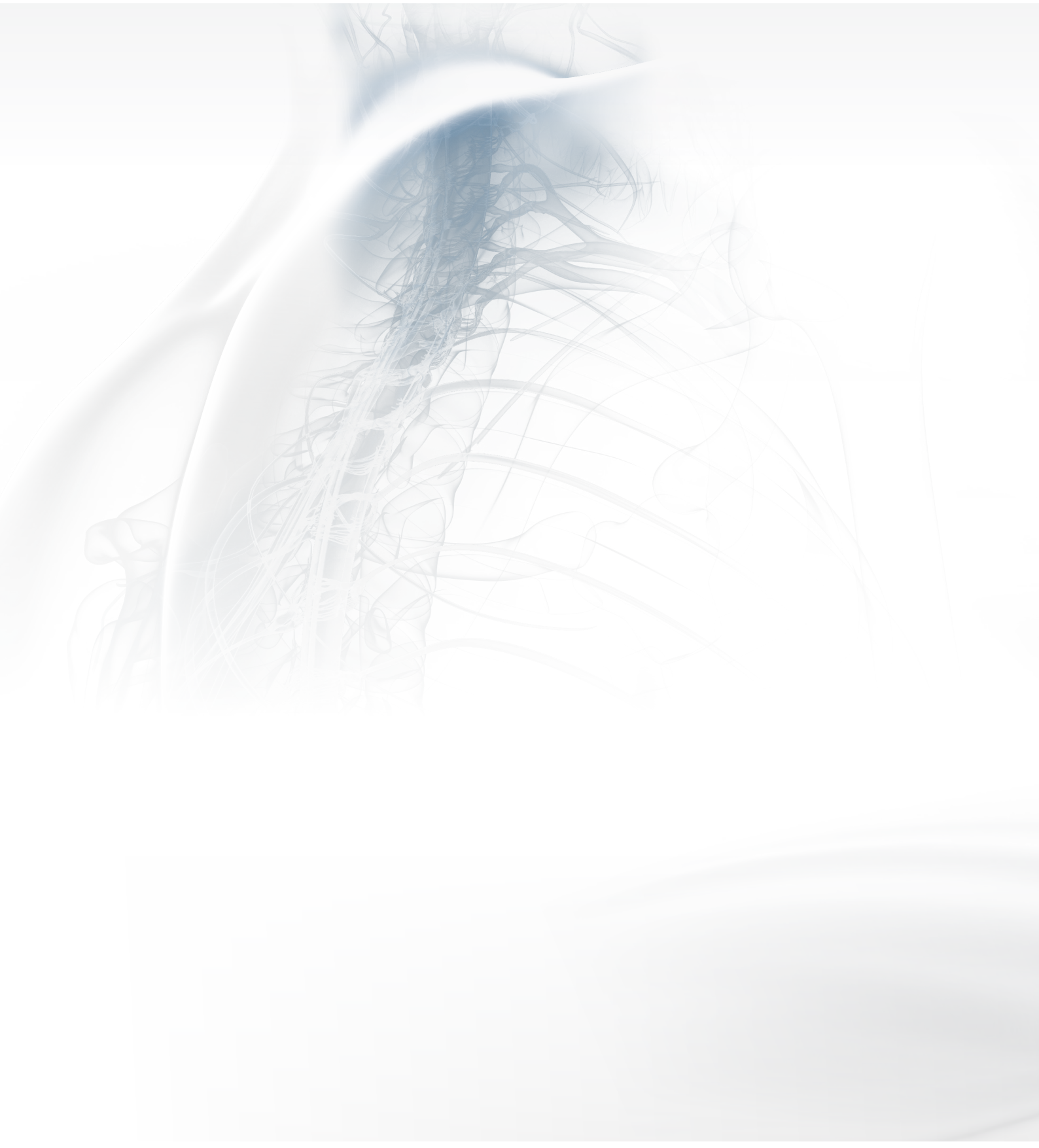
RICHARD WOLF

spirit of excellence

Takes the pressure

VERTEBRIS cervical

Full-endoscopic Decompression
of the cervical spine -
posterior and anterior techniques



VERTEBRIS cervical

Full-endoscopic Spine Instrumentation

RICHARD WOLF
spirit of excellence

Contents

VERTEBRIS cervical

Foreword

In the area of the cervical spine, radicular symptoms due to degenerative causes, in other words pain in the arms, are typically caused by mediolateral to lateral spinal disk herniations or stenoses of the intervertebral foramen. At the beginning of the 1940s, the clinical symptoms of this nature with a topographical reference to changes in the cervical disks were classified for the first time. Although good results are frequently obtained using conservative methods, surgical intervention may become necessary in the presence of pain or neurological deficits.

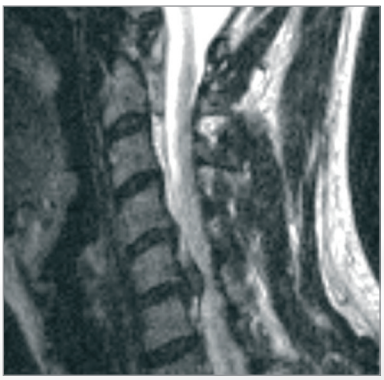
The development of the posterior surgical access to the cervical spine was also initiated at the beginning of the 1940s. Surgical procedures with anterior access were described at the end of the 1950s. Right up to the present day, anterior decompression and fusion has developed into a standard procedure when operating on cervical radicular pathologies. This procedure is regarded as safe and adequate with good fusion rates. However, specific problems, e.g. sintering of implants, pseudoarthroses and access complications, have been described. Subsequent cases of degeneration are discussed as specific disadvantages of fusion. An attempt is made here to reconstruct the intervertebral space while retaining segment mobility. The most frequent alternative to the anterior approach is provided by posterior foraminectomy in the case of lateral pathologies. This procedure is carried out without additional stabilization and therefore retains the mobility of the segment. Access-related neck pain and intraoperative bleeding may prove problematic. There can be no reconstruction of the intervertebral space.

In the case of cervical spinal disk herniations with radicular symptoms, the volume of the herniating disk material is generally low. The anterior and posterior open standard procedure therefore frequently involves a relatively extended intervention due to issues relating to access in relation to the limited pathology. In order to reduce the disadvantages of the conventional procedure, modifications were described, e.g. anterior decompression without fusion, anterior foraminotomy with various techniques, or posterior microscopically assisted or endoscopically assisted "Keyhole Foraminotomy". The potential problems of sintering and segmental kyphosis are discussed, particularly in relation to anterior interventions without reconstruction of the intervertebral space.

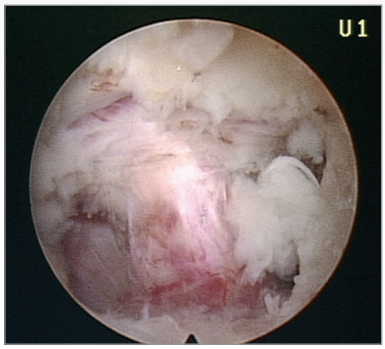
Since the 1990s, full-endoscopic operations of the cervical spine have primarily been discussed in terms of the anterior, transdiscal intervention. The constricted anatomical conditions were problematic since they only permitted small telescopes and working sheaths. This gave rise to technical problems, e.g. poor visibility, working under X-ray control without direct visualization or restricted bone resection. Foraminal hernias could not be operated from an anterior position. Today, the development of new endoscopes, instrument sets and operating procedures, offers the enablers for operating on cervical disk herniations using full-endoscopic methods under continuous visualization through the anterior and posterior access. The possibility of adequate bone resection under visualization – e.g. in the area of the foramen, the uncinate process or the posterior edge of

Posterior access for the full-endoscopic cervical operation

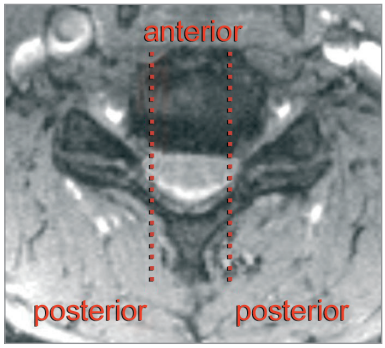
Anterior access for full-endoscopic cervical operation



Soft spinal disk herniations are the main indication



Cervical spinal cord with spinal nerve and spinal disk herniation



The lateral boundary of the spinal cord is the indication line for posterior of anterior access

the spinal column – and different surgical instruments provide technical conditions akin to conventional microscopically assisted surgical inventions with the simultaneous advantages of the full-endoscopic approach with 25° telescopes with a continuous flow of fluid.*

The main indications for cervical full-endoscopic operations are "soft" spinal disk herniations with radicular symptoms, in other words pain in the arms. Since the cervical spinal cord cannot be manipulated medially, the posterior approach is used for herniations where the main section is localized laterally to the lateral edge of the spinal cord. Reaching the pathology cannot be guaranteed here if an anterior approach is adopted even with resection of the uncinate process. Herniations presenting with their main part located medially to the lateral spinal edge are regarded as indications for anterior access, since there the spinal cord precludes a posterior approach. Furthermore, the height of the ventral edge of the intervertebral space must be at least 4 mm when the patient assumes a reclining position in order to prevent injury resulting from the approach. Potential craniocaudal sequestration must not exceed half of the body of the vertebra in either of the two approaches.
The surgeon also needs to have the skills to perform conventional and maximally invasive procedures on the cervical spine. Potential problems and complications arising from cervical operations may have significant consequences. For example, the possibility of vascular injuries can never be entirely excluded in cervical spine surgery. If these injuries occur, the surgeon has to move to open surgery immediately. The personnel and equipment should always be available to adopt this approach if necessary.

* see Literature

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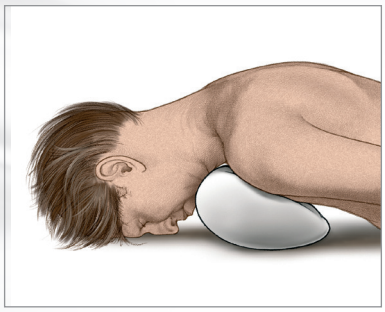
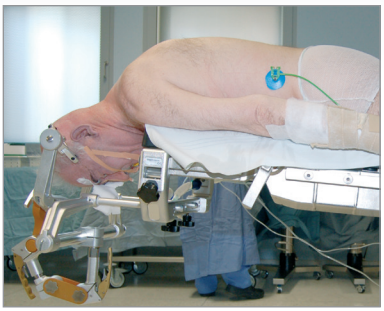
VERTEBRIS cervical

The full-endoscopic **posterior** technique

Storage

The operation is performed with the patient in the prone position lying on a hip and thorax roll. The head and the cervical spine must be resting with correct lordotic adjustment in a fixed position in keeping with a posterior intervention on the cervical spine. X-ray monitoring should be permitted during the operation in two planes. General fixation in the Mayfield Clip or a similar holder offers excellent prerequisites and always provides the circumstances for an open intervention if an emergency occurs. Particularly in the case of the lower cervical spine, it may be necessary to tape the shoulders caudally or to extend the arms in a caudal direction by means of traction. Application of a C-arc is required during the operation.

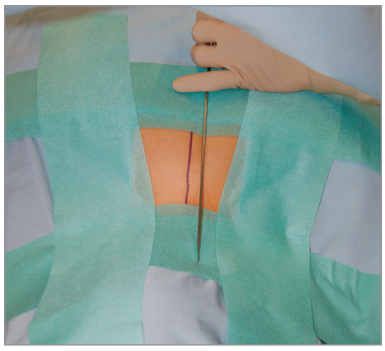




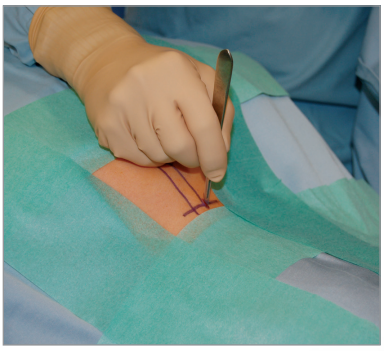
Prone position, fixation of the head in the Mayfield Clip, traction on the arms in a caudal direction

Determination of the access

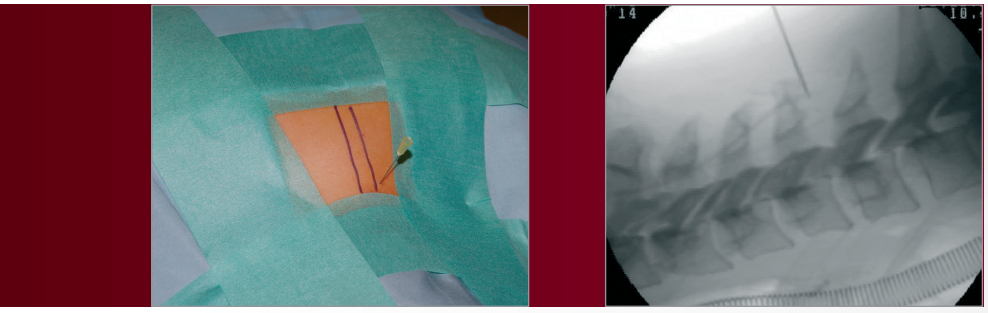
The access is determined under image intensifier control on the basis of anatomical landmarks in the posterior-anterior beam path and taking account of the anatomy and pathology in the orthograde lateral and anterior-lateral beam path. The access must be precisely positioned through the zygoapophyseal joint at the disk level.



Drawing the line of the of the zygoapophyseal joints in the anterior-posterior beam path



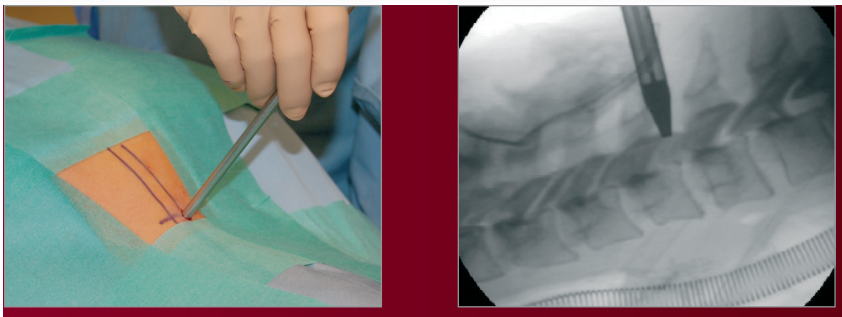
Stab incision



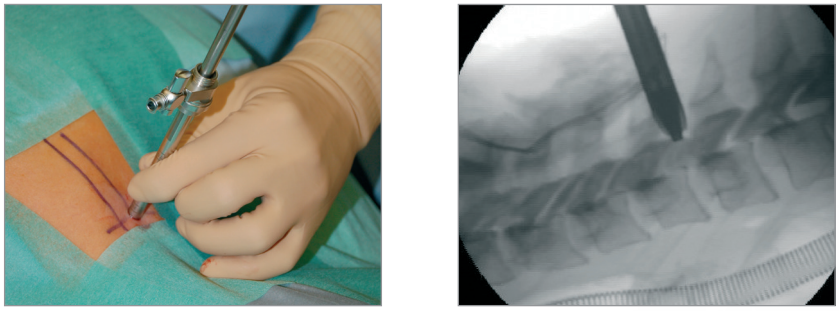
Determination of the spinal disk level in the orthograde lateral beam path using cannulas and definition of the entry point

Implementation of the access

After determining the entry point in the skin and carrying out a stab incision, the dilator is inserted until contact is made with bone on the zygoapophyseal joint under lateral image intensifier control. The working sleeve with oblique opening is pushed through the dilator in a medial direction and the dilator is removed.



Insertion of the dilator in the zygoapophyseal joint



The operating sleeve is inserted through the dilator

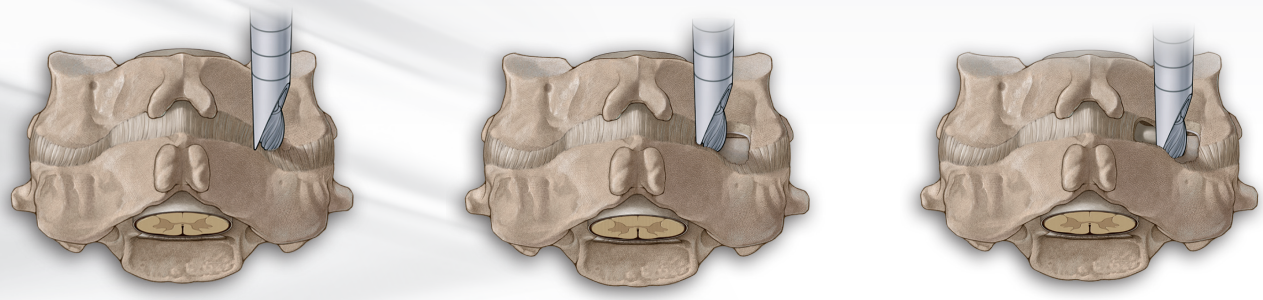
Operating procedure

The endoscope is inserted through the working sleeve. The operation is carried out in vision using different instrument sets positioned through the intra-endoscopic working channel and with a continuous flow of liquid. A foraminotomy bone resection carried out with different instruments is necessary in virtually all cases. After exposure of the bony structures, this procedure is commenced on the descending part of the joint and the cranial lamina taking the anatomy and pathology into account. Parts of the caudal lamina and ascending facets are then resected. At this stage it is important to pay safeguard the spinal nerves and arteries. The ligamentum flavum is then opened and it is now possible to access the spinal canal for resection of the spinal disk herniation.

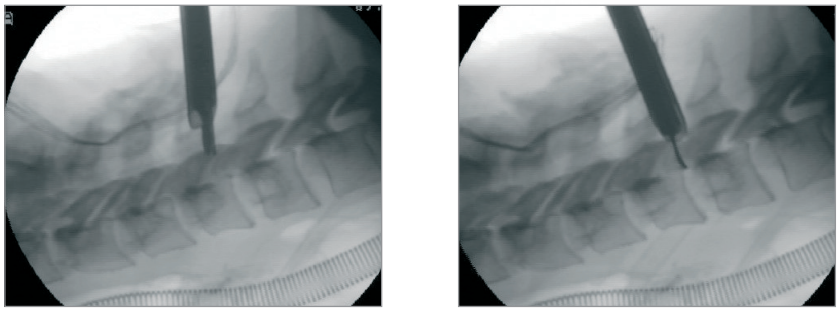
The endoscope is used in conjunction with the surgical sleeve

VERTEBRIS cervical

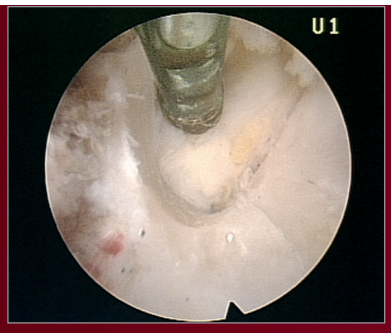
The full-endoscopic **posterior** technique



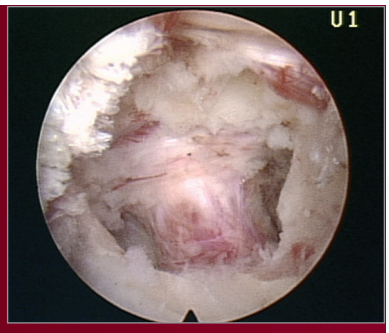
Bony parts of the joint and the lamina are resected to open the foramen



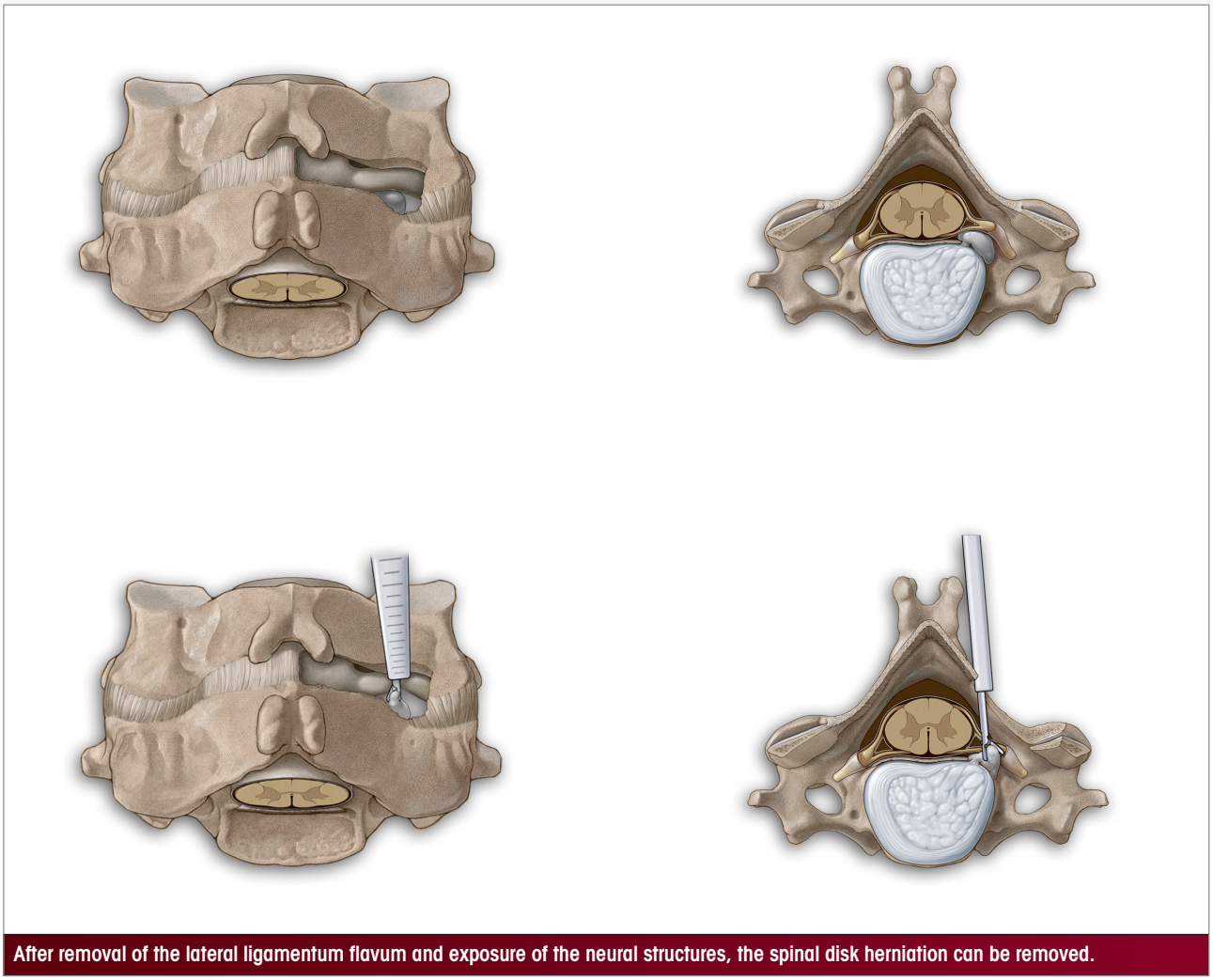
The image intensifier can help with orientation during cutting or when working in the spinal canal



Reamed foramen with view of the ligamentum flavum



View in the lateral spinal canal with cervical spinal cord and spinal nerve



After removal of the lateral ligamentum flavum and exposure of the neural structures, the spinal disk herniation can be removed.

The locking caps for telescope and working sleeve should only be used briefly if bleeding obscures visibility since when operations last a long time and the drainage of fluid is prevented without being noticed, the consequences of volume overload and elevated pressure within the spinal canal and the associated and neighboring structures cannot theoretically be completely excluded.

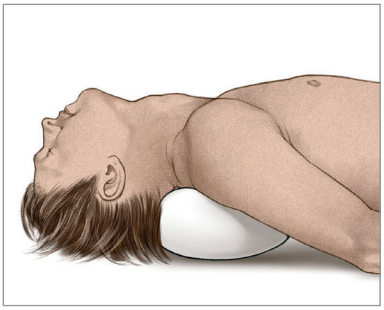
Any manipulation of the spinal cord must be avoided. Experience indicates that generally speaking there is an increased risk of complications occurring when all new procedures are carried out, in particular during the learning curve. This risk may be higher as a result of the general anatomical conditions in the cervical spine compared with the lumbar spine.

VERTEBRIS cervical

The full-endoscopic **anterior** technique

Storage

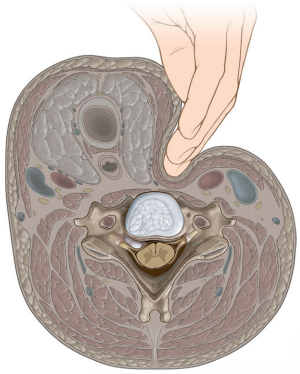
The patient is placed in a supine position. The head and cervical spine must be placed in a slightly reclining position and fixed in keeping with an anterior approach to the cervical spine. X-ray monitoring should be permitted in two planes during the procedure. General fixation in the Mayfield Clip or a similar holder offers excellent prerequisites and always provides the circumstances for an open intervention if an emergency occurs. Particularly in the case of the lower cervical spine, it may be necessary to tape the shoulders caudally or to extend the arms in a caudal direction by means of traction. Application of a C-arc is required during the operation.



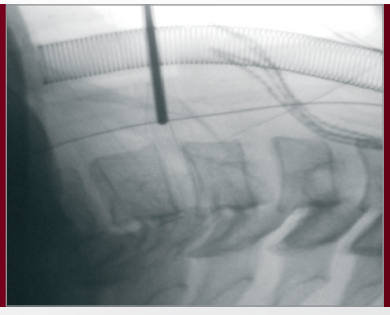
Supine position, fixation of the head in the Mayfield Clip, traction on the arms in a caudal direction

Determination of the access

Access is made on the contralateral side of the pathology. The fingers are used to palpate the anterior spine. The esophagus and the trachea sections are manipulated medially and the vessel-nerve bundle are manipulated laterally. The access is determined using image intensifier control on taking account of the anatomy and pathology in the orthograde lateral and anterior-lateral beam path.



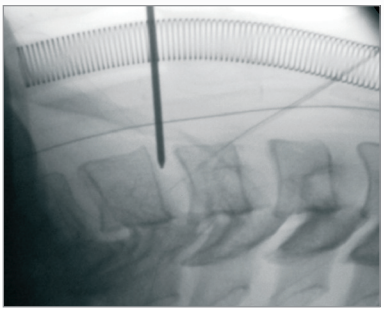
The access must be precisely positioned through the zygoapophyseal joint.

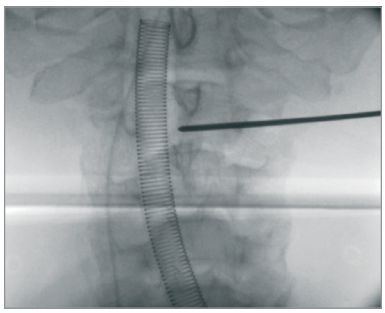


Determination of the access through the intervertebral space.

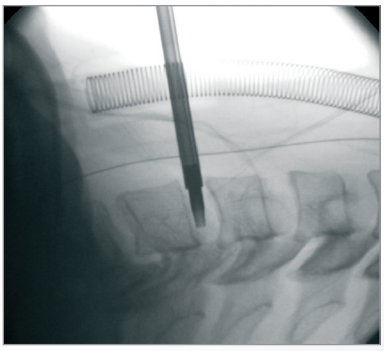
Implementation of the access

After determining the entry point in the skin and carrying out a stab incision in the skin, the first thin dilator is inserted in the intervertebral space under lateral image intensifier control. It is important to make an anterior puncture in the spinal disk and not to miss laterally. This not only precludes further operations but can also lead to injury of the vertebral artery, spinal nerve or esophagus. Alternatively, the spinal disk can be punctured using a spinal cannula and a guide wire is inserted through this. The first dilator can then be pushed through this. After the spinal disk has been punctured with the dilator or with the spinal cannula, the position is then checked under posterior-anterior image intensifier control. The ongoing intervention is then carried out in the lateral beam path. The combined dilator-sleeve system is inserted in the intervertebral space through the first dilatory. The dilators are removed, the surgical sleeve remains in the intervertebral space.

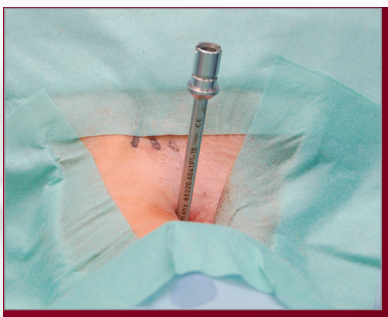


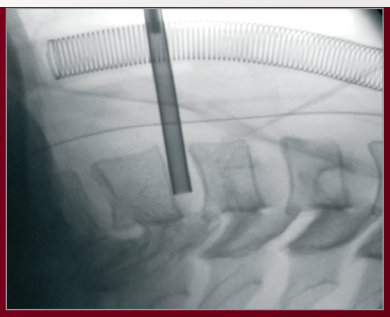


Insertion of the dilator in the intervertebral space



Insertion of the combined dilator sleeve system





The surgical sleeve remains in the intervertebral space

VERTEBRIS cervical

The full-endoscopic **anterior** technique

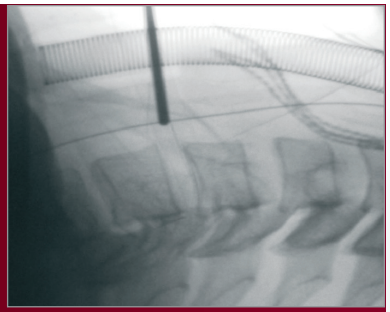
Operating procedure

The endoscope is inserted through the working sleeve. The operation is carried out in vision using different instrument sets positioned through the intra-endoscopic working channel and with a continuous flow of liquid.

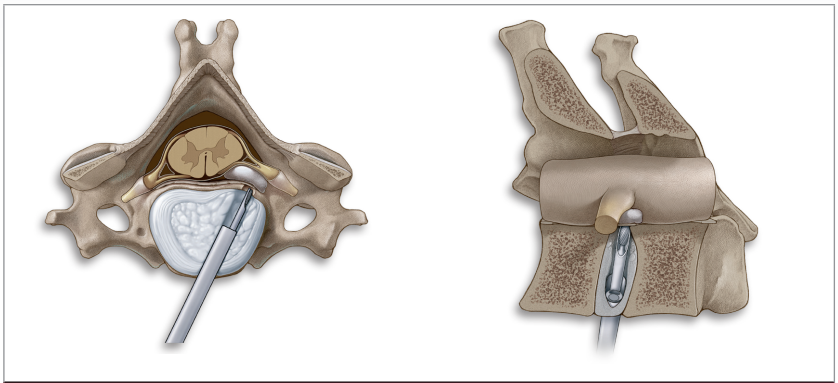
On the side of the pathology, the uncinate process, posterior edge of the spine vertebral body and the posterior annulus are dissected contralaterally for purposes of topographical orientation. Bone resection with different instrument is necessary in many cases in order to reach the epidural space. The posterior annulus and the dorsal longitudinal ligament are opened, depending on the anatomy and pathology, and the spinal canal can be accesses for resection of the spinal disk herniation.

Working with the endoscope through the surgical sleeve

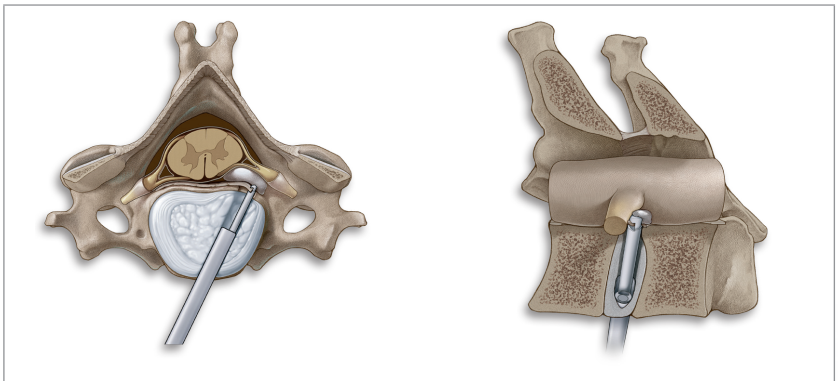
Optical system for full-endoscopic anterior spine surgery



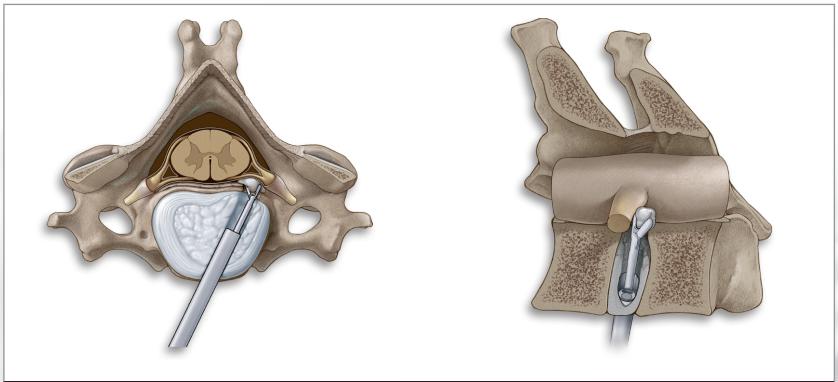
The image intensifier can help with orientation during the operation



Bony resection is frequently necessary to reach the spinal canal



Depending on the findings, the dorsal longitudinal ligament should be opened



Removing the spinal disk herniation

The locking caps for the telescope and the working sleeve should only be used at short notice for hemorrhage that obscures vision because if operations extend over a long period and if the drainage of the irrigation fluid is inadvertently obstructed the consequences of volume strain and pressure increase cannot be entirely excluded within the spinal canal and the associated and adjacent structures.

Any manipulation of the cervical spinal cord must be avoided. Experience indicates that generally speaking there is an increased risk of complications occurring when all new procedures are carried out, in particular during the learning curve. This risk may be higher as a result of the general anatomical conditions in the cervical spine compared with the lumbar spine.

VERTEBRIS cervical

Instrumentation – full-endoscopic **posterior** technique

VERTEBRIS cervical posterior Basic Instrumentation 892101700
comprising:

Endoscope and accessories	
	**PANOVIEW PLUS Discoscope,** 25° direction of view, working channel ID 3.1 mm, WL 122 mm 892108253
	**Fiber Light Cable Set,** D 3.5 mm, WL 1.8 m (80663518), Adapter project side (8095.07) and adapter endoscope side (809509), color code orange 806635181

Access instruments	
	**Dilator,** two-channel, for working sleeve OD 7.0 mm 8792.764
	**Working sleeve,** with 30° oblique window, OD 7.0 mm, WL 80 mm 89220.7007
	**Handle attachment,** for working sleeve OD 7.0 mm 89200.1007

Working instruments	
	Auxiliary instruments atraumatic
	**Elevator,** OD 2.5 mm, WL 290 mm 89250.2025
	**Dissector,** OD 2.5 mm, WL 350 mm 8792.591
	**Exploring probe with flexible tip,** comprising: Handle (892500600), guide tube (15570644), probe jaw insert (892506625), OD 2.5 mm, WL 290 mm 892506925
	Auxiliary instruments Sharply abrading
	**Reamer,** OD 3.0 mm, WL 350 mm 89260.1113

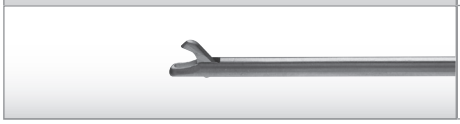
VERTEBRIS cervical posterior Basic Instrumentation

Working instruments

Rongeurs and punches
Color coding for simple identification of the instrument diameter

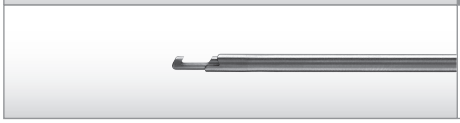
Micro-Rongeur,
- OD 2.0 mm, WL 290 mm 892406002
- OD 2.5 mm, WL 290 mm 89240.2025

- **Rongeur** OD 3.0 mm, WL 290 mm 89240.3003



Micro-Punch,
- OD 2.0 mm, WL 290 mm 892406202
- OD 2.5 mm, WL 290 mm 89240.2225

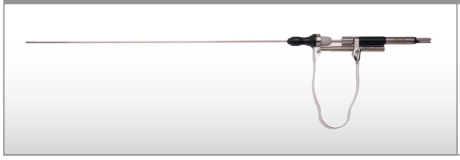
Tubular punch



Bone punch,
- OD 2.5 mm, WL 290 mm 89240.2325
- OD 3.0 mm, WL 290 mm 89240.3903

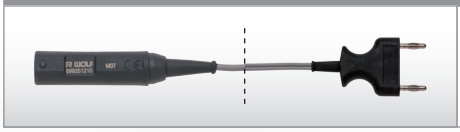
Radio-Frequency Surgery System

TipControl RF accessory, short



TipControl RF Instrument Set short, WL 290 mm*
comprising:
Bipolar handle (899351100), sheath tube, short, OD 2.5 mm (899351010) 899351000

TipControl connection cable for connecting to RF devices



TipControl connection cable, bipolar,**
Connector for EU flat plug,
2-PIN International power plug, cable length 3 m 899351210

* for application with TipControl RF electrode, short, sterile (499351000) see below / page 20 (not in included in the set 899351000)
** Radioblator RF 4 MHz radio frequency device for full-endoscopic spine surgery see page 20.

Accessories for VERTEBRIS cervical posterior Basic Instrumentation

Instrumentation for single use

Accessory for TipControl RF instrument for single use

TipControl RF electrode, short,
sterile, pack of 5 499351000

VERTEBRIS cervical

Instrumentation – full-endoscopic **anterior** technique

VERTEBRIS cervical anterior Basic Instrumentation 892101800
comprising:

Endoscope and accessories	
	**Cervical Discoscope,** 25° direction of view, OD 2.7 mm, WL 150 mm 892106250
	**Telescope connector** 892006000
	**Fiber Light Cable Set,** D 3.5 mm, WL 1.8 m (80663518), adapter projector side (8095.07) and adapter endoscope side (809509), color code orange 806635181

Access instruments	
	Dilation Set, three-part 892206500
	**Guide cannulas,** OD 1.8 mm, WL 250 mm 892206118
	**Guide rod,** OD 1.8 mm, WL 250 mm 892206318
	**Access system – for application with instruments OD max. 2.5 mm** Matched with color coding:
	**Dilator,** conical, for working sleeve 892206038 892206438
	**Dilator,** for working sleeve 892206038 892206538
	**Working sleeve,** OD 3,8 x 6.2 mm, WL 102 mm 892206038
	**T handle,** ID 12 mm 892006120
	**Handle attachment,** for working sleeve 892206038 892006038

VERTEBRIS cervical anterior Basic Instrumentation

Working instruments

Auxiliary instruments

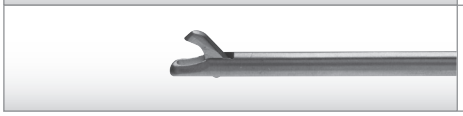
Exploring hook,
OD 2.0 mm, WL 290 mm 892506003

Exploring probe with flexible tip,
comprising:
Handle (892500600), guide tube (15570644), probe jaw insert (892506625), D 2.5 mm, WL 290 mm 892506925

Rongeurs and punches

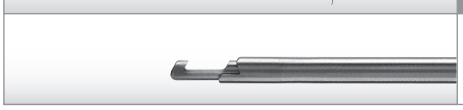
Color coding for simple identification of the instrument diameter

Micro-rongeur,
- OD 2.0 mm, WL 290 mm 892406002
- OD 2.5 mm, WL 290 mm 89240.2025



Micro-punch,
- OD 2.0 mm, WL 290 mm 892406202
- OD 2.5 mm, WL 290 mm 89240.2225

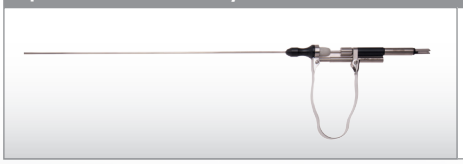
Bone punches



Bone punch,
- OD 2.5 mm, WL 290 mm 89240.2325

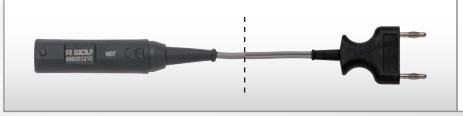
Radiofrequency Surgical System

TipControl RF accessory, short



TipControl RF Instrument Set short, WL 290 mm*
comprising:
Bipolar handle (899351100), sheath tube, short, OD 2.5 mm (899351010) 899351000

TipControl connection cable for connecting to RF devices



TipControl connection cable, bipolar,**
Connector for EU flat plug,
2-PIN International power plug, cable length 3 m 899351210

* for application with TipControl RF electrode, short, sterile (499351000) see below / page 20 (not in included in the set 899351000)
** Radioblator RF 4 MHz radio frequency device for full-endoscopic spine surgery see page 20.

VERTEBRIS cervical

Instrumentation – full-endoscopic **anterior** technique

Accessories for *VERTEBRIS cervical* posterior Basic Instrumentation

Instrumentation for single use	
Access instruments for single use	
	**Spinal Cannula Set,** OD 1.25 mm, WL 90 mm 492206112
Accessory for TipControl RF instrument for single use	
	**TipControl RF electrode, short,** sterile, pack of 5 499351000

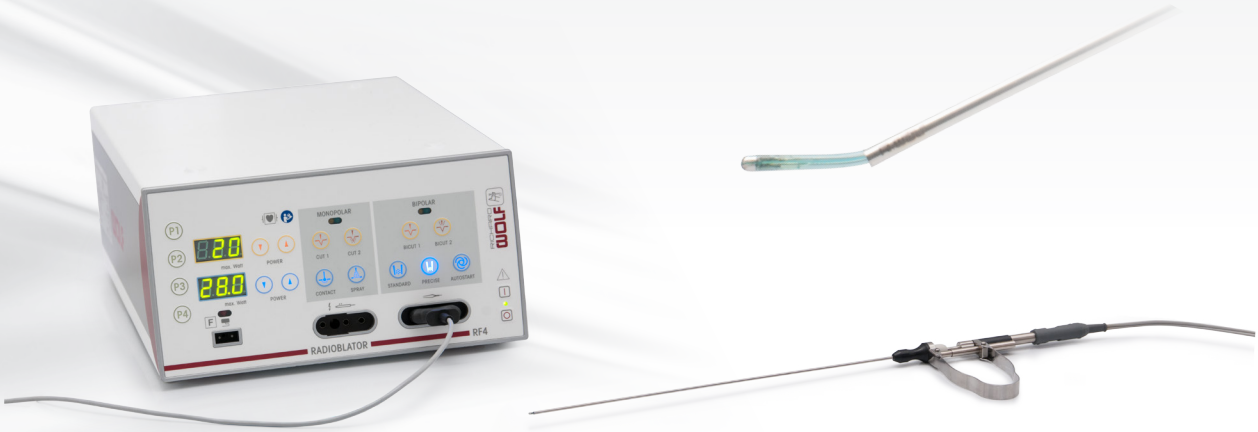
VERTEBRIS cervical

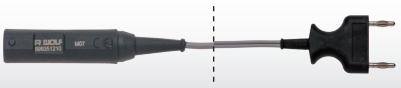
Instrumentation optional – full-endoscopic **anterior** technique

Optional Instrumentation	
	**Access system – for application with instruments OD max. 3.0 mm** Matches color coding: ● ● ●
	**Dilator,** conical, for working sleeve 892206041 892206441
	**Dilator,** for working sleeve 892206041 892206541
	**Working sleeve,** OD 4.1 x 6.7 mm, WL 102 mm 892206041
	**T handle,** ID 12 mm 892006120
	**Handle attachment,** for working sleeve 892206041 892006041
	**Rongeurs and punches** Color coding for simple identification of the instrument diameter
	**Rongeur,** ● OD 3.0 mm, WL 290 mm 89240.3003
	**Micro-punch,** ● OD 3.0 mm, WL 290 mm 89240.3023
	Bone punches
	**Bone punch,** ● OD 3.0 mm, WL 290 mm 89240.3903
	Reamer
	**Reamer, manual** OD 3.0 mm, WL 350 mm 89260.1113
	Trephines For application through the working sleeve
	**Trephine with tissue protector,** OD 3.6 mm, WL 100 mm ..... 892606036 OD 4.0 mm, WL 100 mm 892606004

VERTEBRIS cervical

Radioblator RF 4 MHz - Multidisciplinary Radiofrequency Surgical System

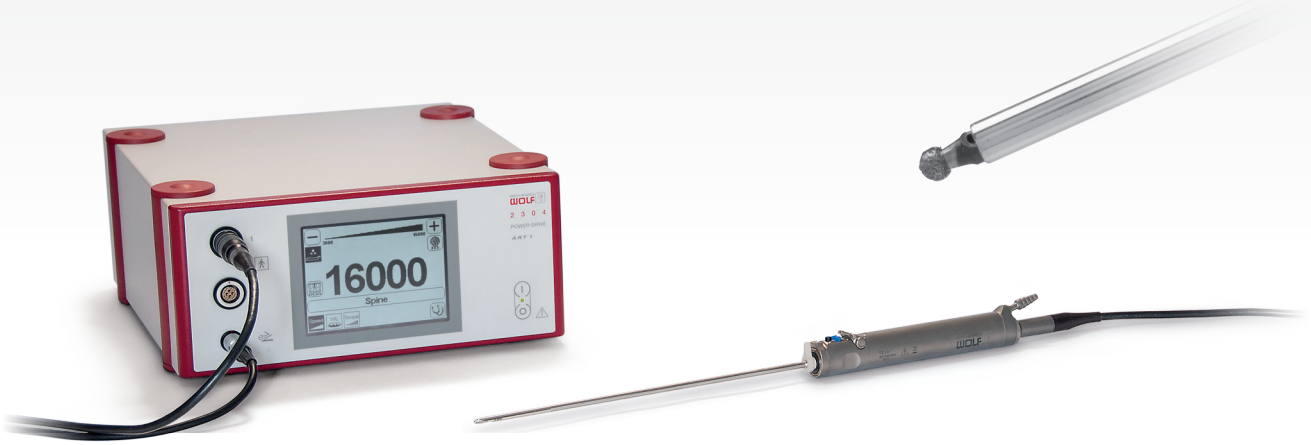


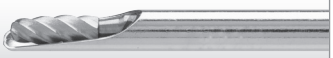
Multidisciplinary radiofrequency surgical system	
TipControl RF accessory, short	
	**TipControl RF Instrument Set short,** WL 290 mm comprising: Bipolar handle (899351100), sheath tube, short, OD 2.5 mm (899351010) 899351000
	**TipControl RF electrode, short,** sterile, pack of 5 499351000
TipControl connection cable for connecting to RF devices	
	**TipControl connection cable, bipolar,** Connector for EU flat plug, 2-PIN International power plug, cable length 3 m 899351210
Radioblator RF 4 MHz 4 MHz working frequency – precisely focused and tissue preserving, monopolar and bipolar cutting and coagulation modes, program memory for 4 User Presets	
	**Radioblator RF device,** comprising: Radioblator RF device (2330001), power cable (244003), two-pedal foot switch (2330901) and cable for disposable neutral electrodes (2330045) 23300011

For detailed information see brochure *B 799 - Radioblator RF 4 MHz.*

VERTEBRIS cervical

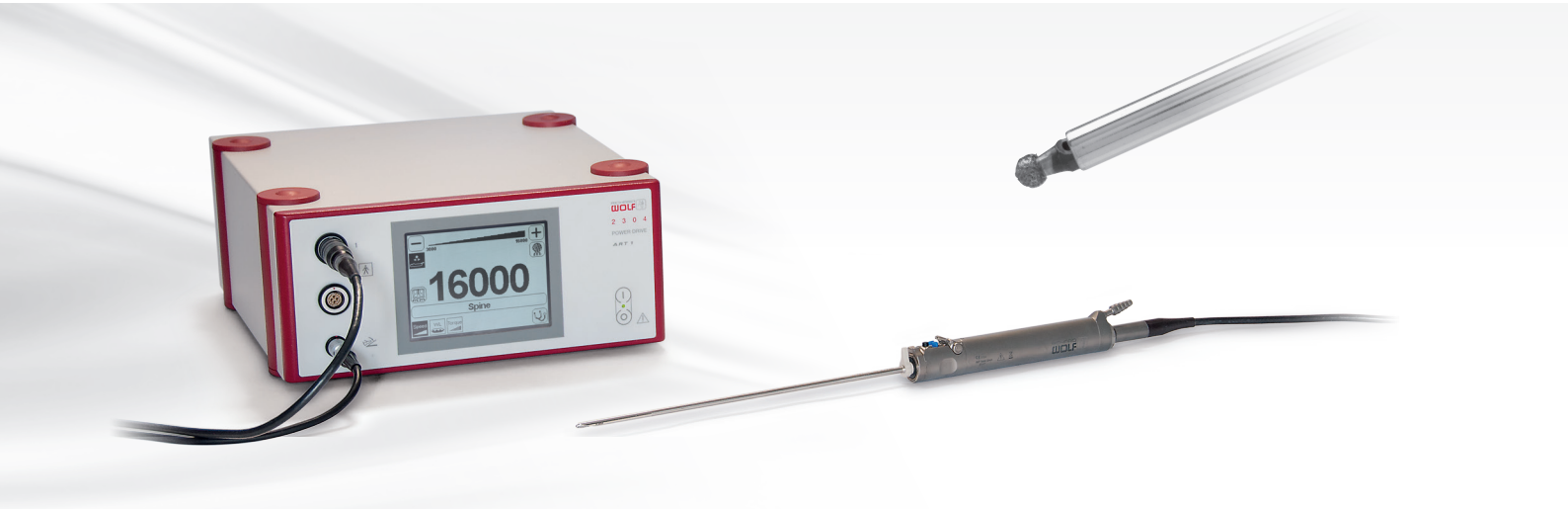
PowerDrive ART1 - Universal Motor System



Accessories for universal motor system – motor handle Power Stick M5	
Burrs	
	**Oval burr,** with side protector, WL 350 mm, OD 2.5 mm .....899751502 OD 3.0 mm 899751503
	**Oval burr,** with front protector, WL 350 mm, OD 2.5 mm .....899751512 OD 3.0 mm 899751513
	**Round burr,** WL 350 mm, OD 2.5 mm .....899751302 OD 3.0 mm 899751303
	**Round burr, diamond,** WL 350 mm, OD 2.5 mm .....899751402 OD 3.0 mm 899751403
Nucleus resectors	
	**Nucleus resector,** WL 350 mm, OD 3.0 mm 899751003
Motor handles – Power Stick M5 Rotary speed 16.000 rpm, sterilizable, firmly seated connection cable	
	**Power Stick M5/0** Operation with foot switch 8995500001
	**Power Stick M5/3** Operation with touchpad and foot switch 8995500031

VERTEBRIS cervical

PowerDrive ART1 - Universal Motor System



Universal motor system	
	PowerDrive ART1 - Universal Motor System, Set incl. power cable, Can-Bus connection cable **Technical features:** automatic handle and tool recognition, storage function user-specific parameters and memory function for tools
	**Power supply unit 230 V,** 50/60 Hz 23040011
	Power supply unit 100 V, 50/60 Hz 23040021
	Power supply unit 110 V, 50/60 Hz 23040041
	Power supply unit 115 V, 50/60 Hz 23040061
	Power supply unit USA 120 V, 50/60 Hz 23040071
	Power supply unit 127 V, 50/60 Hz 23040121
	Power supply unit 240 V, 50/60 Hz 23040141
	**Double pedal foot switch** for PowerDrive ART1 (Series 2304) 2304.901

For detailed information see brochure *B 759 - PowerDrive ART1*.

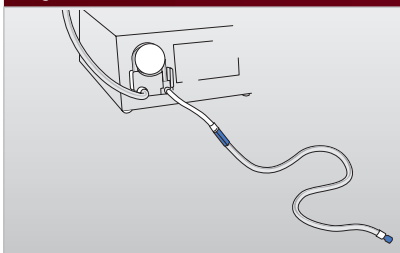
VERTEBRIS cervical

FLUID CONTROL Arthro-Spine - Innovative Fluid Management System

FLUID CONTROL Arthro-Spine

FLUID CONTROL Arthro-Spine 2204 cpl., irrigation and suction pump with software module spine mode for arthroscopy and full-endoscopic spine surgery
with automatic tube recognition, comprising:
Fluid Control Arthro (2204001), software module Spine Mode (2204101),
Tube set with piercing connector (8171223), vacuum tube (8170401),
Protective filter for gas filtration (4171121) and power cable (244003) 22040012

Irrigation



Accessories – reusable

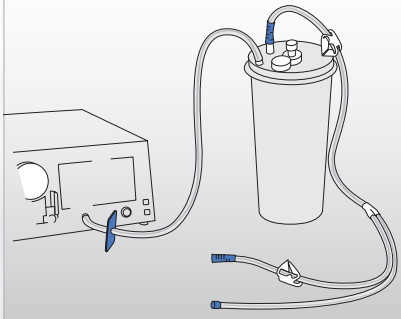
Tube set with piercing connector, with luer-lock connector, autoclavable,
incl. 10 substitute membranes, reusable for 20 reprocessing cycles 8171223

Accessories – for single use

Tube Set with piercing connector, (pack = 10 pcs.), with luer-lock connector,
sterile single use product 4171223

Tube set with CARE-LOCK, (pack = 10 pcs.),
sterile single use product 4171224

Suction / Evacuation



Accessories – reusable

Vacuum tube, silicone, autoclavable,
for connection of vacuum (pump) with Suction container 8170.401

Suction container,
3 liters, incl. holder, autoclavable 8170.981

Accessory – for single use

Suction container,
3 liters, (pack = 2 pcs.) 2215.971

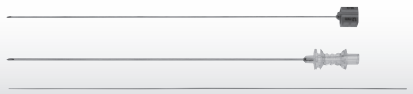
Drain tube, PVC, with Y-shaped piece, length 5 m, sterile single-use product,
(pack = 10 pcs.) for connecting instruments with suction container 4170.901

to vacuum tube 8170.401:
Protective filter for gas filtration, hydrophobic (hygiene filter) 4171.121

For detailed information see brochure *B 815 - FLUID CONTROL Arthro.*

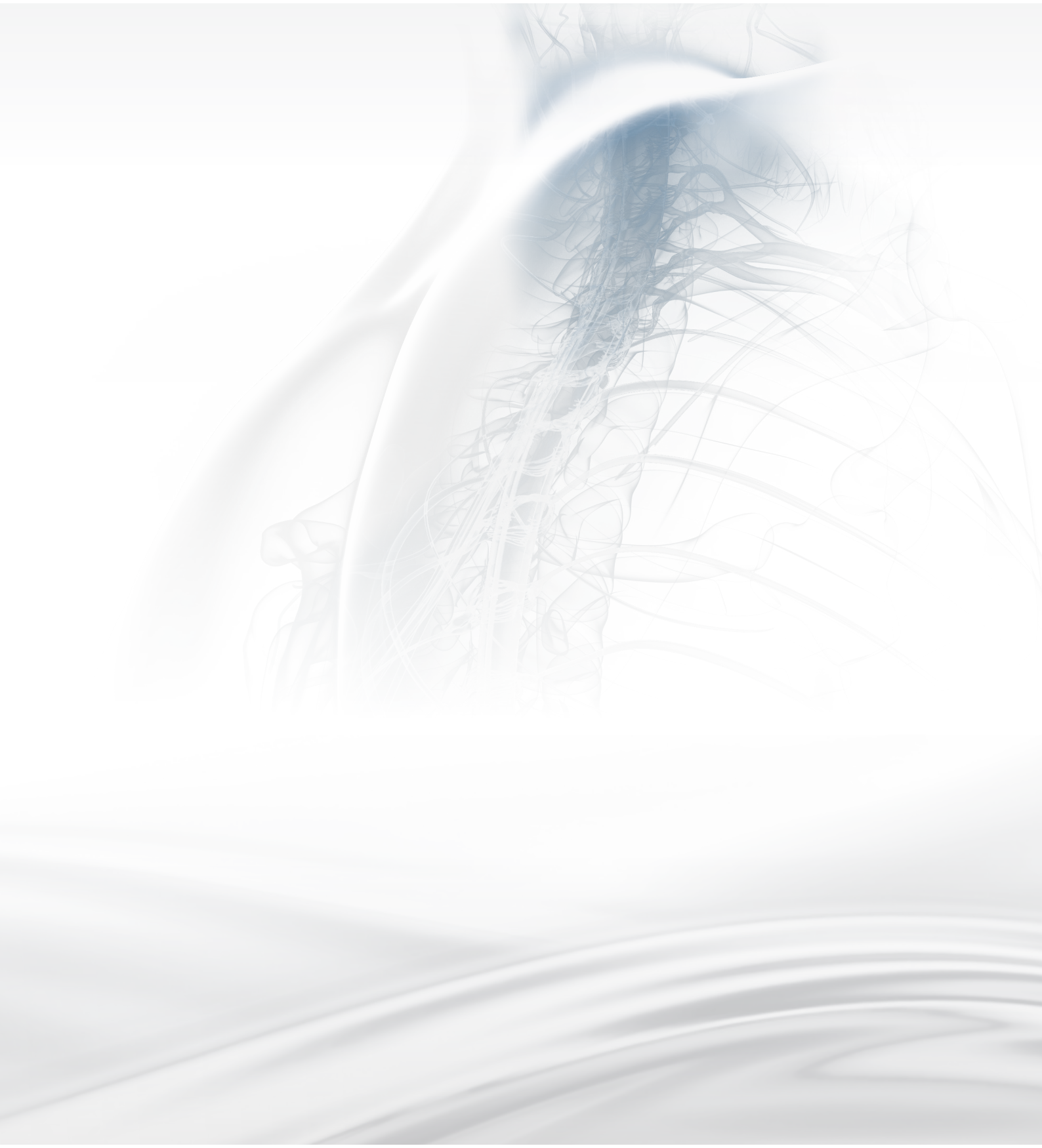
VERTEBRIS cervical

Consumables and accessories

Access instruments for single use	
	**Spinal Cannula Set,** pack = 10 pcs., sterile OD 1.25 mm, WL 90 mm ..... 492206112 OD 1.25 mm, WL 150 mm 4792.803

Accessory for radiofrequency surgical system - TipControl RF instruments	
TipControl RF accessory, short	
	**Sheath tube, short,** OD 2.5 mm 899351010
	**TipControl RF electrode, short,** sterile, pack = 5 pcs. 499351000

Accessory for radiofrequency surgical system with US 2-PIN instrument plug - TipControl RF instruments	
	**Connection cable,** bipolar connector for EU flat plug, US 2 PIN power plug 899351220



VERTEBRIS cervical

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