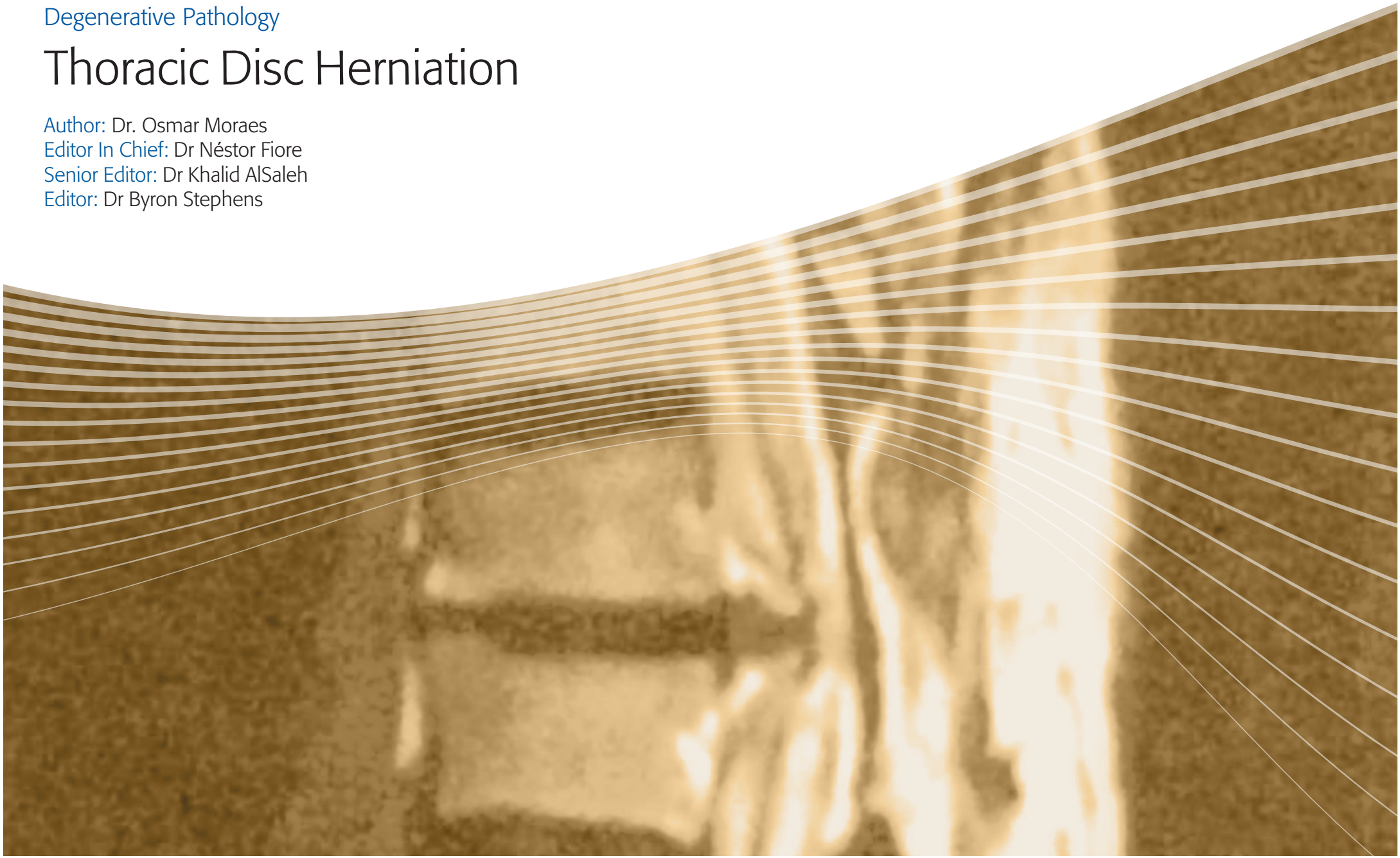
AOSPINE

CONTINUOUS LEARNING LIBRARY

Degenerative Pathology

Thoracic Disc Herniation

Author: Dr. Osmar Moraes
Editor In Chief: Dr Néstor Fiore
Senior Editor: Dr Khalid AlSaleh
Editor: Dr Byron Stephens



OBJECTIVES

CONTINUOUS LEARNING LIBRARY

Degenerative Pathology

Thoracic Disc Herniation

- To present epidemiological data about the disease.
- To describe the forms of clinical presentations and findings from physical examinations.
- To assess the importance of different complementary examinations.
- To describe treatment options.
- To describe treatment results and possible complications.

CONTENTS

1. INTRODUCTION

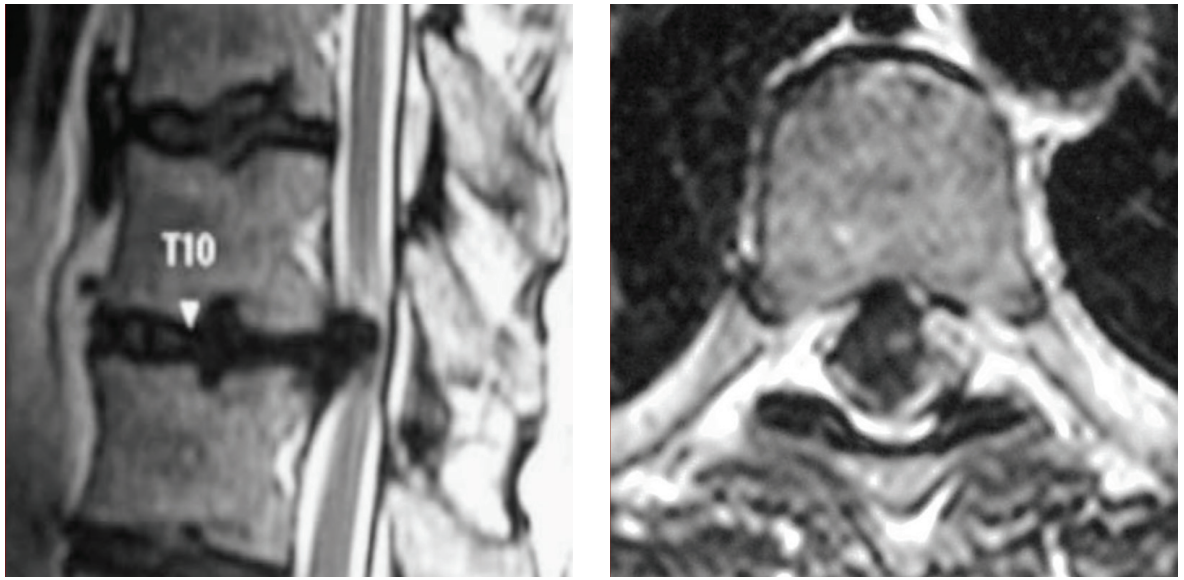
Overview

Herniated thoracic discs are rare in comparison with herniated cervical or lumbar discs, comprising just 0.25 to 1% of all herniated discs.

Symptomatic herniated discs in the thoracic spine occur infrequently. In addition, those which receive surgical treatment amount to less than 5% of all operations on herniated discs at any level of the spinal column. This low incidence, a lack of appropriate knowledge about the disease's natural history, diagnostic difficulties and the variety of options for surgical treatment make herniated thoracic discs (HTD) a controversial subject.

Men and women are affected in equal proportions. The majority of thoracic herniations occur centrally or posterolaterally, with less than 10% of HTDs being lateral herniations (McInerney and Ball, 2000).

Between 30% and 70% of herniated thoracic discs are calcified. This finding deserves attention because 5-10% of these cases are associated to intradural extension.



MRI of the thoracic spine, T2-weighted sequence, sagittal and axial images demonstrating evidence of intradural extension

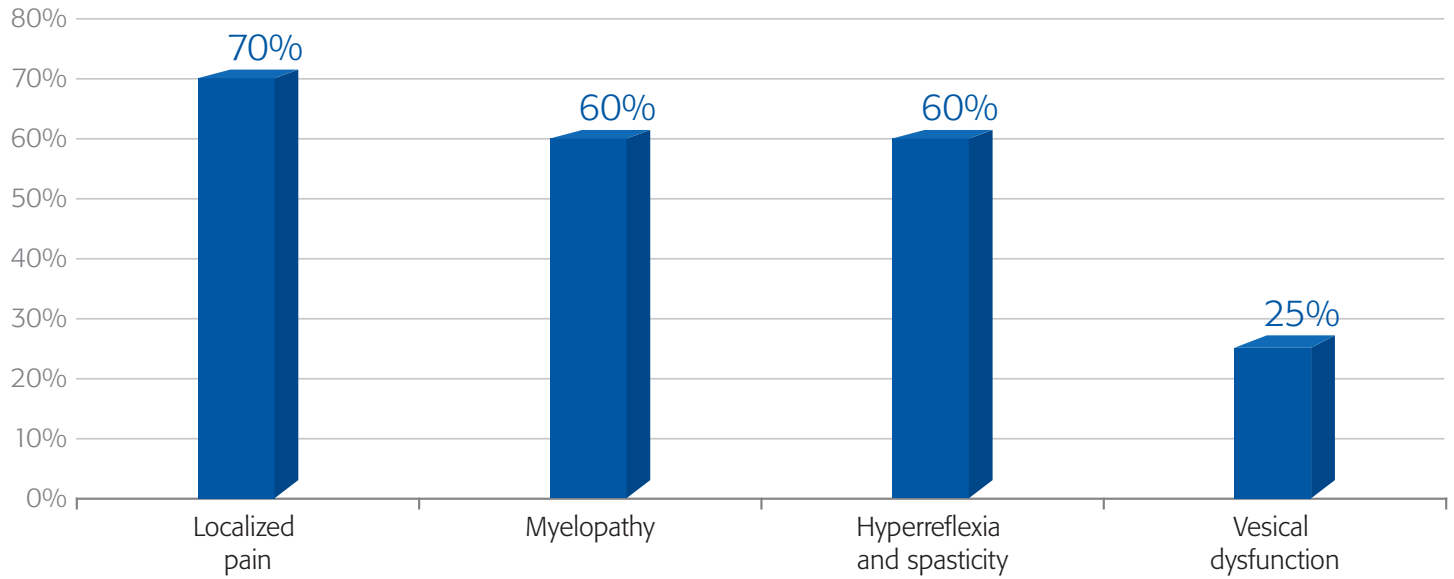
The vast majority of herniated thoracic discs are found below T7, presumably because of increasing mobility towards the thoracolumbar junction.

2. CLINICAL PRESENTATION

As with locations in other levels, thoracic disc herniations are often asymptomatic. There is no characteristic pattern of clinical presentation that distinguishes a herniated thoracic disc from other lesions in the thoracic spine.

The most commonly encountered pre-operative signs and symptoms are:

- pain
  - localized
  - axial
  - radicular
- motor impairment (myelopathy)
- hyperreflexia and spasticity
- bowel and bladder dysfunction



Frequency of pre-operative symptoms

Myelopathy associated with thoracic disc herniations is generally progressive and, in the central herniations, often accompanied by sensory disturbances below the level of compression.

When the disc fragment is lateral, it can often cause a radiculopathy characterized by pain in the dermatome of the root, which can be associated with parasthesia or dysestheisia. This radicular pain is often positional, and nocturnal pain is very common.

3. COMPLEMENTARY STUDIES

MRI provides detailed information about the herniated disc and the intrinsic spinal cord injury, including chronicity.

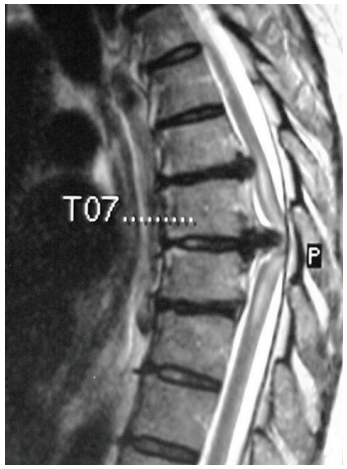
Imaging studies of the thoracic region of the spine can be more difficult to analyze as it is contained within the thoracic cavity underneath several layers of tissues of varying densities.

In the past, myelography was the examination of choice for diagnosis of thoracic disc herniations. It has subsequently been replaced by computed tomography (CT) and CT myelography.

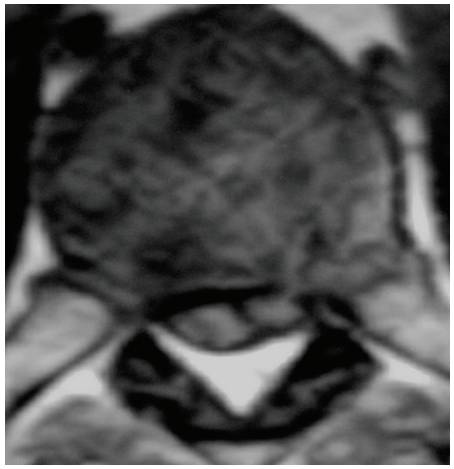
Axial CT myelogram of the thoracic spine section demonstrating a central disc herniation

Sagittal CT myelogram of the thoracic spine demonstrating a calcified herniation

In addition, magnetic resonance imaging (MRI) has emerged as the primary imaging modality in the evaluation of thoracic disc hernations. In addition, plain CT studies are needed to evaluate the degree of calcification of the herniation. Also, it is important to distinguish between disc calcification (peripheral mineralization) and disc ossification (complete bony remodeling), as this has important implications for surgical planning purposes.



T2 Thoracic spine MRI, demonstrating a large T7-8 herniation with cord effacement and myelomalacia

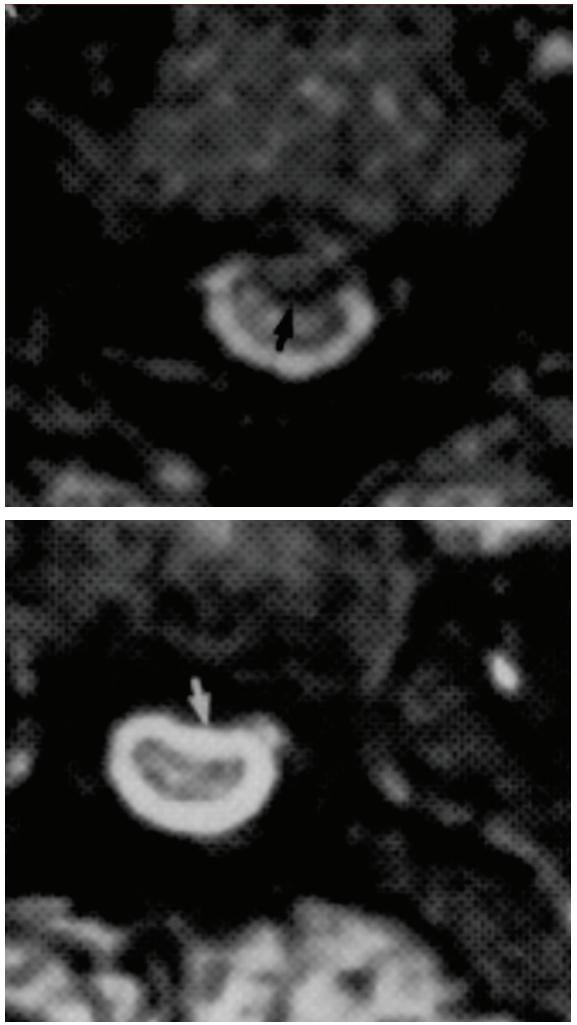


Axial T2 MRI demonstrating a central disc herniation

Sagittal T2 MRI showing a moderate T8-9 herniation

4. NATURAL HISTORY AND CONSERVATIVE TREATMENT

Small (up to 3 mm) and medium-sized (3-6 mm) thoracic herniations retain the same dimensions in 85% of cases; the larger ones decrease in size in 60% of cases.



There are clear signs of total reabsorption after 1 year.

Thoracic spine MRI, T2-weighted sequence

Conservative treatment utilizes analgesic and non-steroidal anti-inflammatory medication, this is complemented with different medications according to the time of evolution and intensity of pain, such as:

- gabapentin
- pregabalin
- tricyclic antidepressants

The use of corticosteroids is controversial and reserved for cases of progressive motor deficit or uncontrollable pain.

Immobilization using a thoracic support vest is an option that can present an analgesic effect, as can relative rest in the acute phase.

Treatments such as external traction or osteopathic manipulation do not usually result in improvement.

Adjuvant treatments such as analgesic physiotherapy, acupuncture and similar therapies appear to reduce pain; however, they cannot be associated to the general prognosis of the clinical course.

The natural history indicates that herniations maintain or decrease their original size in the majority of cases, thus establishing conservative treatment as the first therapeutic option.

5. SURGICAL TREATMENT

Indication

Uncertainty about the natural history of thoracic disc hernias makes it difficult to define appropriate surgical indications. Prophylactic surgery should be avoided, and the most accepted indications are those where the patient presents with progressive—or severe—myelopathy or radiculopathy.

Surgical treatment should be considered for cases classified as grade 3A or worse according to the classification suggested by Regan (Anand and Regan, 2002). Patients who have primarily axial or radicular pain should fail extensive attempts at nonoperative management prior to surgery. Conversely, patients with progressive myelopathy or incontinence should have surgical decompression in a more expedient manner.

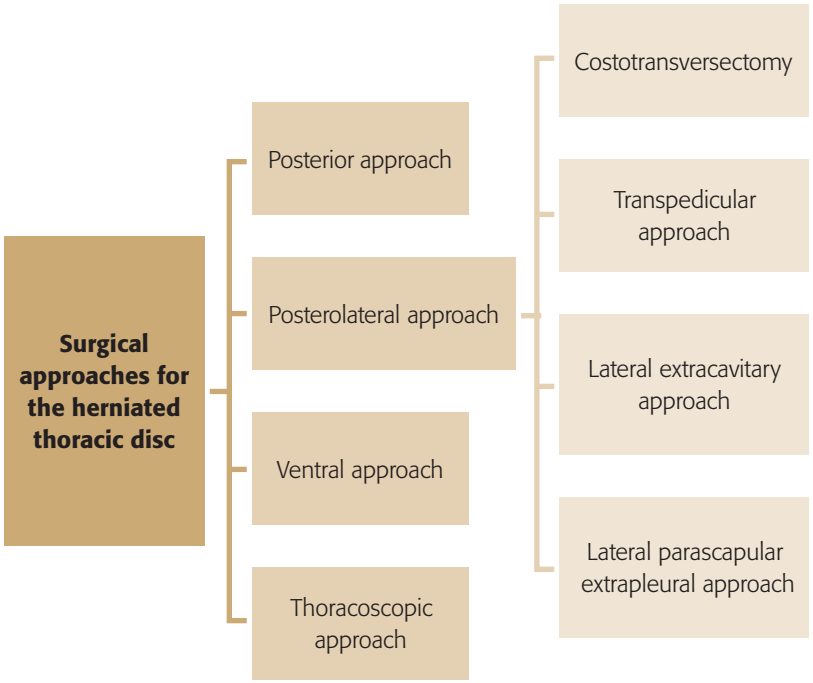
1	Predominantly central (axial) thoracic pain.
2	Predominantly radicular thoracic pain.
3A	Significant axial and radicular thoracic pain.
3B	Significant axial pain and pain in the lower leg, with or without radicular thoracic pain.
4	Myelopathy without significant motor weakness.
5	Paretic/paralytic (significant motor weakness).

Surgical Approaches

There is no universally accepted selection criterion to help surgeons when choosing the most appropriate surgery for a given patient. Preoperative planning based on location, patient anatomy, and characteristics of the disc herniation is essential to successful surgical management.

Early attempts at surgical treatment of thoracic disc herniations demonstrated limited efficacy and high rates of neurologic compromise. The limited space available for the spinal cord in this region and the diminutive vascular supply increased the likelihood of injuring the spinal cord during decompression. It is important to emphasize that the thoracic spinal cord cannot tolerate any degree of retraction, a lesson learned the hard way by early surgeons.

New thoracic spine approach routes have been developed in recent years, offering better access to the ventral spinal canal and the disc space. As surgeons familiarize themselves with these types of access they have more options when selecting the most appropriate for each patient.



5

The most influential factors in the choice of surgical approach are:

- level of the herniation
- position of the herniation
- penetration in the dura mater
- consistency of the disc
- need for fusion
- physiological age of the patient
- the surgeon's familiarity with each approach

Posterior Approach

Early treatment options consisted of simple laminectomies and the results, in general, were poor. Some surgeons performed a simple decompression, without removing the disc, to avoid any potentially harmful effects caused by manipulating the spinal cord in order to reach the ventrally positioned discs. Others utilized attempts to reach the disc material via an intradural route, by sectioning denticulate ligaments and performing a rhizotomy.

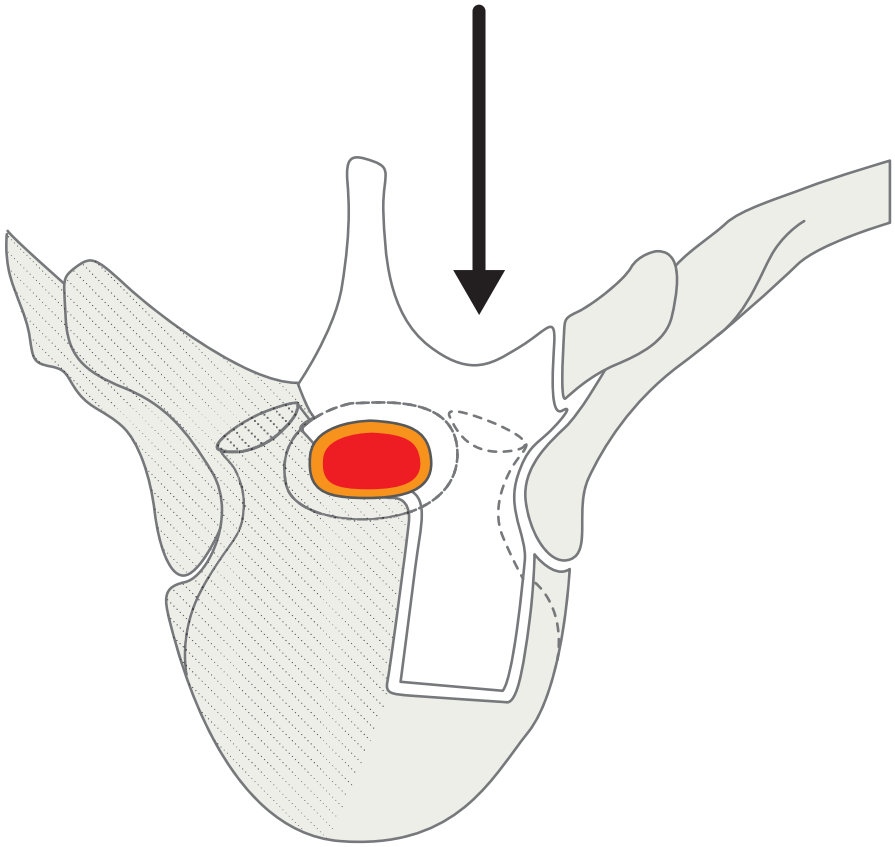


Diagram of a posterior approach (Mulier and Debois, 1998)

The significantly high rate of post-operative neurological deficits following laminectomies for the treatment of herniated thoracic discs is apparently due to a combination of vascular insufficiency and microcontusions secondary to spinal cord manipulation.

i

Posterolateral Approach

Posterolateral approaches afford greater access to ventral pathology and avoid the need for dangerous spinal cord manipulation associated with the direct posterior approach.

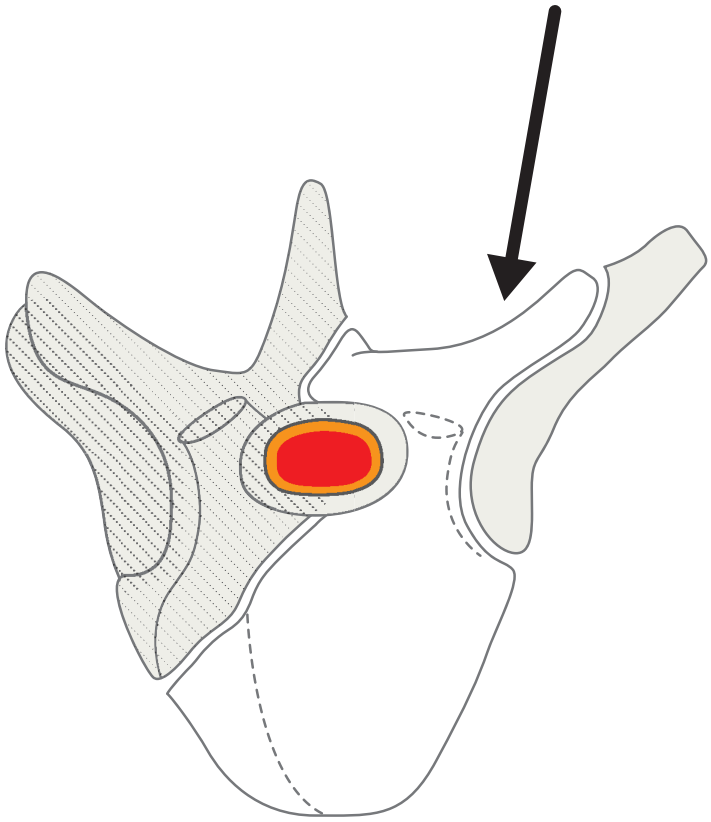


Diagram of a posterolateral approach (transpedicular) (Mulier and Debois, 1998)

Costotransversectomy

Resection of the rib head and the transverse process affords a wider, more convenient access route than that of a laminectomy.

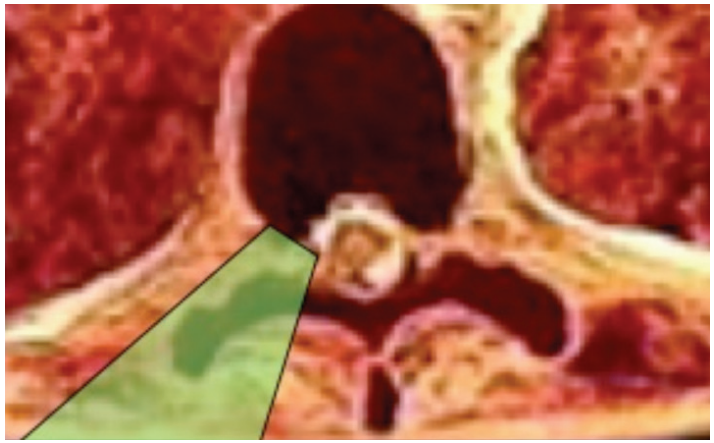
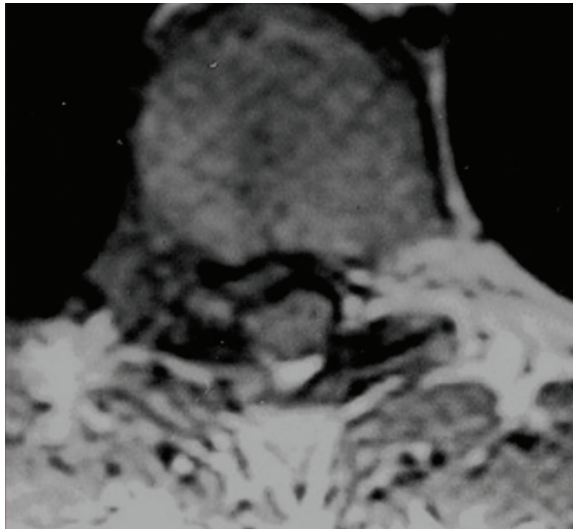


Diagram showing the view attainable with a transpedicular approach (Putz and Pabst, 2006)

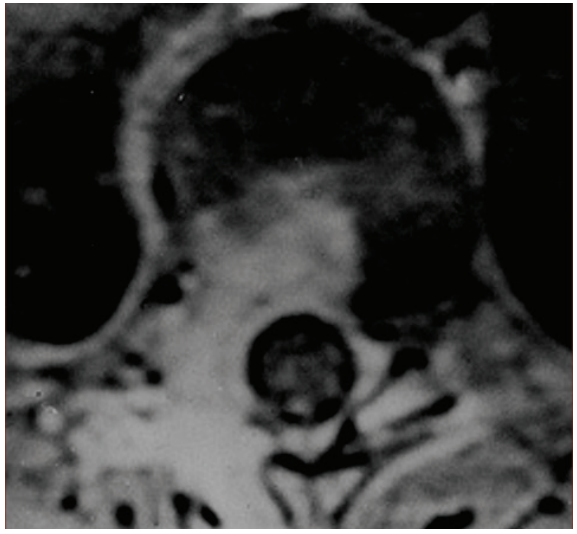
5

Shown below are pre- and post-operative images of a patient with a right posterolateral herniation.



Right-sided posterolateral herniation is evident.

Pre-operative thoracic spine MRI, T2-weighted sequence, axial section



The approach route and good decompression can be observed.

Post-operative thoracic spine MRI, T2-weighted sequence, axial section

Transpedicular Approach

The transpedicular approach involves removing all of the pedicle caudal to the disc herniation as well as the facet joint.

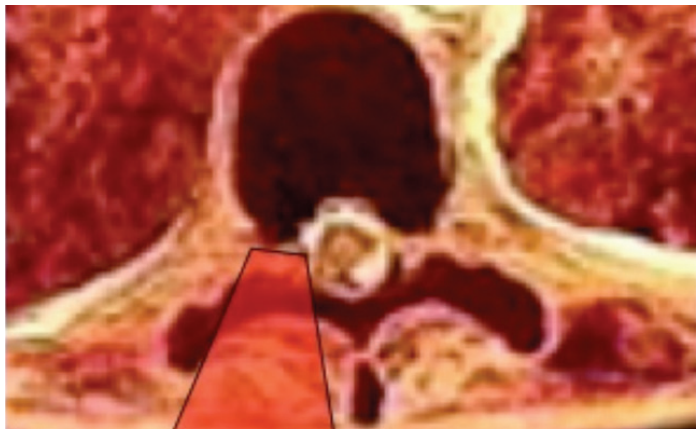


Diagram showing the view attainable with a transpedicular approach (Putz and Pabst, 2006)

Affords more direct exposure of the ventrally positioned pathology. The potential for preserving radicular vessels is considered an advantage of this approach.

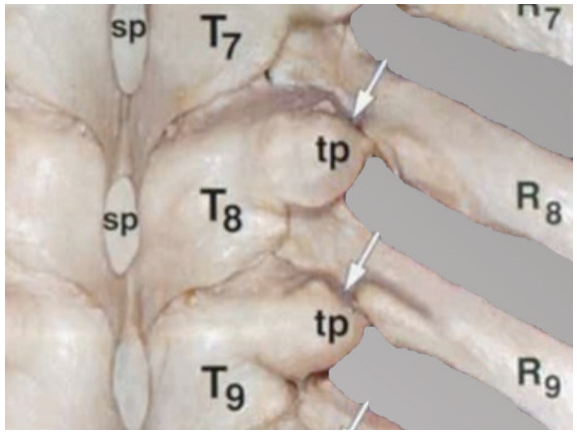
The transpedicular access route.

Post-operative computed tomography of the thoracic spine, axial section

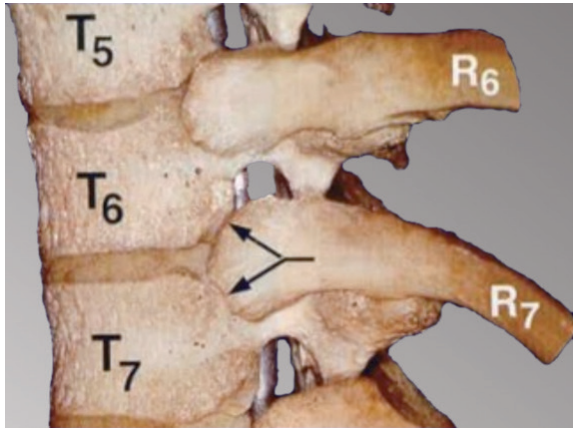
Lateral Extracavitary Approach

A completely extrapleural lateral extracavitary approach can provide excellent ventral exposure to the spinal cord.

This requires extensive dissection and manipulation of the soft tissues, including the paravertebral muscles, which can be denervated and devascularized.



Posterior view showing the relationship between the transverse processes and the ribs.

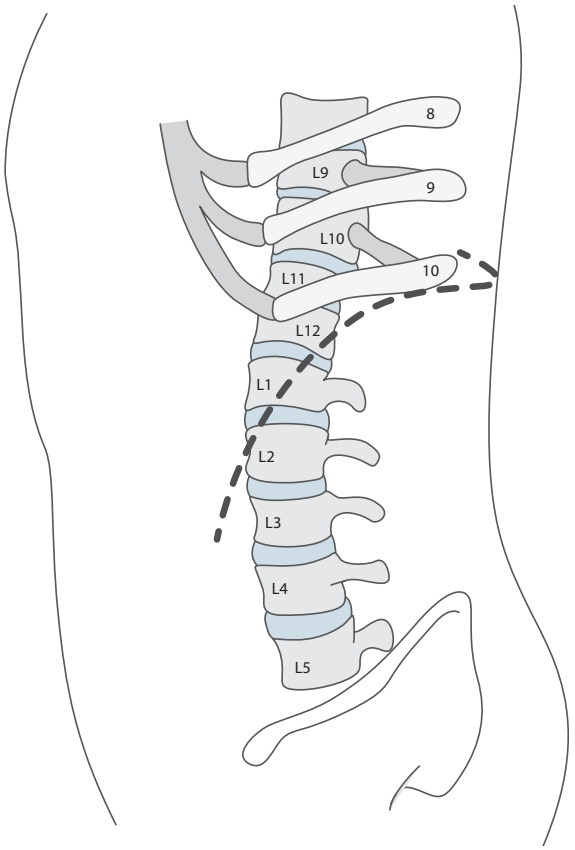


Anterolateral view showing the relationship between costal heads, bodies and discs.

Anatomical references for a posterior extracavitary approach (Putz and Pabst, 2006)

Lateral Parascapular Extrapleural Approach

The lateral parascapular extrapleural approach offers good exposure of the upper thoracic spine, above T5, compared to the lateral extracavitary route.



Combined extrapleural and extraperitoneal approach (Menezes and Sonntag, 1996)

Ventral Approach

From an anatomical standpoint, the ventral approach offers excellent spinal cord exposure with an optimal angle for removing intradural discs and repairing the dura mater. It also provides access at multiple levels.

The obvious risk of this approach is causing pulmonary morbidity and damage to large vessels and viscera.

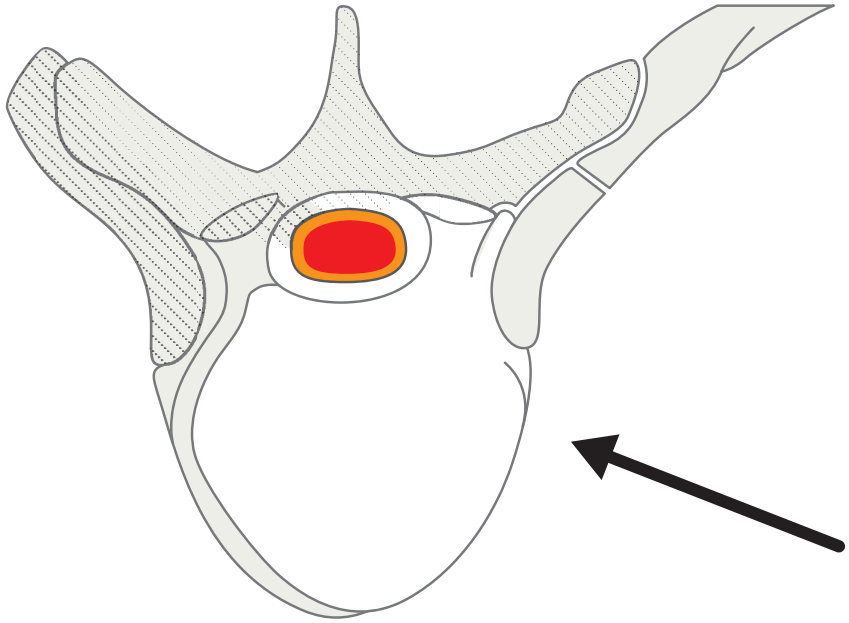
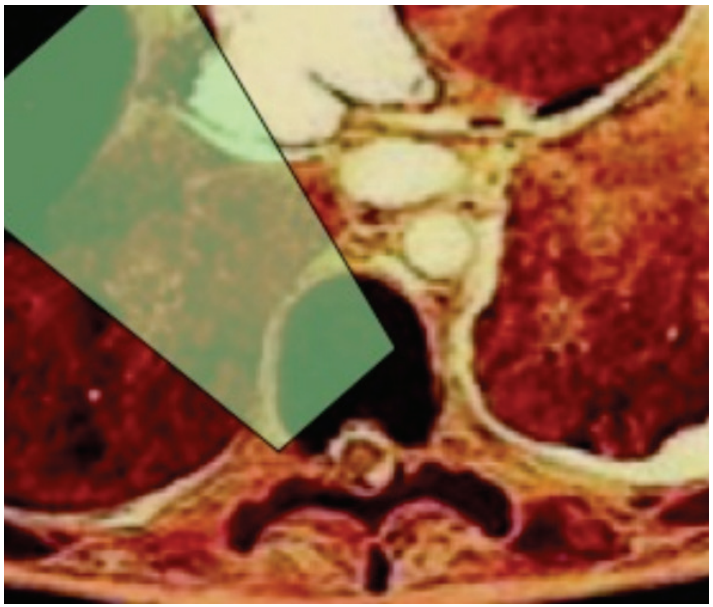


Diagram of an anterolateral approach (Mulier and Debois, 1998)



An axial anatomical section at the thoracic level is shown.

Diagram of the view attainable with a ventral approach (Putz and Pabst, 2006)

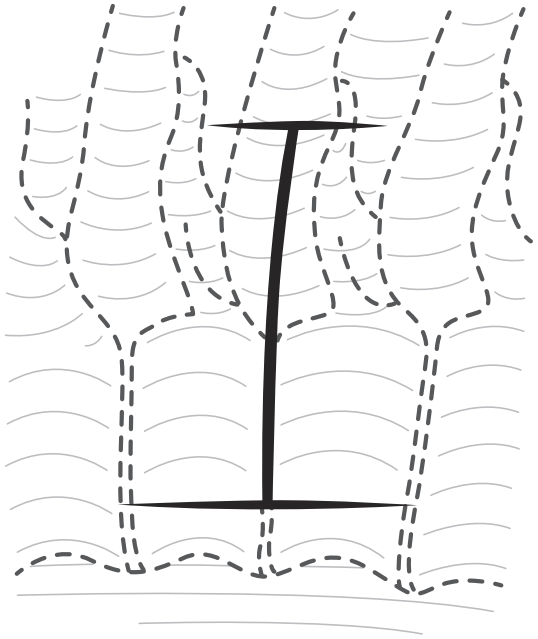
The use of the ventral approach is known to be limited in cases of herniations above T5.

5

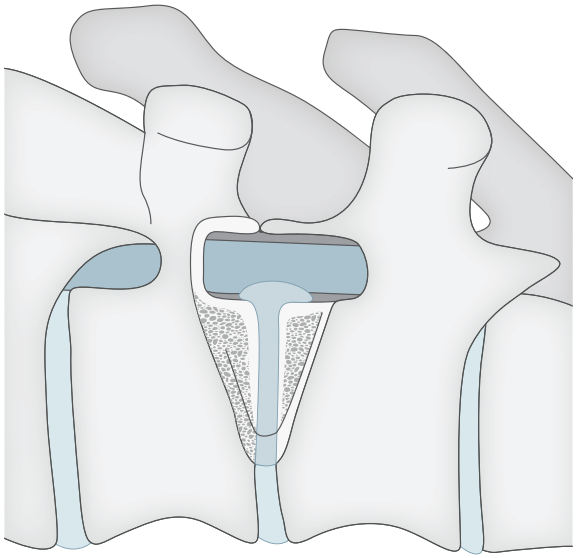
Thoracoscopic Approach

There is currently an overall consensus that the ventral approach is the most appropriate method of treating centrally-located thoracic disc injuries. However, the morbidity of a thoracotomy (hospitalization with intensive therapy, thoracic drainage and post- operative pain) led to the development of minimally invasive ventral approaches.

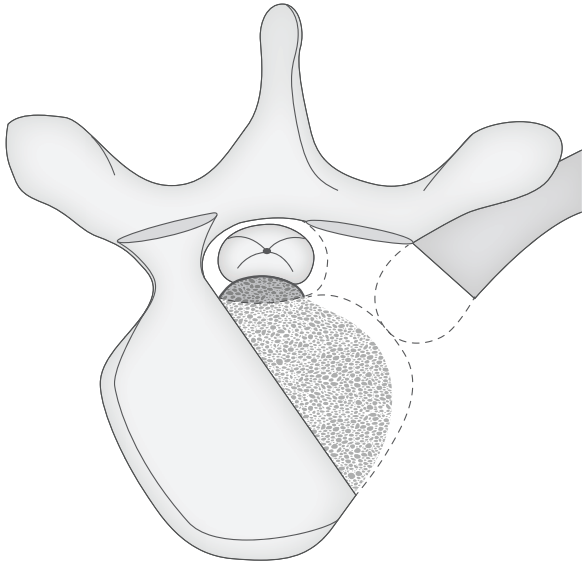
The use of video-assisted thoracoscopic techniques proved to be effective in the treatment of herniated thoracic discs, with reduced morbidity in relation to classical ventral approaches.



Opening the pleura to access
the costal head, bodies and disc.



Lateral view after removing the rib
and part of the vertebral bodies.



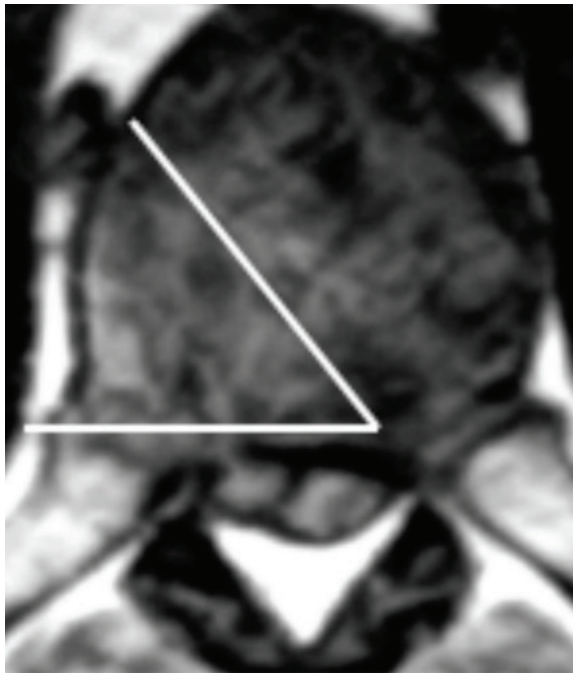
Axial view showing the sections of rib and vertebral bodies resected to reach the anterior face of the cord.

Technically detailed diagrams of a thoracoscopy (Dickman, Rosenthal and Perin, 1999)

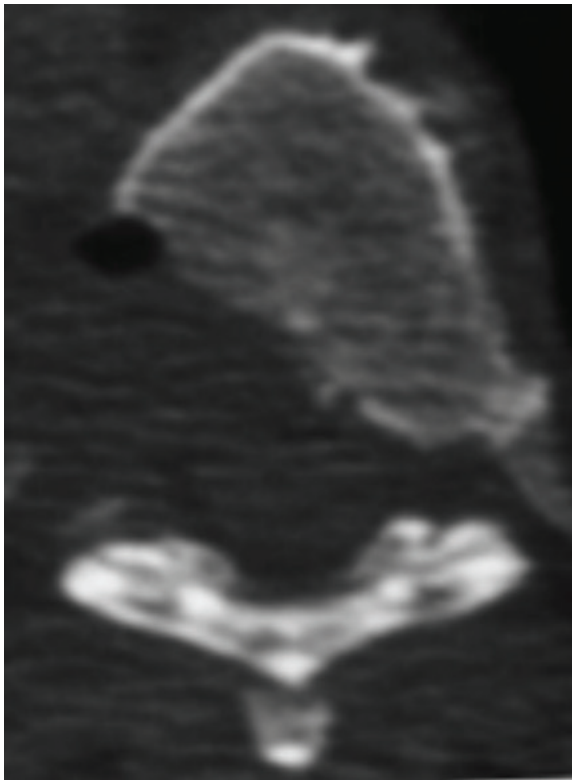
5

Results

Post-operative evaluation of patients who received operations for herniated thoracic discs reveals improved pain and resolution of symptoms in around 87% of cases.



Pre-operative thoracic spine MRI, T2-weighted sequence, axial section



The decompression achieved is evident.

Post-operative thoracic spine MRI, T2-weighted sequence, axial section

As with any operation, the surgical treatment of herniated thoracic discs also presents complications, which occur in 3.5 to 6.0% of all cases.

Each of the different surgical approaches to the thoracic spine described here is associated with a specific set of complications.

Generally speaking the most common pitfalls are the following:

- neurological deterioration
- erroneous identification of the surgical level
- incomplete disc resection
- post-operative instability
- cerebrospinal fluid leak
- pulmonary complications
- infection
- intercostal neuralgia

4

Future Prospects

The results achieved by surgery on herniated thoracic discs would be improved through more detailed knowledge of their natural history, which, in turn, can be attained by studying unoperated asymptomatic and symptomatic cases.

Advances in surgical techniques will be consistent with the development of less invasive procedures that facilitate disc decompression operations incorporating greater safety as well as reduced blood loss and post-operative pain.

7. SUMMARY

HERNIATED THORACIC DISC

Symptomatic herniated discs are relatively uncommon in the thoracic spine. Between 30 and 70% of herniated thoracic discs are calcified.

The most common signs and symptoms are:

- pain (axial or radicular)
- myelopathy
- bowel and bladder dysfunction
- hyperreflexia
- spasticity

Magnetic resonance imaging is the complementary study of choice.

Surgery is indicated for progressive or severe symptoms of intractable radicular pain or myelopathy. Anterior approaches are recommended for midline herniations. Posterior approaches should be considered for lateral herniations. Thoracoscopy is an emerging treatment option for thoracic disc herniations.

REFERENCES

Benzel, E. C. (1995)
Biomechanics of Spine Stabilization: Principles and Clinical Practice. New York: McGraw-Hill.

Brown, C. W.; Deffer, P. A. Jr; Akmakjian, J.; Donaldson, D. H. and Brugman, J. L. (1992)
The natural history of thoracic disc herniation. Spine, 17(Suppl 6), S97-S102.

Burke, T. G. and Caputy, A. J. (2000)
Treatment of thoracic disc herniation: evolution toward the minimally invasive thoracoscopic technique. Neurosurg Focus, 9, E9.

DePalma, A. F. and Rothman, R. H. (1970)
The Intervertebral Disc. Philadelphia (PL): WB Saunders.

Dickman, C.; Rosenthal, D. and Perin, N. (1999)
Thoracoscopic Spine Surgery. New York: Thieme Medical Publishers

McInerney, J. y Ball, P. A. (2000)
The pathophysiology of thoracic disc disease. Neurosurg Focus, 9(4), E1.

Mulier, S. and Debois, V. (1998)
Thoracic Disc Herniations: transthoracic, lateral, or posterolateral approach? Surg Neurol, 49(6), 599-606.

Anand, N. and Regan, J. J. (2002)
Video-assisted thoracoscopic surgery for thoracic disc disease, classification and outcome study of 100 consecutive cases with a 2-year minimum follow-up period. Spine (Phila Pa 1976), 27(8), 871-879.

Ravichandran, G. and Frankel, H. L. (1981)
Paraplegia due to intervertebral disc lesions: a review of 57 operated cases. Paraplegia, 19, 133-139.

Menezes, H. and Sonntag, V. (1996)
Principle of Spine Surgery. Volume 2. New York: McGraw-Hill Healthcare.

Stillerman, C. B.; Chen, T. C.; Couldwell, W. T.; Zhang, W. and Weiss, M. H. (1998)
Experience in the surgical management of 82 symptomatic herniated thoracic discs and review of the literature. J Neurosurg, 88, 623-633.

Stillerman, C. B. and Weiss, M. H. (1996)
Surgical management of thoracic disk herniation and spondylosis. In Menezes A. H.; Sonntag V. K. H. (Eds.): Principles of Spinal Surgery, Vol 1 (pp. 581-601). New York: McGraw-Hill.

Putz, R. and Pabst, R. (2006)
Sobotta Atlas of human anatomy (Head, Neck, Upper Limb, Thorax, Abdomen, Pelvis, Lower Limb) (14° Ed.). Munich: Urban and Fischer.

Project coordination
Néstor Fiore
Luciana Braga Garcia

Instructional design and educational review
María Alejandra Zangara
María Eugenia Bregliano

Project and graphic design
André Secundino

Illustrations
Gustavo Francesconi

AOSPINE

Advancing spine care worldwide

AOSpine International
Stettbachstrasse 6
8600 Duebendorf
Switzerland

T +41 44 200 2409
F +41 44 200 2412
education@aospine.org
www.aospine.org