Endoscopic Surgery on the Thoracolumbar Junction of the Spine

a report by

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Introduction

For certain types of fractures, tumours and infections of the truncal spine associated with extensive destruction or defects of the vertebral body and the intervertebral discs, reconstruction of the load-bearing anterior spine is required to avoid correction loss. Further development of the endoscopic technique and standardisation of the operating procedure has now made it possible to perform the operation on the ventral section of the spine using the minimally invasive technique of thoracoscopy. The operation involves the removal of the ruptured intervertebral discs and vertebra fragments including – where necessary – decompression of the spinal canal. The load-bearing capacity of the anterior spine is restored, using a vertebral body replacement and ventral instrumentation.

The extended thoracoscopic approach described here also opens up the retroperitoneal segment between Th12 and L3 to the endoscopic procedure via partial detachment of the diaphragm, and thus includes the thoracolumbar section of the lumbar spine, which is the area most frequently affected by fractures.

Technical Equipment

For image transmission, a rigid 30° endoscope connected to a xenon light source and a high resolution three-chip camera are used. The image is transmitted onto three flat screens mounted on an endoscopy tower at the foot end of the patient, which are freely positionable. The equipment also includes a suction and irrigation device, the generator for the ultrasonic knife, and a digital image and video recording system.

Instruments specially designed for the endoscopic technique are used for soft tissue preparation and disc and bone resection. Soft reusable threaded trocars 11mm in diameter serve to protect the soft tissue and the intercostal nerve and vascular bundle. All these instruments are offered by several manufacturers nowadays as a complete set.

For ventral instrumentation, the author uses the Modular Anterior Construction System (MACS) TL-System® (Aesculap), an angle-stable implant that has been in use for both the endoscopic and the open procedure since 1999, the screws of which are inserted using the cannulated technique. The technique described below is based on the experience of 1,100 cases at the author’s hospital as a single unit experience.

Indications

The anterior thoracoscopic approach is indicated in the following situations (usually in combination with posterior instrumentation):

- fractures of the thoracic spine located at the thoracolumbar junction from T11 to L3;
- fractures classified as A 1.2, A 1.3, A 2, A 3B, and C according to the AO classification and post-traumatic deformities with significant curvature disturbance of 20° and more in the sagittal or frontal plane;
- in fractures of types B and C, posterior instrumentation is mandatory. In other types it is optional;
- post-traumatic, degenerative, or tumorous narrowing of the spinal canal;
- discoligamentous segmental instability;
- post-traumatic deformities; and
- tumour and infection.

Contraindications

A thoracoscopic approach is contraindicated in the following situations:

- significant previous cardiopulmonary disease with restricted cardiopulmonary function;
- acute post-traumatic lung failure; and
- significant disturbances of hemostasis.
Approach Method for the Thoracolumbar Junction

Patient Position

All operations on the thoracic spine and the thoracolumbar junction are performed with the patient lying on his/her side. The approach side is determined using pre-operative computed tomography (CT) scans and depends on the position of the major vessels shown in the scans and the surgery that is planned. A left-sided approach is usually used at the thoracolumbar junction.

The patient is stabilised in the lateral decubitus position, with four supports and a special U-shaped cushion for the legs. It is also possible to use a vacuum mattress (bean bed).

Marking the Portals

The author uses four portals:

- scope portal;
- working portal;
- suction/irrigation portal; and
- retractor portal.

Their location, and in particular the position of the working portal, is crucial for the endoscopic operation. For this reason, first of all the lesion is displayed in the lateral projection (with reference to the patient’s body) under precise adjustment of the image intensifier, and a marker is used to draw the injured spinal section onto the skin of the lateral thoracic wall. The working portal, is drawn directly above the lesion. The trocar for the endoscope is marked cranially of the working portal following the axis of the spine. The distance from the working portal is approximately two intercostal spaces. The entry points for suction and irrigation, and for the retractor, are then located ventrally from these portals.

After skin disinfection and sterile draping, single lung ventilation is started. As the first approach, the author always selects the portal located in the furthest cranial position, since here the risk of injury to the liver, spleen and diaphragm is comparatively minor. The approach is made using a mini-thoracotomy technique, providing the possibility of examining the immediate surroundings of the insertion site with the fingers before introducing the trocar. The rigid 30° endoscope is then carefully inserted and the thoracic cavity is first inspected to rule out the existence of adhesions or parenchymal lesions. The other three trocars and then the instruments are subsequently introduced under endoscopic control.

Operating Technique for Ventral Decompression and Reconstruction

General Principle

In contrast to tumour surgery on the spine, in spinal trauma there is no need for complete vertebral body resection. It is particularly important to preserve the anterior longitudinal ligament, since this represents a valuable indicator for the original height of the vertebral motor segment. If distractable cages are being used for vertebral body replacement, these can be stretched against the anterior longitudinal ligament. This contributes to a substantial increase in the primary stability of the reconstruction. The extent of the corpectomy depends on the nature of the fracture, tumour or infection and the possible involvement of the posterior vertebral body wall and narrowing of the spinal canal. The author makes the indication for resection of the posterior wall in cases where the trauma has caused displacement of the posterior wall and substantial narrowing of the spinal canal.

The dome-like diaphragm is firmly connected at its margins with the sternum, ribs and spine, and arches up into the thoracic cavity. Topographically speaking, the attachment sites of the diaphragm to the spine are at the level of the first lumbar vertebra, whereas the lowest point of the thoracic cavity projects with the phrenicocostal sinus at the level of the baseplate of the second lumbar vertebra.

This makes it possible to place a trocar intra-thoracically in the phrenicocostal sinus, which, after incision of the diaphragm attachment to the spine, provides access to the retroperitoneal section of the thoracolumbar junction down to the base plate of the second lumbar vertebra. This requires a 4–5cm incision; access to the L1–2 inter-vertebral disc can be obtained with a shorter incision of 2–3cm.

In the online version of this briefing, the approach method for the thoracolumbar junction is discussed under the headings ‘Patient Position’ and ‘Marking the Portals’. There is also to be found a detailed operating technique for ventral decompression and reconstruction, under the following headings: ‘General Principle’, ‘Landmarks’, ‘Preparation of the Segment Vessels’, ‘Partial Corpectomy and Decompression of the Spinal Canal’, ‘Bone Grafting’, ‘Vertebral Body Replacement’ (for which the author uses a new hydraulically distractable cage (Hydrolift®, Aesculap), the Synex®-Cage (Synthes) or, for smaller vertebrae, the X-tenz cage (Depuy)), ‘Ventral Instrumentation’ and ‘Closure’.
The aims of the Spine Society of Europe (SSE) are to stimulate the exchange of knowledge and ideas in the field of research, prevention and treatment of spine diseases and related problems and to coordinate efforts undertaken in European countries for further development in this field. Some projects of the society are:

European Spine Registry: Links to the Swiss/International, German and Austrian modules are provided as well as information about the philosophy, methodology and content. Following the links, the users are taken to the respective national modules for registration or log-in and data entry. The Swiss/International module, also accessible under www.spinetango.com, is used by all Swiss and international users, who do not have a separate national module. The physician administered forms for surgery, staged surgery and follow-up can be downloaded as PDFs. The officially recommended Spine Tango patient forms are also available.

Spine Courses

The Spine Society is organising twice a year instructional courses with a highly reputed faculty, intended for trainees in their early years as well as more qualified staff to focus on interdisciplinary problems within spine disorders (not just surgery). The Spine Society of Europe is exclusive sponsor of these courses, there is no industrial or commercial involvement.

- Barcelona (E) in Autumn
- Liberec (CZ) in Spring

Topics:
- Low Back Pain
- Deformities and Compression Syndromes
- Cervical Spine
- Fractures and Destructive Diseases

SSE as a society of spine specialists of various disciplines disposes about a universal know how about spine pathologies. Therefore all well known treatment modalities of spine pathologies are represented by the members of the society. SSE would like to share this accumulated experience with our patients by means of the “patient line”.

This is NOT JUST ANOTHER PATIENT INFORMATION! Apart from well understandable general medical information SSE Patient line contains the unique feature of information of expert’s opinion about different treatment modalities.