spirit of excellence

Takes the pressure

VERTEBRIS lumbar - thoracic

Full-endoscopic decompression of the
lumbar-thoracic spine -
Interlaminar and transforaminal technique

RICHARD WOLF

spirit of excellence

VERTEBRIS lumbar - thoracic

Full-endoscopic Spine Instrument Set

Contents

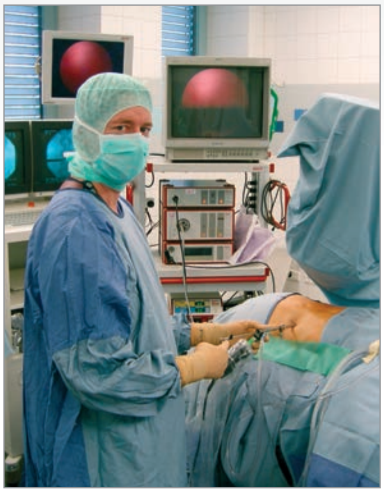
VERTEBRIS lumbar

Foreword

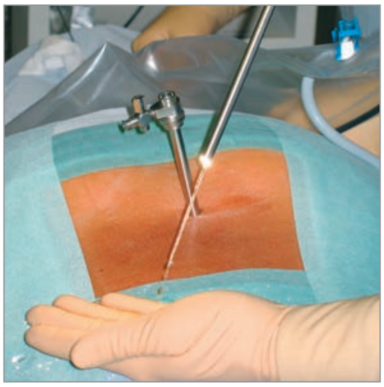
Musculoskeletal pain ranks among the most frequent reasons for seeking medical help. Degenerative diseases of the spine form a daily focus. The therapy encompasses medical and socioeconomic problems.

After conservative measures have been exhausted, surgical intervention may be necessary in circumstances of exacerbated pain or neurological deficits. In spite of good therapeutic results from conventional operations, consecutive damage may result from traumatization. It is therefore important to continuously optimize the procedures and workflows. The latest research results and technical innovations need to be critically assessed and used constructively in order to facilitate the best treatment strategies. The aim in this process of continuous improvement is to minimize the trauma induced by the operation and negative long-term effects while observing existing quality standards.
Minimally invasive techniques allow tissue damage and its consequences to be reduced. Endoscopic operations carried out during a continuous flow of fluid demonstrate advantages which these procedures standard practice in many areas. Over the past 20 years, transforaminal procedures with posterolateral access have been used in the area of the lumbar spine. The working area is mainly intradiskal, as well as involving an intraforaminal and extraforaminal approach. Since 1998, our Center for Spine Surgery and Pain Therapy has therefore been developing a transforaminal and an interlaminar access in order to reach the spinal canal full-endoscopically. These expand the indication spectrum and permit an equivalent approach in vision that is comparable with conventional operations taking account of the indication criteria, which offer all the advantages of a genuine, minimally invasive procedure.

Problems on the technical side emerged as a result of the availability of optical systems with a small intraendoscopic working channel and the correspondingly restricted repertoire of instruments. Insurmountable difficulties were liable to arise in respect of the resection of hard tissue, the resection of hard tissue, the surgical access passage, and mobility. Adequate work on the pathology was technically limited and had to be carried out in part without direct visualization. The developed of new rod-lens telescopes with an intraendoscopic 4.1 mm working channel and hence new instruments, as well as shavers and burrs was therefore necessary. This enabled working under continuous, excellent visual conditions. Adequate bony resection was also facilitated for the first time. This expanded the principal indication spectrum to spinal disk herniations, spinal stenoses and stabilizing methods.



Lateral access for the full-endoscopic transforaminal operation



A continuous flow of fluid permits outstanding intraoperative visual conditions

Full-endoscopic surgery on the lumbar spine has now achieved an established status within the overall concept of surgery. Taking due account of the indication criteria, it provides an adequate and safe complement or alternative to conventional surgery. Full-endoscopic operations are also possible on the cervical and thoracic spine.
A change is taking place for the first time as a result of the latest technical developments and new access passages, which appears to be the start of a radical new departure comparable with the establishment of arthroscopic interventions in joints. Nevertheless, conventional and maximally invasive operations will continue to be indispensable in spine surgery today and in the future. Surgeons must be able to perform such operations so that they are in a position to deal safely with any problems and complications that may emerge during full-endoscopic interventions as in any other invasive procedure.

The development of full-endoscopic methods should not be evaluated as a replacement for existing standard operations but as a complementary procedure and alternative within the overall concept of spine surgery.

The telescopes in the current generation have a large 4.1 mm intraendoscopic channel

The development of new instruments offers expanded opportunities for implementation

Priv.-Doz. Dr. med. habil.
Sebastian Ruetten

Dr. med. Semih Oezdemir

Dr. med. Martin Komp

Center for Spine Surgery and Pain Therapy
Head: Priv.-Doz. Dr. med. habil. Sebastian Ruetten

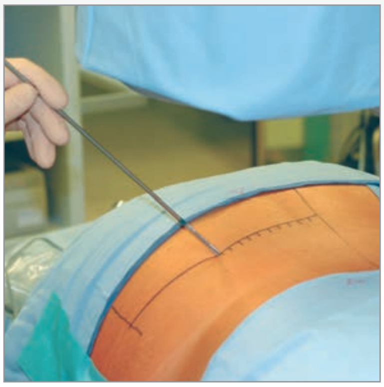
ST. ELISABETH GRUPPE
KATHOLISCHE KLINIKEN RHEIN-RUHR

Center for Orthopedics and Traumatology
of the St. Elisabeth Group – Catholic Hospitals Rhein-Ruhr
St. Anna Hospital Herne/Marien Hospital Herne University Hospital/Marien Hospital Witten
Director: Prof. Dr. med. Georgios Godolias

VERTEBRIS lumbar

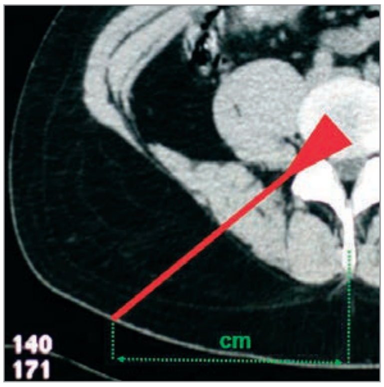
The full-endoscopic **transforaminal and extraforaminal** technique

Details of percutaneous operations on lumbar disks to achieve intradiskal decompression were published at the beginning of the 1970s. Optical systems dedicated to inspection of the intervertebral space following an open operation have been used since the early 1980s. A full-endoscopic approach was subsequently developed using a transforaminal technique. In anatomical terms, this means accessing the intervertebral disk in a posterolateral to lateral approach within the area of the intervertebral foramen between the exiting and traversing spinal nerves without the need for resection of bony or ligament structures. The entry point in the skin for the surgical access passage is defined in centimeters from the midline. The applications are generally carried out for intradiskal or extradiskal foraminal therapy. Intradiskal volume and pressure reduction is intended to achieve reduced compression due to the intervertebral disk. Removal of the intraforaminal and extraforaminal intradiskal material is technically possible. Sequestered material located within the spinal can generally only be resected retrograde intradiscally through the annulus defect. This is carried out within the scope of an "In-out technique".



The established posterolateral access is measured in centimeters from the midline

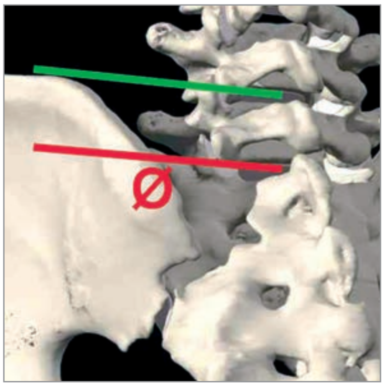
Nucleus material is located within the spinal canal posterior to the annulus level in the anterior epidural space medial to the medial pedicle line. It frequently reaches to the mid-line or the contralateral side. Clinical experience indicates that the annulus defect is frequently smaller than the diameter of the sequester volume. Furthermore, there is no continuous connection intradiskally in the majority of cases. In cases of advanced disk degeneration or older spinal disk herniations, the sequester frequently does not comprise a contiguous substance. Removal in such cases is not possible in a single piece. These factors frequently prevent the retrograde resection carried intradiskally of sequestered nucleus material. Direct access to the extradiskal ventral epidural space with continuous visualization is hence necessary for adequate decompression.



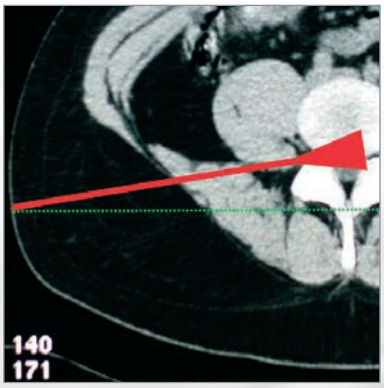
The working area is primarily intradiskal in the posterolateral access

The most frequent localization of lumbar disk herniations relates to the lower levels. The diameter of the intervertebral foramen decreases from the cranial to caudal position. An additional constriction can be caused by degenerative changes. These anatomical conditions frequently prevent extradiskal access to the anterior epidural space with full visualization when using the posterolateral access passage particularly at the lower levels. There are also technical limits to a lateral alignment of the endoscope in order to reach the spinal canal tangentially after implementing the access as a result of the approach access passage within the soft tissue and the zygoapophyseal joint. The predictable adequate decompression by means of the posterolateral access may therefore be significantly restricted.

The lateral transforaminal access allows the spinal canal to be reached in the caudal levels



The pelvis can prevent the necessary lateral transforaminal access at the lower levels



The lateral transforaminal access shifts the working area into the spinal canal working area

The new transforaminal passage has therefore been developed in the past several years. *

This approach does not entail measurement in centimeters being carried out to define the entry point in the skin, but involves an individual anatomical determination under radiographic control. The access permits the spinal canal to be reached tangentially and hence affords direct visualization of the epidural space with a continuous flow of fluid for purposes of adequate decompression. A broad but clearly defined indication spectrum is provided in conjunction with the newly developed endoscopes designed with a large working channel and the corresponding new instruments, shavers and burrs.
Mobility in a caudal direction to the middle of the pedicle and in a cranial direction to the commencement of the pedicle serves as a guide for decompression within the spinal canal. Constricted foramina no longer constitute restrictions but can be expanded. The pelvis can prevent the necessary lateral access so that the center of the cranially positioned pedicle should be reached maximally in the orthograde lateral beam path. At the upper levels, there are limits to the laterality of the access due to the organs of the thorax and abdomen. The increase in size of the foramen in a cranial direction and the possibility of bone resection achieves a larger radius of action so that the access can be selected less laterally. There are no restrictions for intraforaminal and extraforaminal decompression. Selection of a lateral access is also attempted here in order to be able to pass under the exiting spinal nerves atraumatically. The surgical access method for intraforaminal or extraforaminal spinal disk herniations and in foraminal stenoses may vary from the conventional approach in order to avoid damaging the dislocated nerves or exiting nerves which cannot be localized with certainty. This relates to the extraforaminal access.

In the case of the intradiskal approach, e.g. in the case of fusions or infections, the posteriolateral access is frequently necessary. The access always depends on the target point and takes into account individual pathology and anatomy. Outside the indication criteria, there are well-defined limits to the transforaminal procedure.

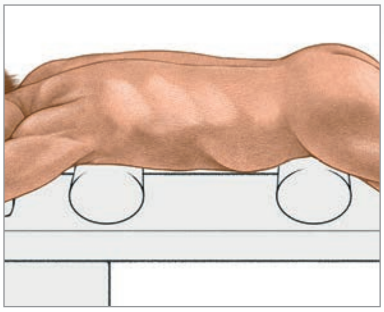
* see literature

VERTEBRIS lumbar

The full-endoscopic **transforaminal and extraforaminal** technique

Positioning

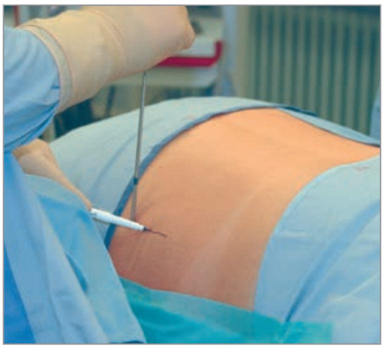
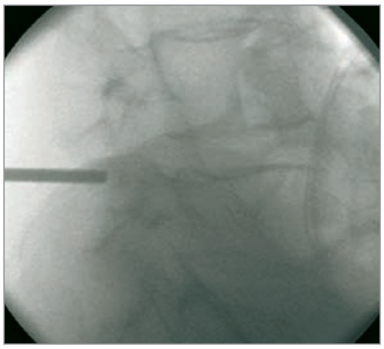
The patient is in the prone position lying on a hip and thorax roll on an X-ray permeable table. Application of a C-arc is required during the operation.

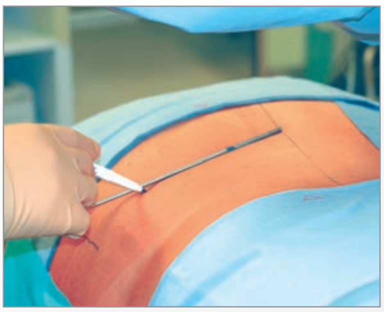
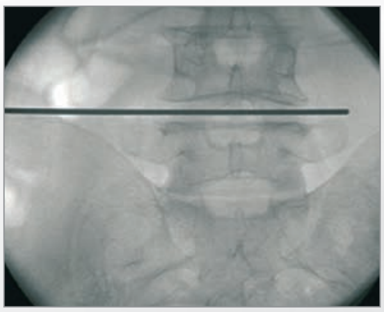
Prone position with pelvic and thorax rolls

Determination of the lateral access

The access is determined under image intensifier control on the basis of anatomical landmarks in the orthograde lateral and posterior-anterior beam path and taking account of the pathology. Depending on the level, injury to the abdominal organs must be excluded.

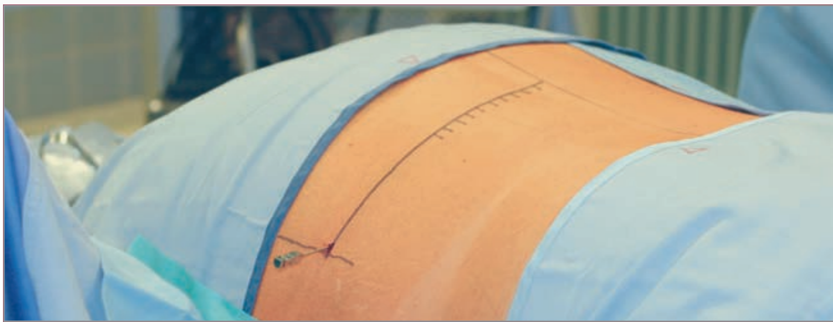
Determination of the maximum anteriority on the basis of individual anatomical landmarks and drawing the entry line in the skin

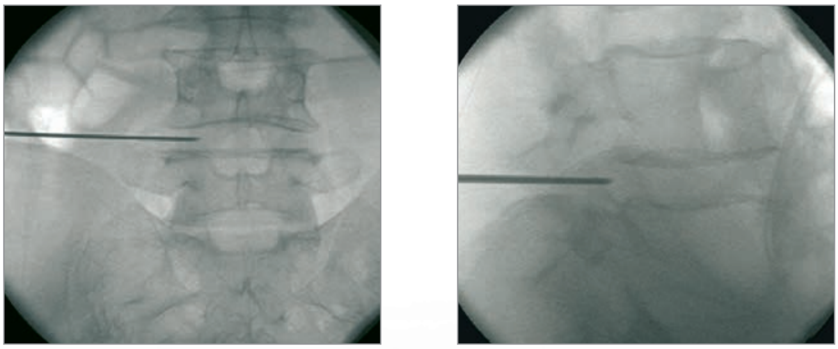
Establishment of the spinal disk level in the orthograde posterior-anterior beam path and definition of the entry point

Implementation of the lateral access

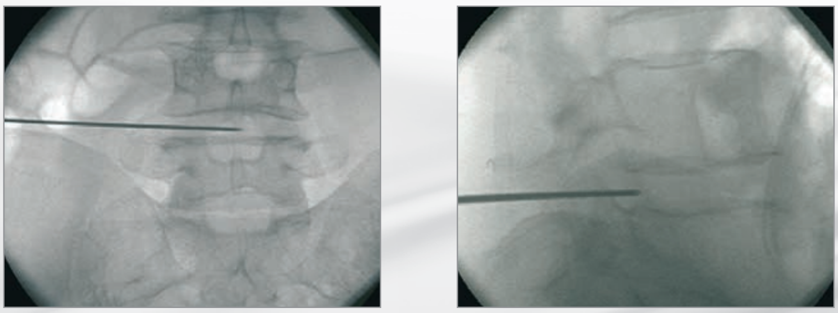
After determining the entry point in the skin and carrying out a stab incision, a spinal cannula is inserted under lateral image intensifier control and with conservation of the neural structures. The positioning in relation to the spinal canal is carried out individually in relation to the spinal canal. The guide wire is then inserted and the spinal cannula is removed.

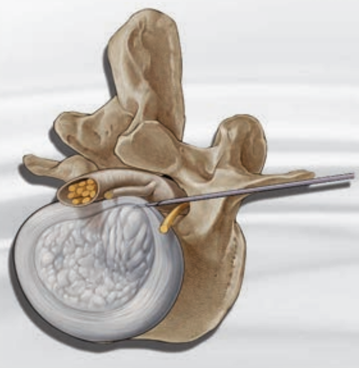


Inserted spinal cannula



At the start of the spinal canal, the spinal cannula contacts the posterior annulus in the medial pedicle line



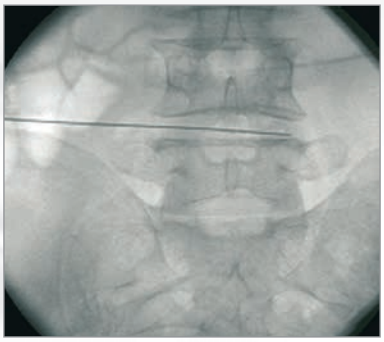


The spinal cannula is pushed in the posterior annulus in the direction of the spinal canal

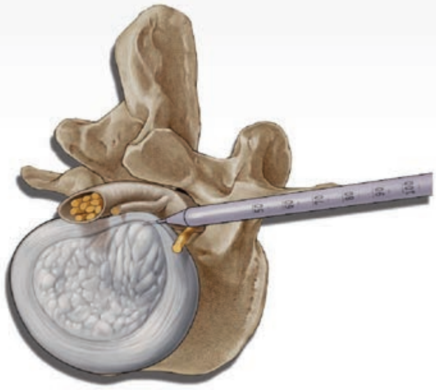
VERTEBRIS *lumbar*

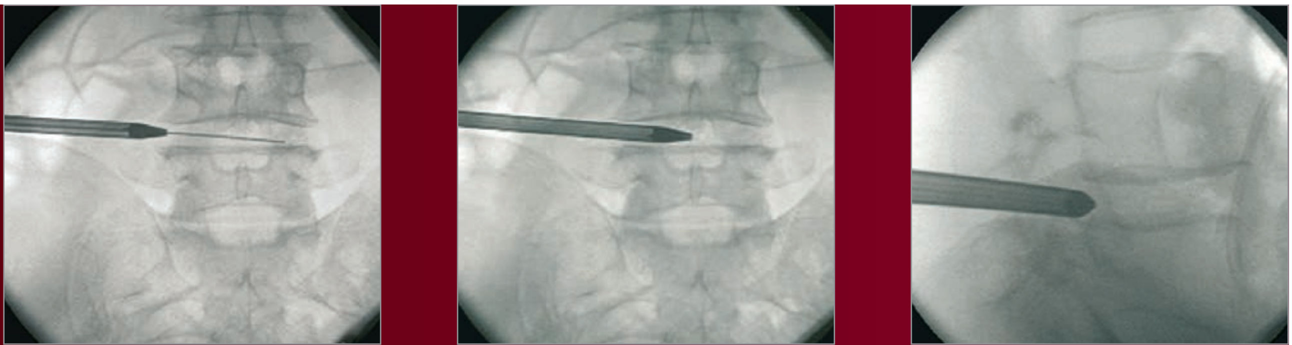
The full-endoscopic **transforaminal and extraforaminal** technique

The dilator is initially inserted along the guide wire by means of rotating movements initially as far as the foramen and after removal of the guide wire it is inserted in the spinal canal depending on the pathology. The beveled working sleeve is then pushed along the dilator and the dilator is removed. All the work stages must be carried with protection of the neural structures.

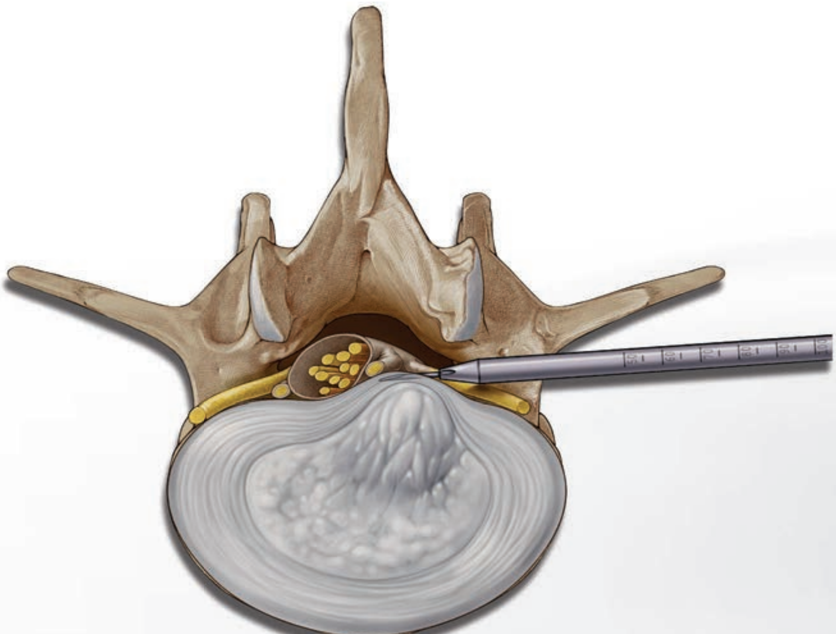


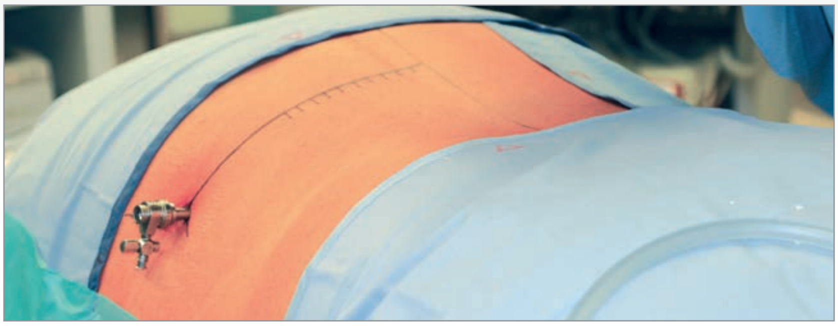
The guide wire is positioned and the spinal cannula is removed

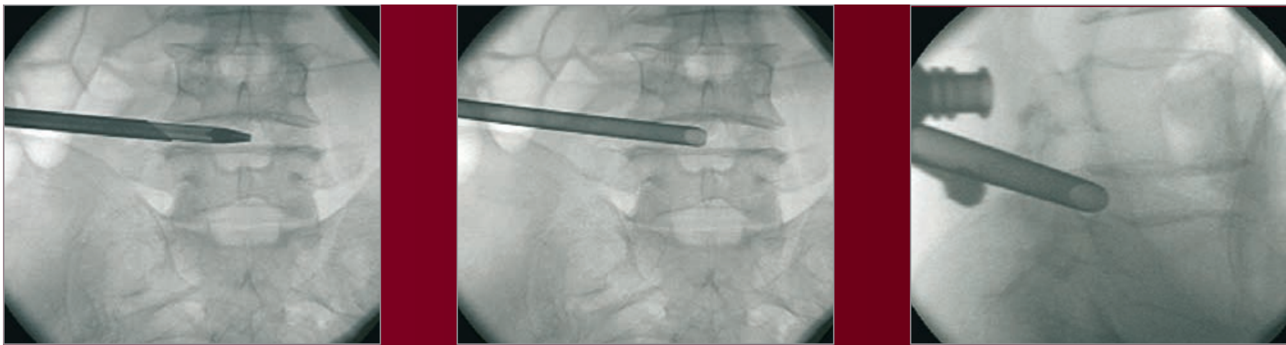




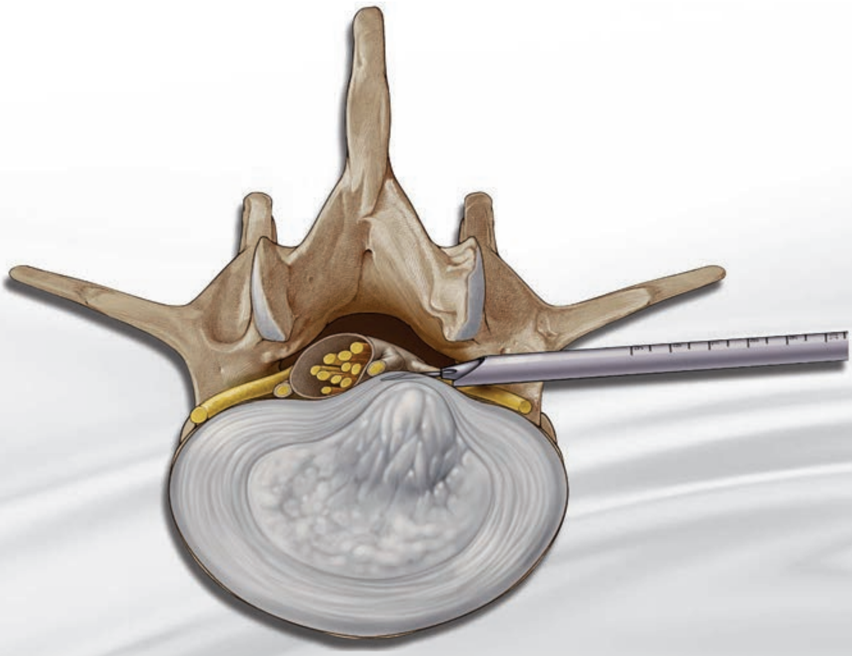
The dilator is inserted along the guide wire and in the final position is located in the spinal canal or posterior annulus defect







The working sleeve is positioned along the dilator and the dilator is removed; the beveled opening is located within the spinal canal posterior to the annulus



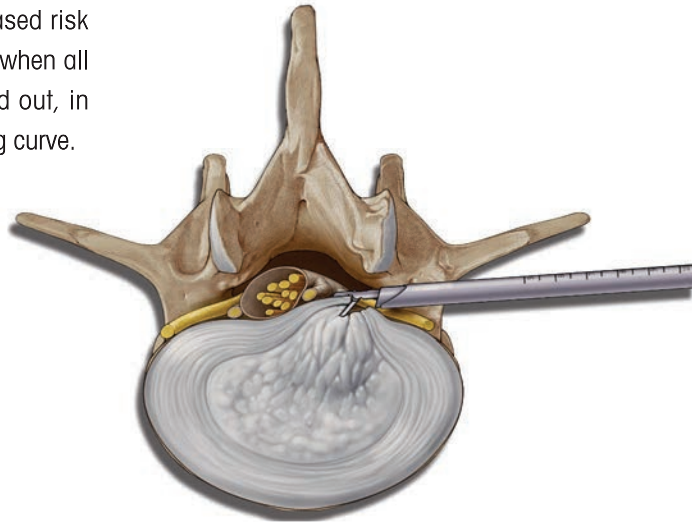
VERTEBRIS lumbar

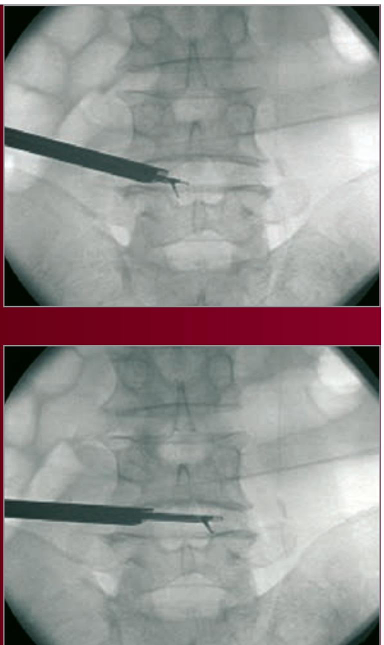
The full-endoscopic **transforaminal and extraforaminal** technique

Operating procedure

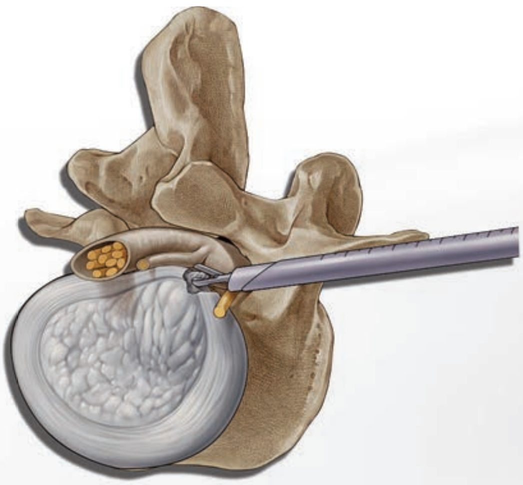
The endoscope is inserted through the working sleeve. The operation is carried out in vision using different instrument sets positioned through the intraendoscopic working channel and with a continuous flow of liquid.

The locking caps for the 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. 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.



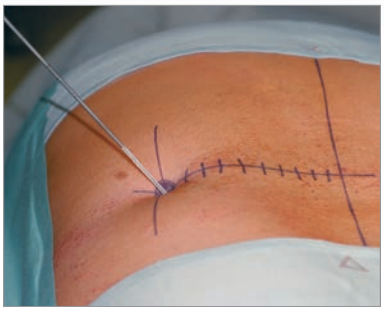


The lateral access permits working the spinal canal in vision

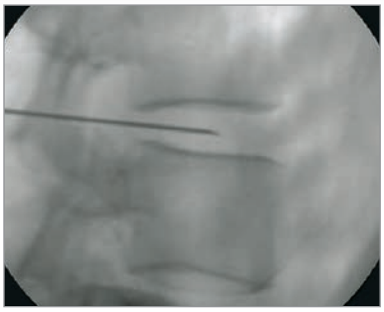


Implementation of the posterolateral access

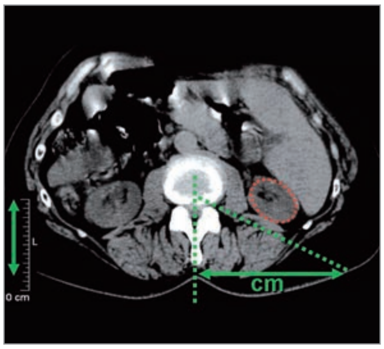
In intradiskal operations, prevention of a lateral access through the pelvic or for avoidance of injuries to the abdominal or thoracic organs at the cranial levels, a more posterior to posterolateral access may be necessary. The entry point in the skin is determined by the pathology and anatomy, and can be measured in centimeters from the midline. Alternatively it is localized by adequate positioning of the inserted spinal cannulas. The subsequent stages with insertion of the guide wire, the dilator the operating sleeve and then the telescope are not different from the procedure already described.



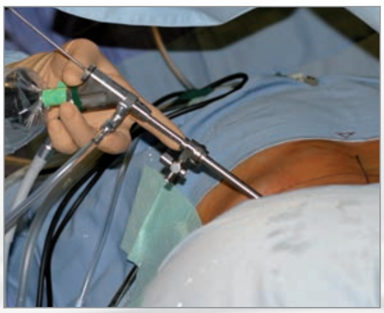
Measurement of the entry point in centimeters laterally from the midline



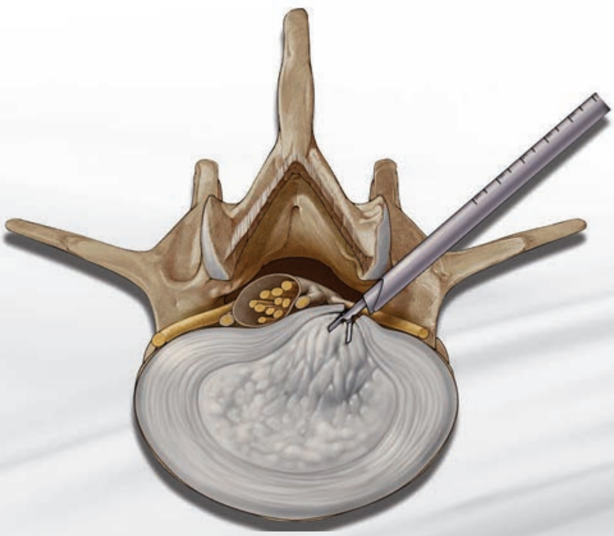
The inserted spinal cannulas in the desired target point can determined the localization of the stab incision



The maximum laterality of the access can be measured on the basis of a preoperative CT scan in order to avoid injury to organs



Operation with posterolateral transforaminal access

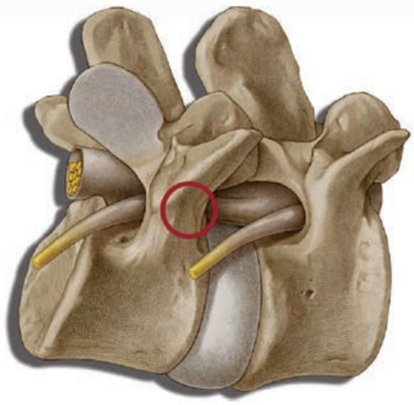


VERTEBRIS *lumbar*

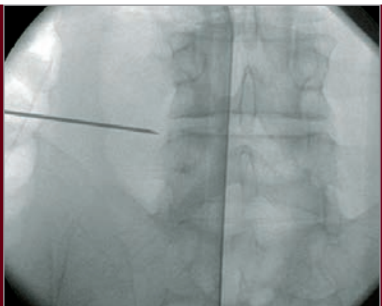
The full-endoscopic **transforaminal and extraforaminal** technique

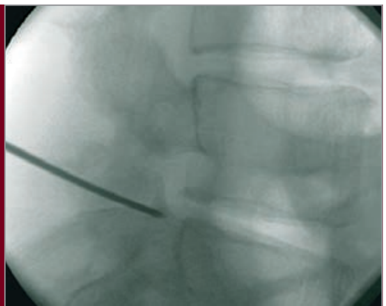
Implementation of the extraforaminal access

In the case of intraforaminal and extraforaminal spinal disk herniations and foraminal stenoses, there may be an increased risk of injury to the exiting nerves during the passage through the foramen with the access instrument set. The extraforaminal access may be necessary here. The entry point into the skin is possible from posterolateral to lateral. The spinal cannula is not guided through the foramen into the spinal canal but on the caudal pedicle of the level to be operated. This is the safest zone in relation to the exiting nerves and an access-related risk is avoided. The guide wire, dilator and operating sleeve are then also inserted on to the pedicle up to the bony contact. The anatomical structures of the caudal foramen and the exiting nerve can then be dissected in vision and the surgical intervention can be carried out with conservation of the nerves.

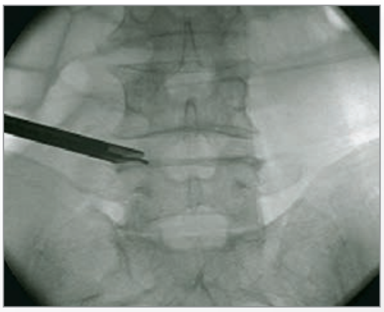


The caudal pedicle is a safe zone in relation to the exiting nerve





Insertion of the spinal cannula on to the caudal pedicle

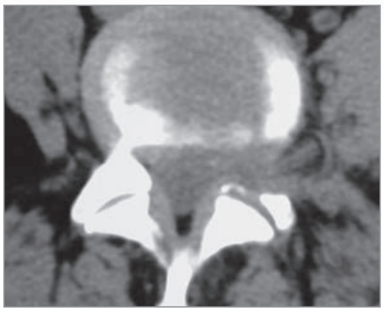


Dissection of the anatomical structures of the caudal foramen and the exiting spinal nerve

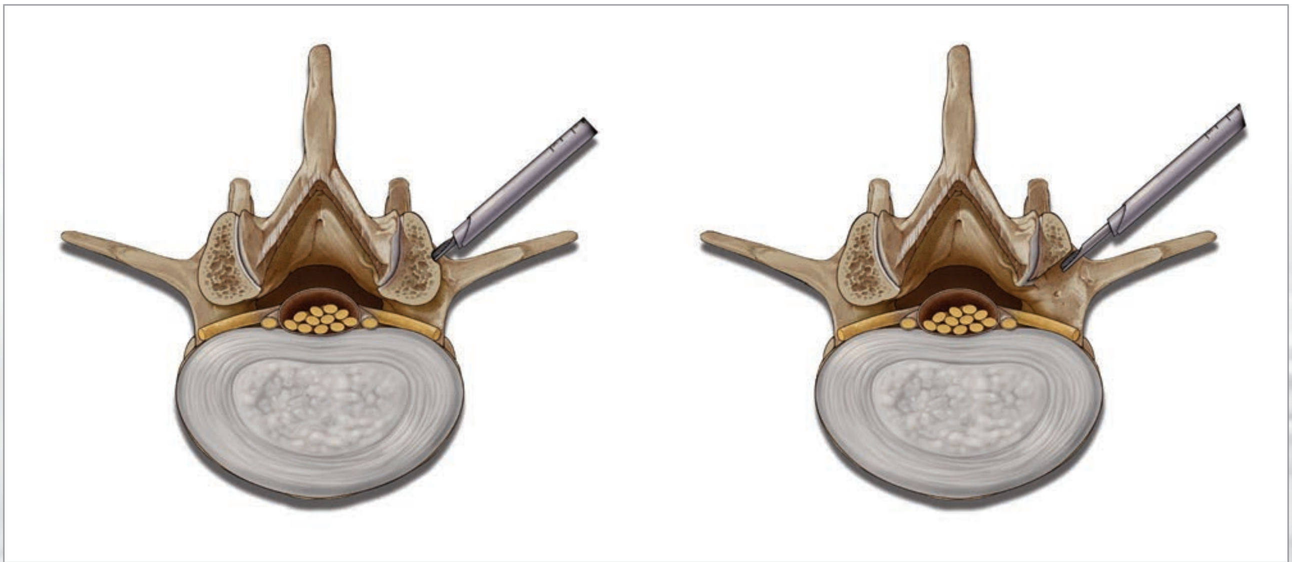
Implementation of bony resection

Bone resection may be necessary in order to expand mobility within the spinal canal or if there are problems during access. This may be the case e.g. in degenerative and position-related foramen stenosis or during an operation on recess stenosis. The entry point into the skin is possible from posterolateral to lateral. After the transforaminal or extraforaminal access has been implemented, the bony structures have to be dissected for this. This generally involves resection of the anterior structures of the ascending facets. If a resection of the structures of the caudal pedicle is carried out, it is important to take account of the fact that this is a support structure. Extensive resections can lead to bio-mechanical weaknesses and to pedicle breaks.

A range of burrs or bone punches is available for bone resection



An opening of the joint cannot always be avoided in order to reach medial edge of the ascending facet



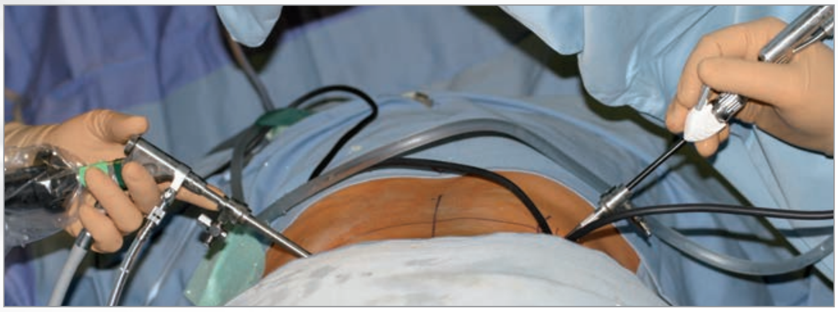
Bone resection generally relates to the anterior structures of the ascending facets

VERTEBRIS *lumbar*

The full-endoscopic **transforaminal and extraforaminal** technique

Biportal access

A biportal approach may be necessary with special indications, e.g. spondylodiskitis, introduction of implants or when working with special instruments. Normally, the access is normally carried out postero-laterally with the usual method. The telescope can be uses on one side or alternately.



Biportal transforaminal access

VERTEBRIS lumbar

The full-endoscopic **interlaminar** technique

Direct access to the epidural space with continuous visualization is hence necessary for adequate operations within the spinal canal. A lateral access is necessary for this when using the full-endoscopic transforaminal technique. The bony and neural boundaries of the neuro-foramen define limits for mobility and hence also in relation to the indication criteria. Furthermore, the necessary lateral access in the lower levels may be prevented by the pelvis. On the basis of our experience, these restrictions encompass a spectrum of pathologies which are not operable using the full-endoscopic transforaminal approach due to technical limitations.

Making use of anatomically preformed access areas is effective for reducing surgically related traumatization to the structures of the spinal canal. Alongside the inter-vertebral foramen, the sacral hiatus and the interlaminar window are located here. Resection of large pathologies is not possible in technical terms using epiduroscopy through the sacral hiatus. The surgical access through the interlaminar window is therefore used. This has been familiar in lumbar spine surgery for the longest and is frequently used. It has been described since the beginning of the 1920s. Alternative methods were subsequently developed, such as the posterolateral approach for taking biopsies from vertebras at the end of the 1940s or intra-diskal decompression using chemonucleolysis in the early 1970s. Endoscopic inspections of the intervertebral space after open decompression were described during the early 1980s. The implementation of full-endoscopic operations concentrated on the transforaminal technique with postero-lateral access.

Since the end of the 1970s, the microsurgical procedure using the microscope has also been developed and today this has achieved the status of "Gold Standard" for inter-laminar decompression in the area of the spinal canal. Details of an endoscopically assisted technique known as a microendoscopic operation were published in the late 1990s. This relates to visualization of the opened operation site using an endoscope and a monitor.

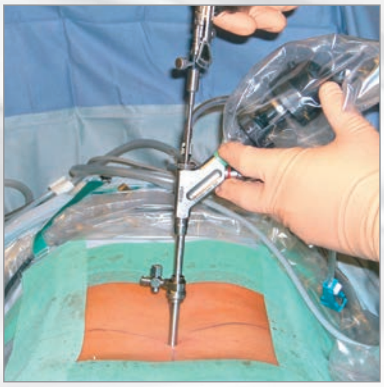
Opening the spinal canal is necessary in the conventional method for reaching the epidural space. This generally involves incision of the ligamentum flavum and resection of bone. Adequate access must be created which ensures vision into the spinal canal and permits working with instruments. Problems may arise as a result of trauma-tization of the access passage, as a result of resection of stabilizing structures and in particular in relation to potential revisions resulting from scar formation. The microscope principally reduces the size of the access passage and creates very good light and envisioning conditions. Resection of structures of the spinal canal can generally not be avoided. Access using the microendoscopic method may be structured to be more gentle on tissue than the microscopic procedure. The advantage is in the smaller distance between the working area and the visualizing system. Visibility conditions and illumination are generally poor. This is not an endoscopic procedure in the true sense. Today, the microendoscopic access method and the microendoscopic operating procedure are partly combined. Overall, a larger access generally has to be selected with all procedures than would actually be necessary for actually working in the spinal canal.

In order to make use of the known advantages from the transforaminal operation and arthroscopy, the new full-endoscopic interlaminar access was developed over recent years.*

* see literature

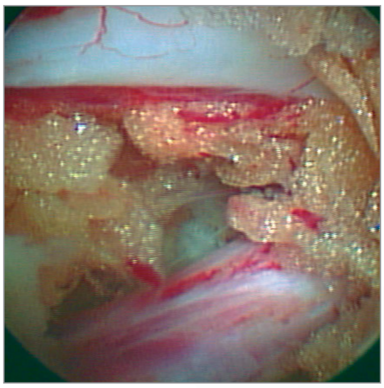
VERTEBRIS *lumbar*

The full-endoscopic **interlaminar** technique



Full-endoscopic interlaminar access

Handling the telescope using the joystick principle permits mobility



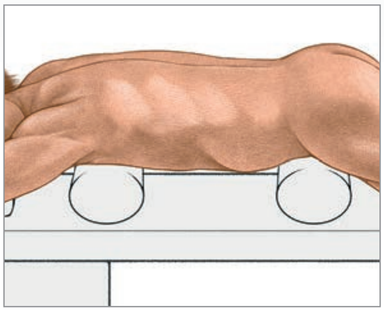
The interlaminar access guarantees outstanding visibility for the structures of the spinal canal

The light and imaging system with 25° direction of view is located directly in the relevant working area so that traumatization ca be minimized in the access passage and also in connection with the structures of the spinal canal. Working in a continuous flow of liquid provides excellent visibility conditions. Mobility for the new endoscope is achieved by handling with joystick technology. Protection of the neural structures is provided by manipulating the beveled operating sleeve like a nerve hook. In combination with the newly developed instrument sets, this represents a genuine minimally invasive procedure.

Indications primarily relate to pathologies within the spinal column. It is important note that the size of the interlaminar window can prevent free passage of the endoscope. In this case, the bone can be cut until the target point is reached without opening the ligamentum flavum or damaging the zygoapophyseal joints. In most cases, bony resection should be avoided, although the pathology precludes this in the case of spinal canal stenoses. The incision in the ligamentum flavum can be reduced to a few millimeters because the elasticity of the intervertebral disc facilitates entry into the spinal canal. On the other hand, mobility to the other side is equivalent to conventional operations. In a craniocaudal direction, access along adjacent levels can be considered in order to minimize the resection of structures of the spinal canal. The full endoscopic interlaminar technique permits selective operation of pathologies within the spinal canal with minimized access-related traumatization. The transforaminal access is generally the most appropriate for intradiskal, intraforaminal or extraforaminal working. The transforaminal procedure has more restrictions compared with the interlaminar approach, although it provides the best tissue conservation. The anatomical and pathological conditions mean that the percentage of transforaminal to interlaminar procedures is approximately 40 to 60 in practice.

Positioning

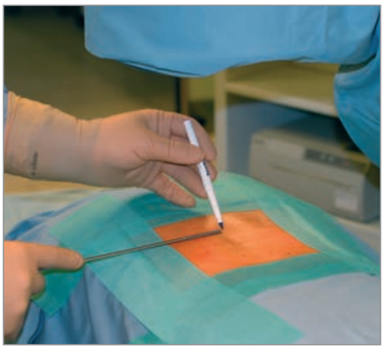
The patient is in the prone position lying on a pelvic and thorax roll on an X-ray permeable table.
Application of a C-arc is required during the operation.



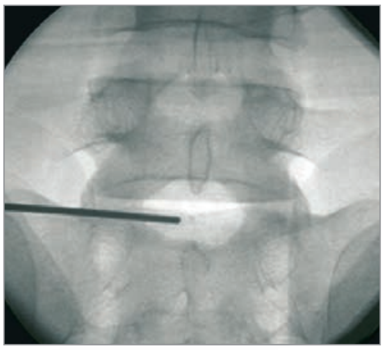
Prone position with pelvic and thorax rolls

Determination of the access

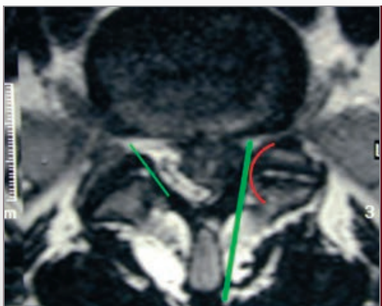
The access is determined under image intensifier control on the basis of the anatomical landmarks in the Using image intensifier control postero-anterior beam path and taking account of the pathology. It must be positioned maximally medially in the interlaminar window in order to permit entry under the obliquely positioned zygoapophyseal joints laterally.



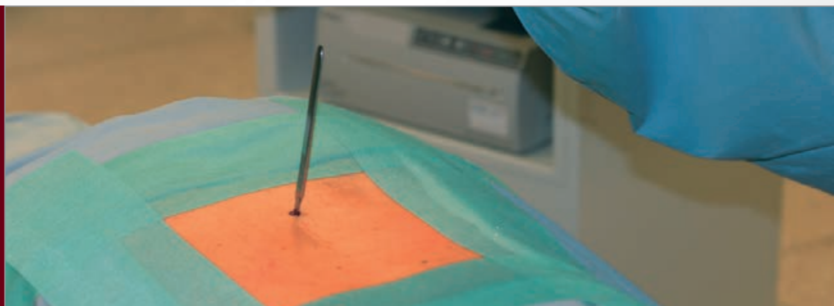
Marking the entry point on the skin



Entry point should be in a maximally medial position



Entry under the zygoapophyseal joints should be facilitated



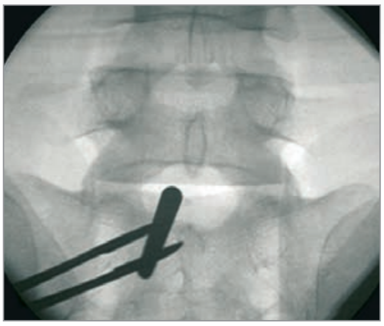
Stab incision

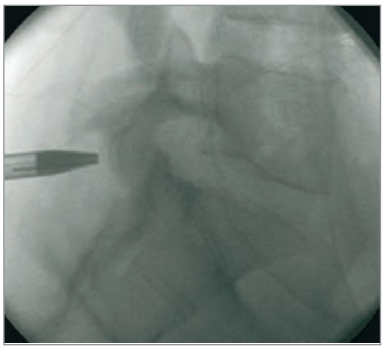
VERTEBRIS lumbar

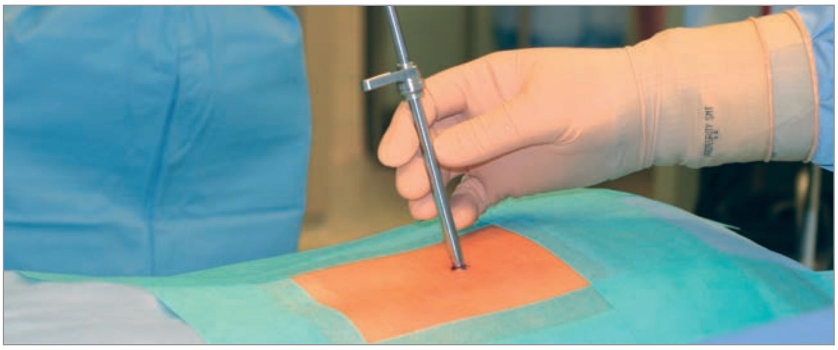
The full-endoscopic **interlaminar** technique

Implementation of the access

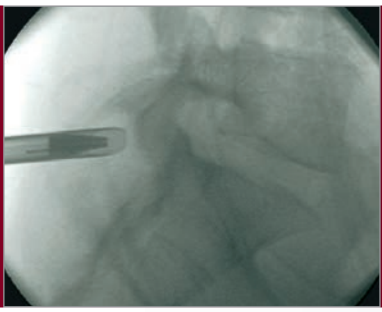
After determining the entry point in the skin and carrying out the stab incision, the dilator is inserted under posterior-anterior image intensifier control until the ligamentum flavum. The subsequent procedure is then performed in the lateral beam path. The working sleeve with oblique opening is pushed through the dilator toward the ligament and the dilator is removed.

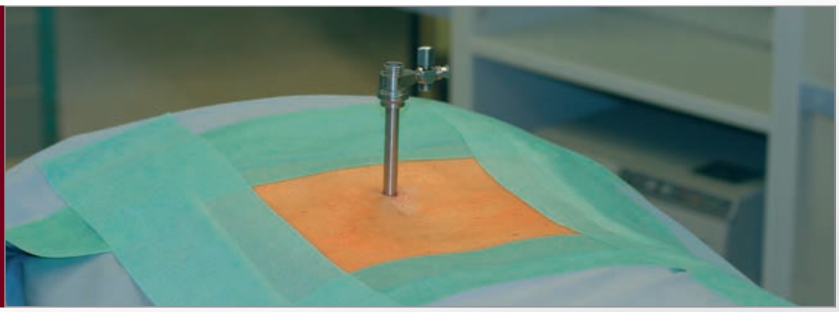






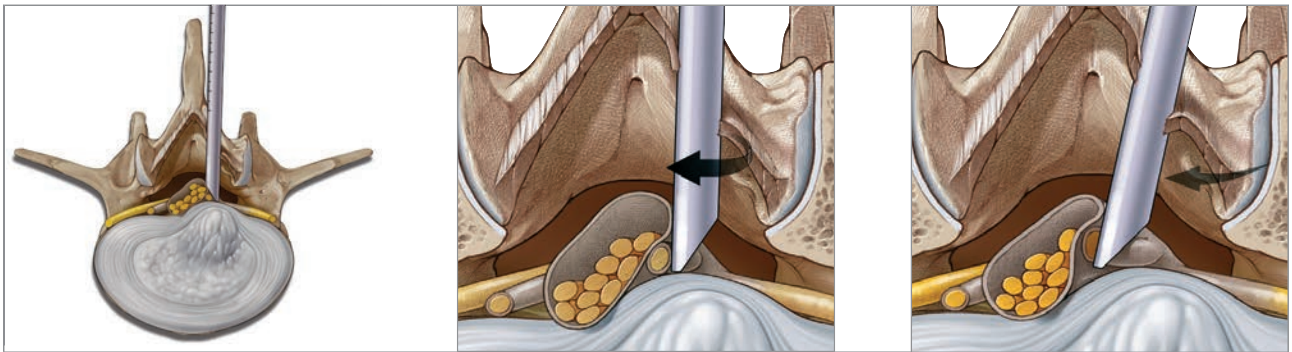
Insertion of the dilator and then the sleeve under image intensifier control to the ligamentum flavum





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.After opening the ligamentum flavum, it is possible to enter the spinal canal. Mobility for the telescope is achieved by handling using the joystick principle. Protection of the neural structures is provided by the beveled working sleeve serving as a second instrument and through rotation.

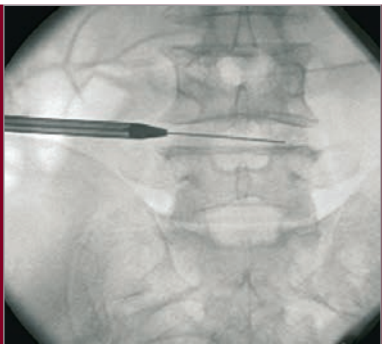


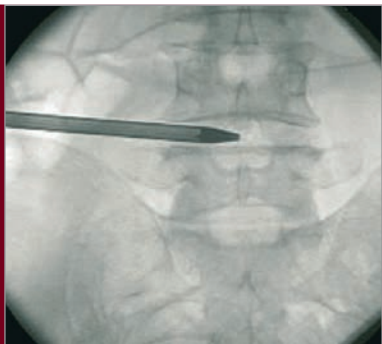
The beveled working sleeve can be used as a second instrument by rotation

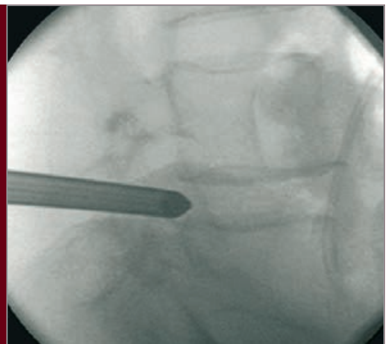
VERTEBRIS lumbar

The full-endoscopic **interlaminar** technique

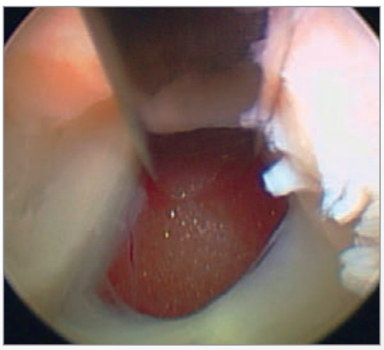
The locking caps for the telescope and working sleeve should only be used briefly if bleeding obscures visibility since when operations last a long time and the drainage of fluid is prevented without being noticed, the consequences of volume overload and elevated pressure within the spinal canal and the associated and neighboring structures cannot theoretically be completely excluded. An extended and uninterrupted excessive retraction of the neural structures with the working sleeve in a medial direction must be avoided particularly in cranial areas, or only carried out intermittently, in order to avoid the risk of neurological damage. Experience indicates that generally speaking there is an increased risk of complications occurring when all new procedures are carried out, in particularly during the learning curve.



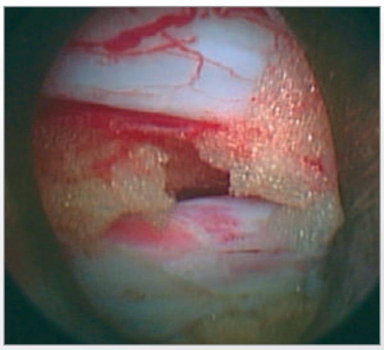




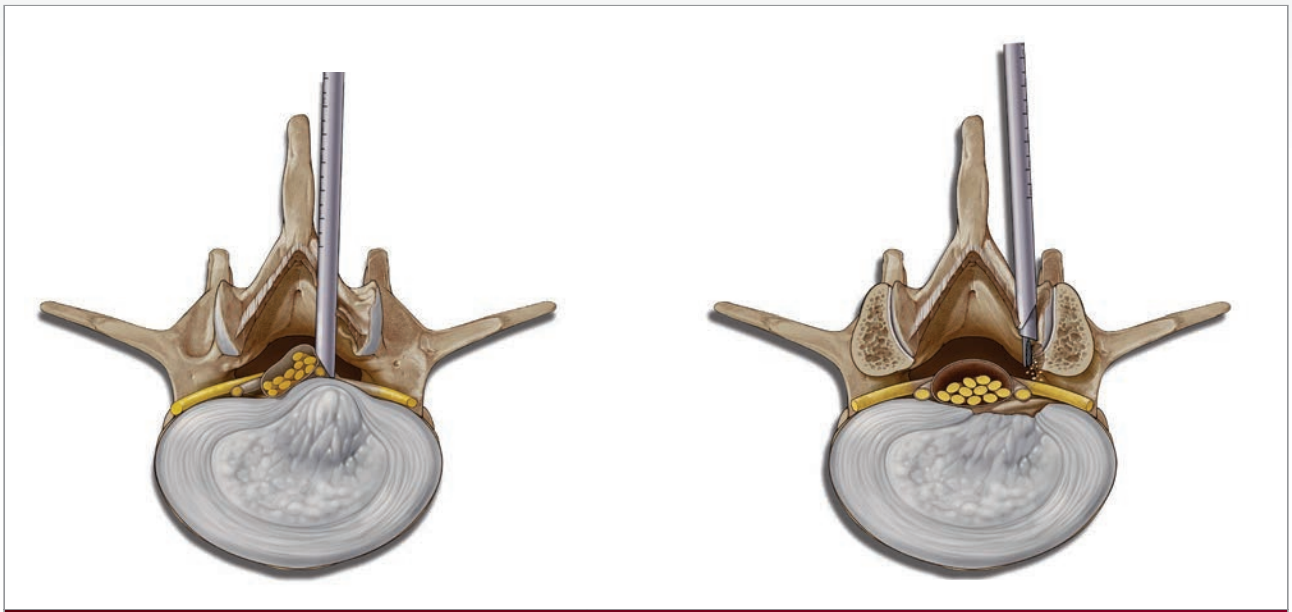
Mobility is achieved by handling with the joystick principle.



Opening of the ligamentum flavum



View of the axilla at L5/S1



A necessary bone resection is possible with the instruments and burrs available

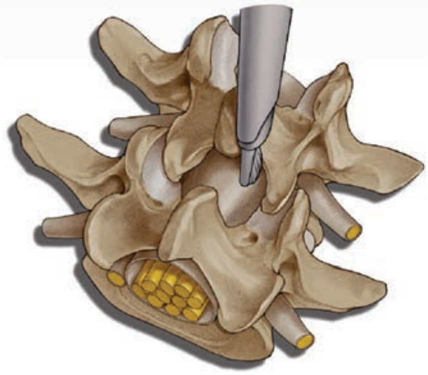
The interlaminar access permits working in the spinal canal in vision

VERTEBRIS lumbar

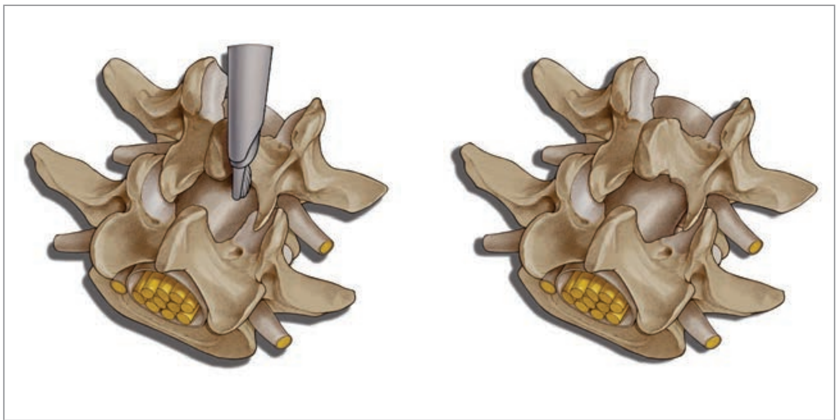
The full-endoscopic **interlaminar** technique

Implementation of bony resection

Bone resection may be necessary in order to expand mobility within the spinal canal or if there are problems during access. The may be the case e.g. in sequestered spinal disk herniations, small interlaminar windows or during an operation on recess stenosis. After the access has been implemented , the bony structures are dissected. It may be helpful to start decompression at the caudal end of the descending facets. Medial structures of the descending and ascending facets or the caudal and cranial laminas may be resected depending on the pathology.

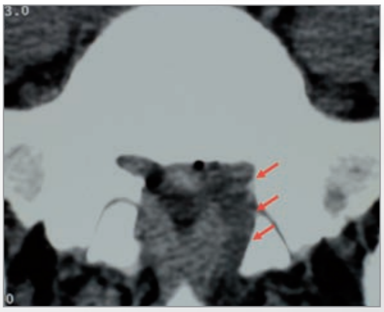


It may be helpful to start decompression at the caudal end of the descending facets



The extent of bony resection depends on the pathology

A range of burrs and bone punches is available for bone resection which can be inserted through the intraendoscopic working channel



Lateral bone resection is carried out on the floor of the spinal canal directly in the working area

VERTEBRIS thoracic

Foreword

The transforaminal and interlaminar approaches are possible in the area of the cervical spine depending on pathology and anatomy. The main indication is provided by thoracic disk herniations without significant compression of the spinal cord, which continue to give symptoms in spite of conservative therapy. Generally speaking, only pathologies positioned laterally are feasible for a surgical intervention in technical terms because manipulations of the spinal cord need to be avoided due to the risk of lesions and a lateral transforaminal access is prevented by the thoracic organs. At the planning stage of a transforaminal access, a preoperative CT scan should always be carried out in order to determine the safe entry point in the skin and the possibility of free access to the intervertebral disk. Resection of bone is generally necessary the interlaminar access because the size of the interlaminar window is generally not adequate, particularly laterally to the spinal cord. Technical implementation of both ports is equivalent to the lumbar procedure, and is possible from the cervical-thoracic to the thoracic-lumbar junction. Contrary to the lumbar spine, in the case of the thoracic spine there is a higher overall risk of injury to neural and surrounding structures and, on account of these constraints, in the implementation of the ports and during the surgical procedure. In limiting cases relating to anatomy, pathology and symptoms, surgical intervention with the conventional procedure may be the only suitable option.

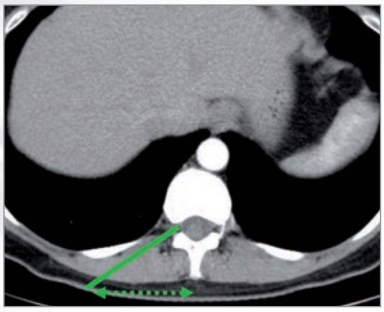
Thoracic disk herniation

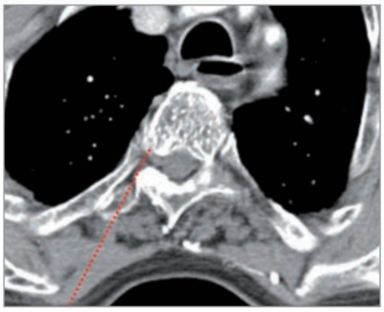
VERTEBRIS thoracic

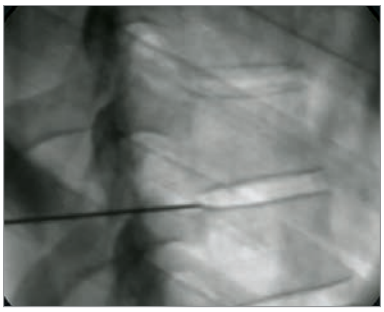
The full-endoscopic transforaminal technique

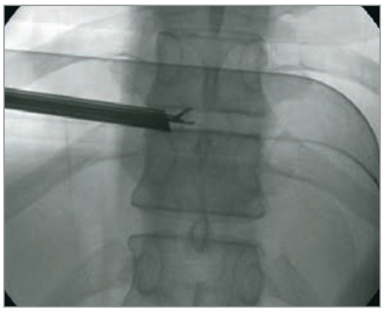
The access should be determined on the basis of a CT scan. The structures being conserved are laterally the lungs, medially the spinal cord and anteriorly the vessels. Access may be prevented by anatomical or degenerative bony structures, e.g. ribs, transverse processes or osteophytes. Overall, a significantly posterior access is necessary.

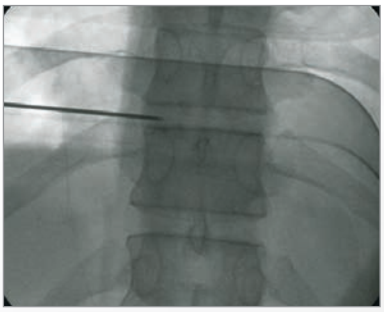
In order to avoid injuries, the spinal cannulas should be inserted in the postero-anterior beam path in parallel to the intervertebral space, oriented strictly caudally in the foramen, and should be located precisely between the medial and lateral pedicle line in the foramen when in contact with the intervertebral disk. For enhanced safety, the spinal cannula can initially be brought on to the bony structures of the spinal joint in order to then be oriented along the bone anteriorly. After the dilator, the operating sleeve and the telescope have been inserted, particular attention should be paid to the medially positioned spinal cord while the operation is being carried out.

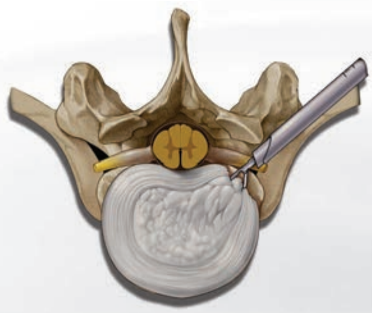






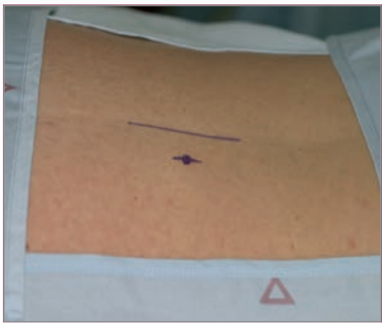


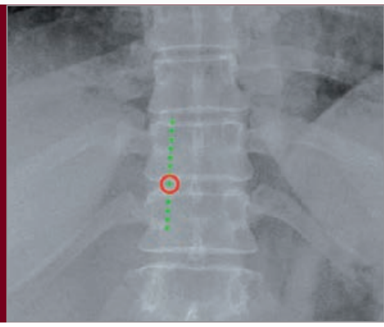


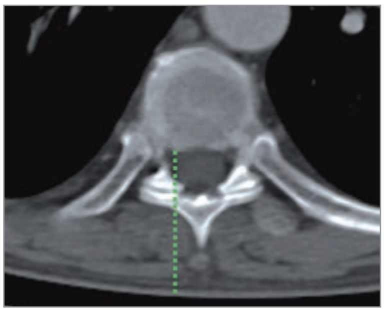


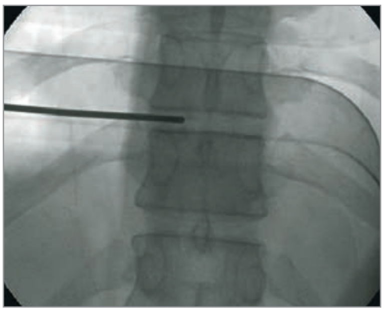
The full-endoscopic interlaminar technique

The entry point in the skin is located in a similar position to cervical foraminotomy over the spinal joint or the spinal disk at the medial pedicle line. Here it is possible to reach the spinal cord without manipulation.

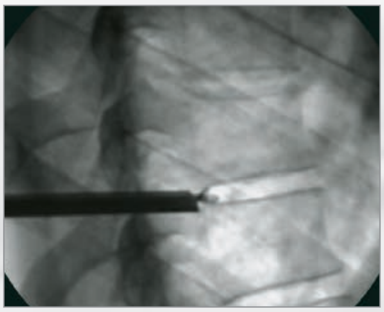


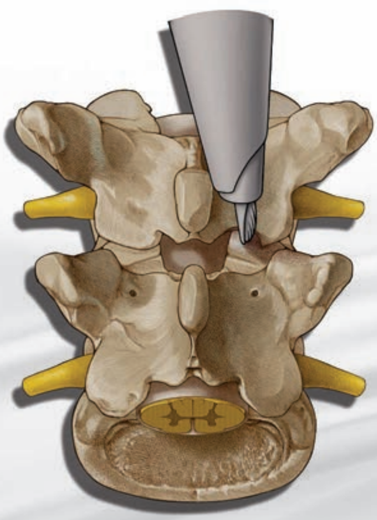






After inserting the dilator, operating sleeve and telescope, the size of the interlaminar window is generally no longer adequate to enter the spinal canal without bone resection. Limited abrading is carried out here of the medial structures of the joint facets is carried out and as necessary also of the cranial and caudal laminas. The lateral spinal canal must be reachable medially up to the intervertebral disk without manipulation of the spinal cord. There is no restriction to expansion cranio-caudally.





VERTEBRIS lumbar - thoracic

Overview

Transforaminal / extraforaminal technique

Access lateral / posterolateral

Indication criteria:

- Pathologies at level segment L4 / L5 and higher with localization intraspinal / intraforaminal / extra-foraminal and intradiskal, at level L5 / S1extraforaminal

Technical specification:

- Access sheath OD 8.0 mm, working length 185 mm
- Working channel for instruments with outer diameter max. 4.0 mm
- Instruments with working length 360 mm

VERTEBRIS lumbar
Transforaminal / extraforaminal 8.0 mm
Basic Instrument Set .... Page 30

Indication criteria:

- Pathologies at level segment L4 / L5 and higher with localization intraspinal / intraforaminal / extraforaminal and intradiskal, at level L5 / S1 extraforaminal
- Specially developed **for tight anatomical conditions**

Technical specification:

- Access sheath OD 7.0 mm, working length 185 mm
- Working channel for instruments with outer diameter max. 3.0 mm
- Instruments with working length 360 mm

VERTEBRIS lumbar
transforaminal / extraforaminal 7.0 mm
Basic Instrument Set .... Page 33

Interlaminar technique

Access posterior

Indication criteria:

- Pathologies at level segment L1 - S1, L4 / L5

Technical specification:

- Access sheath OD 8.0 mm, working length 120 mm
- Working channel for instruments with outer diameter max. 4.0 mm
- Instruments with working length 290 mm
- Maximum mobility

VERTEBRIS lumbar
interlaminar
Basic Instrument Set .... Page 36

Transforaminal / extraforaminal and interlaminar technique

Access lateral / posterolateral / posterior

Technical specification:

- Two endoscopic systems combined with a universal instrument set for optimum treatments of pathologies inside and outside the spinal canal
- Working channel for instruments with outer diameter max. 4.0 mm
- Instruments with working length 360 mm

VERTEBRIS lumbar
universal
Basic Instrument Set .... Page 39

VERTEBRIS lumbar - thoracic

Instrument Set for full-endoscopic **transforaminal and extraforaminal** technique

VERTEBRIS lumbar transforaminal / extraforaminal 8 mm Basic Instrument Set 892101100

comprising:

Endoscope and accessories	
	**PANOVIEW PLUS Discoscope,** 25°, WL 207 mm, ID 4.1 mm working channel, for use with instruments WL 360 mm 89210.1254
	**Round adapter** 8791.751
	**Membrane attachment** 8792.451
	**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 for discoscopes with 4.1 mm working channel	
	**Dilator,** two-channel, for working sleeve 89220.1078 .... 89220.1508
	**Working sleeve,** with 30° oblique window, passage 7.0 mm, WL 185 mm 89220.1078
	**Irrigation attachment,** with quick-disconnect coupling, for working sleeve 89220.1078 .... 89220.1308
	**Extension sleeve,** OD 8.0 mm, WL 155 mm 89220.1408
	**X-Tractor,** for extraction of cylindrical access instruments (working sleeves) 89230.0000
	**Hammer** 8866.956

VERTEBRIS lumbar transforaminal / extraforaminal 8 mm Basic Instrument Set

Working instruments	
	Auxiliary instruments atraumatic
	**Dissector,** OD 2.5 mm, WL 350 mm 8792.591
	**Exploring probe,** comprising: Probe inner jaw (892506625), handle (892500600), Guide tube (15570644) with flexible tip, OD 2.5 mm, WL 290 mm 892506925
	Auxiliary instruments Sharply abrading
	**Reamer,** OD 4.0 mm, WL 350 mm 89260.1114
	**Rongeurs, grasping forceps and punches** Color coding for simple identification of the instrument diameter
	**Micro-rongeur,** with extended jaw, ● OD 2.5 mm, WL 360 mm 89240.1125
	**Micro-rongeur,** curved upward, ● OD 2.5 mm, WL 360 mm (fits in 4 mm-working channel) 89240.1044
	**Micro-rongeur,** articulated, ● OD 4.0 mm, WL 360 mm 89240.1624
	**Nucleus grasping forceps,** serrated, ● OD 3.0 mm, WL 360 mm .... 89230.1003 ● OD 4.0 mm, WL 360 mm 89230.1004
	**Micro-punch,** ● OD 2.5 mm, WL 360 mm 8792.671
	**Micro-punch,** curved upward, ● OD 2.5 mm, WL 360 mm (fits in 4 mm-working channel) 89240.1034
	**Tube sheath punches**
	**Tube sheath punch,** ● OD 4.0 mm, WL 360 mm 89240.1904

VERTEBRIS lumbar - thoracic

Instrument Set for full-endoscopic **transforaminal and extraforaminal** technique

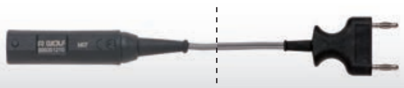
VERTEBRIS lumbar transforaminal / extraforaminal 8 mm Basic Instrument Set

TipControl RF accessories, bipolar

TipControl RF Instrument

TipControl RF Instrument Set long, WL 400 mm*
comprising:
Bipolar handle (899351100), sheath tube long, OD 2.5 mm (899352010) 899352000

TipControl connection cable for connection with RF devices



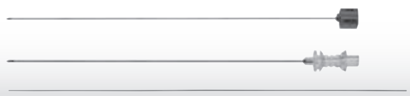
TipControl connection cable, bipolar,**
connector for EU flat plug,
2-PIN International power plug, cable length 3 m 899351210

* for use with TipControl RF electrode, long, sterile (499352000) see below / Page 45 (not included in the set 899352000)
** Radioblator RF 4 MHz radiofrequency surgical system for full-endoscopic spine surgery see Page 45.

Accessories for VERTEBRIS lumbar transforaminal/extraforaminal 8 mm Basic Instrument Set

Instrument Set for single use

Access instruments for single use



Spinal Cannula Set,
OD 1.5 mm, WL 250 mm, pack of 10, sterile 492201215

Accessory for TipControl RF instrument for single use

TipControl RF electrode, long,
sterile, pack of 5 499352000

Instrument sieve

Instrument sieve VERTEBRIS lumbar***,
for sterilization
comprising:
Sieve basket bottom section, sieve basket lid, 2x locking section, instrument carrier top incl. set of silicone holders, instrument carrier bottom, incl. set of silicone holders
L x W x H: 530 mm x 250 mm x 150 mm 85841217

*** Supply without Instrument Set.

VERTEBRIS *lumbar* transforaminal / extraforaminal 7 mm Basic Instrument Set 892101200

comprising:

Endoscope and accessories

	**PANOVIEW PLUS Discoscope,** 25°, WL 207 mm, ID 3.1 mm working channel, for use with instruments WL 360 mm 89210.1253
	**Round adapter** 8791.751
	**Membrane attachment** 8792.451
	**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 for discoscopes with 3.1 mm working channel

	**Dilator,** two-channel, for working sleeve 89220.1047 .... 8792.764
	**Working sleeve,** with 30° oblique window, WL 185 mm 89220.1047
	**Irrigation attachment,** for working sleeve 89220.1047 .... 89220.1307
	**Extension sleeve,** OD 7 mm, WL 155 mm 89220.1407
	**X-Tractor,** for extraction of cylindrical access instruments (working sleeves) 89230.0000
	**Hammer** 8866.956

VERTEBRIS lumbar - thoracic

Instrument Set for full-endoscopic **transforaminal and extraforaminal** technique

VERTEBRIS lumbar transforaminal / extraforaminal 7 mm Basic Instrument Set

Working instruments	
	Auxiliary instruments atraumatic
	**Dissector,** OD 2.5 mm, WL 350 mm 8792.591
	**Exploring probe,** comprising: Probe jaw insert (892506625), handle (892500600), Guide tube (15570644) with flexible tip, OD 2.5 mm, WL 290 mm 892506925
	Auxiliary instruments Sharply abrading
	**Reamer,** OD 3.0 mm, WL 350 mm 89260.1113
	**Rongeurs, grasping forceps and punches** Color coding for simple identification of the instrument diameter
	**Micro-rongeur,** with extended jaw, ● OD 2.5 mm, WL 360 mm 89240.1125
	**Nucleus grasping forceps,** serrated, ● OD 3.0 mm, WL 360 mm 89230.1003
	**Micro-punch,** ● OD 2.5 mm, WL 360 mm 8792.671
	**Tube sheath punches**
	**Tube sheath punch,** ● OD 3.0 mm, WL 360 mm 89240.1903

RICHARD WOLF

spirit of excellence

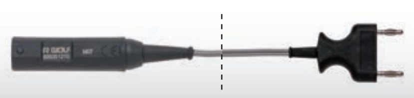
VERTEBRIS lumbar transforaminal / extraforaminal 7 mm Basic Instrument Set

TipControl RF accessories, bipolar

TipControl RF Instrument

	**TipControl RF Instrument Set long,** WL 400 mm* comprising: Bipolar handle (899351100), sheath tube long, OD 2.5 mm (899352010) 899352000

TipControl connection cable for connection with RF devices

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

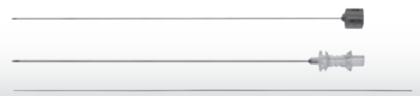
* for use with TipControl RF electrode, long, sterile (499352000) see below / Page 45 (not included in the set 899352000)

** Radioblator RF 4 MHz radiofrequency surgical system for full-endoscopic spine surgery see Page 45.

Accessories for VERTEBRIS lumbar transforaminal/extraforaminal 7 mm Basic Instrument Set

Instrument Set for single use

Access instruments for single use

	**Spinal Cannula Set,** OD 1.5 mm, WL 250 mm, pack of 10, sterile 492201215

Accessory for TipControl RF Instrument for single use

	**TipControl RF electrode, long,** sterile, pack of 5 499352000

Instrument sieve

	**Instrument sieve VERTEBRIS lumbar*****, for sterilization and storage comprising: Sieve basket bottom section, sieve basket lid, 2x locking section, instrument carrier top incl. set of silicone holders, instrument carrier bottom, incl. set of silicone holders L x W x H: 530 mm x 250 mm x 150 mm 85841217

*** Supply without Instrument Set.

VERTEBRIS *lumbar - thoracic*

The full-endoscopic **interlaminar** technique

VERTEBRIS *lumbar* interlaminar 8 mm Basic Instrument Set 892101300
comprising:

Endoscope and accessories	
	**PANOVIEW PLUS Discoscope,** 25°, WL 165 mm, ID 4.1 mm working channel, for application with working sleeve WL 120 mm 89210.3254
	**Endoscope adapter** for distance control 892009000
	**Conical adapter** 8791.751
	**Membrane attachment** 8792.451
	**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 for discoscopes with 4.1 mm working channel	
	**Dilator,** two-channel, for working sleeve OD 8.0 mm, WL 235 mm 89220.1508
	**Working sleeve,** with 30° oblique window, OD 8.0 mm, WL 120 mm 89220.3008
	**Irrigation attachment,** with quick-disconnect coupling, for working sleeve OD 8.0 mm 89220.1308
Working instruments	
	Auxiliary instruments
	**Dissector,** OD 2.5 mm, WL 350 mm 8792.591
	**Dissector,** OD 4.0 mm, WL 350 mm 89250.1004

RICHARD WOLF

spirit of excellence

VERTEBRIS *lumbar* interlaminar 8 mm Basic Instrument Set

Working instruments

Auxiliary instruments
Sharply abrading

Reamer,
OD 4.0 mm, WL 350 mm 89260.1114

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

Micro-rongeur,
- ● OD 2.5 mm, WL 290 mm 89240.2025
- ● OD 3.0 mm, WL 290 mm 89240.3003
- ● OD 4.0 mm, WL 290 mm 89240.3004

Micro-rongeur, curved upward,
- ● OD 2.5 mm, WL 360 mm (fits in 4 mm-working channel) 89240.1044

Micro-punch,
- ● OD 2.5 mm, WL 290 mm 89240.2225

Micro-punch, curved upward,
- ● OD 2.5 mm, WL 360 mm (fits in 4 mm-working channel) 89240.1034

Tube sheath punches

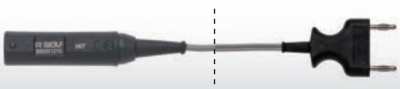
Tube sheath punch,
- ● OD 4.0 mm, WL 290 mm 89240.3904

TipControl RF accessories, bipolar

TipControl RF Instrument

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, long, sterile (499352000) see below / Page 45 (not included in the set 899352000)
** Radioblator RF 4 MHz radiofrequency surgical system for full-endoscopic spine surgery see Page 45.

VERTEBRIS *lumbar - thoracic*

Instrument Set for full-endoscopic **interlaminar** technique

Accessories for VERTEBRIS *lumbar* interlaminar 8 mm Basic Instrument Set

Instrument Set for single use	
Accessory for TipControl RF instrument for single use	
	**TipControl RF electrode, short,** sterile, pack of 5 499351000

Instrument sieve	
	**Instrument sieve VERTEBRIS lumbar***,** for sterilization comprising: Sieve basket bottom section, sieve basket lid, 2x locking section, instrument carrier top incl. set of silicone holders, instrument carrier bottom, incl. set of silicone holders L x W x H: 530 mm x 250 mm x 150 mm 85841217

*** Supply without Instrument Set.

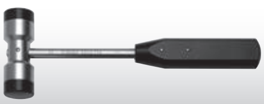
VERTEBRIS *lumbar - thoracic*

RICHARD WOLF
spirit of excellence

Instrument Set **universal**

VERTEBRIS *lumbar* interlaminar 8 mm Basic Instrument Set 892101400
comprising:

Endoscopes and accessories	
	**PANOVIEW PLUS Discoscope,** 25°, WL 165 mm, ID 4.1 mm working channel, for use with instruments WL 290 mm 89210.3254
	**PANOVIEW PLUS Discoscope,** 25°, WL 207 mm, ID 4.1 mm working channel, for use with instruments WL 360 mm 89210.1254
	**Endoscope adapter** for distance control 892009000
	**Conical adapter** 8791.751
	**Membrane attachment** 8792.451
	**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

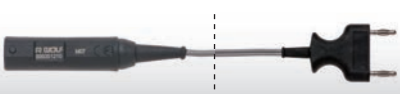
Access instruments for discoscopes with 4.1 mm working channel	
	**Dilator,** two-channel, for working sleeve OD 8.0 mm, WL 235 mm 89220.1508
	**Working sleeve,** with 30° oblique window, OD 8.0 mm, WL 120 mm for application with discoscope 89210.3254 .... 89220.3008
	**Working sleeve,** with 30° oblique window, OD 8.0 mm, WL 185 mm for application with discoscope 89210.1254 .... 89220.1078
	**Irrigation attachment,** with quick-disconnect coupling, for working sleeve OD 8.0 mm 89220.1308
	**Extension sleeve,** OD 8.0 mm, WL 155 mm 89220.1408
	**X-Tractor,** for extraction of cylindrical access instruments (working sleeves) 89230.0000
	**Hammer** 8866.956

VERTEBRIS lumbar - thoracic

Instrument Set **universal**

VERTEBRIS lumbar interlaminar 8 mm Basic Instrument Set

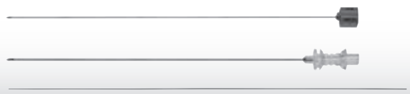
Working instruments	
	Auxiliary instruments
	**Dissector,** OD 2.5 mm, WL 350 mm 8792.591
	**Dissector,** OD 4.0 mm, WL 350 mm 89250.1004
	**Rongeurs, grasping forceps and punches** Color coding for simple identification of the instrument diameter
	**Micro-Rongeur,** with extended jaw, ● OD 2.5 mm, WL 360 mm 89240.1125
	**Micro-Rongeur,** curved upward, ● OD 2.5 mm, WL 360 mm (fits in 4 mm-working channel) 89240.1044
	**Micro-rongeur,** articulated, ● OD 4.0 mm, WL 360 mm 89240.1624
	**Nucleus grasping forceps,** serrated, ● OD 3.0 mm, WL 360 mm .... 89230.1003 ● OD 4.0 mm, WL 360 mm 89230.1004
	**Micro-punch,** ● OD 2.5 mm, WL 360 mm 8792.671
	**Micro-punch,** curved upward, ● OD 2.5 mm, WL 360 mm (fits in 4 mm-working channel) 89240.1034
	Tube sheath punches
	**Tube sheath punch,** ● OD 4.0 mm, WL 360 mm 89240.1904

TipControl RF accessories, bipolar	
TipControl RF Instrument	
	**TipControl RF Instrument Set long,** WL 400 mm* comprising: Bipolar handle (899351100), sheath tube long, OD 2.5 mm (899352010) 899352000
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, long, sterile (499352000) see below / Page 45 (not included in the set 899352000)

** Radioblator RF 4 MHz radiofrequency surgical system for full-endoscopic spine surgery see Page 45.

Accessories for *VERTEBRIS lumbar* universal 8 mm Basic Instrument Set

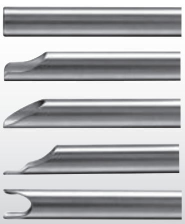
Instrument Set for single use	
Access instruments for single use	
	**Spinal Cannula Set,** OD 1.5 mm, WL 250 mm, pack of 10, sterile 492201215
Accessory for TipControl RF Instrument for single use	
	**TipControl RF electrode, long,** sterile, pack of 5 499352000

Instrument sieve	
	**Instrument sieve *VERTEBRIS* lumbar***,** for sterilization and storage comprising: Sieve basket bottom section, sieve basket lid, 2x locking section, instrument carrier top incl. set of silicone holders, instrument carrier bottom, incl. set of silicone holders L x W x H: 530 mm x 250 mm x 150 mm 85841217

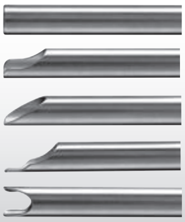
*** Supply without Instrument Set.

VERTEBRIS lumbar - thoracic

Instrument Set **optional**

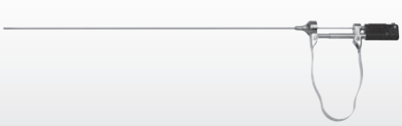
Endoscopes	
	**PANOVIEW PLUS Discoscope,** 25°, WL 165 mm, ID 3.1 mm working channel, for use with instruments WL 290 mm 89210.3253
Access instruments	
	Working sleeves for application with discoscope 89210.3253
	**Working sleeve, OD 7.0 mm,** with 30° oblique window, WL 120 mm .... 89220.3007 without window, WL 145 mm 89220.1057
	Working sleeves for application with discoscope 89210.1253
	**Working sleeve, OD 7.0 mm,** for foraminoplasty, WL 165 mm .... 89220.1007 with elevation lip, WL 185 mm 89220.1157
	**Basic Set, WL 165 mm,** comprising: Working sleeve without window (15208.261), with side window (15208.255), with 30° oblique window (15208.257), with elevation lip (15208.258), with double window (15208.260) 89220.1907
	Attachments for working sleeves OD 7.0 mm
	**Irrigation attachment,** with quick-disconnect coupling 89220.1307
	**Handle attachment,** with quick-disconnect coupling 89200.1007

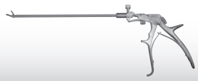
spirit of excellence

	Working sleeves for application with discoscope 89210.1254
	**Working sleeve, OD 8.0 mm,** with 30° oblique window, WL 185 mm .... 89220.1078 with 45° oblique window, WL 185 mm .... 89220.1038 for long elevation lip, WL 165 mm .... 89220.1068 with elevation lip, WL 185 mm 89220.1088
	**Basic Set of working sleeves, OD 8.0 mm, WL 165 mm,** comprising: Working sleeve without window (15208.264), with side window (15208.263), with 30° oblique window (15208.262), with elevation lip (15208.265), for foraminoplasty (15208.266) 89220.1908
	Attachments for working sleeves OD 8.0 mm
	**Irrigation attachment,** with quick-disconnect coupling 89220.1308
	**Handle attachment,** with quick-disconnect coupling 89220.1008

VERTEBRIS lumbar - thoracic

Instrument Set **optional**

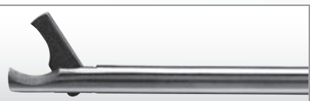
Instrument Set optional – for application through the endoscope	
	Auxiliary instruments Sharply abrading
	**Annulotome,** OD 2.5 mm, WL 350 mm 8792.581
	**Reamer,** OD 3.0 mm, WL 350 mm .... 89260.1113 OD 4.0 mm, WL 350 mm 89260.1114
	Auxiliary instruments atraumatic
	**Exploring hook,** OD 2.5 mm, WL 290 mm 89250.2125
	**Dissector,** OD 2.5 mm, WL 350 mm 8792.591
	**Dissector,** OD 3.0 mm, WL 350 mm 89250.1003
	**Dissector,** OD 4.0 mm, WL 350 mm 89250.1004
	Auxiliary instruments Atraumatic / flexible
	**Exploring probe,** comprising: Probe jaw insert (892506625), handle (892500600), Guide tube (15570644) with flexible tip, OD 2.5 mm, WL 290 mm 892506925
	**Exploring probe,** comprising: Probe jaw insert (892501625), handle (892500600), Guide tube (15570643) with flexible tip, OD 2.5 mm, WL 350 mm 892501925

Instrument Set optional – for application through the working sleeve	
	**Trephines**
	**Trephine,** OD 3.0 mm, WL 195 mm 8792.503
	**Trephine,** OD 5.3 mm, WL 195 mm 8792.504
	**Trephine,** OD 6.3 mm, WL 195 mm 89260.1108
	**Forceps and punches, articulated**
	**Intradiskal grasping forceps,** OD 5.2 mm, WL 210 mm 8792.623
	**Intradiskal rongeur,** Jaw conical, OD 5.2 mm, WL 210 mm 89240.1052
	**Rongeures, punches and scissors**
	**Rongeur,** OD 4.5 x 4.2 mm, WL 210 mm 8791.691
	**Rongeur,** OD 4.5 x 4.2 mm, WL 210 mm 8791.601

VERTEBRIS lumbar - thoracic

Instrument Set **optional**

Working instruments - transforaminal / extraforaminal and universal
for application with endoscopes with working channel ID 4.1 mm (color coding ● ● ●)
and endoscopes with working channel ID 3.1 mm (color coding ● ●)

	Rongeurs, grasping forceps and punches Color coding for simple identification of the instrument diameter
	**Rongeur,** WL 360 mm, ● OD 2.5 mm .... 8792.632 ● OD 3.0 mm .... 89240.1003 ● OD 4.0 mm 89240.1004
	**Rongeur,** double-action jaw insert, WL 360 mm ● OD 2.5 mm .... 8792.636 ● OD 3.0 mm .... 89240.1013 ● OD 4.0 mm 89240.1014
	**Rongeur,** extended jaw insert, WL 360 mm ● OD 2.5 mm**/***/**** 89240.1125
	**Micro-rongeur,** curved upward, WL 360 mm ● OD 4.0 mm**/***/**** (fits in 4 mm-working channel) 89240.1044
	**Micro-rongeur,** articulated, WL 360 mm ● OD 4.0 mm***/**** 89240.1624
	**Nucleus grasping forceps,** WL 360 mm, ● OD 2.5 mm .... 89230.1125 ● OD 3.0 mm**/***/**** .... 89230.1003 ● OD 4.0 mm***/**** 89230.1004
	**Dissection spreader,** WL 360 mm, ● OD 3.0 mm 89230.1803
	**Punch,** WL 360 mm, ● OD 2.5 mm**/***/**** .... 8792.671 ● OD 3.0 mm .... 89240.1023 ● OD 4.0 mm 89240.1024
	**Micro-punch,** curved upward, WL 360 mm ● OD 4.0 mm*/***/**** (fits in 4 mm-working channel) 89240.1034
	**Tube sheath punch,** WL 360 mm, ● OD 3.0 mm** .... 89240.1903 ● OD 4.0 mm***/**** 89240.1904
	**Hook scissors,** WL 360 mm ● OD 3.0 mm 89240.1703

RICHARD WOLF
spirit of excellence

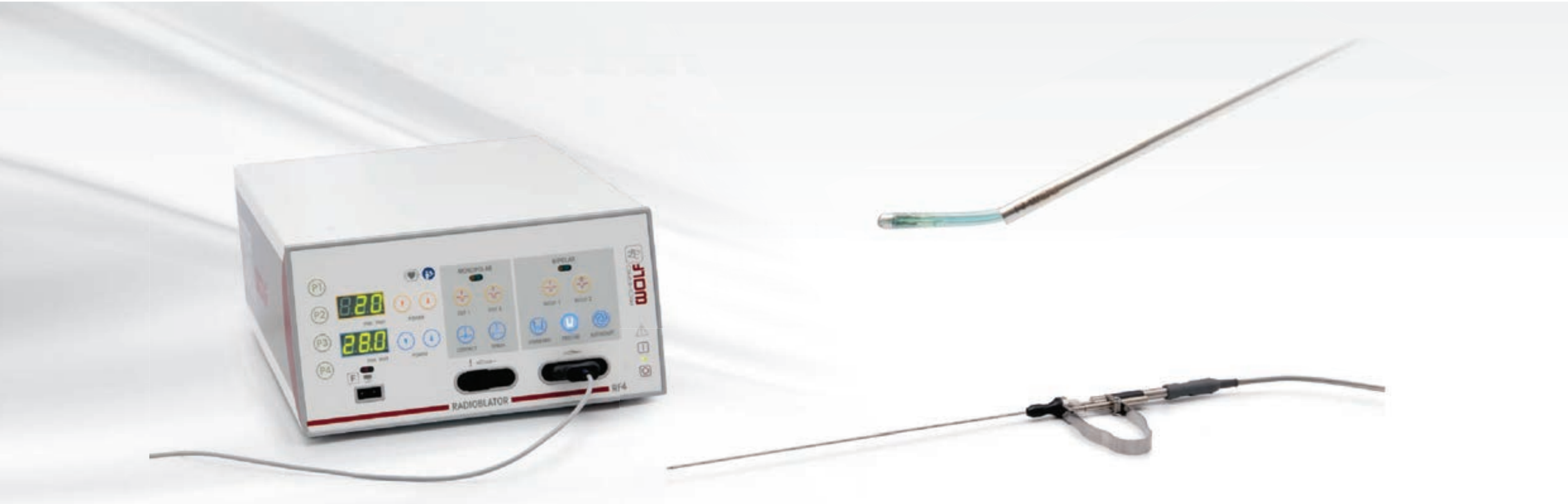
Working instruments - interlaminar
for application with endoscopes with working channel ID 4.1 mm (color coding ● ● ● ●)
and endoscopes with working channel ID 3.1 mm (color coding ● ● ●)

	Rongeurs, grasping forceps and punches Color coding for simple identification of the instrument diameter
	**Rongeur,** WL 290 mm, ● OD 2.0 mm .... 892406002 ● OD 2.5 mm* .... 89240.2025 ● OD 3.0 mm* .... 89240.3003 ● OD 4.0 mm* 89240.3004
	**Rongeur,** double-action jaw insert, WL 290 mm ● OD 2.5 mm .... 89240.2125 ● OD 3.0 mm 89240.3013
	**Punch,** WL 290 mm, ● OD 2.0 mm .... 892406202 ● OD 2.5 mm* .... 89240.2225 ● OD 3.0 mm .... 89240.3023 ● OD 4.0 mm 89240.3024
	**Micro-punch,** curved upward, WL 360 mm ● OD 4,0 mm* (fits in 4 mm-working channel) 89240.1034
	**Tube sheath punch,** WL 290 mm, ● OD 2.5 mm .... 89240.2325 ● OD 3.0 mm .... 89240.3903 ● OD 4.0 mm* 89240.3904

* Instrument included in VERTEBRIS lumbar interlaminar Basic Instrument Set (892101300)
** Instrument included in VERTEBRIS lumbar transforaminal / extraforaminal 7 mm Basic Instrument Set (892101200)
*** Instrument included in VERTEBRIS lumbar transforaminal / extraforaminal 8 mm Basic Instrument Set (892101100)
*** Instrument included in VERTEBRIS lumbar universal 8 mm Basic Instrument Set (892101400)

VERTEBRIS lumbar - thoracic

Radioblator RF 4 MHz – Multidisciplinary Radiofrequency Surgical System



Radiofrequency Surgical System

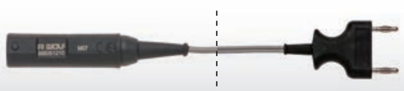
TipControl RF accessories, bipolar, short

	**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 RF accessories, bipolar, long

	**TipControl RF Instrument Set long,** WL 400 mm comprising: Bipolar handle (899351100), sheath tube, short, OD 2.5 mm (899352010) 899352000
	**TipControl RF electrode, long,** sterile, pack of 5 499352000

TipControl connection cable for connecting to RF device

	**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

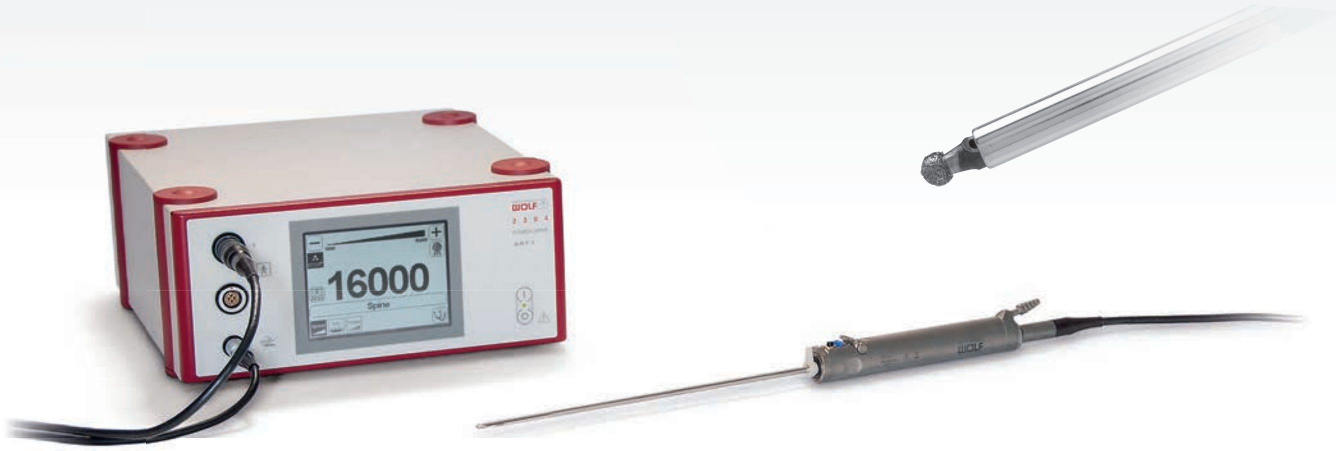
For detailed information see brochure *B 799 - Radioblator RF 4 MHz.*

RICHARD WOLF

spirit of excellence

VERTEBRIS lumbar - thoracic

PowerDrive ART1 - Universal Motor System

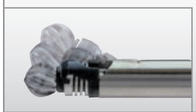


Accessories for Universal Motor System – Motor Handle Power Stick M5	
	Burrs
	**Oval burr,** with side protection, WL 350 mm, OD 2.5 mm .... 899751502 OD 3.0 mm .... 899751503 OD 4.0 mm 899751504
	**Oval burr,** with front protector, WL 350 mm, OD 2.5 mm .... 899751512 OD 3.0 mm .... 899751513 OD 4.0 mm 899751514
	**Round burr,** WL 350 mm, OD 2.5 mm .... 899751302 OD 3.0 mm .... 899751303 OD 4.0 mm 899751304
	**Round burr, diamond,** WL 350 mm, OD 2.5 mm .... 899751402 OD 3.0 mm .... 899751403 OD 4.0 mm 899751404
	Nucleus resectors
	**Nucleus resector,** WL 350 mm, OD 3.0 mm .... 899751003 OD 4.0 mm 899751004
	Nucleus resectors, sterile, for single use
	**Nucleus resector*,** OD 4.5 mm, WL 240 mm, pack of 5, sterile 499751045
	**Nucleus resector, curved**,** OD 4.5 mm, WL 240 mm, pack of 5, sterile 499751245

* Application only through working sleeves with OD 7.0 mm and 8.0 mm
** Application only through working sleeve with OD 8.0 mm

VERTEBRIS lumbar - thoracic

PowerDrive ART1 - Universal Motor System

Accessories for Universal Motor System – Motor Handle Power Stick M5	
	Articulated burr
	**TipControl articulated bone burr, complete,** OD 4.0 mm, WL 290 mm (899753754), drive shaft, complete (15336058), cardanic burr insert, sterile, pack of 5 (499751704), key for insertion and removal of the cardanic burr insert (15372005), irrigation adapter (15261106) 899753794
	**TipControl articulated bone burr, complete,** OD 4.0 mm, WL 350 mm (899751754), drive shaft, complete (15336056), cardanic burr insert, sterile, pack of 5 (499751704), key for insertion and removal of the universal burr insert (15372005), irrigation adapter (15261106) 899751794

	Motor Handles – Power Stick M5 Rotary speed 16,000 rpm, sterilizable, fixed connection cable
	**Power Stick M5/0** operation with foot switch 8995500001
	**Power Stick M5/3**operation with touchpad and foot switch 8995500031

Universal Motor System	
	PowerDrive ART1 Universal Motor System, Set incl. power cable, Can-Bus connection cable **Technical features:** autom. 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 lumbar - thoracic

RICHARD WOLF
spirit of excellence

COMBIDRIVE EN - High-Speed Motor System

Accessories for High-Speed Motor System and High-Speed Handle	
	Burr with distal protection
	**Round burr, carbide,** OD 3.0 mm, WL 350 mm, pack of 3 ....82960.3730
	Outer tube, with distal protection, OD 4,0 mm 82970.1330
	**Round burr, diamond,** OD 3.0 mm, WL 350 mm, pack of 3 ....82960.3930
	Outer tube, with distal protection, OD 4.0 mm 82970.1330
	Burr without distal protection
	**Round burr, diamond,** burr head Ø 3.7 mm, WL 350 mm, pack of 3 ....82960.3940
	Outer tube, OD 4.0 mm 82970.1340
	High-Speed Handle
	**Angle handle with adapter** 20,000 rpm, INTRA interface 82950.1301

High-Speed Motor System	
	COMBIDRIVE EN for application with high-speed accessories and accessories for Power Stick M5 (see page 49)
	**COMBIDRIVE EN Set** High-Speed Motor System incl. electronic motor middle, foot pedal and comprehensive accessories 20951.0000

For detailed information see brochure *B 767 - COMBIDRIVE EN* .

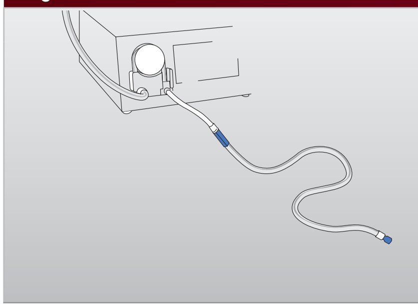
VERTEBRIS lumbar - thoracic

FLUID CONTROL Arthro-Spine - Innovative Fluid Management System

FLUID CONTROL Arthro-Spine

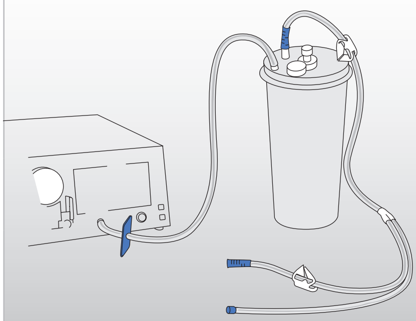
FLUID CONTROL Arthro-Spine 2204 cpl., irrigation and suction pump with software module spine mode for arthroscopy and full-endoscopic spine surgery
with automatic tube recognition, comprising:
Fluid Control Arthro (2204001), software module Spine Mode (2204101),
Tube set with piercing connector (8171223), 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 of 10), with luer-lock connector, Sterile single-use product 4171223
Tube Set with CARE-LOCK, (pack of 10), sterile single-use product 4171224

Suction / Evacuation



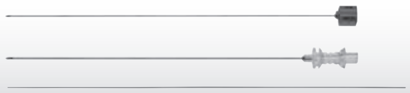
Accessories - reusable
Vacuum tube, silicone, autoclavable, for connection of vacuum (pump) with suction container 8170.401
Suction container, 3 liters, incl. holder, autoclavable 8170.981
Accessories – for single use
Suction container, 3 liters, (pack of 2) 2215.971
Drain tube, PVC, with Y-shape piece, length 5 m, sterile single-use product, (pack of 10) 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 lumbar - thoracic

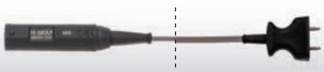
RICHARD WOLF
spirit of excellence

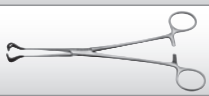
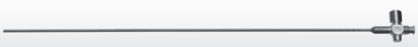
Consumables and accessories

Access instruments for single use	
	**Spinal Cannula Set,** pack of 10, sterile OD 1.25 mm, WL 150 mm .... 4792.803 OD 1.25 mm, WL 250 mm .... 4792.802 OD 1.5 mm, WL 250 mm 492201215

Accessory for motor system - TipControl articulated bone burr	
	**Universal burr insert,** sterile, pack of 5 499751704

Accessories for radiofrequency surgical system - TipControl RF instruments	
TipControl RF accessories, short	
	**Sheath tube, short,** OD 2.5 mm 899351010
	**TipControl RF electrode, short,** sterile, pack of 5 499351000
TipControl RF accessories, long	
	**Sheath tube, long,** OD 2.5 mm 899352010
	**TipControl RF electrode, long,** sterile, pack of 5 499352000

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 instrument plug 899351220

Consumables and accessories	
	**Positioning rod,** OD 5.0 mm, WL 400 mm 8791.701
	**Instrument holding forceps,** OD 3.0 mm, WL 350 mm 8793.856
	**Aspirator,** OD 2.5 mm, WL 290 mm 89270.2025

VERTEBRIS lumbar - thoracic

Literature

Komp M, Hahn P, Oezdemir S, Giannakopoulos A, Heikenfeld R, Kasch R,Merk H, Godolias G, Puchstein C, Ruetten S.
Bilateral decompression of lumbar central stenosis using the full-endoscopic interlaminar technique compared with microsurgical technique: A prospective, randomized, controlled study.
Pain Physician 2015; 18:61-70

Ruetten S, Komp M, Oezdemir S.
Current status of full-endoscopic techniques in the surgical treatment of disk herniations and spinal canal stenosis.
Chinese Journal of Bone and Joint 2014; 3:571-584

Komp M, Hahn P, Oezdemir S, Merk H, Kasch R, Godolias G, Ruetten S.
Operation of lumbar zygoapophyseal joint cysts using a full-endoscopic interlaminar and transforaminal approach: prospective 2-year results of 74 patients.
Surg Innov 2014; 21:605-14

Ruetten S, Komp M, Hahn P, Oezdemir S.
Decompression of lumbar lateral spinal stenosis: full-endoscopic, interlaminar technique.
Oper Orthop Traumatol 2013:DOI 10.1007/s00064-012-0195-2

Ruetten S., Komp M, Hahn P.
Endoscopic disk and decompression surgery. In: Haertl R, Korge A (eds) AO Spine - Minimally Invasive Spine Surgery – Techniques, Evidence, and Controversies. Thieme, Stuttgart New York 2012, pp 315-330

Ruetten S.
Equipment for full-endoscopic spinal surgery. In: Vieweg U, Grochulla F (eds) Manual of Spine Surgery. Springer, Heidelberg, New York, Dordrecht, London 2012, pp 59-62

Ruetten S.
Endoscopic lumbar disk surgery.
In: Vieweg U, Grochulla F (eds) Manual of Spine Surgery. Springer, Heidelberg, New York, Dordrecht, London 2012, pp 303-308

Ruetten S.
Full-endoscopic operations of the spine in disk herniations and spinal stenosis.
Surg Technol Int 2011; XXI:284-298

Ruetten S.
Full-endoscopic interlaminar lumbar diskectomy and spinal decompression.
In: Kim DH, Kim K-H, Kim Y-C (eds) Minimally Invasive Percutaneous Spinal Techniques. Elsevier, Philadelphia, 2011, pp 351-359

Komp M, Hahn P, Merk H, Godolias G, Ruetten S.
Bilateral operation of lumbar degenerativecentral spinal stenosis in full-endoscopic interlaminar technique with unilateral approach: Prospective 2-year results of 74 patients.
J Spinal Disord Tech 2011; 24:281-287

Ruetten S, Komp M, Merk H, Godolias G.
Surgical treatment for lumbar lateral recess stenosis with the full-endoscopic interlaminar approach versus conventionalmicrosurgical technique: A prospective, randomized, controlled study.
J Neurosurg Spine 2009; 10:476-485

Ruetten S, Komp M, Merk H, Godolias G.
Recurrent lumbar disk herniation following conventional diskectomy: A prospective, randomized study comparing full-endoscopic inter-laminar and transforaminal versus microsurgical revision.
J Spinal Disord Tech 2009; 22:122-129

Kuonsongtum V, Paiboonsirijit S, Kesornsak W, Chaiyosboorana V, Rukskul P, Chumnanvej S, Ruetten S.
Result of full-endoscopic uniportal lumbardisectomy: Preliminary report.
J Med Assoc Thai 2009;6:776-780

Ruetten S, Komp M, Merk H, Godolias G.
Full-endoscopic anterior decompression versus conventional anterior decompression and fusion in cervical disk herniations.
Int Orthop 2008; 33:1677,DOI 10.1007/s00264-008-0684-y

Ruetten S, Komp M, Merk H, Godolias G.
Full-endoscopic cervical posterior foraminotomy for the operation of lateral disk herniations using 5.9-mm endoscopes: A prospective, randomized, controlled study.
Spine 2008; 33:940-948

Ruetten S, Komp M, Merk H, Godolias G.
Full-endoscopic interlaminar and transforaminal lumbar diskectomy versus conventional microsurgical technique: A prospective, randomized, controlled study.
Spine 2008; 33:931-939

Ruetten S, Komp M, Merk H, Godolias G.
A new full-endoscopic technique for cervical posterior foraminotomy in the treatment of lateral disk herniations using 6.9-mm endoscopes: prospective 2-year results of 87 patients.
Minim Invas Neurosur 2007; 50:219-226

Ruetten S, Komp M, Merk H, Godolias G.
Use of newly developed instruments and endoscopes: full-endoscopic resection of lumbar disk herniations via the inter-laminar and lateral transforaminal approach.
J Neurosurg Spine 2007; 6:521-530

Ruetten S.
Full-endoscopic operations of lumbar disk herniations with transforaminal and interlaminar approach.
European Musculoskeletal Review 2007:69-72

Ruetten S, Komp M, Godolias G.
A new full-endoscopic technique for the interlaminar operation of lumbar disk herniations using 6 mm endoscopes: Prospective 2-year results of 331 patients.
Minim Invasive Neurosur 2006; 49:80-87

Ruetten S, Komp M, Godolias G.
An extreme lateral access fort he surgery of lumbar disk herniations inside the spinal canal using the full-endoscopic uniportal transforaminal approach. Technique and prospective results of 463 patients.
Spine 2005; 30:2570-2578

Ruetten S, Komp M, Godolias G.
Full-endoscopic interlaminar operation of lumbar disk herniations using new endoscopes and instruments.
Orthop Praxis 2005;10:527-532

Ruetten S.
The full-endoscopic interlaminar approach for lumbar disk herniations.
In: Mayer HM (ed) Minimally Invasive Spine Surgery. Springer, Berlin Heidelberg New York, 2005, pp 346-355

Ruetten S, Meyer O, Godolias G.
Endoscopic surgery of the lumbar epiduralspace (epiduroscopy): Results of therapeutic intervention from 93 patients.
Minim Invas Neurosur 2003; 46:1-4

Ruetten S, Meyer O, Godolias G.
Application of Holmium:YAG Laser in Epiduroscopy: Extended Practicabilities in the Treatment of Chronic Back Pain Syndrome.
J Clin Laser Med Surg 2002;20:203-206

Ruetten S, Meyer O, Godolias G.
Epiduroscopic Diagnosis and Treatment of Epidural Adhesions at Chronic Back Pain Syndrome of Patients with Previous Surgical Treatment: First Results of 26 Interventions.
Z Orthop 2002; 140:171-175

RICHARD WOLF

spirit of excellence

Specifications subject to change without notice.

B 756.IV.16.de.7

Richard Wolf GmbH
Pforzheimer Straße 32
75438 Knittlingen
Germany

Phone: +49 7043 35-0
Fax: +49 7043 35-4300
info@richard-wolf.com
www.richard-wolf.com

Managing Directors:
Siegfried Karst
Jürgen Pfab
Jürgen Steinbeck

Trade Register:
Mannheim HRB 510031
V.A.T. ID No.: DE 144 521 586
Tax No.: 48020/00171

www.richard-wolf.com