



CLINICAL RESULTS OF CALCIFIED THORACIC DISC HERNIATION TREATED WITH A TRANSPEDICULAR APPROACH

TRANSPEDİKÜLER YAKLAŞIMLA TEDAVİ EDİLEN KALSİFİYE TORASİK DİSK HERNİLERİNİN KLİNİK SONUÇLARI

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SUMMARY

Introduction: Symptomatic thoracic disc herniations (TDHs) are relatively rare and challenging due to the wide variety of clinical presentations, a lack of consensus on the surgical indications, and the variety of surgical approaches. Our objective was to describe our series of calcified thoracic disc herniations and their outcomes.

Materials and Methods: A retrospective cohort study of ten patients with calcified TDH received surgery between 2008 and 2013. Data were collected by reviewing the patients' notes and radiological studies, and included basic demographic data, clinical presentation and outcome, operative procedure, and complications. The ten patients included six males and four females (mean age: 35.6 years, range: 22–58 years). The mean follow-up was 28.1 (12–48) months. All patients received surgery with a transpedicular approach, and posterior transpedicular stabilization was performed for seven patients.

Results: In the preoperative period, three patients were Nurick grade 1, two were grade 2, three were grade 3, and two were grade 4. Surgical treatment obtained satisfactory results and the Nurick grade improved in all of the patients (100%), with five patients postoperatively Nurick grade 0, and five patients Nurick grade 1. The mean Nurick grade improved from 2.4 to 0.5.

Conclusion: Calcified TDH remains a surgical challenge. The goal of surgery is to decompress the neural elements without any manipulation of the spinal cord aside from that required by the surgical technique. When adequately diagnosed and treated, satisfactory results can be achieved.

Key Words: Thoracic disc herniation, transpedicular approach, surgical results.

Level of Evidence: Retrospective clinical study, Level III

ÖZET

Giriş: Semptomatik torakal disk hernileri oldukça nadir görülmesi, farklı klinik durumlarla ortaya çıkması, ortak kabul edilebilir bir cerrahi endikasyonu olmaması ve farklı cerrahi girişimlerin olması nedeniyle tedavisi zor bir patolojidir. Biz bu çalışmada kalsifiye torakal disk hernili olgu serimizi ve sonuç- larını sunduk.

Hasta ve Yöntemler: Bu geriye dönük çalışmada 2008-2013 yılları arasında torakal disk hernisi nedeniyle ameliyat edilmiş olgular incelendi. Bilgiler, temel demografik veriler, klinik bulgular, sonuçlar, ameliyat notları ve komplikasyon bilgilerini içeren hasta dosyalarından elde edildi.

Sonuçlar: 10 olgunun 6'sı bayan, 4'ü erkekti (yaşları ortalaması 35,6 yıl olup 22-58 arasındaydı). Ortalama takip süresi 28,1 aydır (12-48). Bütün olgular transpediküler yaklaşımla ameliyat edildi ve 7 olguya posterior transpediküler fiksasyon uygulandı. Preoperatif dönemde 3 olguda Nurick skoru 1 iken, iki olguda 2, üç olguda 3 ve 2 olguda 4 olarak tespit edildi. Cerrahi tedavi tüm olgularda yeterli iyileşme ve Nurick skorlarında düzelme sağladı (%100). Beş olguda Nurick skoru 0 olurken 5 olguda 1 olarak tespit edildi. Ortalama Nurick skoru 2,5 dan 0,5 e iyileşti.

Sonuç: Kalsifiye torakal disk hernilerininin cerrahisinde çelişkiler mevcuttur. Cerrahideki amaç seçilecek yöntemle spinal kortta herhangi bir manipülasyona neden olmadan nöral elemanları dekompresyonudur. Uygun şekilde tanı konup tedavi edildiğinde başarılı sonuçlar alınabilir.

Anahtar Kelimeler: Torasik disk herniyasyonu, transpediküler yaklaşım, cerrahi sonuçlar.

Kanıt Düzeyi: Retrospektif klinik çalışma, Düzey III

INTRODUCTION

Thoracic disc herniation (TDH) is one of the most challenging problems in neurosurgical practice. Symptomatic TDHs are rare compared to their lumbar or cervical counterparts, and constitute only 0.1–4% of all disc herniation^{1,16}. Men are affected more than woman, and the vast majority of herniated thoracic discs are seen during the third to fifth decades, particularly in the lower thoracic segments⁴. T10–11 and T11–12 are the segments most involved, probably due to the increased mobility of this region¹⁹. The clinical signs vary widely, including thoracolumbar pain, radicular pain, bladder dysfunction, sensory disturbances, and myelopathy. Cord compression by the herniated and usually calcified disc is the main cause of these symptoms in most cases. The anatomically narrow spinal canal in the thoracic region facilitates compression with even minor disc herniation. The aim of surgical treatment for TDH is decompression of the neural elements and the provision of spinal stability. In this context, multiple surgical techniques have been described for the treatment of TDH, such as transpedicular, transfacet pedicle-sparing, lateral extracavitary, thoracoscopic, costotransversectomy, and transthoracic transpleural approaches^{2,3,9}. The following report presents our series of calcified thoracic disc herniations treated with a transpedicular approach, and the clinical outcomes.

MATERIALS AND METHODS

Between 2008 and 2013, ten patients underwent 13 thoracic microdiscectomies by a transpedicular approach. The patient population consisted of six men and four women, with an age range from 22 to 58 years, and a mean age of 35.6 ± 10.1 years.

The level of herniation ranged from T7 to T12, and the most common disc levels were T8–9 and T9–10 (four discs each, 30.8%). 11 (84.6%) herniations were located between T8 and T11. Three (33.3%) of the ten patients presented with multiple disc herniation. Calcification of the herniated disc was detected by either computerized tomography (CT), X-ray, or during intraoperative inspection in all patients. There was no intradural extension of the calcified disc material.

Data collected prospectively at each visit, before and after surgery, included medical records, clinical examinations, and radiological studies. The most common symptom at presentation was dysesthesia, reported in all patients

(Table-1). Axial pain, generally characterized as moderate to severe in intensity, was reported in eight patients (80%). None of the patients were operated on for isolated axial pain. Among the accompanying symptoms, ataxic gait was reported in five (50%), weakness in the lower extremities in four (40%), and bladder dysfunction in two (20%) patients. The mean duration of the symptoms was 12.1 ± 3.7 months (range: 6–20 months) (Figure-1). Before and after surgery, all patients underwent CT, MRI, or both, and all nine TDHs appeared to be calcified in the preoperative radiological work-up. Postoperative plain radiography was also performed, to check the internal fixation devices, in particular (Figure-2).

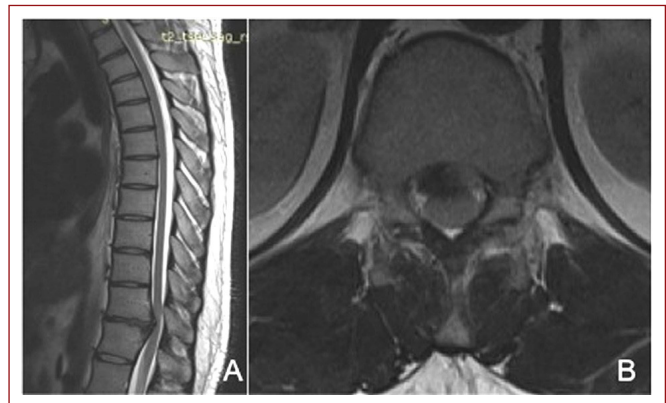


Figure-1. T2-weighted a) sagittal and b) axial MRI demonstrating central thoracic disc herniation compromising the spinal cord.

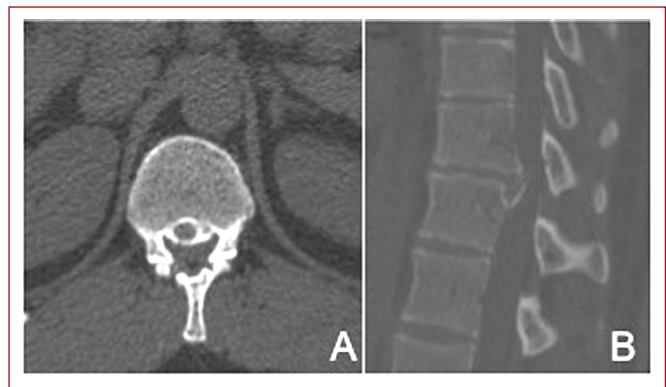


Figure-2. a) Axial and b) sagittal CT demonstrating calcified thoracic disc herniation.

Preoperative and postoperative clinical status was also classified using the modified Nurick Grading System (Table-2) (15). The mean follow-up period was 28.1 ± 6.1 months (range: 12–48 months). Intraoperative neuromonitorization was carried out for five of the cases operated on in the last three years.

Table-1. Summary of patient demographic and clinical characteristics

Cases	Signs	Duration of Symptoms	Preop Nurick Grade	Postop Nurick Grade	Stabilization	Level	Follow-up months	Complications
30 F	Axial pain, bilateral dysesthesia	11	1	0	-	T10-11	24	None
27 M	Axial pain, bilateral dysesthesia	6	2	1	+	T10-11	18	Intercostal neuralgia for 3 months - gabapentine
33 M	Leg dysesthesia, bladder hesitancy	9	2	0	+	T7-8 T8-9	12	None
37 F	Axial pain, bilateral dysesthesia	11	1	0	+	T10-11	24	Transient urinary retention for 2 months
58 F	Urinary incontinence, dysesthesia, weakness, ataxic gait	14	4	1	+	T8-9 T9-10	18	None
47 M	Axial pain, dysesthesia, weakness, ataxic gait	14	3	1	-	T9-10	48	Postoperative axial pain (1 year), no instability in radiological examinations
22 M	Axial pain, dysesthesia, weakness, ataxic gait	20	3	0	+	T10-11 T11-12	24	None
32 M	Axial pain, dysesthesia, ataxic gait	12	3	1	-	T8-9	48	Postoperative axial pain (8 months), no instability in radiological examinations
41 F	Axial pain, dysesthesia, weakness, ataxic gait, bladder hesitancy	9	4	1	+	T10-11	42	None
29 M	Axial pain, bilateral dysesthesia,	15	1	0	+	T8-9	12	None

Table-2. Modified Nurick Scale

Grade 0	No root or cord symptoms
Grade 1	Signs and symptoms of root involvement only (no spinal cord symptoms or signs)
Grade 2	Signs and symptoms of spinal cord involvement, normal gait
Grade 3	Mild gait abnormality, able to be employed
Grade 4	Gait abnormality prevents employment
Grade 5	Only able to walk with assistance
Grade 6	Chair bound or bedridden

Surgical Technique:

Patients were placed in the prone position and secured to the table so that they could be rotated perioperatively, to maximize visibility for the surgeon. Prior to making the skin incision, the disc level was identified by fluoroscopy. The level was determined by identifying the twelfth rib. A linear midline skin incision was made, and the paraspinal muscles were dissected sufficiently to expose the transverse processes and facet joint. The caudal pedicle adjacent to the disc space must be located, as this pedicle provides exposure for disc exenteration. In a patient with T9–10 disc herniation, the T10 pedicle is located adjacent to the disc space. The thoracic pedicles lie beneath the intersection of the pars interarticularis, transverse process, and lamina². A high-speed drill was used to drill the central cancellous bone of the pedicle and also to achieve partial superior and inferior facetectomies. While drilling the pedicle, a difference in the drill resistance can be felt, indicating that the cortical bone of the vertebral body has been reached. After this step, the cortical bone adjacent to the spinal canal was removed with curettes and a small cavity was drilled in the vertebral bodies rostral and caudal to the disc space. Partial or complete laminectomy may be performed to decompress the canal in the presence of disc calcification, as in this study. The lateral disc space was incised and discectomy was performed using pituitary rongeurs and curettes. In our study, there was no intradural extension of herniated discs. The goal of surgery is to remove the disc herniation without any manipulation of the spinal cord. Transpedicular stabilization was performed for seven patients in our study.

RESULTS

In the preoperative period, three patients were Nurick grade 1, two were grade 2, three were grade 3, and two were grade 4. Surgical treatment obtained satisfactory results and the Nurick grade improved in all of the patients (100%), with five patients Nurick grade 0 and five patients grade 1 postoperatively. The mean Nurick grade improved from 2.4 ± 1.1 to 0.5 ± 0.5 postoperatively.

There were no serious postoperative complications in our series. Two patients had postoperative obstinate axial pain which lasted for about one year in one patient and eight months in the other. Spinal transpedicular screw stabilization was not performed for either of these patients, no instability was detected in the radiological studies, and both patients used a brace for six months.

One patient had intercostal neuralgia for three months. No screw irritation was detected with CT. Gabapentine treatment was beneficial for this patient. One patient also had transient urinary retention, which lasted two months. There were no major complications such as death, deterioration in neurological status, or any problems requiring further surgery.

DISCUSSION

The management of TDH is a challenging topic in neurosurgery. This may be due to the low incidence, wide variety of clinical presentations, lack of consensus on surgical indications, and variety of surgical approaches. The annual incidence of symptomatic TDH is estimated to be one per million⁵. The advent of MRI revealed the high frequency of TDH. The incidence of asymptomatic TDH has been found to be between 11–37% in some studies^{20,21}. MRI has become the gold standard diagnostic technique for disc herniation, as it provides excellent soft tissue images non-invasively. However, showing calcification, which is very common and important in TDH, is a weak point of MRI. 60% of TDH cases have been reported to be calcified in the literature^{6,7}. As in our series, Gille et al. reported that all the thoracic disc herniations in their cohort were calcified¹¹. Calcification has also been found to be associated with intradural extension in the literature¹². Stillerman et al. found a rate of calcification of 65% in their series, with evidence of intradural extensions at a rate of 7%¹⁷. However, Le Roux et al. did not report any transdural perforation with 26% disc calcification in a study including 20 patients¹³. Although all the patients in our series demonstrated disc calcification, similarly to Le Roux et al., none of them were associated with signs of dural tear. This may be due to the low sample size in our series.

The vast majority of TDH is found below the level of T7. The eighth, ninth and tenth ribs are fixed to the sternum, whereas the eleventh and twelfth ribs are floating, making these levels more flexible than higher thoracic levels¹⁹. Consistent with the literature, 66% of the disc herniation in our series was at the T8–9 and T9–10 levels. Although multi-level disc herniation is not as common as single-level herniation, 33% of our patients had two-level TDH. However, higher rates of TDH have been published in the literature. Bransford et al. reported that nine of 18 patients (50%) in their series had multi-level TDH. They suggested that as

they were the only tertiary referral center for a four-state area, this caused this high ratio, as they accepted a greater percentage of unusual or complicated cases³.

The symptoms at presentation and the neurological deficits experienced by our patients consisted of radiculopathy, ataxic gait, and axial pain, which is similar to those reported in the literature, excluding myelopathy^{4,8}. In 1998, Stillermann et al. divided the presentation of TDH into three symptom complexes: localized thoracolumbar pain, radicular pain, and myelopathy¹⁸. The most common symptom was pain (76%), but it must be noted that nearly 25% of patients did not present with any symptomatic pain. Less common but associated symptoms include bladder dysfunction (24%), motor deficits (61%), and sensory impairment (61%). Motor deficits were more likely to be paraparesis than monoparesis. In our series, the most common presenting symptom was dysesthesia instead of pain. It may be argued that instead of severe motor deficits or myelopathy signs, the fact that the main symptoms of our patients were sensorial may be a factor in the satisfactory results seen in our series. In large studies in the literature, the degree of preoperative symptoms has always been indicated as one of the main factors affecting the outcome. However, according to Le Roux, apart from the duration of the symptoms, no other factors affected the outcome, including neither the size nor the location of the herniation¹³. Stillerman et al. could also find no correlation between the size of the disc herniation, the patient's initial presentation, and the surgical outcome¹⁸.

The initial treatment modality, laminectomy, is associated with unsatisfactory results. As a result, anterior, posterior, and posterolateral approaches have been described to minimize cord manipulation^{2,9,14}.

Posterolateral surgeries, such as transpedicular and transfacet approaches, are considered to be simpler than anterolateral operations. However, for central calcified TDH in particular, posterolateral approaches have been considered to be insufficient due to the more limited visibility of the spinal canal. Each surgical approach carries a potential for complication. According to Fessler and Sturgill, "The mortality and morbidity associated with the transpedicular, costotransversectomy, lateral extracavitary, and transthoracic approaches to thoracic disc disease are virtually identical. Thus the key determinants in selecting an approach should be:

1) the anatomical location of the herniated material; 2) the general health of the patient; and 3) the surgeon's experience."¹⁰. No universally accepted selection criteria exist to choose the best technique, and no single approach fits all patients well.

Performing fusion concurrently with thoracic discectomy is another topic of debate. All of our patients were operated on using a transpedicular route, and usually some degree of facetectomy was also performed. Only two of the ten patients did not receive transpedicular stabilization, and both of them complained about axial back pain postoperatively for up to one year. According to Bransford, "Segmental fusion should help to minimize postoperative axial back pain because of the potential increase in motion following the facetectomy and discectomy, especially in the lower thoracic spine where the main motion segment is located"³. We believe that stabilization is needed to prevent postoperative instability, and also axial back pain.

Calcified TDH remains a surgical challenge. The goal of surgery is to decompress the neural elements without any manipulation of the spinal cord apart from the choice of surgical technique. When adequately diagnosed and treated, the results are satisfactory, as shown in this study.

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