ENDOSCOPIC SKULL BASE
AND PITUITARY APPROACHES
A STEP-BY-STEP GUIDE FOR SURGICAL INSTRUCTION
AND CADAVERIC DISSECTION

Theodore H. SCHWARTZ
Professor of Neurosurgery, Otorhinolaryngology and Neurology
and Neuroscience, Co-Director, Institute for Minimally Invasive Skull
Base and Pituitary Surgery, Weill Cornell Medical College
New York-Presbyterian Hospital, New York, U.S.A.

Vijay K. ANAND
Clinical Professor of Otorhinolaryngology
Co-Director, Institute for Minimally Invasive Skull Base
and Pituitary Surgery, Weill Cornell Medical College
New York-Presbyterian Hospital, New York, U.S.A.
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Dr. Theodore H. SCHWARTZ
Professor of Neurosurgery, Otorhinolaryngology and Neurology and Neuroscience, Co-Director, Institute for Minimally Invasive Skull Base and Pituitary Surgery

Correspondence address:
Department of Neurosurgery
Weill Cornell Medical College
New York Presbyterian Hospital
525 East 68th St., Box #99
New York, N.Y. 10021, U.S.A.
Phone: (212) 746-5620
Fax: (212)746-8947
schwarh@med.cornell.edu
http://www.endoscopicskullbasesurgery.com
http://www.weillcornell.org/tschwartz

Dr. Vijay K. ANAND
Clinical Professor of Otorhinolaryngology
Co-Director, Institute for Minimally Invasive Skull Base and Pituitary Surgery
Department of Otorhinolaryngology

Correspondence address:
772 Park Ave.
New York, NY 10021, U.S.A.
Phone: (212) 452-3005
Fax: (212) 452-3660
http://www.sinusitis-solutions.com
Vijayanandmd@aol.com
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Medical Illustrator:
Hugh Thomas
212-254-5463
hugh.thomas@verizon.net

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## Table of Contents

Preface .................................................................................................................. 7
Introduction ............................................................................................................. 7
Endoscopic Skull Base Corridors, Approaches and Targets ................................ 8
Transsphenoidal Corridor .................................................................................... 9
Transnasal Corridor ............................................................................................. 16
Transethmoidal Corridor ..................................................................................... 19
Transmaxillary Corridor ....................................................................................... 22
Closure ................................................................................................................ 25
Bibliography ....................................................................................................... 26
Dr. Theodore H. Schwartz received his undergraduate and medical degrees from Harvard University where he graduated Magna Cum Laude. After completing his residency and chief residency in Neurosurgery at The Neurological Institute of New York at Columbia-Presbyterian Medical Center, Dr. Schwartz completed advanced fellowship training at Yale-New Haven Medical Center in the surgical treatment of brain tumors and epilepsy. Dr. Schwartz specializes in image-guided minimally invasive surgical techniques such as stereotaxis, endoscopy and intraoperative MRI, and has received numerous awards and fellowships including the prestigious van Wagenen Fellowship, awarded by the American Association of Neurological Surgeons and the von Humboldt Fellowship, awarded by the German Government. Dr. Schwartz was recently awarded the “Gentle Giant Award” by the Pituitary Network and is on the editorial board for the Journal of Neurosurgery and World Neurosurgery. Dr. Schwartz is a Professor of Neurosurgery, Otorhinolaryngology and Neurology and Neuroscience at Weill Cornell Medical Center, New York Presbyterian Hospital, surgical director of the Comprehensive Epilepsy Center, as well as co-director of the Institute for Minimally Invasive Skull Base and Pituitary Surgery and co-director of Surgical neuro-oncology. His recent textbook publications include Practical Endoscopic Skull Base Surgery (Plural Publishing Inc.) and Endoscopic Pituitary Surgery (Thieme).

Dr. Vijay K. Anand is a world renowned endoscopic sinus surgeon who was instrumental in developing image guidance in endoscopic sinus surgery and anterior skull base surgery. He graduated from Madras Medical College in India with honors and has won many awards in the field of medicine. He trained at Manhattan Eye Ear and Throat Hospital in Otolaryngology and currently is the Director of the Rhinology lab and postgraduate education in Rhinology at Weill Medical College of Cornell University and New York Presbyterian Hospital in New York. The Rhinology lab which has been funded by numerous private foundations is dedicated to research in basic and clinical sciences. He was the President of the American Rhinologic Society in 1995 and has been a pioneer in the development of endoscopic sinus surgery and its extended applications. He has published widely in the field of Rhinology including the recently published textbook on Practical Endoscopic Skull Base Surgery (Plural Publishing Inc.). Dr. Anand has been the Course Director and has conducted more than 35 courses in Advanced Endoscopic Sinus surgery at the Weill Medical College of Cornell University. He is the recipient of the Outstanding Teacher Award in Rhinology from the American Rhinological Society. He is a sought after speaker in the field of Rhinology and is a Clinical Professor of Otolaryngology at the Weill Medical College of Cornell University in New York as well as co-director of the Institute for Minimally Invasive Skull Base and Pituitary Surgery.
Preface

Endoscopic approaches to the pituitary and skull base are quickly becoming a standard of care in neurosurgery and otolaryngology. The basis for a comprehensive understanding of the applications and limitations of these approaches is best acquired in the laboratory, performing cadaveric dissections. After teaching and participating in several endoscopic skull base dissection courses, we felt there was a need for a dissection manual that could be helpful to guide the surgeon through the various approaches in a step-by-step fashion. For this reason we have tried to make this manual very simple and illustrative. In addition, since the cadaveric anatomy never quite perfectly simulates real intraoperative conditions, we have linked each step with an intraoperative photo as a demonstration. The purpose of the intraoperative photographs are to assist the surgeon in making the cognitive transition from the cadaver laboratory to the operating room.

Introduction

The skull base lies at the anatomic boundary between the fields of neurosurgery and otolaryngology. Surgery in this region has always been a challenge for both disciplines. The success of endoscopic techniques in the management of inflammatory sinus disease has lead to the next step of applying the endoscope to the resection of tumors of the skull base.

This laboratory manual is intended as a guide for cadaveric dissection which will serve as an introduction to the surgical exercises. We find it useful to think about the endoscopic skull base approaches as a combination of three factors – a target, a skull base approach and a nasal corridor. The first aspect of the surgical plan is the target. We have defined 15 separate targets. They are – anterior fossa, olfactory groove, sella, suprasellar cistern, lateral sphenoid sinus, medial cavernous sinus, lateral cavernous sinus, orbital apex, pterygopalatine fossa, Meckel’s cave, infratemporal fossa, petrous apex, upper third of clivus, lower two-thirds of clivus, odontoid/ventral craniovertebral junction. Some targets have one possible approach, whereas other targets have multiple approaches. The second aspect of the approach involves an understanding of the possible corridors though which one passes on the way to the target. There are four corridors that define the endonasal endoscopic approaches: transnasal, transsphenoidal, transethmoidal, transmaxillary. These corridors correspond to the nasal sinuses and can be combined to reach a variety of targets. The link between the nasal corridor and the surgical target is the approach.

The purpose of the manual is to describe the various nasal corridors that are presently available to reach intracranial targets through the endonasal skull base approaches and to take the participant though each of these approaches. The division of the endonasal skull base approaches into corridors, approaches and targets provides a framework for instruction.
Endoscopic Skull Base Corridors, Approaches and Targets

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Approach</th>
<th>Target</th>
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<tbody>
<tr>
<td>Transnasal</td>
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<td>Anterior Fossa/Olfactory Groove Lower 2/3 of Clivus Odontoid/Craniovertebral Junction</td>
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<td>Transclival</td>
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<td></td>
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</tr>
<tr>
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<td>Transpterygoidal*</td>
<td>Meckel’s Cave</td>
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+ The transethmoidal transorbital approach involves opening the anterior and lateral walls of the sphenoid sinus.
* The transmaxillary transpterygoidal approach involves opening the ethmoid and sphenoid sinuses as well.
**Transsphenoidal Corridor**

The transsphenoidal corridor offers an approach to the sphenoid sinus which is the gateway to the sella, the planum spheniodale, the suprasellar cistern, the intrasphenoidal clivus and medial cavernous sinus. Although a unilateral approach is feasible when removing small pituitary tumors, the bilateral approach is critical for more extensive skull base approaches and eases visualization and instrument manipulation during cadaveric dissection.

**Step 1** Advance the endoscope through each nare and identify the septum (S) medially, the inferior, middle (MT) and superior turbinates laterally and the choana (CH) inferiorly (Fig. 1).
Step 2 Identify the ostia of the sphenoid sinuses bilaterally (OS). These are found 1.5 cm above the choana (CH), just below the superior turbinates (ST). Below the ostium is the sphenoethmoidal recess (Fig. 2). If a nasoseptal flap is being harvested, this must be done at the beginning of the operation (see Closure, p. 25). If not, proceed to Step 3.

Step 3 Remove the posterior nasal septum adjacent to the sphenoid rostrum.

Step 4 Complete a submucous resection of the nasal septum and harvest the bone of the vomer or the perpendicular plate of the ethmoid bone. These specimens can be used to reconstruct the skull base defect.

Step 5 Enlarge the ostia (OS) bilaterally with a mushroom forceps or a drill. Care must be taken not to damage the sphenopalatine artery when opening the ostium inferolaterally (Fig. 3).

Step 6 Identify the sphenoid rostrum and drill the bone until the sphenoid sinus is opened widely. Remove the intersphenoidal septae and identify the sella (S) and the clivus (C) inferiorly. The carotid protuberances (CP) overlie the vertical segment of the carotid artery on each side of the clivus (Fig. 4).
Step 7 Identify the anatomy on the lateral wall of the sphenoid sinus, such as the optic protuberance (OP), the carotid protuberance (CP) and the opticocarotid recess (OCR) (Fig. 5).

Step 8 Identify the tuberculum sellae (TS) and planum sphenoidale (PS) above the sella (S) (Fig. 6).

Step 9 Transsellar Approach: Drill the anterior wall of the sella (S) to expose the dura (D) overlying the pituitary gland. A large opening from carotid protuberance to carotid protuberance is helpful in removing large adenomas. Open the dura in a cruciate fashion to expose the pituitary gland (Fig. 7).
**Step 10 Transtuberculum, Transplanum Approach:**
Drill through the tuberculum sellae and planum sphenoidale to expose the dura of the tuberculum sella (TSD) and planum sphenoidale (PSD). Open the dura above and below the superior intercavernous sinus (SICS) and then cauterize and cut the SICS to expose the optic chiasm (OC), optic nerves (ON) and arachnoid (A) overlying the gyrus rectus (GR). The anterior communicating artery (ACA) can be found above the optic chiasm and the pituitary stalk is below, a common site for craniopharyngiomas (CR). Advancing the endoscope through the floor of the third ventricle will expose the roof of the third ventricle, choroid plexus (CP), fornices (F) and foramina of Monro (FM) (Figs. 8a–d).
Step 11  Tuberculum sellae and planum meningiomas often involve the diaphragma sella (DS), which has to be resected with care taken to preserve the pituitary stalk (PS). Meningiomas, which invade the optic canals must be removed in their entirety. Furthermore, opening of the optic canals is important in achieving this goal. Complete removal of planum meningiomas often exposes the lamina terminalis (LT) as well as the A1, anterior communicating artery (ACA) and A2 branches of the anterior cerebral artery. The view behind the stalk reveals the basilar artery (BA), posterior cerebral arteries (PCA), posterior communicating artery (PCOM), and third cranial nerves (III) arising from the mesencephalon. The optic tract (OT) and mamillary bodies (MB) also come into view (Figs. 9a–c).


Step 12  **Transclival Approach** (superior 1/3 of clivus): Drill the bone of the clivus to expose the clival dura (CD) below the pituitary dura (PD). The bone over the cavernous sinus (CS) and internal cerebral artery (ICA) can also be removed to expose the ICA in order to reach pathology like chordomas that extend behind the CS and ICA. Opening of the dura, which is done in the shape of a capital “I” to avoid damaging the sixth nerve, exposes the basilar artery (BA), third nerve (III), posterior cerebral arteries (PCA) and superior cerebellar arteries (SCA) in the interpeduncular cistern (Figs. 10a–c).
**Step 13** To extend the transsphenoidal, transclival approach more laterally and superiorly to obtain a view behind the pituitary gland and carotid artery, one can remove the posterior clinoid (PC) after removing the bone over the pituitary dura (PD) and cavernous sinus (CS). The bone can be removed over the vertical portion of carotid artery (ICA) to mobilize the ICA laterally. In addition, the pituitary gland (P) is exposed and pushed medially to expose the dura over the posterior clinoid and sellar diaphragma, which can be removed for exposure of the third nerve, ambient cistern, medial temporal lobe and tentorium. This approach is useful for removal of the lateral and superior extend of petroclival meningiomas (T) (Figs. 11a, b).

**Step 14** *Transcavernous Approach*: The bone between the optic nerve and carotid artery, or medial opticocarotid recess can be removed to expose the superomedial aspect of the cavernous sinus (CS). This opening can be extended inferolaterally to expose the carotid siphon (ICA) in the medial cavernous sinus. However, the cavernous sinus is best explored later in the dissection after the ethmoids have been opened through a corridor lateral to the middle turbinate and once the medial pterygoid plate has been removed (Figs. 12a, b).
Transnasal Corridor

The transnasal corridor lies medial to the middle turbinate and lateral to the septum. The superior border is the cribriform plate, the inferior border is the palate and posteriorly the nasal corridor extends to the choana, nasopharynx, inferior clivus and odontoid.

**Step 1** Remove the perpendicular plate of the ethmoid bone to expose the cribriform plates bilaterally.

**Step 2** Identify the vertical (V) attachment of the middle turbinate (MT). The cribriform plate (CP) lies medial to the vertical attachment of the middle turbinate and lateral to the septum (which was previously removed). This is a common site for meningoceles (MC) (Fig. 13).
**Step 3** Transcribriform Approach: Remove the mucosa underlying the cribiform plate and drill the plate until paper thin and remove with a curette to expose the dura. Open the dura to expose the olfactory nerves (ON) bilaterally in the olfactory grooves (Fig. 14).

**Step 4** Identify the choana and approach the nasopharynx.

**Step 5** Laterally displace the inferior turbinate bilaterally with a Goldman bar.

**Step 6** Completely remove the vomer. Identify the mucosa of the nasopharynx over the clivus and odontoid and identify the Eustachian tubes (ET) bilaterally (Fig. 15a).

**Step 7** Drill the floor of the sphenoid sinus and identify the vidian nerves laterally. The vidian nerves represent the supero-lateral limits of the transnasal, transclival approach.

**Step 8** Transclival Approach: Elevate a flap of mucosa and fascia at the back of the nasopharynx. This is done in an inverted U-shaped incision to be replaced at the end of the operation. The lateral limits of this flap are the Eustachian tubes (ET). The flap of basopharyngeal fascia is retracted downwards into the oropharynx to expose the clivus (C) and if necessary, the odontoid (Figs. 15b, c).
**Step 9** Drill the clivus (C) to expose the clival dura (CD) (Fig. 16a).

**Step 10** Open the dura in the shape of a capital “I” and cauterize back the edges (Fig. 16b).

**Step 11** Identify the ventral aspect of the pons (P) and medulla (M) as well as the vertebral arteries and basilar artery, which may be visible, depending on how the pathology has displaced the normal anatomy.

**Step 12** **Transodontoid Approach:** Extend the basopharyngeal fascia opening downwards to expose the odontoid (O) and ring of C1. Transect the atlantooccipital membrane, longus capitis and longus colli muscles (LC) (Fig. 17).

**Step 13** The anterior arch of C1 can be removed to expose the dens which can be removed with a high speed drill after separating it from the apical and alar ligaments to expose the craniovertebral junction.
Tranethmoidal Corridor

The tranethmoidal corridor lies lateral to the middle turbinate and is the corridor to the fovea ethmoidalis, orbital apex and lateral sphenoid sinus. The tranethmoid approach is also useful in fully exposing the maxillary sinus and the transpterygoid approach.

**Step 1** Mobilize the middle turbinate medially.
**Step 2** Working lateral to the septum (S) and middle turbinate (MT), identify the uncinate process (U) and starting with an uncinectomy and infundibulotomy, identify the ethmoidal bulla (EB) (Figs. 18a, b).

**Step 3** Complete the uncinectomy superiorly and expose frontal recess.

**Step 4** Penetrate the ethmoidal bulla and complete the ethmoidectomy to expose the fovea ethmoidalis (FE) (Fig. 19).

**Step 5** Identify the anterior ethmoidal artery (AE) at the frontal recess (FR) and transect it after satisfactory clipping of the vessel. It is easily identified at the junction of the lamina papyracea (LP) and the frontal recess (Fig. 20).

**Step 6** Complete the dissection posteriorly, inferiorly and medially to avoid injury to the orbital apex. The middle turbinates can be completely removed to facilitate the exposure.
Step 7 Transfovea Ethmoidalis Approach: Once a total bilateral ethmoidectomy is performed and the nasal septum and vertical attachments of the middle turbinates have been removed the cribriform plate dura (CPD) and fovea ethmoidalis (FE) and are exposed between the lamina papyracea (LP) of the medial orbits. Removal of the FE and opening of the dura expose the frontal lobes (FL) which can be seen in this example of removal of an olfactory groove meningioma (OGM) (Figs. 21a, b).

Step 8 Transcavernous Approach: Open the anterior wall of the sphenoid sinus and remove bone over the sella to expose the pituitary dura (PD). Additional removal of bone overlying the carotid artery will expose the cavernous sinus (CS) more directly than the transsphenoidal corridor which is medial to the middle turbinate. The use of intraoperative Doppler is often useful to localize the carotid artery within the cavernous sinus (Fig. 22).

Step 9 Transorbital Approach: Remove the lamina papyracea to expose the medial wall of the orbit and the periorbital fat (OF). Care must be taken not to damage the medial rectus muscle. The bone removal can extend back into the sphenoid sinus to expose the orbital apex. The medial orbital apex generally presents to the lateral wall of the sphenoid sinus, although in 12–25% a posteriorly located ethmoid air cell or “Onodi cell” will contain the medial orbital apex (Fig. 23).
Transmaxillary Corridor

The transmaxillary corridor is used to reach the maxilla, pterygopalatine fossa, lateral sphenoid sinus and cavernous sinus, Meckel's cave, infratemporal fossa and petrous apex.

Step 1 At this point, the nasal septum (S) and middle turbinates (MT) have been removed. A total ethmoidectomy has been performed. Identify the opening of the maxillary sinus ostium (MO) (Fig. 24).
**Step 2** Enlarge the posterior ridge of the maxillary sinus ostium and dissect the anterior vertical process of the pterygoid plate (PP) of the palatine bone to expose the sphenopalatine artery (SPA) and vidian nerve. Transect the sphenopalatine artery (Fig. 25).

**Step 3** Transpterygoidal Approach: Remove the posterior plate of the palatine bone (PP) and drill the lateral wall of the sphenoid sinus as well as the posterior wall of the maxillary sinus (MS) to expose the pterygopalatine fossa (Fig. 26).

**Step 4** The contents of the pterygopalatine fossa can be identified such as the origin of the sphenopalatine artery (SPA) emerging above the crista ethmoidalis (CE) as well as the descending palatine artery (DPA), posterior superior alveolar artery (PSAA) maxillary nerve (Max N) and infraorbital artery (IOA) and nerve (ION) (Fig. 27).

**Step 5** Exposure of the posterior wall of the pterygopalatine fossa (PPF) reveals the vidian cana (VN) which can be followed posteriorly toward the ICA and foramen rotundum (FR) which can be followed towards Meckel's cave and the middle fossa (Fig. 28).
**Step 6** Further drilling of the lateral wall of the sphenoid sinus and the medial pterygoid bone exposes the lateral sphenoid sinus (LSS) and Meckel’s cave (MC) superiorly and the petrous apex inferiorly (Fig. 29).

**Step 7** Exposure of the infratemporal fossa (ITF) requires removal of the inferior turbinate, drilling of the crista ethmoidalis (CE) to fully expose the posterior wall of the maxillary sinus (MAX) and then drilling of the pterygomaxillary fissure. The posterior wall of the maxillary sinus (MAX) is often thinned by the pathology and is easily fractured to reach pathology in the ITF (Figs. 30a, b).
Closure

A watertight closure of the skull base at the conclusion of endoscopic skull base surgery is as critical as the approach and the resection to prevent post-operative CSF leak and meningitis.

**Step 1** Harvesting a Nasoseptal Flap: The nasoseptal flap (NSF) must be harvested at the beginning of the operation. The superior and inferior cuts are made a few millimeters below and above the junction of the septum and cribriform plate and the hard palate respectively. A third vertical cut is made as anterior as possible. Care is taken to preserve the vascular pedicle and the sphenopalatine artery (Fig. 31).

**Step 2** The Gasket-Seal Closure: A piece of fascia lata (FL) is harvested, which is approximately 1 cm larger in diameter than the defect in the skull base. This graft is placed over the defect in the skull and then countersunk with a piece of vomer or Medpor® implant material (P) (Porex Surgical Inc., Newnan, GA, USA) which provides a rigid buttress for the closure. The edges of the FL stick out circumferentially like cauliflower providing a watertight “gasket” seal. The NSF is placed over the gasket seal so that the edges of the NSF extend beyond the FL and lie on the skull base. All mucosa must be removed from behind the NSF to prevent mucocele formation. The NSF is held in place with a final layer of Tisseel (Baxter) or Duraseal (Covidien) (DS) (Figs. 32a–c).
Bibliography


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A Step-By-Step Guide for Surgical Instruction and Cadaveric Dissection


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<td>30°</td>
<td>4.0 mm</td>
<td>18 cm</td>
<td></td>
</tr>
<tr>
<td>7230 FS</td>
<td>4.8 x 6.0 mm</td>
<td>14 cm</td>
<td>7230 FA</td>
<td>45°</td>
<td>4.0 mm</td>
<td>18 cm</td>
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<tr>
<td>7230 CS</td>
<td>4.8 x 6.0 mm</td>
<td>14 cm</td>
<td>7230 CA</td>
<td>70°</td>
<td>4.0 mm</td>
<td>18 cm</td>
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<tr>
<td>7220 AS</td>
<td>3.7 x 4.8 mm</td>
<td>10 cm</td>
<td>7220 AA</td>
<td>0°</td>
<td>3.0 mm</td>
<td>14 cm</td>
<td></td>
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<tr>
<td>7220 BS</td>
<td>3.7 x 4.8 mm</td>
<td>10 cm</td>
<td>7220 BA</td>
<td>30°</td>
<td>3.0 mm</td>
<td>14 cm</td>
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<tr>
<td>7220 FS</td>
<td>3.7 x 4.8 mm</td>
<td>10 cm</td>
<td>7220 FA</td>
<td>45°</td>
<td>3.0 mm</td>
<td>14 cm</td>
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<tr>
<td>7220 CS</td>
<td>3.7 x 4.8 mm</td>
<td>10 cm</td>
<td>7220 CA</td>
<td>70°</td>
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<tr>
<td>7219 AS</td>
<td>3.5 x 4.7 mm</td>
<td>14 cm</td>
<td>7229 AA</td>
<td>0°</td>
<td>2.7 mm</td>
<td>18 cm</td>
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<tr>
<td>7219 BS</td>
<td>3.5 x 4.7 mm</td>
<td>14 cm</td>
<td>7229 BA</td>
<td>30°</td>
<td>2.7 mm</td>
<td>18 cm</td>
<td></td>
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<tr>
<td>7219 FS</td>
<td>3.5 x 4.7 mm</td>
<td>14 cm</td>
<td>7229 FA</td>
<td>45°</td>
<td>2.7 mm</td>
<td>18 cm</td>
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<tr>
<td>7219 CS</td>
<td>3.5 x 4.7 mm</td>
<td>14 cm</td>
<td>7229 CA</td>
<td>70°</td>
<td>2.7 mm</td>
<td>18 cm</td>
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### Probes, Elevators, Knifes and Currettes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>629820</td>
<td><strong>Probe</strong>, double-ended, maxillary sinus ostium seeker,</td>
<td>ball-shaped ends diameter 1.2 and 2 mm, length 19 cm</td>
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<tr>
<td>628712</td>
<td>KUHN-BOLGER <strong>Frontal Sinus Curette</strong>, 55° curved,</td>
<td>oval, forward cutting, length 19 cm</td>
</tr>
<tr>
<td>479100</td>
<td>COTTLE <strong>Elevator</strong>, double-ended, semisharp and blunt,</td>
<td>graduated, length 20 cm</td>
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<tr>
<td>474000</td>
<td>FREER <strong>Elevator</strong>, double-ended, semisharp and blunt,</td>
<td>graduated, length 20 cm</td>
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<tr>
<td>474001</td>
<td>FREER <strong>Suction Elevator</strong>, with stylet,</td>
<td>length 19 cm</td>
</tr>
<tr>
<td>629830</td>
<td>KUHN <strong>Frontal Ostium Seeker</strong>, double-ended, No. 6,</td>
<td>both sides curved 77°, one tip straight, other tip reverse angle,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>length 22 cm</td>
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<tr>
<td>628714</td>
<td>KUHN-BOLGER <strong>Frontal Sinus Curette</strong>, 90° curved,</td>
<td>oval, forward cutting, length 19 cm</td>
</tr>
<tr>
<td>628001</td>
<td><strong>Sickle Knife</strong>, pointed,</td>
<td>length 19 cm</td>
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<tr>
<td>28164 KK</td>
<td>de DIVITIIS-CAPPABIANCA <strong>Scalpel</strong>, with retractable blade,</td>
<td>length 23 cm</td>
</tr>
<tr>
<td></td>
<td>including:</td>
<td>Handle, Outer Sheath, Micro Knife, sickle-shaped</td>
</tr>
<tr>
<td>28164 EC</td>
<td><strong>CASTELNUOVO Elevator</strong>, double-ended,</td>
<td>blunt end angled, semisharp end slightly curved, graduated, length 26 cm</td>
</tr>
</tbody>
</table>
RHINOFORCE® II Ethmoid Forceps
working length 17 cm

649100 B  BLAKESLEY RHINOFORCE® II
Ethmoid Forceps, straight, size 0, with cleaning connector, working length 16 cm

649101 B  Same, size 1

649102 B  Same, size 2

649110 B  BLAKESLEY-WILDE RHINOFORCE® II
Ethmoid Forceps, 45° curved upwards, size 0, with cleaning connector, working length 16 cm

649111 B  Same, size 1

649123 B  TAKAHASHI RHINOFORCE® II
Ethmoid Forceps, spoon size 4 x 10 mm, with cleaning connector, working length 16 cm
GRÜNWALD-HENKE/CASTELNUOVO RHINOFORCE® II Nasal Cutting Forceps
through-cutting

451000 B  GRÜNWALD-HENKE RHINOFORCE® II Nasal Cutting Forceps,
straight, through-cutting, tissue-sparing, BLAKESLEY shape,
size 0, width 3 mm, with cleaning connector, working length 13 cm

451001 B  Same, size 1, width 3.5 mm
451002 B  Same, size 2, width 4 mm

451010 B  CASTELNUOVO RHINOFORCE® II Nasal Cutting Forceps,
end of sheath 25° upturned, through-cutting,
with straight jaws, BLAKESLEY shape, width 3 mm,
with cleaning connector, working length 13 cm

451500 B  GRÜNWALD-HENKE RHINOFORCE® II Nasal Cutting Forceps,
45° upturned, through-cutting, tissue-sparing, BLAKESLEY shape,
size 0, width 3 mm, with cleaning connector, working length 13 cm

451501 B  Same, size 1, width 3.5 mm
451502 B  Same, size 2, width 4 mm

451510 B  CASTELNUOVO RHINOFORCE® II Nasal Cutting Forceps,
end of sheath 25° upturned, through-cutting,
jaws 45° upturned, BLAKESLEY shape, width 3 mm,
with cleaning connector, working length 13 cm
STRUYCKEN RHINOFORCE® II Nasal Cutting Forceps

![Image of STRUYCKEN RHINOFORCE® II Nasal Cutting Forceps]

455010 STRUYCKEN RHINOFORCE® II Nasal Cutting Forceps, with cleaning connector, working length 13 cm

TAKAHASHI RHINOFORCE® Nasal Forceps

![Image of TAKAHASHI RHINOFORCE® Nasal Forceps]

455010 STRUYCKEN RHINOFORCE® II Nasal Cutting Forceps, with cleaning connector, working length 13 cm

455500 B TAKAHASHI RHINOFORCE® Nasal Forceps, straight, working length 13 cm
SilCut® Instruments

Special features:
- Tactile instrument feedback
- Uniform patented force transmission
- Powerful resection under precise control
- Accurate incision due to small tolerances
- Special cutting geometry to prevent tissue from slipping
- Large aperture angle
- Flat jaws
- Through-cutting and backward-cutting versions also available

GRÜNWALD-HENKE SilCut® Nasal Cutting Forceps, straight, through-cutting, extremely powerful resection, patented uniform force transmission for gently controlled cutting, new ergonomic handle design, BLAKESLEY shape, size 1, with cleaning connector, working length 13 cm

Same, 45° upturned
RHINOFORCE® II Miniature Nasal Forceps

flat jaws, through-cutting

452831  RHINOFORCE® II Miniature Nasal Forceps, with extra fine flat jaws, through-cutting, tissue-sparing, straight sheath, straight jaws, width of cut 1.5 mm, with cleaning connector, working length 13 cm

452832  Same, jaws 45° upturned

452833  Same, sheath curved 30°, straight jaws

452834  Same, sheath curved 30°, jaws 45° upturned
STAMMBERGER **Antrum Punch**
sidebiting downward and forward cutting

![Antrum Punch Image]

- **459051** STAMMBERGER **Antrum Punch**, right side downward and forward cutting, working length 10 cm
- **459052** **Same**, left side downward and forward cutting

STAMMBERGER **Antrum Punch**
backward cutting

![Antrum Punch Image]

- **459010** STAMMBERGER RHINOFORCE® II Antrum Punch, upside backward cutting, with cleaning connector, working length 10 cm
- **459011** **Same**, right side backward cutting
- **459012** **Same**, left side backward cutting
STAMMBERGER Antrum Punch
backward cutting

459016  STAMMBERGER Antrum Punch, backward cutting, sheath 360° rotatable, with fixing screw, dismantling, working length 10 cm, for use with Cleaning Adaptor 459015 LL

STAMMBERGER Antrum Punch
pediatric size, backward cutting

459036  STAMMBERGER Antrum Punch, small pediatric size, slender, backward cutting, sheath 360° rotating, with fixing screw, dismantling, working length 10 cm, for use with Cleaning Adaptor 459015 LL
STAMMBERGER Circular Cutting Punch

Special features:

- Unique design
- For enlarging openings in the sphenoid frontal wall
- Circular cutting punch mechanism allows cutting in a full circle of 360° without rotating the instrument as required with a conventional punch forceps
- No interference with other instruments simultaneously used in the nose (e.g. endoscope, suction tube)
- Available in 2 sizes: diameter 3.5 and 4.5 mm, punch head 4-fold LASER-welded
- Integrated irrigation channel

Multipurpose use:

- In addition to abrading procedures applied to the sphenoid frontal wall, bony ethmoid septa, pieces of nasal concha and other thin bony bridges can also be cut away
- Extremely useful for treatment of choanal atresia
- Blunt punching head reduces injuries
- If used correctly by punching exclusively in the sagittal axis, traumata of vital structures, e.g. cranium, arteria carotis and optic nerve osseous canal are virtually impossible

651055 STAMMBERGER Punch, circular cutting, for sphenoid, ethmoid and choanal atresia, diameter 3.5 mm, with cleaning connector, working length 18 cm

651050 Same, diameter 4.5 mm

651060 STAMMBERGER Punch, circular cutting, 65° upturned, for frontal sinus recess, diameter 3.5 mm, with cleaning connector, working length 17 cm

651065 Same, diameter 4.5 mm
STAMMBERGER Punches
Egg-shaped tip, for opening the ethmoid cells and the sphenoid sinus

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>651057</td>
<td>STAMMBERGER Punch, egg-shaped tip, circular cut, 60° cutting direction from distal above to proximal below, tip diameter 3.5 mm, straight sheath, for sphenoid, ethmoid and choanal atresia, with cleaning connector, working length 18 cm</td>
</tr>
<tr>
<td>651058</td>
<td>Same, circular cut 120°</td>
</tr>
<tr>
<td>651053</td>
<td>STAMMBERGER Punch, egg-shaped tip, circular cut, 120° cutting direction from distal below to proximal above, tip diameter 4.5 mm, straight sheath, for sphenoid, ethmoid and choanal atresia, with cleaning connector, working length 18 cm</td>
</tr>
<tr>
<td>651052</td>
<td>Same, circular cut, 60° cutting direction, tip diameter 4.5 mm</td>
</tr>
<tr>
<td>651061</td>
<td>STAMMBERGER Punch, egg-shaped tip, circular cut, 90° cutting direction, tip diameter 3.5 mm, sheath 65° upturned, for frontal sinus recess, with cleaning connector, working length 17 cm</td>
</tr>
<tr>
<td>651066</td>
<td>Same, tip diameter 4.5 mm</td>
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Frontal Sinus Punches
with link chain sheath, backward cutting

- **651521 – 651523**

**Frontal Sinus Punch**, with link chain sheath 70° upturned, backward cutting, to reduce the spina nasalis superior, small, jaws 2.5 x 2 mm, working length 13 cm

- **651522**

**Same**, medium (standard size), jaws 3.5 x 3 mm

- **651523**

**Same**, large, jaws 5.5 x 5 mm
KERRISON Bone Punches

662101  KERRISON Bone Punch, detachable, rigid, 90° upbiting, not through-cutting, size 1 mm, working length 17 cm

662102  Same, size 2 mm

662112  KERRISON Bone Punch, detachable, rigid, 90° downbiting, not through-cutting, size 2 mm, working length 17 cm

662120  KERRISON Bone Punch, detachable, rigid, upbiting 40° forward, size 0.7 mm, working length 17 cm
**Punches**

28164 MKA – 28164 MKB

- 28164 MKA **KERRISON Bone Punch**, detachable, rigid, upbiting 60° forward, size 1 mm, working length 17 cm
- 28164 MKB **Same**, size 2 mm

**Suction Tubes**

10383 B – BL

10380 C – E

- 10383 B **Suction Tube**, with cut-off hole, diameter 3 mm, working length 35 cm
- 10383 BL **Same**, diameter 5.5 mm
- 10380 C **Suction Tube**, diameter 2 mm, working length 25 cm
- 10383 D **Same**, diameter 3 mm
- 10383 E **Same**, diameter 4 mm
Suction Tubes and Antrum Cannulas

- **529207** FRAZIER Suction Tube, with cut-off hole and stylet, angled, outer diameter 7 Fr./2 mm, working length 10 cm, total length 17.5 cm
- **586031** v. EICKEN Antrum Cannula, Luer-Lock, with cut-off hole, long curved, outer diameter 3 mm, length 12.5 cm
- **586226** v. EICKEN Antrum Cannula, Luer-Lock, with cut-off hole, short curved, outer diameter 2.5 mm, length 12.5 cm
- **586241** Same, outer diameter 4 mm
- **641625** Suction Tube, for frontal sinus, with cut-off hole, Luer, outer diameter 2.5 mm, length 14.5 cm
- **662885** FRANK-PASQUINI Suction Tube, angular, tip curved upwards, ball end, with grip plate and cut-off hole, Luer, diameter 3 mm, working length 13 cm
- **662886** Same, tip curved downwards
Suction Tubes and Irrigation Tube

<table>
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<th>Code</th>
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<tr>
<td>206600</td>
<td>FISCH Suction and Irrigation Tube, cylindrical, suction tube outer diameter 2.5 mm, irrigation tube outer diameter 2 mm, working length 9.5 cm</td>
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<tr>
<td>649183</td>
<td>FERGUSON Suction Tube, with cut-off hole and stylet, Luer, 10 Fr., working length 15 cm</td>
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<tr>
<td>663818</td>
<td>Suction Tube, angular, malleable, with round handle and cut-off hole, diameter 2 mm, working length 13 cm</td>
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<tr>
<td>649179 B</td>
<td>Suction Tube, malleable, with elongated cut-off hole and stylet, Luer, 4 Fr., working length 15 cm</td>
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<tr>
<td>649180 B</td>
<td>Suction Tube, malleable, with elongated cut-off hole and stylet, Luer, 6 Fr., working length 15 cm</td>
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<tr>
<td>649182 B</td>
<td>Suction Tube, malleable, with elongated cut-off hole and stylet, Luer, 8 Fr., working length 15 cm</td>
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<tr>
<td>649183 B</td>
<td>Suction Tube, malleable, with elongated cut-off hole and stylet, Luer, 10 Fr., working length 15 cm</td>
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</table>
TAKE-APART® Bipolar Forceps

28164 BDL  **TAKE-APART® Bipolar Forceps**, with fine jaws, width 1 mm, distally angled 45°, vertical closing, outer diameter 3.4 mm, working length 20 cm, including:
- Bipolar Ring Handle
- Outer Sheath
- Inner Sheath
- Forceps Insert

28164 BDM  **TAKE-APART® Bipolar Forceps**, with fine jaws, width 1 mm, distally angled 45°, horizontal closing, outer diameter 3.4 mm, working length 20 cm, including:
- Bipolar Ring Handle
- Outer Sheath
- Inner Sheath
- Forceps Insert

28164 BDD  **TAKE-APART® Bipolar Forceps**, width 2 mm, distally angled 45°, horizontal closing, outer diameter 3.4 mm, working length 20 cm, including:
- Bipolar Ring Handle
- Outer Sheath
- Inner Sheath
- Forceps Insert

28164 BDG  **TAKE-APART® TAN Bipolar Coagulation Forceps**, size 3.4 mm, working length 20 cm, including:
- Bipolar Ring Handle
- Outer Sheath
- Inner Sheath
- Forceps Insert

26176 LA  **Bipolar High Frequency Cord**, with 2x 4 mm banana plug for **KARL STORZ** Coagulator 26020 XA/XB and Valleylab, length 300 cm
STAMMBERGER Bipolar Suction Forceps

461010

STAMMBERGER Bipolar Suction Forceps, 15° upturned, with suction channel, for bipolar coagulation in paranasal areas, working length 12.5 cm, for use with Bipolar High Frequency Cord 847002 E or 847002 A/M/V/U

461015

STAMMBERGER Bipolar Suction Forceps, 45° upturned, with suction channel, for bipolar coagulation in paranasal areas, working length 12.5 cm, for use with Bipolar High Frequency Cord 847002 E or 847002 A/M/V/U
## High Frequency Cords

for use with STAMMBERGER Bipolar Suction Forceps

### Accessories

<table>
<thead>
<tr>
<th>KARL STORZ Instruments</th>
<th>High Frequency Electrosurgery Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>847002 E</td>
<td><strong>Bipolar High Frequency Cord</strong>, for KARL STORZ Coagulator 26021 B/C/D, 860021 B/C/D, 27810 B/C/D, 28810 B/C/D, AUTOCON® system (50, 200, 350), AUTOCON® II 400 SCB system (111, 113, 115) and Erbe coagulator, T and ICC series, with two 2 mm cable sockets for KARL STORZ Bipolar Suction Forceps 461010, 461015 and Bipolar Forceps 8615 A/AS, 28164 BGK, length 450 cm</td>
</tr>
<tr>
<td>847002 M</td>
<td><strong>Bipolar High Frequency Cord</strong>, for Martin and Berchtold coagulator, with two 2 mm cable sockets for KARL STORZ Bipolar Suction Forceps 461010, 461015 and Bipolar Forceps 8615 A/AS, 28164 BGK, length 450 cm</td>
</tr>
<tr>
<td>847002 A</td>
<td><strong>Bipolar High Frequency Cord</strong>, with 2 x 4 mm banana plug for KARL STORZ coagulator 26020 XA/ XB, with two 2 mm cable sockets for KARL STORZ Bipolar Suction Forceps 461010, 461015 and Bipolar Forceps 8615 A/AS, 28164 BGK, length 450 cm</td>
</tr>
<tr>
<td>847002 V</td>
<td><strong>Bipolar High Frequency Cord</strong>, for KARL STORZ AUTOCON® II 400 SCB system (112, 114, 116), Valleylab coagulator, with two 2 mm cable sockets for KARL STORZ Bipolar Suction Forceps 461010, 461015 and Bipolar Forceps 8615 A/AS, 28164 BGK, length 450 cm</td>
</tr>
<tr>
<td>847002 U</td>
<td><strong>Bipolar Universal High Frequency Cord</strong>, one side with two 2 mm cable sockets for KARL STORZ Bipolar Suction Forceps 461010, 461015 and Bipolar Forceps 8615 A/AS, 28164 BGK, other side with standard pin for connection to all current forceps bipolar cords, length 40 cm</td>
</tr>
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</table>
MONTGOMERY-YOUNGS **RHINOFORCE® II Clip Applicator**  
for endonasal endoscopic sphenopalatine artery ligature

![Image of the clip applicator](image)

The **Cutlers’ Surgical Prize** is one of the most prestigious annual awards for innovation in the design or application of surgical instruments or techniques. The prize as well as the Clarke medal are awarded by the surgical association and the president of the Royal College of Surgeons of England.

- **452650 A** MONTGOMERY-YOUNGS **RHINOFORCE® II Clip Applicator**, for endonasal endoscopic sphenopalatine artery ligature, with suction channel, handle with spring, straight, with cleaning connector, working length 13 cm, for use with Titanium Clips 8665 T
- **452650 C** *Same*, jaws angled to the right
- **452650 D** *Same*, jaws angled to the left

---

**Coagulation Ball Electrode**

![Image of the coagulation ball electrode](image)

- **28164 ED** *Coagulation Ball Electrode*, diameter 2 mm, laterally curved, working length 13 cm
- **28164 EF** *Same*, diameter 4 mm
Fine and Delicate Instruments
Forceps, working length 15 cm

- 662202 Forceps, straight, extra delicate, oval cupped jaws, width 0.6 mm, working length 15 cm
- 662203 Same, curved to right
- 662204 Same, curved to left
- 662205 Same, 45° upturned

Forceps, working length 18 cm

- 28164 TF Forceps, round cupped jaws, diameter 0.6 mm, straight, extra delicate, working length 18 cm
- 28164 TD Same, very delicate, oval cupped jaws 0.9 mm, straight
- 28164 T Forceps, oval cupped jaws, diameter 0.6 mm, curved to right, extra delicate, working length 18 cm
- 28164 TE Same, very delicate, oval cupped jaws 0.9 mm, straight
- 28164 TF Same, curved to left
- 28164 TA Forceps, oval cupped jaws, diameter 0.9 mm, upturned, extra delicate, working length 18 cm
Fine and Delicate Instruments

Miniature Forceps, working length 15 cm

- **Miniature Forceps**, straight, through-cutting, with fine flat jaws, width of cut 1 mm, working length 15 cm
- **Same**, curved to right
- **Same**, curved to left
- **Same**, curved upwards
- **Grasping Forceps**, straight, fine-serrated, working length 15 cm

Miniature Forceps, working length 18 cm

- **Miniature Forceps**, straight, through-cutting, with fine flat jaws, bite 1 mm, working length 18 cm
- **Same**, curved right
- **Same**, curved to left
- **Same**, curved upwards
- **Grasping Forceps**, straight, fine-serrated, working length 18 cm
Fine and Delicate Instruments

Scissors, working length 15 cm

662300 Scissors, straight, working length 15 cm
662301 Scissors, straight, extra delicate, working length 15 cm
662304 Same, curved to right
662305 Same, curved to left
662307 Same, 45° curved up

Scissors, working length 18 cm

663300 Scissors, straight, working length 18 cm
**Sellar Stage**

**Curette, round spoon**

![Image of Sellar Stage Curette](image)

- **28164 KA**
  - **Curette**, round spoon, tip slightly angled, size 1 mm, with round handle, length 25 cm
- **28164 KB**
  - **Curette**, round spoon, tip slightly angled, size 2 mm, with round handle, length 25 cm
- **28164 KC**
  - **Curette**, round spoon, tip slightly angled, size 3 mm, with round handle, length 25 cm
- **28164 KF**
  - **Curette**, round spoon, tip highly angled, size 2 mm, with round handle, length 25 cm
- **28164 KG**
  - **Curette**, round spoon, tip highly angled, size 3 mm, with round handle, length 25 cm

**de DIVITIIS-CAPPABIANCA Suction Curette, with styplet, round wire – basket-shaped**

![Image of Suction Curette](image)

- **28164 RSB**
  - **CAPPABIANCA-de DIVITIIS Suction Curette**, blunt, inner diameter 5 mm, tip angled 45°, Luer, length 25 cm
- **28164 RSC**
  - **Same**, inner diameter 7 mm
- **28164 RT**
  - **CAPPABIANCA-de DIVITIIS Suction Curette**, with basket, round, size 5 mm, rotatable tube, Luer, length 25 cm
- **28164 RU**
  - **Same**, size 6.5 mm

**CASTELNUOVO Elevator**

![Image of CASTELNUOVO Elevator](image)

- **28164 EA**
  - **CASTELNUOVO Elevator**, double-ended, semisharp and blunt, length 26 cm
### Sellar Stage

**Curettes**

- **28164 RP**
  - **CAPPABIANCA-de DIVITIIS Ring Curette**, with round wire, inner diameter 7 mm, tip angled 45°, with round handle, length 25 cm

- **28164 RN**
  - **CAPPABIANCA-de DIVITIIS Ring Curette**, with round wire, inner diameter 3 mm, tip angled 45°, with round handle, length 25 cm

- **28164 RO**
  - **CAPPABIANCA-de DIVITIIS Ring Curette**, with round wire, inner diameter 5 mm, tip angled 45°, with round handle, length 25 cm

- **28164 RP**
  - **CAPPABIANCA-de DIVITIIS Ring Curette**, with round wire, inner diameter 7 mm, tip angled 45°, with round handle, length 25 cm

- **28164 RG**
  - **CAPPABIANCA-de DIVITIIS Ring Curette**, with round wire, inner diameter 5 mm, tip angled 90°, with round handle, length 25 cm

- **28164 RH**
  - **Same**, inner diameter 7 mm

- **28164 RB**
  - **CAPPABIANCA-de DIVITIIS Ring Curette**, with round wire, inner diameter 3 mm, laterally curved sheath end, with round handle, length 25 cm

- **28164 RA**
  - **Same**, inner diameter 5 mm

- **28164 RC**
  - **Same**, inner diameter 7 mm

- **28164 RD**
  - **CAPPABIANCA-de DIVITIIS Ring Curette**, with round wire, inner diameter 5 mm, laterally curved 90° sheath end, with round handle, length 25 cm

### Delicate Dissectors and Elevators

- **28164 DA**
  - **Dissector**, sharp, tip angled 45°, round spatula, with round handle, size 2 mm, length 25 cm

- **28164 DB**
  - **Dissector**, sharp, tip angled 45°, round spatula, with round handle, size 3 mm, length 25 cm

- **28164 DF**
  - **Dissector**, sharp, tip angled 15°, flat long spatula, with round handle, size 1.5 mm, length 25 cm

- **28164 DS**
  - **Dissector**, sharp, tip angled 15°, with round handle, size 2 mm, length 25 cm

- **28164 DM**
  - **Dissector**, sharp, straight tip, slightly curved spatula, with round handle, size 3 mm, length 25 cm
Antrum Curette, Frontal Sinus Curette, Antrum Cannula and Suction Tube

628701 Antrum Curette, round, length 19 cm
628702 Same, oblong, small size
628703 Same, large size
628712 KUHN-BOLGER Frontal Sinus Curette, 55° curved, oval, forward cutting, length 19 cm
586025 v. EICKEN Antrum Cannula, Luer-Lock, long curved, malleable, serrated grip plate, outer diameter 2.5 mm, length 12.5 cm
586030 Same, outer diameter 3 mm
586040 Same, outer diameter 4 mm
586125 v. EICKEN Antrum Cannula, Luer-Lock, long curved, malleable, serrated grip plate, outer diameter 2.5 mm, length 12.5 cm
586130 Same, outer diameter 3 mm
529309 FRAZIER Suction Tube, with mandrel and cut-off hole, with distance marking at 5–9 cm, 9 Fr., working length 10 cm
SEPEHRNIA Neurosurgical Micro-Instruments
Needle Holder and Forceps

28164 NBC

28164 NBC **Micro Needle Holder**, bayonet-shaped, jaws curved to left, 1 x 6 mm, working length 10 cm

28164 PBE

28164 PBB **Micro Forceps**, bayonet-shaped, spoon, 2 mm, working length 10 cm

28164 PBE **Same**, 4 mm spoon

28164 PBG

28164 PBG **Micro Forceps**, bayonet-shaped, spoon horizontal, 2 mm, working length 10 cm

28164 PBH **Same**, 4 mm spoon horizontal
SEPEHRNIA Neurosurgical Micro-Instruments

Scissors

28164 SBC

28164 SBA  **Micro Scissors**, bayonet-shaped, sharp/sharp, cutting edges straight, working length 10 cm

28164 SBB  **Same**, bayonet-shaped, sharp/sharp, left curved

28164 SBC  **Same**, bayonet shaped, blunt/blunt, jaw straight

28164 SBD  **Same**, bayonet shaped, sharp/sharp, jaw curved to right

28164 SBE  **Same**, bayonet shaped, sharp/sharp, jaws horizontal
Dissectores and Ring Curettes

GAAB Recommended Instruments

28164 GFO Dissector, sharp, flat long spatula, tip angled upwards 15°, with round handle, size 1.5 mm, working length 15 cm

28164 GBO Dissector, bayonet-shaped, sharp, round spatula, tip angled upwards 45°, with round handle, size 3 mm, working length 15 cm

28164 GBU Same, tip angled downwards 45°

28164 GFO Ring Curette, bayonet-shaped, round wire, inner diameter 5 mm, tip angled upwards 90°, with round handle, working length 15 cm

28164 GGU Same, tip angled downwards 90°

28164 GKO Ring Curette, bayonet-shaped, blunt, tip angled upwards 45°, outer diameter 4 mm, working length 15 cm

28164 GKU Same, tip angled downwards 45°

28164 GLL Ring Curette, bayonet-shaped, blunt, tip angled to left 90°, outer diameter 3.3 mm, with round handle, working length 15 cm

28164 GLR Same, tip angled to right 90°
Micro Vascular Knife and Dissector

28164 GM  **Micro Vascular Knife**, bayonet-shaped, curved downwards, length 18.5 cm

28164 DL  **Dissector**, bayonet-shaped, sharp, curved to left, length 11 cm

28164 DR  Same, curved to right
**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

**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

**Sustainable investment**
- Compatible with all light sources

**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**

**FULL HD image**

**CHROMA**

**FULL HD image**

**SPECTRA A**

**FULL HD image**

**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>Power supply</th>
<th>Power frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 2x DVI-D</td>
<td>1920 x 1080p, 50/60 Hz</td>
<td>100–120 VAC/200–240 VAC</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>LINK video inputs</td>
<td>3x</td>
<td>Protection class</td>
<td>I, CF-Defib</td>
</tr>
<tr>
<td>USB interface</td>
<td>4x USB, (2x front, 2x rear)</td>
<td>Dimensions w x h x d</td>
<td>305 x 54 x 320 mm</td>
</tr>
<tr>
<td>SCB interface</td>
<td>2x 6-pin mini-DIN</td>
<td>Weight</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) 22220055-3, 22220056-3, 22220053-3, 22220060-3, 22220061-3, 22220054-3, 22220085-3 (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.
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

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” 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>

SPECIFICATIONS:

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

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
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></th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall-mounted with VESA 100 adaption</td>
<td>9619 NB</td>
<td>9826 NB</td>
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### Inputs:

<table>
<thead>
<tr>
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<th>26&quot;</th>
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</thead>
<tbody>
<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>
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</table>

### Outputs:

<table>
<thead>
<tr>
<th></th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<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>
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<tr>
<td>RGBS (VGA)</td>
<td>●</td>
<td>–</td>
</tr>
<tr>
<td>3G-SDI</td>
<td>–</td>
<td>●</td>
</tr>
</tbody>
</table>

### Signal Format Display:

<table>
<thead>
<tr>
<th></th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<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>Desktop with pedestal</td>
<td>optional</td>
<td>optional</td>
</tr>
<tr>
<td>Product no.</td>
<td>9619 NB</td>
<td>9826 NB</td>
</tr>
<tr>
<td>Brightness</td>
<td>200 cd/m² (typ)</td>
<td>500 cd/m² (typ)</td>
</tr>
<tr>
<td>Max. viewing angle</td>
<td>178° vertical</td>
<td>178° vertical</td>
</tr>
<tr>
<td>Pixel distance</td>
<td>0.29 mm</td>
<td>0.3 mm</td>
</tr>
<tr>
<td>Reaction time</td>
<td>5 ms</td>
<td>8 ms</td>
</tr>
<tr>
<td>Contrast ratio</td>
<td>700:1</td>
<td>1400:1</td>
</tr>
<tr>
<td>Mount</td>
<td>100 mm VESA</td>
<td>100 mm VESA</td>
</tr>
<tr>
<td>Weight</td>
<td>7.6 kg</td>
<td>7.7 kg</td>
</tr>
<tr>
<td>Rated power</td>
<td>28 W</td>
<td>72 W</td>
</tr>
<tr>
<td>Operating conditions</td>
<td>0–40°C</td>
<td>5–35°C</td>
</tr>
<tr>
<td>Storage</td>
<td>-20–60°C</td>
<td>-20–60°C</td>
</tr>
<tr>
<td>Rel. humidity</td>
<td>max. 85%</td>
<td>max. 85%</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>469.5 x 416 x 75.5 mm</td>
<td>643 x 396 x 87 mm</td>
</tr>
<tr>
<td>Power supply</td>
<td>100–240 VAC</td>
<td>100–240 VAC</td>
</tr>
<tr>
<td>Certified to</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>
Accessories for Video Documentation

495 NL  Fiber Optic Light Cable,  
          with straight connector, diameter 3.5 mm,  
          length 180 cm

495 NA  Same, length 230 cm

Cold Light Fountain XENON 300 SCB

20133101-1  Cold Light Fountain XENON 300 SCB  
              with built-in antifog air-pump, and integrated  
              KARL STORZ Communication Bus System SCB  
              power supply:  
              100–125 VAC/220–240 VAC, 50/60 Hz  
              including:  
              Mains Cord  
              Silicone Tubing Set, autoclavable, length 250 cm  
              SCB Connecting Cable, length 100 cm

20133027  Spare Lamp Module XENON  
          with heat sink, 300 watt, 15 volt

20133028  XENON Spare Lamp, only,  
          300 watt, 15 volt

Cold Light Fountain XENON NOVA® 300

20134001  Cold Light Fountain XENON NOVA® 300,  
          power supply:  
          100–125 VCA/220–240 VAC, 50/60 Hz  
          including:  
          Mains Cord

20132028  XENON Spare Lamp, only,  
          300 watt, 15 volt
KARL STORZ AIDA® compact NEO advanced

Brilliance in documentation

Data Acquisition

Still images, video sequences and audio comments can easily be recorded during an examination or intervention by pressing the on-screen button, activating the footswitch, or pressing the camera head button.

All captured data are displayed on the right-hand side as a thumbnail preview to ensure the data have been generated. Patient data can be entered via an onscreen or standard keyboard. The system also offers the possibility to transfer all relevant patient data via a DICOM worklist or a link to the hospital information system (HIS) without requiring manual entry in the patient entry screen.

Flexible Review, Data Storage and Efficient Data Export

Captured still images or video files can easily be viewed, edited, or deleted on-screen before final storage. KARL STORZ AIDA® compact NEO efficiently stores all recorded data on DVD, CD, USB stick, external/internal drive, the relevant network and/or on a FTP server. It is also possible to save the data directly on the PACS and/or HIS servers via HL7/DICOM. Data that cannot be stored successfully remains in a cache until final archiving is possible.

Special Features:

- SD and HD signal support:
  - Y/C (S-Video)
  - Composite input
  - DVI-D input
- Picture-in-Picture function:
  - Display of channel 2 (SD) in channel 1 (FULL HD)
- Resolution:
  - Still images 1920 x 1080 and SD
  - Videos 1080p, 720p and SD
- Interface package (DICOM/H7) included
- NEO Secure security software
- Recommended applications:
  - Universal (cart or OR1™ installation)

20040913-EN* KARL STORZ AIDA® compact NEO advanced

Documentation system for digital storage of still images, video sequences and audio files, power supply 115/230 VAC, 50/60 Hz

*Available in the following languages:
DE, ES, FR, IT, PT, PL, RU, DK, SE, JP, CN
**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
- **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
Notes:
WITH COMPLIMENTS OF
KARL STORZ—ENDOSKOPE