Volume: 25, • Issue: 4, • October 2014 pp. 271-275 ORIGINAL ARTICLE / ORJİNAL MAKALE

# TREATMENT OF THORACIC DISC HERNIAS WITH POSTERIOR TRANSFORAMINAL THORACIC INTERBODY FUSION

## *TORASİK DİSK HERNİLERİNİN POSTERİOR TRANSFORAMİNAL TORASİK İNTERBODY FÜZYON İLE TEDAVİSİ*

M. Nuri ERDEM[1],
İsmail OLTULU[2],
Sinan KARACA[3],
Yener ERKEN[4],
Taner BEKMEZCİ[5],
Mehmet AYDOĞAN[6]

[1]*Orthopedics and Traumatology Specialist, International Kolan Hospital, İstanbul.*
[2]*Orthopedics and Traumatology Specialist, Medipol University, Medical School, İstanbul.*
[3]*Orthopedics and Traumatology Specialist, Fatih Sultan Mehmet Training Research Hospital, İstanbul.*
[4]*Orthopedics and Traumatology Specialist, Anadolu Health Center, Kocaeli.*
[5]*Orthopedics and Traumatology Specialist, Bahçeşehir University Medical School, İstanbul.*
[6]*Assoc. Dr, Orthopedics and Traumatology Specialist, Liv Hospital, Bosphorus Spine Center, İstanbul.*

## SUMMARY

**Introduction:** Treatment of thoracic disc hernias (TDH) remains controversial due to their lower incidence than hernias in the cervical or lumbar spine. The objectives of this retrospective study are to demonstrate the surgical outcomes for patients with TDH undergoing posterior transforaminal thoracic interbody fusion (TTIF) and discectomy with posterior instrumentation and fusion.

**Materials and Methods:** We enrolled ten patients who underwent TTIF for chronic pain due to TDH and were followed up for at least one year. Of the ten patients, one had TDH at two levels. Discs were classified as central or paracentral. The mean age at surgery was 53.5 years and the average period of follow-up was 32.6 months. The pre- and postoperative pain status was evaluated using the Visual Analog Score (VAS). Outcomes and complications were retrospectively assessed in this patient series. The status of fusion was evaluated using plain radiographs and computed tomography.

**Results:** None of the patients showed any signs of instrument migration or failure in the follow-up, and each showed radiographic fusion. The average pre- and postoperative VAS scores were 7.4 and 1.9, respectively. One patient developed a postoperative wound infection requiring additional operative debridement.

**Conclusions:** Transforaminal thoracic interbody fusion combined with segmental fusion offers a means of achieving concurrent decompression and segmental stabilization, and is an effective option for certain subtypes of TDH.

**Key words:** Transforaminal thoracic interbody fusion (TTIF), thoracic disc hernia, surgical treatment

**Level of evidence:** Retrospective case series, Level IV.

## ÖZET

**Giriş:** Torakal disk hernileri (TDH)'nin tedavisi servikal ve lomber disk hernilerine oranla daha az görülmelerine bağlı olarak hala tartışmalıdır. Bu retrospektif çalışmanın amacı TDH nedeni ile posterior transforaminal torasik interbody füzyon (TTIF) ve diskektomi ile birlikte posterior enstrümantasyon ve füzyon yapılan hastaların sonuçlarını açıklamaktır.

**Metot:** TDH'ne bağlı kronik ağrı şikayeti nedeni ile TTIF yöntemiyle tedavisi yapılan ve en az 1 yıllık takibi olan 10 hasta çalışmaya dâhil edildi. 10 hastadan bir tanesinde iki seviyeli TDH mevcuttu. Diskler santral ve parasantral olarak sınıflandırıldı. Cerrahi sırasındaki ortalama yaş 53.5 yıl, ortalama takip süresi 32.6 ay olarak kaydedildi. Pre- ve postoperatif ağrı durumu Visual Analog Score (VAS) sistemine göre değerlendirildi. Serimizdeki tüm hastalarda sonuçlar ve komplikasyonlar retrospektif olarak kaydedildi. Füzyon durumu düz grafi ve bilgisayarlı tomografi kullanılarak değerlendirildi. Sonuçlar: Tüm hastalarda takip süresinin sonunda radyolojik olarak füzyon elde edildi. Hiçbir hastada enstrüman yetmezliği saptanmadı. Ortalama VAS skoru preoperatif 7.4, postoperatif 1.9 olarak saptandı. Bir hastada postoperatif yara yeri enfeksiyonu gelişti ve cerrahi debridman ile tamamen iyileşti. Çıkarım: Transforaminal torasik interbody füzyon ve segmental enstrümantasyon eşzamanlı dekompresyon ve stabilizasyonu temin eden ve tüm TDH tiplerinde uygulanabilen efektif bir metottur.

**Anahtar kelimeler:** Transforaminal torasik interbody füzyon (TTIF), torasik disk hernisi, cerrahi tedavi

**Kanıt düzeyi:** Retrospektif vaka serisi, Level IV.

**Address:** Mehmet Nuri Erdem, Ağaoğlu My World Europe, A3 Blok, Daire:57 Başakşehir / İstanbul
**Tel:** 0533 2215938
**E-mail:** mnerdem@yandex.com
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## INTRODUCTION

Thoracic disc hernia (TDH) is rarely observed compared to lumbar and cervical disc hernia, due to the stability caused by the rib cage. TDH consists of 0.15–4% of all disc hernia[1]. Its prevalence is 1/1.000.000 in the general population[2]. It is often observed in the third to fifth decades, and more frequently in males[3]. It is observed between the T8 and T12 levels in more than 90% of cases, and commonly occurs at the T11–12 level[1].

The aim of surgical treatment of TDH is complete decompression of the spinal cord and/or nerve roots without iatrogenic neurological damage, to correct spinal instability or deformity and to prevent disc hernia formation at the same level. Decompressive laminectomy was abandoned due to high mortality and morbidity rates[1,4,5], and many surgical methods have been described as alternatives. There are many studies reporting successful results from an anterior surgical approach[2,6-9]. A transthoracic approach is suggested, particularly in treatment of central, large, and calcified TDH, as it safely provides ventral decompression of the spinal cord[10]. However, this method shows severe morbidity due to bleeding and reduced lung capacity[11]. Therefore, surgical treatment with a posterior approach has become more popular in recent years.

The aim of this study is to present the results of patients who did not respond to conservative treatment for TDH, treated by fixation with pedicle screws with a posterior approach due to chronic pain, and who received posterolateral costotransversectomy and transforaminal thoracic interbody fusion (TTIF) surgery.

## MATERIALS AND METHODS

Ten patients, who did not give response to conservative treatment for TDH, received TTIF surgery due to chronic pain, and were followed up for more than one year between 2009 and 2013, were included in the study. All surgical processes were performed by a single surgeon (M.A.). The mean age of the group, that included six males and four females, was 53.5 (34–69) years. The mean follow-up period was 2.6 (12–53) months. TTIF was performed at a total of 11 levels, including two levels to a single patient and one level to the remaining patients (Table-1).

According to the clinical signs, MRI and radiological evaluations of the related regions were performed for all patients. The thoracic vertebrae of all patients were assessed with 3D CT to detect the presence of calcification at a thoracic level. If most of the herniated disc fragment was at the anterior of the cord, it was evaluated as central, and if more than 50% was lateral to the midline, it was evaluated as lateral. According to this criterion, lateral and central disc herniations were detected in seven and four segments, respectively. For levels with thoracic disc herniation, it was observed that the diameter of the spinal canal was narrowed by about 30% in all levels, including two levels that showed more than 50% narrowing. In one patient, associated L4–5 lumbar disc hernia was detected. In the same session, additional microscopic lumbar discectomy was applied to the relevant region. In another patient, ligamentum flavum ossification with TDH was detected at the same level.

The evaluation of the clinical pain of the patients was performed using the Visual Analog Score (VAS), during admission and after the first year postoperatively. The duration between the onset time and surgical treatment was 7.1 (0.3–44) months, on average. During application, back pain in seven patients, back pain and intercostal neuralgia in one patient, back pain and lower extremity pain in one patient, and back pain and right lower leg pain (total loss in tibialis anterior and extensor hallucis longus strength) and weakness of the right lower extremity (quadriceps muscle strength 3/5) in one patient were detected.

The operation duration, bleeding amount, and intraoperative and postoperative complications were recorded. The evaluation of bone fusion was performed with plain radiography and CT at the first year postoperatively. By CT, the bone fusion between the corpuses and the cage and any loosening of the pedicle screws were evaluated.

### *Surgical Technique:*

The same surgical procedure was applied to all patients. Catheters and neuromonitorization probes were placed in a supine position after intubation under general anesthesia. Then, the patient was moved to a prone position. Bilateral pedicle screws were sent to one level above and below the affected segment with a posterior approach.

**Table-1.** Demographic information of the patients.

| *Case number* | *Age(year)* | *Gender* | *Level* | *Follow-up period (months)* | *Type* | *Extra spinal pathology?* |
|---|---|---|---|---|---|---|
| 1 | 57 | M | T11–12 | 53 | CENTRAL | NO |
| 2 | 34 | M | T8–9 | 44 | LATERAL | NO |
| 3 | 51 | F | T10–11, T11–12 | 41 | CENTRAL | NO |
| 4 | 48 | M | T10–11 | 38 | CENTRAL | NO |
| 5 | 52 | M | T8–9 | 34 | CENTRAL | NO |
| 6 | 54 | M | T10–11 | 32 | LATERAL | NO |
| 7 | 53 | F | T11–12 | 32 | LATERAL | NO |
| 8 | 69 | F | T11–12 | 21 | LATERAL | NO |
| 9 | 62 | F | T6–7 | 19 | LATERAL | NO |
| 10 | 55 | M | T9–10 | 12 | LATERAL | Lumbar disc hernia |

A temporary rod was placed on the opposite site to the region where discectomy would be performed. After hemilaminectomy, rib resection of about 2 cm was performed, until the costotranverse junction.

The disc space was reached from the posterolateral, and discectomy from the lateral to the midline was performed with specific reverse curettes under microscopy. After filling a titanium mesh cage with grafts taken from the patient, it was adapted to the disc space.

Suitably countered permanent rods were placed, compression was carried out, and then the system was locked (Figure-1.a and b).

The incision was closed by a standard method. In the patient with large posterior decompression including unilateral pediculectomy, a unilateral pedicle screw was placed on the opposite site to the region where one upper and one lower vertebrae received discectomy and a bilateral pedicle screw was placed on the further upper and lower vertebrae (Figure-2.a and b).

## RESULTS

The mean operation duration was 175 (120–280) min and the mean blood loss was 600 (250–1150) ml. There were no complications during surgery. A superficial wound infection developed in one patient, who recovered with debridement and antibiotherapy.

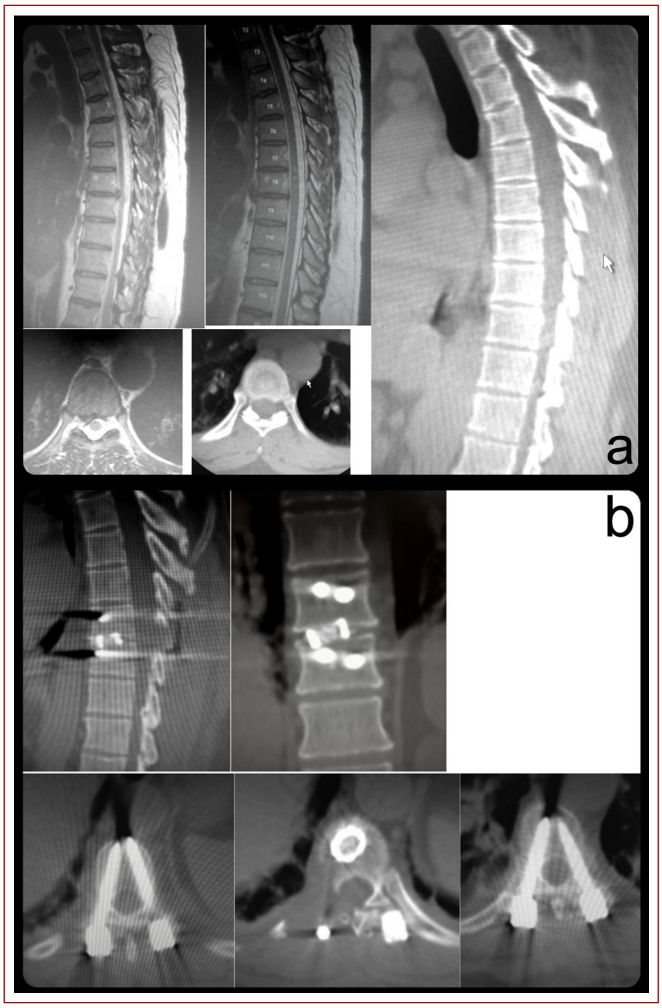


**Figure-1. a)** Preoperative MRI and CT images showing lateral disc hernia at the T8–9 level; **b)** postoperative CT images of the same patient.

Postoperative ankle extension strength did not change in the patient with lower leg weakness, but a total recovery was detected in quadriceps strength at the sixth week postoperatively (muscle strength 5/5). In radiological evaluations performed in the first year postoperatively, fusion had been obtained in all patients, and there were no loosened pedicle screws or rod fracture. The mean preoperative VAS score was 7.4 (5–9), while the VAS score was 1.9 (0–3) at the first year postoperatively.

## DISCUSSION

The surgical treatment of thoracic disc hernias shows differences and difficulties compared to cervical and lumbar disc hernias. The main surgical indications are myelopathy, persistent radiculopathy, and axial back pain[12-14]. In accordance with the literature, the main complaint of our patients was back pain that did not respond to medical treatment. Although it is often detected at a single level, there have been studies showing multi-level thoracic disc hernias[7,15]. As for one patient in our series, it should be considered that the presence of associated lumbar or cervical disc hernia can complicate the back pain caused by TDH, and patients should be also examined in terms of clinical and radiological lumbar and cervical disc pathologies.

Many factors play a role in the choice of surgical method, including the education and experience of the surgeon, neurological symptoms, compressed neurological structures, structure of the herniated disc (soft or calcified), presence of spinal deformity, presence and location of osteophytes, and medical co-morbidity of the patient. Without spinal cord manipulation, an anterior transthoracic approach has been used in TDH treatment, as it provides sufficient space to reach the anterior of the canal and allows safe ventral decompression.

It was defined for the first time by Crafoord[16] and was subsequently preferred by many authors[6-9]. It has been usedeffectively for central and calcified disc surgeries and removal of osteophytes.

However, an anterior approach causes difficulties in patients with current lung disease, chest wall pathology, or morbid obesity[2,11]. It requires some modification for the upper thoracic levels[17]. This limited approach is a major disadvantage for cases of posterior compression, such as uncontrollable epidural bleeding, postoperative pneumonia, intercostal neuralgia risk, and ossified ligamentum flavum.

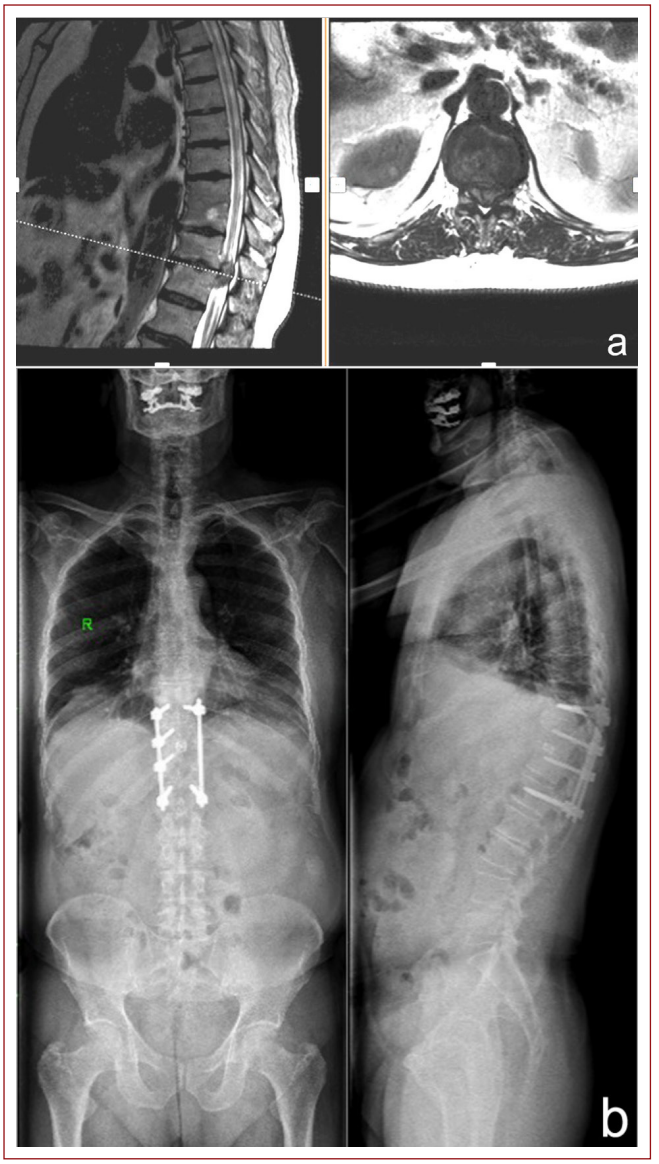


**Figure-2.**a) Preoperative MRI showing a central disc hernia narrowing the spinal canal at T11–12 level; **b)** X-ray of the same patient in the first year postoperatively.

Therefore, a posterior approach alone has become popular in the surgical treatment of TDH without thoracotomy.

Traditional posterior decompressive laminectomy was commonly used for thoracic disc hernia surgery in the past, but it had high mortality and morbidity rates[1,4,5]. Later, many modified techniques have been developed for a posterior approach. Bransford et al.[15] defined the modified trans-facet pedicle-sparing decompression and fusion technique for TDH surgical treatment. Machino

et al.[18] applied the TTIF technique for ten patients, including three patients with TDH thoracic spine pathologies and obtained satisfactory results.

The surgical approach used in this study is a version of transforaminal lumbar interbody fusion (TLIF) modified for the thoracic region. After hemilaminectomy and costotransversectomy, gentle distraction over pedicle screws can provide a sufficient opening to reach the disc space. In various offsets, the use of low-profile flat and inverted cuvettes allows full removal of midline discs, and spinal instability can be prevented with interbody arthrodesis. If there is a current deformity, this can also be corrected using pedicle screws. There was no iatrogenic neurological damage from this approach in any of the seven patients. Continuous neuromonitorization used during surgery also has great importance. In the first year postoperatively, all patients clinically indicated regression of their complaints, as further proof for the efficacy of this method.

The treatment of TDH with the TTIF technique is an effective and safe method that provides necessary space for an approach and safe decompression, and allows concurrent correction of spinal deformity. The use of this approach with few modifications, especially by surgeons familiar with the TLIF procedure, can provide satisfactory results for TDH treatment. For safety, the use of neuromonitorization during surgery and the presence of tools necessary for disc removal should be considered.

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