vice versa including passage of the normally dilated cerebral aqueduct offering the possibility of manipulations such as biopsy, ventriculostomy and septostomy
- Endoscopy of the subdural and subarachnoid region.
- Endoscopy of the spinal canal combined with the opportunity for operative manipulations, e.g. extradural, intradural-extramedullary, but also particularly for the treatment of a cystic intramedullary process such as syringomyelia.
- Very suitable for endoscopic-assisted micro-neurosurgery in narrow spaces of the cerebral ventricles.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11161 C</td>
<td><strong>Neuro-Fiberscope, steerable</strong></td>
</tr>
<tr>
<td></td>
<td>Deflection up/down: 170°/120°</td>
</tr>
<tr>
<td></td>
<td>Direction of view: 0°</td>
</tr>
<tr>
<td></td>
<td>Angle of view: 90°</td>
</tr>
<tr>
<td></td>
<td>Working length: 40 cm</td>
</tr>
<tr>
<td></td>
<td>Total length: 70 cm</td>
</tr>
<tr>
<td></td>
<td>Working channel inner diameter: 1.2 mm</td>
</tr>
<tr>
<td></td>
<td>Distal tip outer diameter: 2.8 mm</td>
</tr>
</tbody>
</table>

Following accessories included:
- 27677 A  Case
- 11161 KA Biopsy Forceps
- 11161 KB Grasping Forceps
- 11161 AB Coagulating Electrode, unipolar
- 11025 E Pressure Compensation Cap
- 13242 XL Leakage Tester
- 27651 AK Cleaning Brush
- 11161 HD Guiding Tube
IMAGE1 S Camera System

Economical and future-proof
- Modular concept for flexible, rigid and 3D endoscopy as well as new technologies
- Forward and backward compatibility with video endoscopes and FULL HD camera heads
- Sustainable investment
- Compatible with all light sources

Innovative Design
- Dashboard: Complete overview with intuitive menu guidance
- Live menu: User-friendly and customizable
- Intelligent icons: Graphic representation changes when settings of connected devices or the entire system are adjusted
- Automatic light source control
- Side-by-side view: Parallel display of standard image and the Visualization mode
- Multiple source control: IMAGE1 S allows the simultaneous display, processing and documentation of image information from two connected image sources, e.g., for hybrid operations

Dashboard

Live menu

Intelligent icons

Side-by-side view: Parallel display of standard image and Visualization mode
**IMAGE1 S Camera System**

**Brilliant Imaging**
- Clear and razor-sharp endoscopic images in FULL HD
- Natural color rendition

**Reflection is minimized**
- Multiple IMAGE1 S technologies for homogeneous illumination, contrast enhancement and color shifting

*FULL HD image*

- **CLARA**
- **CHROMA**
- **SPECTRA A**
- **SPECTRA B**

---

* SPECTRA A: Not for sale in the U.S.
** SPECTRA B: Not for sale in the U.S.
**IMAGE1 S Camera System**

**TC 200EN**

TC 200EN* IMAGE1 S CONNECT, connect module, for use with up to 3 link modules, resolution 1920 x 1080 pixels, with integrated KARL STORZ-SCB and digital Image Processing Module, power supply 100–120 VAC/200–240 VAC, 50/60 Hz including:

- **Mains Cord**, length 300 cm
- **DVI-D Connecting Cable**, length 300 cm
- **SCB Connecting Cable**, length 100 cm
- **USB Flash Drive**, 32 GB, USB silicone keyboard, with touchpad, US

*Available in the following languages: DE, ES, FR, IT, PT, RU

**Specifications:**

<table>
<thead>
<tr>
<th>HD video outputs</th>
<th>Format signal outputs</th>
<th>USB interface</th>
<th>SCB interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 2x DVI-D</td>
<td>1920 x 1080p, 50/60 Hz</td>
<td>3x</td>
<td>4x USB, (2x front, 2x rear)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2x 6-pin mini-DIN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Power frequency</th>
<th>Protection class</th>
<th>Dimensions w x h x d</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>100–120 VAC/200–240 VAC</td>
<td>50/60 Hz</td>
<td>I, CF-Defib</td>
<td>305 x 54 x 320 mm</td>
<td>2.1 kg</td>
</tr>
</tbody>
</table>

**For use with IMAGE1 S**

**IMAGE1 S CONNECT Module TC 200EN**

**TC 300**

TC 300 IMAGE1 S H3-LINK, link module, for use with IMAGE1 FULL HD three-chip camera heads, power supply 100–120 VAC/200–240 VAC, 50/60 Hz, for use with IMAGE1 S CONNECT TC 200EN including:

- **Mains Cord**, length 300 cm
- **Link Cable**, length 20 cm

**Specifications:**

<table>
<thead>
<tr>
<th>Camera System</th>
<th>TC 300 (H3-Link)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supported camera heads/video endoscopes</td>
<td>TH 100, TH 101, TH 102, TH 103, TH 104, TH 106 (fully compatible with IMAGE1 S) 222200055-3, 222200056-3, 222200053-3, 222200060-3, 222200061-3, 222200054-3, 222200085-3 (compatible without IMAGE1 S technologies CLARA, CHROMA, SPECTRA*)</td>
</tr>
<tr>
<td>LINK video outputs</td>
<td>1x</td>
</tr>
<tr>
<td>Power supply</td>
<td>100–120 VAC/200–240 VAC</td>
</tr>
<tr>
<td>Power frequency</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Protection class</td>
<td>I, CF-Defib</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>305 x 54 x 320 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>1.86 kg</td>
</tr>
</tbody>
</table>

* SPECTRA A: Not for sale in the U.S.
** SPECTRA B: Not for sale in the U.S.
Brain Endoscopy in Hydrocephalus

IMAGE1 S Camera Heads

For use with IMAGE1 S Camera System
IMAGE1 S CONNECT Module TC 200EN, IMAGE1 S H3-LINK Module TC 300
and with all IMAGE1 HUB™ HD Camera Control Units

**TH 100**

**IMAGE1 S H3-Z Three-Chip FULL HD Camera Head,**
50/60 Hz, IMAGE1 S compatible, progressive scan,
soakable, gas- and plasma-sterilizable, with integrated
Parfocal Zoom Lens, focal length f = 15–31 mm (2x),
2 freely programmable camera head buttons,
for use with IMAGE1 S and IMAGE1 HUB™ HD/HD

### Specifications:

<table>
<thead>
<tr>
<th>IMAGE1 FULL HD Camera Heads</th>
<th>IMAGE1 S H3-Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product no.</td>
<td>TH 100</td>
</tr>
<tr>
<td>Image sensor</td>
<td>3x 1/3&quot; CCD chip</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>39 x 49 x 114 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>270 g</td>
</tr>
<tr>
<td>Optical interface</td>
<td>integrated Parfocal Zoom Lens, f = 15–31 mm (2x)</td>
</tr>
<tr>
<td>Min. sensitivity</td>
<td>F 1.4/1.17 Lux</td>
</tr>
<tr>
<td>Grip mechanism</td>
<td>standard eyepiece adaptor</td>
</tr>
<tr>
<td>Cable</td>
<td>non-detachable</td>
</tr>
<tr>
<td>Cable length</td>
<td>300 cm</td>
</tr>
</tbody>
</table>

**TH 104**

**IMAGE1 S H3-ZA Three-Chip FULL HD Camera Head,**
50/60 Hz, IMAGE1 S compatible, *autoclavable*,
progressive scan, soakable, gas- and plasma-sterilizable,
with integrated Parfocal Zoom Lens, focal length
f = 15–31 mm (2x), 2 freely programmable camera head
buttons, for use with IMAGE1 S and IMAGE1 HUB™ HD/HD

### Specifications:

<table>
<thead>
<tr>
<th>IMAGE1 FULL HD Camera Heads</th>
<th>IMAGE1 S H3-ZA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product no.</td>
<td>TH 104</td>
</tr>
<tr>
<td>Image sensor</td>
<td>3x 1/3&quot; CCD chip</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>39 x 49 x 100 mm</td>
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<tr>
<td>Weight</td>
<td>299 g</td>
</tr>
<tr>
<td>Optical interface</td>
<td>integrated Parfocal Zoom Lens, f = 15–31 mm (2x)</td>
</tr>
<tr>
<td>Min. sensitivity</td>
<td>F 1.4/1.17 Lux</td>
</tr>
<tr>
<td>Grip mechanism</td>
<td>standard eyepiece adaptor</td>
</tr>
<tr>
<td>Cable</td>
<td>non-detachable</td>
</tr>
<tr>
<td>Cable length</td>
<td>300 cm</td>
</tr>
</tbody>
</table>
Monitors

9619 NB  19" HD Monitor, color systems PAL/NTSC, max. screen resolution 1280 x 1024, image format 4:3, power supply 100–240 VAC, 50/60 Hz, wall-mounted with VESA 100 adaption, including:
- External 24 VDC Power Supply
- Mains Cord

9826 NB  26" FULL HD Monitor, wall-mounted with VESA 100 adaption, color systems PAL/NTSC, max. screen resolution 1920 x 1080, image format 16:9, power supply 100–240 VAC, 50/60 Hz including:
- External 24 VDC Power Supply
- Mains Cord
## Monitors

### KARL STORZ HD and FULL HD Monitors

<table>
<thead>
<tr>
<th>Wall-mounted with VESA 100 adaption</th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product no.</strong> 9619 NB</td>
<td>9619 NB</td>
<td>9826 NB</td>
</tr>
<tr>
<td><strong>Inputs:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DVI-D</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Fibre Optic</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>3G-SDI</td>
<td>–</td>
<td>●</td>
</tr>
<tr>
<td>RGBS (VGA)</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>S-Video</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Composite/FBAS</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td><strong>Outputs:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DVI-D</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>S-Video</td>
<td>●</td>
<td>–</td>
</tr>
<tr>
<td>Composite/FBAS</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>RGBS (VGA)</td>
<td>●</td>
<td>–</td>
</tr>
<tr>
<td>3G-SDI</td>
<td>–</td>
<td>●</td>
</tr>
<tr>
<td><strong>Signal Format Display:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4:3</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>5:4</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>16:9</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Picture-in-Picture</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>PAL/NTSC compatible</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

### Optional accessories:

- **9826 SF**  
  Pedestal, for monitor 9826 NB

- **9626 SF**  
  Pedestal, for monitor 9619 NB

### Specifications:

<table>
<thead>
<tr>
<th>KARL STORZ HD and FULL HD Monitors</th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Desktop with pedestal</strong></td>
<td>optional</td>
<td>optional</td>
</tr>
<tr>
<td><strong>Product no.</strong></td>
<td>9619 NB</td>
<td>9826 NB</td>
</tr>
<tr>
<td><strong>Brightness</strong></td>
<td>200 cd/m² (typ)</td>
<td>500 cd/m² (typ)</td>
</tr>
<tr>
<td><strong>Max. viewing angle</strong></td>
<td>178° vertical</td>
<td>178° vertical</td>
</tr>
<tr>
<td><strong>Pixel distance</strong></td>
<td>0.29 mm</td>
<td>0.3 mm</td>
</tr>
<tr>
<td><strong>Reaction time</strong></td>
<td>5 ms</td>
<td>8 ms</td>
</tr>
<tr>
<td><strong>Contrast ratio</strong></td>
<td>700:1</td>
<td>1400:1</td>
</tr>
<tr>
<td><strong>Mount</strong></td>
<td>100 mm VESA</td>
<td>100 mm VESA</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>7.6 kg</td>
<td>7.7 kg</td>
</tr>
<tr>
<td><strong>Rated power</strong></td>
<td>28 W</td>
<td>72 W</td>
</tr>
<tr>
<td><strong>Operating conditions</strong></td>
<td>0–40°C</td>
<td>5–35°C</td>
</tr>
<tr>
<td><strong>Storage</strong></td>
<td>-20–60°C</td>
<td>-20–60°C</td>
</tr>
<tr>
<td><strong>Rel. humidity</strong></td>
<td>max. 85%</td>
<td>max. 85%</td>
</tr>
<tr>
<td><strong>Dimensions w x h x d</strong></td>
<td>468.5 x 418 x 75.5 mm</td>
<td>643 x 396 x 87 mm</td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td>100–240 VAC</td>
<td>100–240 VAC</td>
</tr>
<tr>
<td><strong>Certified to</strong></td>
<td>EN 60601-1, protection class IPX0</td>
<td>EN 60601-1, UL 60601-1, MDD93/42/EEC, protection class IPX2</td>
</tr>
</tbody>
</table>
Fiber Optic Light Cables
for Cold Light Fountains

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>495 NA</td>
<td><strong>Fiber Optic Light Cable</strong>&lt;br&gt;size 3.5 mm, length 230 cm</td>
</tr>
<tr>
<td>495 NB</td>
<td><strong>Same</strong>, size 4.8 mm, length 180 cm</td>
</tr>
<tr>
<td>495 NCS</td>
<td><strong>Same</strong>, size 4.8 mm, length 250 cm</td>
</tr>
</tbody>
</table>

Cold Light Fountain XENON 300 SCB

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20133101-1</td>
<td><strong>Cold Light Fountain XENON 300 SCB</strong>&lt;br&gt;with built-in antifog air-pump, and integrated&lt;br&gt;KARL STORZ Communication Bus System SCB&lt;br&gt;power supply: 100–125 VAC/220–240 VAC, 50/60 Hz&lt;br&gt;including:&lt;br&gt;<strong>Mains Cord</strong>&lt;br&gt;<strong>Silicone Tubing Set</strong>, autoclavable, length 250 cm&lt;br&gt;<strong>SCB Connecting Cable</strong>, length 100 cm</td>
</tr>
<tr>
<td>20133027</td>
<td><strong>Spare Lamp Module XENON</strong>&lt;br&gt;with heat sink, 300 watt, 15 volt</td>
</tr>
<tr>
<td>20133028</td>
<td><strong>XENON Spare Lamp</strong>, only, 300 watt, 15 volt</td>
</tr>
</tbody>
</table>

Cold Light Fountain XENON NOVA® 300

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20134001</td>
<td><strong>Cold Light Fountain XENON NOVA® 300,</strong>&lt;br&gt;power supply:&lt;br&gt;100–125 VCA/220–240 VAC, 50/60 Hz&lt;br&gt;including:&lt;br&gt;<strong>Mains Cord</strong></td>
</tr>
<tr>
<td>20133028</td>
<td><strong>XENON Spare Lamp</strong>, only, 300 watt, 15 volt</td>
</tr>
</tbody>
</table>
Data Management and Documentation
KARL STORZ AIDA® – Exceptional documentation

The name AIDA stands for the comprehensive implementation of all documentation requirements arising in surgical procedures: A tailored solution that flexibly adapts to the needs of every specialty and thereby allows for the greatest degree of customization.

This customization is achieved in accordance with existing clinical standards to guarantee a reliable and safe solution. Proven functionalities merge with the latest trends and developments in medicine to create a fully new documentation experience – AIDA.

AIDA seamlessly integrates into existing infrastructures and exchanges data with other systems using common standard interfaces.

WD 200-XX*
AIDA Documentation System, for recording still images and videos, dual channel up to FULL HD, 2D/3D, power supply 100–240 VAC, 50/60 Hz including:
- USB Silicone Keyboard, with touchpad
- ACC Connecting Cable
- DVI Connecting Cable, length 200 cm
- HDMI-DVI Cable, length 200 cm
- Mains Cord, length 300 cm

WD 250-XX*
AIDA Documentation System, for recording still images and videos, dual channel up to FULL HD, 2D/3D, including SmartScreen® (touch screen), power supply 100–240 VAC, 50/60 Hz including:
- USB Silicone Keyboard, with touchpad
- ACC Connecting Cable
- DVI Connecting Cable, length 200 cm
- HDMI-DVI Cable, length 200 cm
- Mains Cord, length 300 cm

*XX Please indicate the relevant country code (DE, EN, ES, FR, IT, PT, RU) when placing your order.
Workflow-oriented use

Patient
Entering patient data has never been this easy. AIDA seamlessly integrates into the existing infrastructure such as HIS and PACS. Data can be entered manually or via a DICOM worklist. All important patient information is just a click away.

Checklist
Central administration and documentation of time-out. The checklist simplifies the documentation of all critical steps in accordance with clinical standards. All checklists can be adapted to individual needs for sustainably increasing patient safety.

Record
High-quality documentation, with still images and videos being recorded in FULL HD and 3D. The Dual Capture function allows for the parallel (synchronous or independent) recording of two sources. All recorded media can be marked for further processing with just one click.

Edit
With the Edit module, simple adjustments to recorded still images and videos can be very rapidly completed. Recordings can be quickly optimized and then directly placed in the report. In addition, freeze frames can be cut out of videos and edited and saved. Existing markings from the Record module can be used for quick selection.

Complete
Completing a procedure has never been easier. AIDA offers a large selection of storage locations. The data exported to each storage location can be defined. The Intelligent Export Manager (IEM) then carries out the export in the background. To prevent data loss, the system keeps the data until they have been successfully exported.

Reference
All important patient information is always available and easy to access. Completed procedures including all information, still images, videos, and the checklist report can be easily retrieved from the Reference module.
**Equipment Cart**

Equipment Cart
wide, high, rides on 4 antistatic dual wheels equipped with locking brakes 3 shelves, mains switch on top cover, central beam with integrated electrical subdistributors with 12 sockets, holder for power supplies, potential earth connectors and cable winding on the outside,

Dimensions:
Equipment cart: 830 x 1474 x 730 mm (w x h x d),
shelf: 630 x 510 mm (w x d),
caster diameter: 150 mm

including:

- Base module equipment cart, wide
- Cover equipment, equipment cart wide
- Beam package equipment, equipment cart high
- 3x Shelf, wide
- Drawer unit with lock, wide
- 2x Equipment rail, long
- Camera holder

**Monitor Swivel Arm,**
height and side adjustable,
can be turned to the left or the right side, swivel range 180°, overhang 780 mm, overhang from centre 1170 mm, load capacity max. 15 kg, with monitor fixation VESA 5/100, for usage with equipment carts UG xxx
Recommended Accessories for Equipment Cart

**Isolation Transformer**,
200 V–240 V; 2000 VA with 3 special mains socket, expulsion fuses, 3 grounding plugs, dimensions: 330 x 90 x 495 mm (w x h x d), for usage with equipment carts UG xxx

**Earth Leakage Monitor**, 200 V–240 V, for mounting at equipment cart, control panel dimensions: 44 x 80 x 29 mm (w x h x d), for usage with isolation transformer UG 310

**Monitor Holding Arm**, height adjustable, inclinable, mountable on left or right, turning radius approx. 320°, overhang 530 mm, load capacity max. 15 kg, monitor fixation VESA 75/100, for usage with equipment carts UG xxx

Please note that the described products in this medium may not be available yet in all countries due to different regulatory requirements.
with the compliments of
KARL STORZ — ENDOSKOPE