

EXPERIENCE ON SURGICAL TREATMENT OF SINGLE-LEVEL THORACIC DISC HERNIATIONS VIA COSTOTRANSVERSECTOMY APPROACH

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SUMMARY

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

Patients and Method: Presenting symptoms, signs, recovery of symptoms after surgery and complication rates of twenty-one consecutive patients with single-level thoracic disc herniation treated via costotransversectomy in between 2004 and 2010 were presented.

Results: Overall complication rate is 38% based on complicated events, and 19% based on patient population. The most common presenting symptom was axial, localized or radicular pain. The highest recovery rate was detected for pain. Operating time was short and blood loss was minimal for this method of operation.

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

Kant düzeyi: Retrospektif klinik çalışma, IV

INTRODUCTION

The incidence of thoracic disc herniation (TDH) is estimated between 1/1000 and 1/1000000 in general population⁽¹²⁾. Thoracic discectomy constitutes only 0.15 to 4 % of all discectomies^(2,10). Male to female ratio is slightly less than 1, with highest incidence at 40 to 50 years of age⁽¹⁰⁾.

Patients with TDH may present with pain, radiculopathy or myelopathy⁽⁸⁾. If a surgical intervention indicated to treatment, discectomy may be performed via a posterior approach including

the costotransversectomy. Performing a thoracic discectomy by a midline posterior laminectomy alone is associated with a high risk of neurologic morbidity and generally accepted as a contraindication^(1,5,7).

New posterior and posterolateral approaches to the thoracic spine evolved to provide improved access to the disc space of the thoracic region^(3,9). The following report on thoracic microdiscectomies reflects our experience on costotransversectomy approach for surgical treatment of TDH and its outcomes and complications.

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PATIENTS AND METHODS

Between 2004 and 2011, 21 patients with single-level TDH were treated by thoracic microdiscectomies following a costotransversectomy approach performed by the authors. The patient population consisted of 12 women and 9 men whose ages ranged between 24 and 64 years with a mean age of 49 years. None of the patients have 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

Levels of disc diseases ranged from T7-8 to T11-12. The most common site of herniations 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 laterally located in 5 patients (23.8 %), central in 6 patients (28.6 %) and centrolateral in 10 patients (47.6 %) (Table-2).

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

Thoracic levels 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

Calcification of disc on either computerized tomography (CT) scanning or during intraoperative inspection was present in 11 patients (52.4 %), (Fig-1.a,b). Intradural extension of disc was not seen at surgery in any patient.



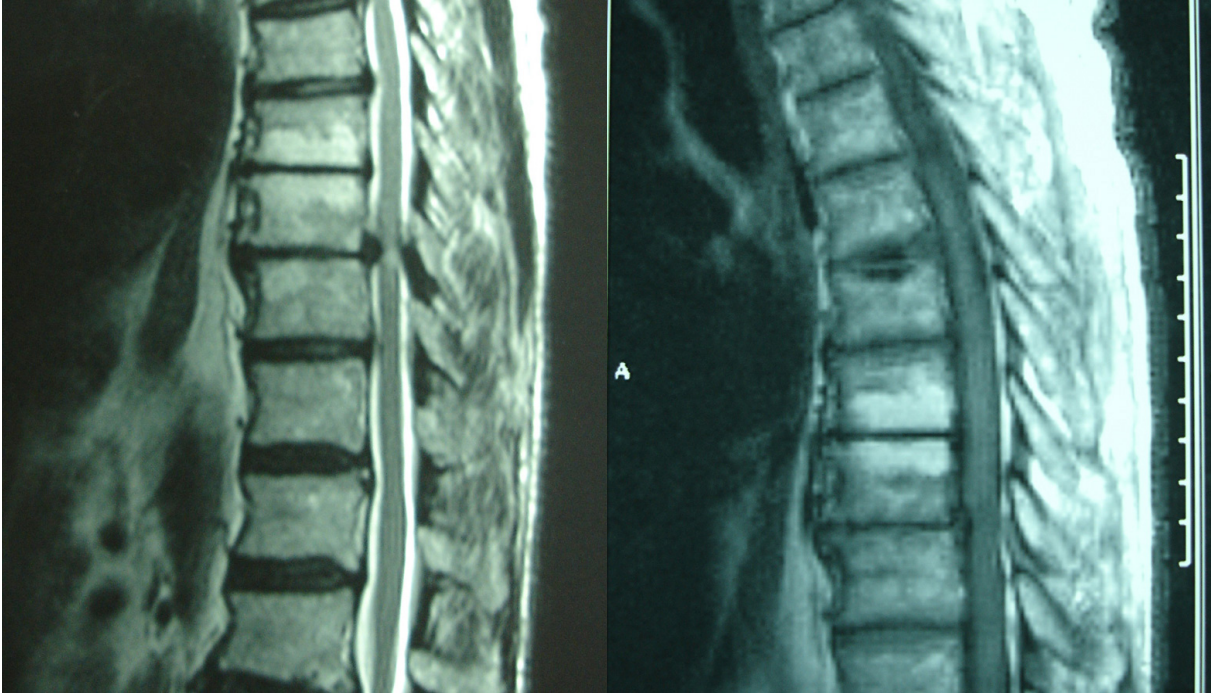
Şekil-1. Axial (a) and sagittal reformatted (b) CT of a calcified TDH. CL location of the calcified disc herniation is seen.

Axial, localized or radicular pain was the most common presenting symptom, which occurred in 17 (80.9 %) patients. The pain was characterized as severe in intensity in majority of patients. Sensory impairment was reported in 14 (66.7 %) patients. Bladder dysfunction was seen in 3 (14.3 %) patients. Spasticity and hyperreflexia occurred in 9 (42.9 %) patients. A positive Babinski sign was detected in 8 (38.1 %) patients. Lower extremity weakness was recorded in 10 (47.6 %) patients (Table-1). Majority

of patients with lower extremity weaknesses had paraparesis rather than monoparesis.

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

All patients were performed a magnetic resonance imaging (MRI) and CT scan preoperatively for diagnosis and preoperative planning. The extent of herniated disc removal and detection of residual compression site were evaluated by an MRI (Figure-2.a,b and Figure-3.a,b).



Şekil-2. Preoperative (a) and postoperative (b) Sagittal T1-W MRI of the T7-8 disc herniation. Myelopathy in the spinal cord is observed.



Şekil-3. Sagittal (a) and axial (b) T1-W MRI of the giant T9-10 TDH. Spinal canal was narrowed due to the disc. Severe compression is seen.

The mean follow-up period was 34 months. Postoperative signs and symptoms were checked and recorded.

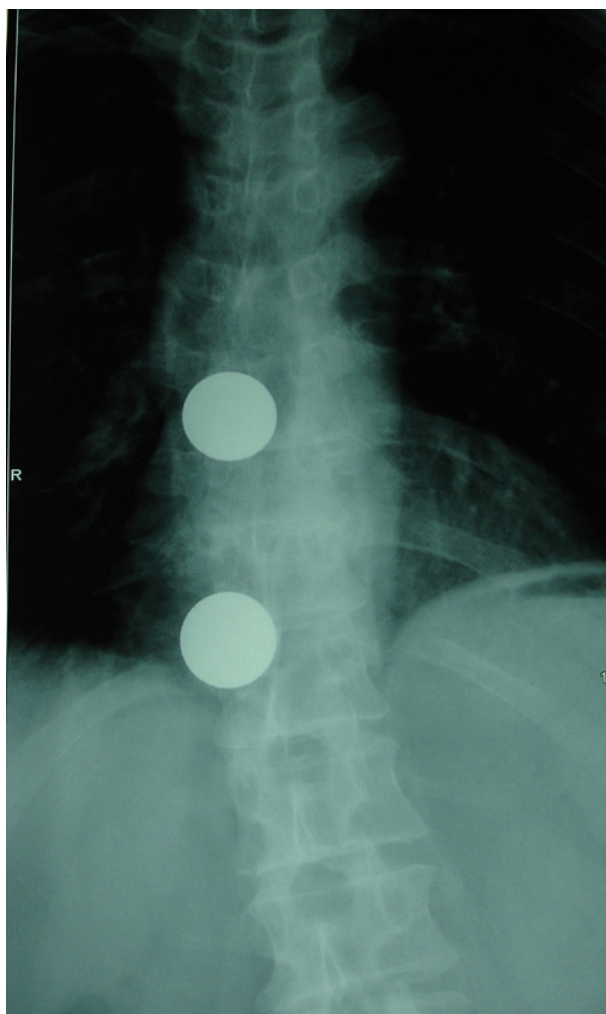
All operations were performed via costotransversectomy approach. After exposure, discectomies were completed microsurgically under a surgical microscope.

SURGICAL PROCEDURE:

All operations were performed via costotransversectomy approach under total intravenous general anesthesia (TIVA). The patients were prone on chest rolls. Radiolucent operating table was used. 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).

Paramedian incision was made 3 to 6 cm off the midline. Subcutaneous tissue, latissimus dorsi and thoracodorsal fascia were divided by an electrocautery. Erector spinae muscles were dissected in a subperiosteal fashion and reflected medially to expose the transverse process and ipsilateral hemilamina.



Şekil-4. Preoperative radiographic level confirmation.

Two radiolucent signs are always safer and more accurate.

Rib was identified and stripped by electrocautery on the dorsal surface. Transverse process was identified, costotransverse ligament was divided, and transverse process was removed. Rib was cut 3 to 6 cm from its origin and dissected from underlying pleura. In this step of operation, pedicle should be visible (Fig. 5). Pedicle can be removed by high-speed drill or by a Kerrison rongeur. Both instruments were necessary in majority of operations. This approach provided gain access to the spinal canal. Lateral techal sac should be visible in this step. After this step, decompression should be done under operating microscope for better visualization.

Posterior vertebral body closely adjacent to the disc space might be drilled and removed. This maneuver may create a trough into which the disc herniation can be pushed with curettes. After decompression with various disc punches and curettes, 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. Any arthrodesis requiring bone removal was not implemented in this series.

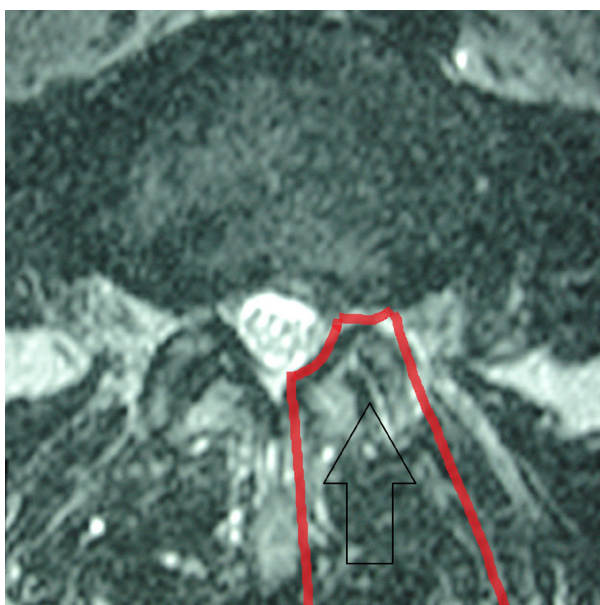
RESULTS

Overall resolution of pain occurred in 14 (82.4 %) patients. Patients with radicular pain showed more improvement than patients with axial or localized pain. Improvement of hyperreflexia and spasticity were seen in 7 (77.8 %), 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 of this series is 38.1% based on complicated events, and 19% based on patient population. Deterioration of neurological status was the most common complication, which was seen in 3 (14.3%) patients. Inadequate decompression that required the second surgery was noted in 2 (9.5%) patients. Abnormal bleeding, surgical site infection and pneumothorax were recorded in 1 (4.8%) patient each (Table-4).



Şekil-5. Access trajectory of a costotransversectomy toward the ventrolateral aspect of a vertebral body is shown on axial MRI.

Table-4. Complications (n=21, n of patients whose develop complications=4, n of complications=8)

Complications	n	%
Neurologic 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 TDHs has been difficult. The rarity of symptomatic herniations in thoracic region, the lack of characteristic presentation pattern, lack of consensus on surgical indications for treatment, diversity of surgical approaches, no universally accepted selection criteria may be accepted some factors for reason of this difficulty. The midline laminectomy was largely abandoned for the operative treatment of TDH due to the major morbidity and mortality associated with the approach itself⁽⁴⁾. A number of alternative surgical approaches have been developed to gain better access to the ventral thoracic spine⁽¹¹⁾ including 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 relevant literature. Thoracotomy, LECA and costotransversectomy approaches are the most commonly used 3 approaches for surgical treatment of TDH in the modern era. The costotransversectomy approach is the least invasive one; and it has the least complication rate among these 3 approaches.

Excellent posterolateral corridor provided by the costotransversectomy approach lead to easy

removal of lateral, centrolateral and also central lesions. A limited bone removal almost always was sufficient; and arthrodesis was not required for any of the patients in this series. Surgeon can work independently with minimal surgical tools. Small incision is sufficient generally for single-level TDHs. Avoidance of entering the thoracic cavity is another advantage of the costotransversectomy approach. Limited posterior muscle dissection, minimal osseous and ligamentous removal and maintenance of disc integrity are some benefits of this approach.

Operating time, blood loss and length of hospital stay were low due to its advantages mentioned above. In the presented series, mean operating time with the costotransversectomy approach was approximately 45 minutes (range from 24 to 105 min.) for single-level procedures. Average blood loss was 155±27 ml. All patients were discharged home between 1 to 3 postoperative days.

The thoracic neuraxis is vulnerable to manipulation and trauma⁽⁶⁾. Tenuous blood supply of the thoracic spinal cord, with the lower segments often dependent of a single feeding artery, makes the thoracic cord susceptible to manipulation. Thus, selection of a less invasive approach suits for removing compressive part of a herniated thoracic disc such as the costotransversectomy approach.

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 and centrally located thoracic disc herniations.

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

Costotransversectomy approach remains a worthwhile option for majority of TDHs.

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