High thoracic disc herniation: a case-based discussion with a review of literature

Ali M. Maziad

Department of Orthopedic & Spine Surgery, Ain Shams University, Abbassia, Cairo, Egypt

Correspondence to Ali M. Maziad, MD, PhD, Department of Orthopedic & Spine Surgery, Ain Shams University, Abbassia, Cairo, Egypt. Tel: +2-010-67051543; fax: +2-24511101; e-mail: ali.maziad@gmail.com

Received: 9 October 2021
Revised: 1 December 2021
Accepted: 1 January 2022
Published: 31 May 2022

The Egyptian Orthopaedic Journal 2022, 57:91–97

Aim
This article aims to describe a case of a 28-year-old male patient with progressively worsening of myelopathic symptoms owing to a large T4-5 thoracic disc herniation with severe cord compression.
Background
A 28-year-old male patient was referred to the clinic by a neurologist for worsening of bilateral lower extremity numbness, tingling, and progressive weakness over a period of few months with a clinical examination significant for severe myelopathy and imaging confirming a large thoracic disc herniation.
Procedure
T4-5 left hemilaminectomy and transfacet discectomy with unilateral right T4/T5 fixation and fusion were done.
Outcomes
The patient experienced delayed postoperative paraplegia that was reversible despite negative imaging studies, suggesting intraoperative incidental trauma to the cord or progressive postoperative cord edema.
Scientific message
Literature review of similar cases is presented as well as learning points from this challenging case. If the posterior approach is to be used, complete thorough decompression of the cord is advisable to minimize the risk of complications.

Keywords:
myelopathy, postoperative paraplegia, thoracic disc herniation

Egypt Orthop J 57:91–97

1110-1148

Introduction

The incidence of thoracic disc herniations in autopsy studies ranges between 7% and 15%; however, there is lower incidence of symptomatic thoracic disc herniations and is estimated to be 1 in 1 000 000 in the general population. Thoracic discectomy procedures constitute only 0.15%–4% of all disc surgical procedures.

Common challenges associated with thoracic discs are calcified disc, long-standing herniations causing dural adhesions, increased spinal cord diameter-to-canal diameter ratio in thoracic spine than cervical/lumbar, thus increasing the potential for neural compromise. The cord in the midthoracic region lies in a Watershed zone [1,2].

A challenging case with thoracic disc herniation is presented with patient outcomes and literature review.

Case

A 28-year-old male patient presenting to the clinic was referred by a neurologist for worsening bilateral lower extremity numbness, tingling, and progressive weakness over a period of few months. The patient had a history of premature birth and mild cerebral palsy as well as scoliosis.

He had been using a cane to support his ambulation that had progressively worsened over prior 5 months stopping him from his job as a manual factory worker. He had been taking only simple medications for pain, and owing to low socioeconomic status, the patient had not pursued any medical advice previously.

The patient did not recall any specific trauma that may have triggered symptoms that were insidious in nature and started with tingling sensation only in lower extremities that then progressed to motor weakness and gait abnormalities requiring a cane.

Examination revealed the following:

	P	Q	TA	EHL	GSC
R	3/5	3/5	3/5	3/5	3/5
L	3/5	3/5	3/5	3/5	3/5

There was diffuse decrease in sensation of both lower extremities in all distributions, with preserved rectal tone and preserved perianal sensations.

The patient had clasp-knife rigidity at knee joints as well as bilateral hyper-reflexia in patellar and ankle reflexes with 5 beats of ankle clonus bilaterally.

Gait without a cane was impossible, and even with the cane, the patient experienced marked gait instability and extreme difficulty in ambulating.

Immediate decision for surgery was taken. Overall, 4 mg of Decadron Q8 was started.

Imaging studies

The rib count and level of surgery were noted: T4/5 herniation and stenosis. No other abnormalities were noted on cervical and lumbar magnetic resonance imaging (MRI) (Figs. 1 and 2).

Surgical procedure

A posterior-based spinal decompression and transfacet discectomy were planned. Although the patient was severely symptomatic, the size of the disc was considered amenable to a posterior based resection, avoiding the possible respiratory complications of a thoracic posterior approach. Therefore, a posterior thoracic discectomy and T4-5 fusion were decided.

The patient was placed prone on a Jackson frame.

Neuromonitoring using electromyography (EMG), somatosensory evoked potentials (SSEP), and motor evoked potential (MEP) was performed throughout the case study. However, there were no baseline monitorable MEPs in both lower extremities. Mean arterial pressure was increased to maximize cord perfusion during the procedure and patient temperature was maintained at physiologic level.

Localization of the surgical level was done under C-arm imaging counting from the first rib down and confirming and correlating number of ribs and surgical level with preoperative imaging.

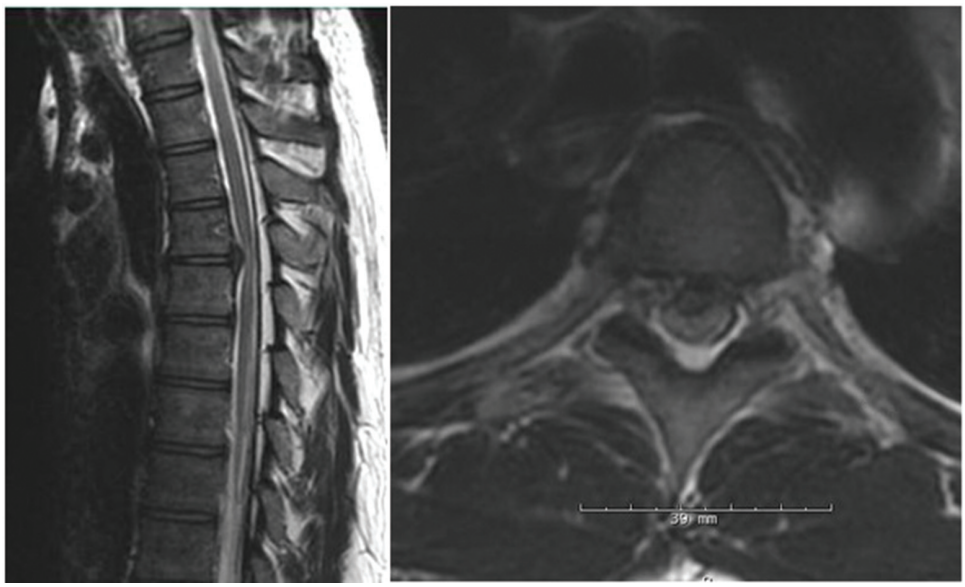
A standard midline posterior approach was used with bilateral subperiosteal dissection of muscles to expose the laminae and pedicles of T4 and T5.

Left-side facetectomy and hemilaminotomy were done followed by transfacet discectomy. Pedicle screw and rod placement was done on the right side in the standard fashion followed by burring the lamina and placing bone graft on right side.

Operative time was 1 h and 15 min. Estimated blood loss was 100 cc. There was no change from baseline monitoring values throughout the case study. Baseline interpretation was given for the case. There were no significant changes. All findings were discussed with the surgeon in real time during the course of monitoring. This intraoperative neurophysiologic monitoring was supervised by the attending staff neurologist.

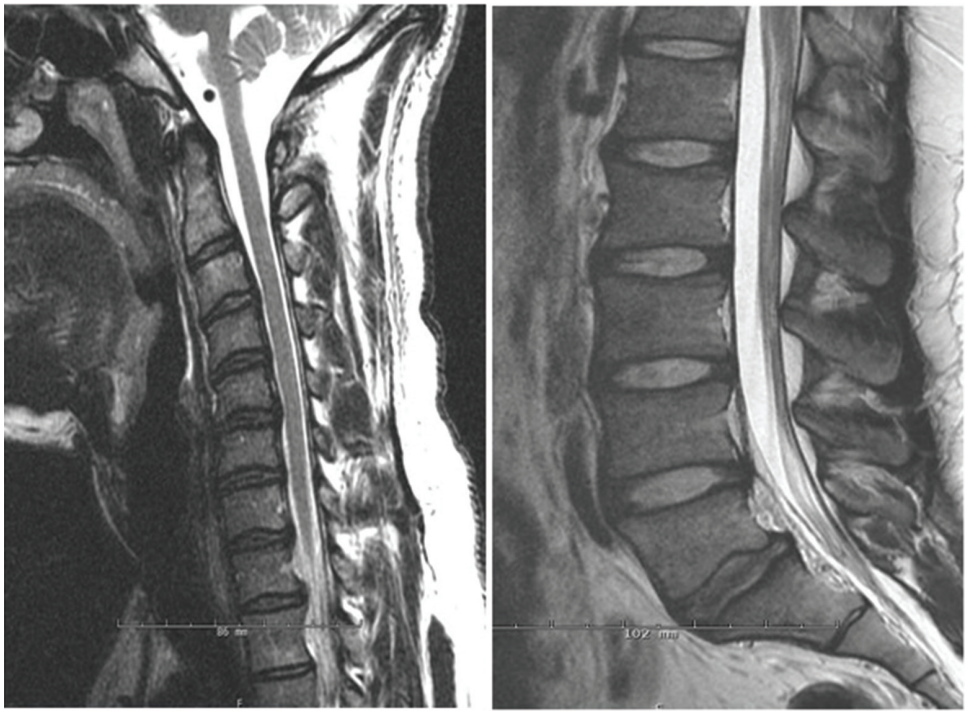
Postoperative check within 1 h of surgery revealed increased weakness in both lower extremities, more on the left side.

Figure 1



T4-5 thoracic disc herniation with severe cord compression.

Figure 2



Mild degenerative changes in cervical and lumbar spine.

	HF (L2)	KE (L3)	AD (L4)	LTE (L5)	APF (S1)
RLE	2/5	3/5	3/5	2/5	2/5
LLE	2/5	2/5	0/5	0/5	0/5

Decadron 6 mg Q8 was initiated with close neurocheck monitoring.

On examination a few hours later, the patient was found to be completely paralyzed in both lower extremities.

	HF (L2)	KE (L3)	AD (L4)	LTE (L5)	APF (S1)
R	0/5	0/5	0/5	0/5	0/5
L	0/5	0/5	0/5	0/5	0/5

Emergent computerized tomography imaging (CT) scan and MRI were done, which confirmed good position of screws and did not reveal any new compression over the spinal cord. A decision for conservative management and continuation of steroids at 6 mg Q8 was made (Figs. 3 and 4).

Over the next 48 h, the patient started showing gradual improvement in lower extremity motor power.

	HF (L2)	KE (L3)	AD (L4)	LTE (L5)	APF (S1)
R	2/5	2/5	2/5	2/5	2/5
L	2/5	2/5	1/5	1/5	1/5

The patient was transferred to a rehabilitation center and physical therapy was started.

Over the next 6 months, the rigidity in both lower extremities improved as well as motor power and he plateaued to a functional level despite the persistent weakness in both lower extremities.

	HF (L2)	KE (L3)	AD (L4)	LTE (L5)	APF (S1)
R	3/5	3/5	3/5	3/5	3/5
L	3/5	3/5	3/5	2/5	2/5

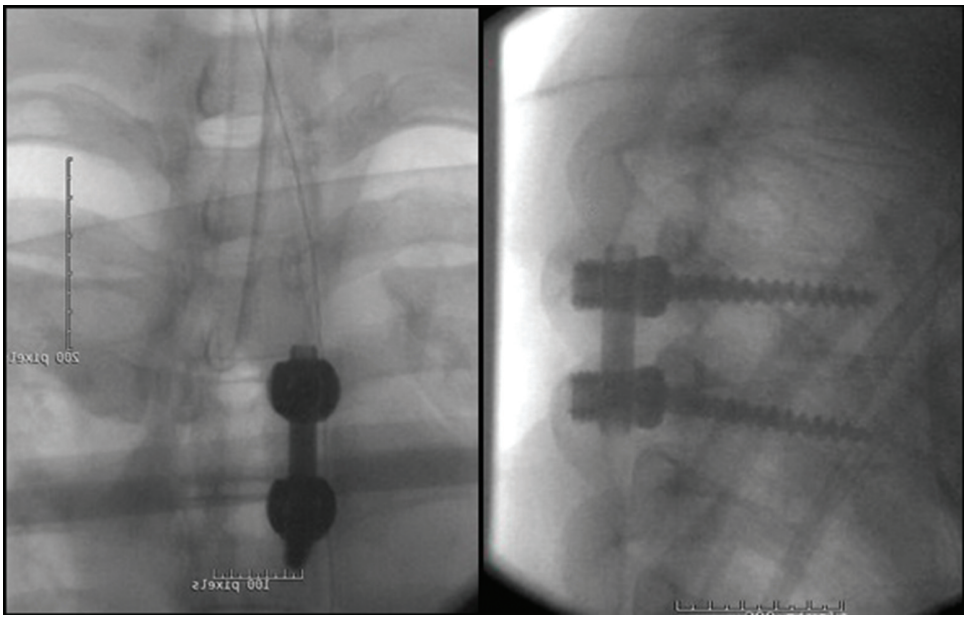
He was able to ambulate more steadily than preoperatively with a cane/walker and alternated the use of cane and wheelchair in his daily activities.

Discussion

Common surgical corridors to the thoracic disc include the following:

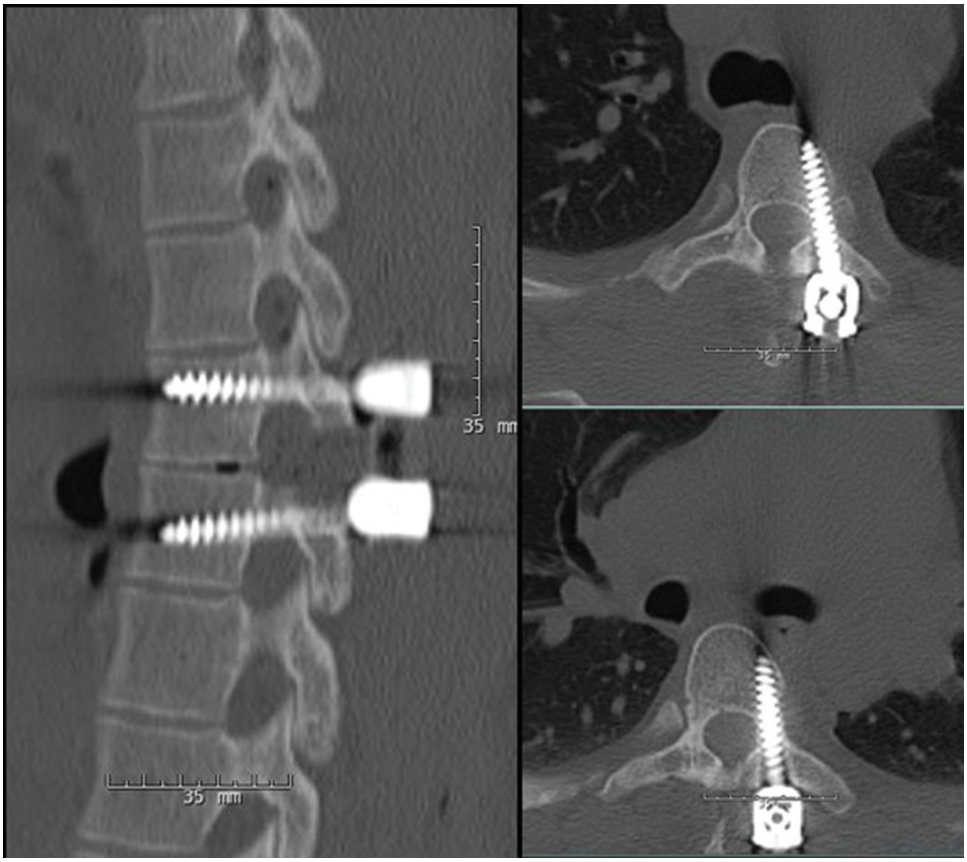
(1) Posterior (laminectomy, transpedicular, or transfacet pedicle-sparing).
(2) Posterolateral (costotransversectomy).
(3) Lateral (lateral thoracotomy, lateral extracavitary, or miniextracavitary).
(4) Anterolateral (transthoracic or thoracoscopic approach).

Figure 3



AP and lateral x-rays showing good position of hardware.

Figure 4



CT scan showing good position of hardware.

(5) Anterior (transsternal procedure).
(6) Laminectomy alone has been linked to progressive kyphosis owing to violation of the posterior elements with inadequate decompression of the disc herniation with resulting further injury to the spinal cord.

Laminectomy

Early reports of laminectomy showed increased paresis or paralysis: 24% of Love and Kiefer's patients, 27% of Logue's patients, and 29% of Tovi and Strang's patients. Other complications such as loss of bladder control, infection, and postoperative embolism raised the overall morbidity of laminectomy to 59% with mortality rates up to 13%. Based on those results, simple laminectomy alone was abandoned for this disease after 1960 [3–7] (Fig. 5).

Anterolateral transthoracic

Anterolateral thoracotomy for thoracic disc disease was reported by Perot and Munro and Ransohoff *et al.* Among their five patients, they reported no mortalities and no morbidity.

Benjamin reported one infection among 30 patients treated with the anterolateral thoracotomy, with no other morbidity or mortality encountered [8–10].

Lateral extracavitary approach

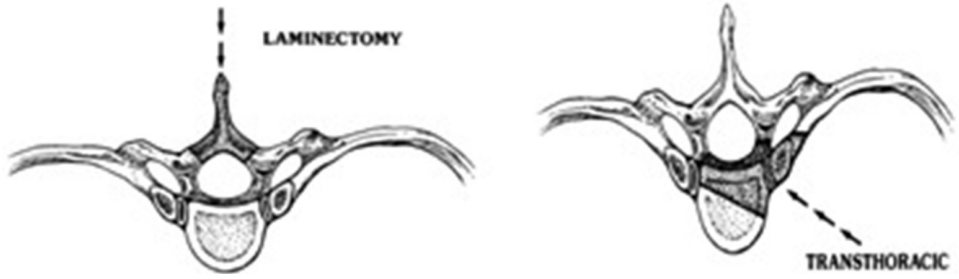
Lesoin *et al.* (21 patients) reported a series of 21 patients with an incidence of only 10% of increased paresis or paralysis, whereas Ridenour reported 4% incidence of increased paresis after surgery, with 0 mortalities. Finally, Stillerman reported 51 patients, with only 2% incidence of increased paresis (Fig. 6).

In other studies, costotransversectomy in 17 patients with disc herniations had no increased paresis, whereas the transthoracic approach used in 88 had less than 1% paresis as a result of the procedure. However, there was 2% incidence of pneumonia or atelectasis, 1% experienced pulmonary embolus, 3% had deep or superficial wound infections, 1% experienced bowel obstruction, and 1% experienced postoperative seizure, with total overall morbidity of 11% with the transthoracic procedure and no mortality [10–12].

Finally, the extracavitary approach was reported in 76 patients, with 4% experiencing either pneumonia or atelectasis postoperatively, 3% deep or superficial surgical wound infections, and 4% had a pleural tear during the procedure, with a final total postoperative morbidity of 12% [11].

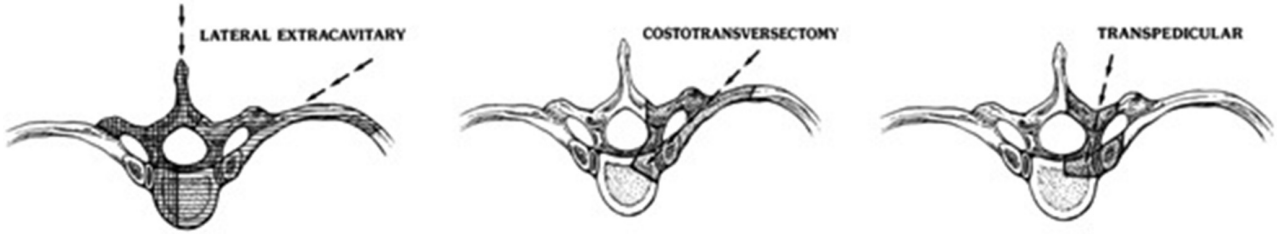
The transfacet approach was reported by Nishimura *et al.* in 16 patients with central/paracentral and calcified/noncalcified discs. Microdiscectomy through a posterior transfacet pediclesparing approach was done. All of the patients had significant improvement except one patient, who had preoperative ASIA grade A cord injury. None of the patients had new neurological symptoms postoperatively with only one patient developing postoperative wound infection that required

Figure 5



Laminectomy and transthoracic.

Figure 6



Extracavitary, costotransversectomy, and transpedicular.

additional operative debridement and revision of hardware.

It is important to note that the transpedicular approach and costotransversectomy are relatively inadequate for centrally located herniated discs and are better utilized for lateral herniations [13,14].

However, the lateral extracavitary approach and the transthoracic approach provide excellent exposure of the anterior spinal canal for decompression of centrally herniated discs.

Several approaches have been reported in the literature to treat thoracic disc herniations. There is no gold standard approach, and each technique has unique advantages and disadvantages.

These approaches include transpedicular approach, transfacet pedicle-sparing approach, costotransversectomy approach, transthoracic transpleural approach, and thoracoscopic approach.

A retrospective study by Quraishi *et al*. [15], utilizing the left- or right-sided thoracotomy approach for large calcified thoracic disc, on 13 patients with calcified giant thoracic disc herniations and average canal encroachment of 62% reported 8 patients with improvement by 1 Frankel grade (62%), 2 improved by 2 grades (15%) and 3 did not change their grade (23%). The complication rate was 4/13 (31%; 3 patients with durotomies and 1 with disc recurrence).

In a study by Yoshihara *et al*. [16] comparing anterior to nonanterior approaches to thoracic disc herniations, it was found that the respiratory complication rate for anterior approach procedures was 5.4-fold higher than that of nonanterior approach procedures as well as increased morbidity, morality, duration of hospital stay, and costs in the anterior group.

Based on those results, it was advisable that if thoracic disc herniation can be adequately excised by either approach, a nonanterior approach procedure may be a better option.

It is worth mentioning that with the advancement of minimally invasive spinal retractors in recent years, along with microscopic and endoscopic equipment, a minimally invasive anterior transthoracic discectomy would be a feasible option, providing excellent spinal cord visualization and decompression while avoiding the respiratory complications commonly associated with standard open anterior thoracic approaches.

Nie *et al*. [17] reported on 13 patients who underwent endoscopic thoracic discectomy under local anesthesia with a mean follow-up of 17 months with patient self-reported satisfactory rate of 77%, improvement in visual analog scale (VAS) for mid back pain from 9.1 to 4.2, and the mean oswestry disability index (ODI) from 61.0 to 43.8. They reported one patient with postoperative spinal positional headache that was successfully treated with epidural blood patch and one patient with recurrence of symptoms 8 months after surgery.

They recommended, however, that the endoscopic procedure is to be used for soft discs and contraindicated in large calcified discs.

In addition, this technique may be more suitable for patients with a chief complaint of back pain owing to disc herniation and may not be suitable for patients with myelopathic symptoms as thorough excision of a large herniation is necessary to achieve complete neural decompression that may not be possible with an endoscope particularly in central herniations.

Learning points from this case

Although we believe that the chosen posterior approach for the procedure is acceptable, perhaps a transthoracic approach might have been a safer option given the size of the herniation.

Alternatively, if the same posterior transfacet approach was chosen, bilateral laminectomy and thorough cord decompression are probably more advisable.

Although no significant cord signal change was noted on postoperative MRI, we believe that the deteriorated postoperative neurologic status is likely to be owing to postoperative cord edema, which could have been avoided if bilateral laminectomy was performed.

Another reason for this complication is our attempt to remove a calcified portion of the disc from underneath the cord indirectly, which may have posed excessive manipulation or a minimal direct injury to an already much compromised cord from long-standing compression.

It would be highly advisable in such cases with thoracic disc herniation to obtain preoperative CT scan along with the MRI to identify the extent of calcification of the herniation that is often difficult to detect on MRI scans and may dictate an anterior approach as a safer option to posterior approaches if calcification exists.

Prophylactic steroids during and after surgery are advisable in those patients to reduce postoperative cord edema.

Conclusion

Long-standing thoracic disc herniations with neurological compromise can be very challenging and may have unpredictable results after surgery. Preoperative CT scan is very valuable and regardless of the chosen approach, thorough spinal cord decompression and no cord manipulation along with prophylactic steroids are advised to obtain the best possible outcomes.

Acknowledgements

The manuscript has been read and approved by the authors.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Abbott KH, Retter RH. Protrusions of thoracic intervertebral disks. Neurology 1956; 6:1–10.

2 Arseni C, Nash F. Thoracic intervertebral disc protrusion: a clinical study. J Neurosurg 1960; 17:418–430.

3 Hawk WA. Spinal compression caused by ecchondrosis of the intervertebral fibrocartilage: with a review of the recent literature. Brain 1936; 59:204–224.

4 Logue V. Thoracic intervertebral disc prolapse with spinal cord compression. J Neurol Neurosurg Psychiatry 1952; 15:227–241.

5 Mixter WJ, Barr JS. Rupture of the intervertebral disc with involvement of the spinal canal. N Engl Surg Soc 1934; 211:210–215.

6 Tove D, Strang RR. Thoracic intervertebral disk protrusions. Acta Chirurgica Scand 1960; 267 (Suppl.):3–41.

7 Love JG, Kiefer EJ. Root pain and paraplegia due to protrusions of thoracic intervertebral disks. J Neurosurg 1950; 7:62–69.

8 Benjamin V. Diagnosis and management of thoracic disc disease. Clin Neurosurg 1982; 30:577–605.

9 Perot PL, Munro DD. Transthoracic removal of midline thoracic disc protrusions causing spinal cord compression. J Neurosurg 1969; 31:452–458.

10 Stillerman CB, Weiss MH. Management of thoracic disc disease. Clin Neurosurg 1991; 38:325–352.

11 Lesoin F, Rousseaux M, Autricque A, Ressaul Y, Villette L, Clarisse J, Jomin M. Thoracic disc herniations: evolution in the approach and indications. Acta Neurochir (Wien) 1986; 80:30–34.

12 Ridenour T, Haddad S, Hitchon P, VanGilder J, Menezes A, Traynelis V. Herniated thoracic disks: operative procedures and clinical results. Seventh Annual Meeting of the Joint Section on Disorders of the Spine and Peripheral Nerves; 1991. pp. 130-131.

13 Hulme A. The surgical approach to thoracic intervertebral disc protrusions. J Neurol Neurosurg Psychiatry 1960; 23:133–137.

14 Menard V. Causes de la paraplegie dans le maladie de Pott, son traitment chirurgical par l'ouverture directe du foyer tuberculeaux des vertebres. Rev Orthopaed 1894 5:47–64.

15 Quraishi NA, Khurana A, Tsegaye MM, Boszczyk BM, Mehdian SMH. Calcified giant thoracic disc herniations: considerations and treatment strategies. Eur Spine J 2014; 23 (suppl 1):S76–S83.

16 Yoshihara H, Yoneoka D. Comparison of in-hospital morbidity and mortality rates between anterior and nonanterior approach procedures for thoracic disc herniation. Spine 2014; 39:E728–E733.

17 Nie HF, Liu KX. Endoscopic transforaminal thoracic foraminotomy and discectomy for the treatment of thoracic disc herniation. Minim Invasive Surg 2013; 2013:264105.