



EXPERIENCE OF SURGICAL TREATMENT OF SINGLE-LEVEL THORACIC DISC HERNIATIONS USING A COSTOTRANSVERSECTOMY APPROACH

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SUMMARY

Objective: To present the surgical results of patients with a single-level thoracic disc herniation treated by a costotransversectomy approach, and to discuss the advantages and disadvantages of this method.

Patients and Methods: Here, we present the symptoms and signs at presentation, the recovery of symptoms after surgery, and the complication rates of 21 consecutive patients with single-level thoracic disc herniation treated with a costotransversectomy between 2004 and 2011.

Results: The overall complication rate was 38% based on complication events, and 19% based on the patient population. The most common symptom at presentation was axial, localized, or radicular pain. The highest recovery rate was detected for pain. The operation time was short and the blood loss was minimal with this surgical method.

Conclusions: Costotransversectomy should be kept in mind as a first-line surgical option due to its safety and minimal invasiveness. It provides excellent posterolateral vision for the surgeon.

Key Words: Costotransversectomy, Surgery, Thoracic disc herniation

Level of Evidence: Retrospective clinical study, IV

ÖZET

Amaç: Kostotransversektomi yaklaşımı ile tedavi edilen tek seviyeli torakal disk hernisi hastalarının sonuçlarını sunmak ve yaklaşımın avantaj ve dezavantajlarını tartışmak.

Hastalar ve Yöntem: 2004 ve 2011 yılları arasında kostotransversektomi yöntemi ile ameliyat edilen 21 hastanın disk seviyeleri, geliş yakınmaları, izlem süresinde bulgu ve belirtilerindeki düzelmeler ve komplikasyon oranları sunuldu. Sonuçlar: Genel komplikasyon oranı komplike olay bazında % 38, hasta topluluğu bazında ise %19 olarak hesaplandı. En sık başvuru yakınması ağrı olup aksiyal, bölgesel ya da radiküler olarak görülebilmektedir. En yüksek iyileşme oranı ağrı yakınmasında izlenmiştir. Bu yaklaşımda ameliyat süresi kısa, kan kaybı azdır.

Son Çıkarım: Kostotransversektomi iyi bir posterolateral görüş sağlayan, güvenli, kolay, az invaziv bir yaklaşım olarak torakal disk hernilerinin cerrahi tedavisinde ilk sıralarda akılda bulundurulması gereken bir yöntemdir.

Anahtar Kelimeler: Cerrahi, Kostotransversektomi, Torakal disk hernisi

Kanıt düzeyi: Retrospektif klinik çalışma, IV

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INTRODUCTION

The incidence of thoracic disc herniation (TDH) is estimated to be between 1/1,000 and 1/1,000,000 in the general population¹². Thoracic discectomy represents only 0.15–4% of all discectomies^{2,10}. The male to female ratio is slightly less than 1, with the highest incidence at 40–50 years of age¹⁰.

Patients with TDH may present with pain, radiculopathy, or myelopathy⁸. If a surgical intervention is indicated for treatment, discectomy may be performed using a posterior approach, including costotransversectomy. Performing a thoracic discectomy by a midline posterior laminectomy alone is associated with a high risk of neurological morbidity and generally accepted as a contraindication^{1,5,7}.

New posterior and posterolateral approaches to the thoracic spine have been developed to provide improved access to the disc space of the thoracic region^{3,9}. The following report on thoracic microdiscectomy reflects our experience of the costotransversectomy approach for the surgical treatment of TDH, and its outcomes and complications.

PATIENTS AND METHODS

Between 2004 and 2011, 21 patients with single-level TDH were treated by thoracic microdiscectomy following costotransversectomy, performed by the authors. The patient population consisted of 12 women and nine men, with ages ranging between 24 and 64 years and a mean age of 49 years. None of the patients had a history of trauma (Table-1).

Table-1. Presentation and demographics (n=21, male=9, female=12, age range: 24–64 years, mean=49 years, mean follow-up=34 months).

Presentation	n	%
Pain (axial, localized, radicular)	17	80.9
Sensory impairment	14	66.7
Lower extremity weakness	10	47.6
Spasticity/Hyperreflexia	9	42.9
Babinski sign	8	38.1
Bladder dysfunction	3	14.3

The level of the disc disease ranged from T7–8 to T11–12. The most common herniation sites were T9–10 (7 patients, 33.3%), T10–11 (6 patients, 28.6%), T8–9 (5 patients, 23.8%), T7–8 (2 patients, 9.5%), and T11–12 (1 patient, 4.8%). Herniated discs were located laterally in 5 patients (23.8%), centrally in 6 patients (28.6%), and centrolaterally in 10 patients (47.6%) (Table-2).

Table-2. Disc levels and locations (n=21).

Thoracic level of herniated disc	Location			
	L	C	CL	T
7–8	-	2	-	2
8–9	2	1	2	5
9–10	2	1	4	7
10–11	-	2	4	6
11–12	1	-	-	1
	5	6	10	21

L: Lateral; C: Central; CL:Centrolateral

Disc calcification was present in 11 patients (52.4%), detected either by computerized tomography (CT) scans or during intraoperative inspection (Fig.-1. a,b). No intradural disc extension was seen at surgery for any patients.

Axial, localized, or radicular pain was the most common symptom at presentation, seen in 17 (80.9%) patients. The pain was characterized as severe in intensity by the majority of patients. Sensory impairment was reported in 14 (66.7%) patients, bladder dysfunction was seen in three (14.3%) patients, spasticity and hyperreflexia occurred in nine (42.9%) patients, a positive Babinski sign was detected in eight (38.1%) patients, and lower extremity weakness was recorded in ten (47.6%) patients (Table-1). The majority of patients with lower extremity weakness had paraparesis rather than monoparesis.

All patients had single-level TDH. Patients with multi-level TDH were excluded from the study.

All patients received magnetic resonance imaging (MRI) and a CT scan preoperatively, for diagnosis and preoperative planning. The extent of herniated disc removal and the detection of the residual compression site were evaluated by MRI (Figure-2.a,b and Figure-3.a,b). The mean follow-up period was 34 months. The postoperative signs and symptoms were checked and recorded.

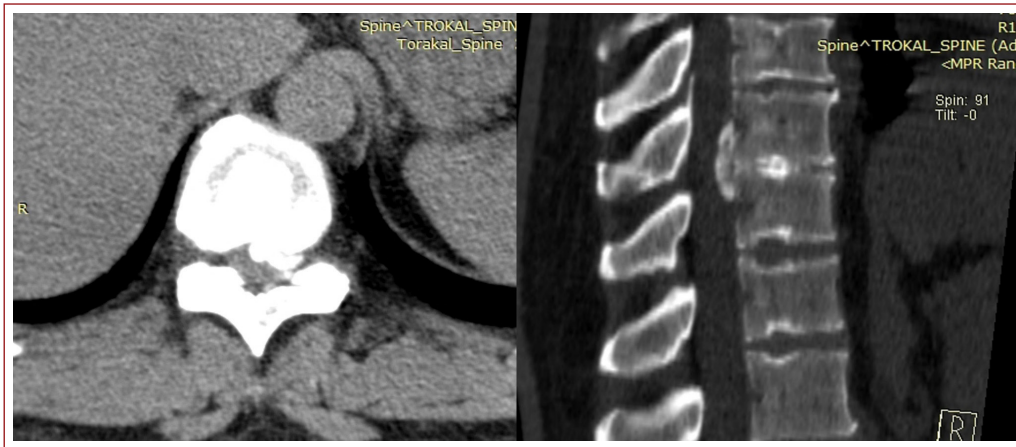


Figure-1. Axial (a) and sagittal reformatted (b) CT of a calcified TDH. CL location of the calcified disc herniation can be seen.

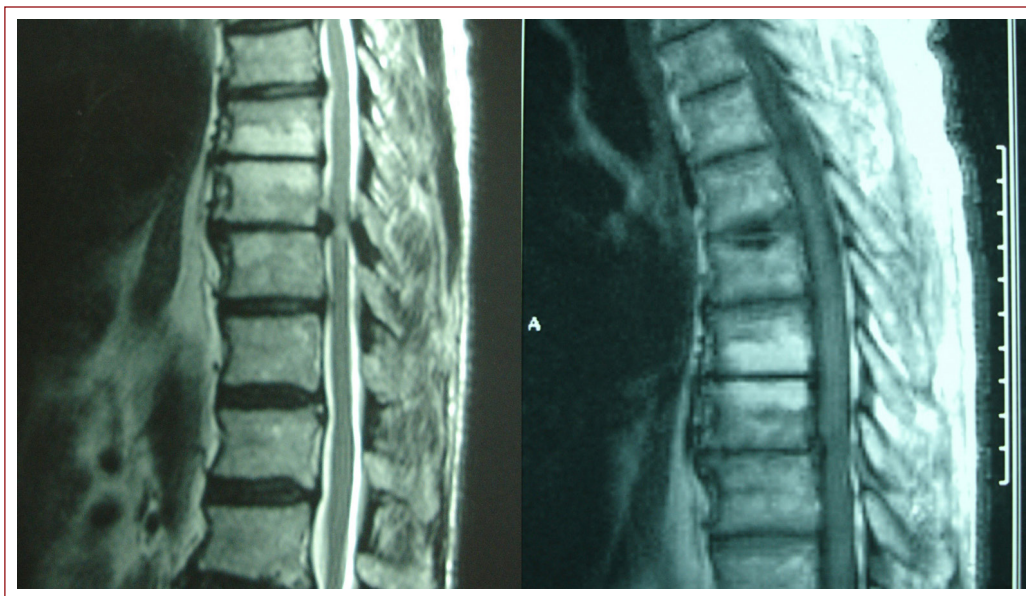


Figure-2. Preoperative (a) and postoperative (b) sagittal T1-W MRI of T7-8 disc herniation. Myelopathy in the spinal cord can be observed.



Figure-3. Sagittal (a) and axial (b) T1-W MRI of giant T9-10 TDH. The spinal canal was narrowed due to the disc. Severe compression can be seen.

All operations were performed using a costotransversectomy approach. After exposure, the discectomies were completed microsurgically under a surgical microscope.

SURGICAL PROCEDURE:

All operations were performed using a costotransversectomy approach under total intravenous general anesthesia (TIVA). The patients were positioned prone on chest rolls. A radiolucent operating table was used. The abdomen was suspended freely to decrease epidural venous congestion. The patient was taped to the table. An intraoperative neuromonitoring (IONM) system was used in all of the operations. Baseline values were obtained immediately after anesthesia was given. After preparation and draping, radiographic confirmation of the level was performed preoperatively (Fig. 4).

A paramedian incision was made 3–6 cm off the midline. The subcutaneous tissue, latissimus dorsi and thoracodorsal fascia were divided by electrocautery. The erector spinae muscles were dissected in a subperiosteal fashion and reflected medially to expose the transverse process and ipsilateral hemilamina.

The rib was identified and stripped by electrocautery on the dorsal surface. The transverse process was identified, the costotransverse ligament was divided, and the transverse process was removed. The rib was cut 3–6 cm from its origin and dissected from the underlying pleura. At this stage of the operation, the pedicle should be visible (Fig.-5). The pedicle can be removed by a high-speed drill or a Kerrison rongeur. Both instruments were necessary in the majority of the operations. This approach provided access to the spinal canal. The lateral thecal sac should be visible at this stage. After this step, decompression should be carried out, under a surgical microscope for better visualization.

The posterior vertebral body closest to the disc space may be drilled and removed. This maneuver can create a trough, into which the disc herniation can be pushed with curettes. After decompression with various disc punches and curettes, the epidural bleeding should be controlled. Subcutaneous drains were not used. Arthrodesis and fixation are optional, and should be considered in case of aggressive bone removal. No arthrodesis requiring bone removal was implemented in this series.

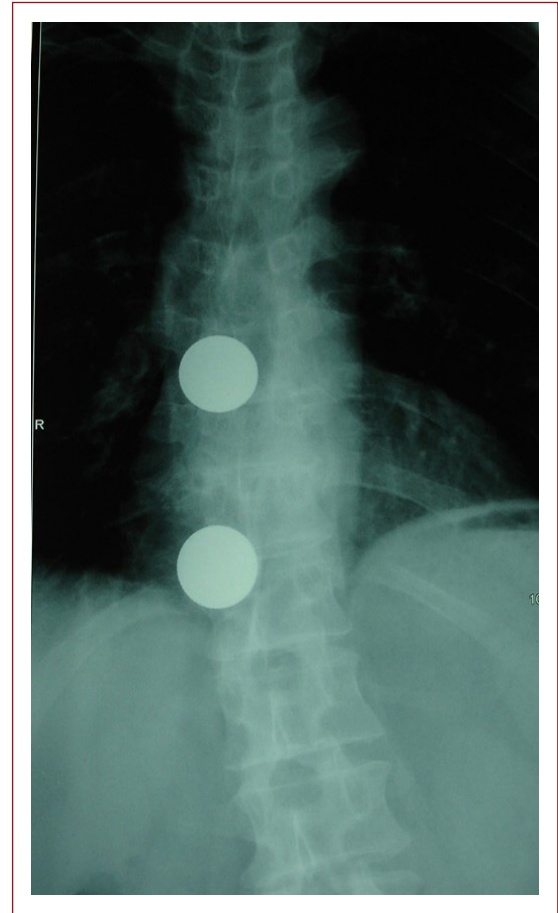


Figure-4. Preoperative radiographic level confirmation. Two radiolucent signs are always safer and more accurate.

RESULTS

Overall resolution of the pain occurred in 14 (82.4%) patients. Patients with radicular pain showed more improvement than patients with axial or localized pain. Improvement of the hyperreflexia and spasticity were seen in 7 (77.8%) patients, sensory dysfunction in 9 (64.3%), and motor weakness in 6 (60%) patients. None of the patients with bladder dysfunction showed any resolution of this symptom after discectomy (Table-3).

Table-3. Results (n=21)

Improvement of symptoms/signs	n	%
Pain	14	82.4
Spasticity/Hyperreflexia	7	77.8
Sensory deficit	9	64.3
Motor weakness	6	60.0
Bladder dysfunction	0	0.0

The overall complication rate in this study was 38.1% based on complication events, and 19% based on the patient population. Deterioration of the neurological status was the most common complication, seen in three (14.3%) patients. Inadequate decompression requiring a second surgery was noted in two (9.5%) patients. Abnormal bleeding, surgical site infection, and pneumothorax were each recorded in one (4.8%) patient (Table-4).

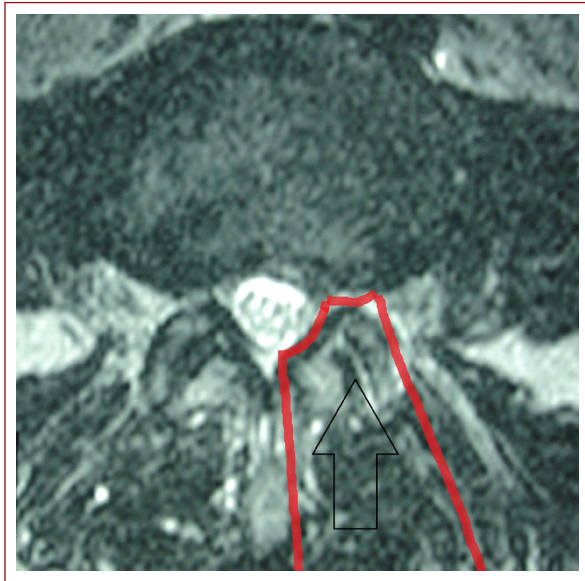


Figure-5. Axial MRI showing the access trajectory of a costotransversectomy toward the ventrolateral aspect of a vertebral body.

Table-4. Complications (n=21, n of patients who developed complications=4, n of complications=8)

Complications	n	%
Neurological deterioration	3	14.3
Inadequate decompression	2	9.5
Infection	1	4.8
Bleeding	1	4.8
Pneumothorax	1	4.8
Overall complication rate:		
Based on patient population - 19.0%		
Based on complicated events - 38.1%		

DISCUSSION

The surgical management of TDH is challenging. The rarity of symptomatic herniation in the thoracic region, lack of a characteristic presentation pattern, lack of a consensus on the surgical indications for treatment, diversity of surgical approaches, and lack of universally accepted selection criteria may be some of the factors for this difficulty. Midline laminectomy as a surgical approach has largely been abandoned for TDH due to the major associated morbidity and mortality with this approach⁴. A number of alternative surgical approaches have been developed to gain better access to the ventral thoracic spine¹¹, including the transthoracic thoracotomy, transpedicular, transfacet pedicle-sparing, lateral extracavitary (LECA), and costotransversectomy approaches. Advantages and disadvantages of these approaches have been reported in detail in the literature. Today, the thoracotomy, LECA and costotransversectomy approaches are the three most commonly used approaches for the surgical treatment of TDH. The costotransversectomy approach is the least invasive one, and it shows the lowest complication rate of these three approaches.

The excellent posterolateral corridor provided by the costotransversectomy approach leads to easy removal of lateral, centrolateral, and central lesions. Limited bone removal was almost always sufficient; and no arthrodesis was required for any of the patients in this series. The surgeon can work independently with minimal surgical tools. A small incision is generally sufficient for single-level TDH. Another advantage of the costotransversectomy approach is the avoidance of entering the thoracic cavity. Limited posterior muscle dissection, minimal osseous and ligamentous removal, and the maintenance of disc integrity, are some of the benefits of this approach.

The operation time, blood loss, and length of hospital stay were low, due to the advantages mentioned above. In this study, the mean operation time with the costotransversectomy approach was approximately 45 minutes (range: 24–105 min) for single-level procedures. The average blood loss was 155 ± 27 ml. All patients were discharged from hospital between one to three days postoperatively.

The thoracic neuraxis is vulnerable to manipulation and trauma⁶. The tenuous blood supply of the thoracic spinal cord, with the lower segments often dependent on a

single feeding artery, makes the thoracic cord at risk on manipulation.

Thus, the selection of a less invasive approach, such as the costotransversectomy approach, is more appropriate for the removal of the compressive part of a herniated thoracic disc.

The main limitation of this approach is that the surgeon is unable to see the ventral sac surface during dissection. This method may not be suited for large, calcified, or centrally-located thoracic disc herniation.

This study reveals that for a large proportion of symptomatic TDH, surgical excision is feasible using a posterolateral approach such as costotransversectomy. The results of this study, considering the complication rates, were comparable with the majority of results reported in the literature.

In conclusion, a costotransversectomy approach remains a worthwhile option for treatment of the majority of TDH.

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