



Posterior Transdural Discectomy for Thoracic Disc Herniation

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ABSTRACT

AIM: To evaluate the safety and efficacy of posterior transdural discectomy for thoracic disc herniation.

MATERIAL and METHODS: The medical records of seven patients who underwent posterior transdural discectomy for thoracic disc herniation were retrospectively evaluated.

RESULTS: Between 2012 and 2020, seven patients (five men and two women) who were aged between 17 and 74 years underwent posterior transdural discectomy. Numbness is the most common presenting symptom, and two patients complained of urinary incontinence. T10–11 was the most affected level. All patients underwent at least 6 months of follow-up. There were no postoperative cerebrospinal fluid leaks and neurological complications postoperatively. All patients maintained their baseline neurological status or improved after surgery. No patient had secondary neurological deterioration or need for further surgical treatment.

CONCLUSION: The posterior transdural approach is a safe procedure that should be considered in lateral and paracentral thoracic disc herniations providing a more direct surgical intervention.

KEYWORDS: Surgical technique, Thoracic, Transdural

ABBREVIATIONS: ASIA: American Spinal Injury Association, CSF: Cerebrospinal fluid, CT: Computed tomography, MRI: Magnetic resonance imaging, TDH: Thoracic disc herniation

INTRODUCTION

Symptomatic thoracic disc herniations (TDH) is a rare condition and accounts for 5% of all disc herniations (13). It is most commonly observed between T11 and T12 (1). The mid-lower thoracic region is the most frequently affected area due to thoracic curvature, and TDH develops as a result of the distribution of axial loading forces at this point since the thoracic kyphotic curvature is the turning point in the mid-lower thoracic segment (3). Since the ratio of the diameter of the spinal canal to the spinal cord in the thoracic region is close to 1, the risk of spinal cord damage is higher in trauma or compression (9). Patients may have ataxia (spinothalamic tract), motor deficits in the lower extremities (pyramidal tract), and bladder dysfunctions. Severe and progressive myelopathy is the main indication for surgery.

The preferred surgical method for TDH is still controversial. A wide variety of surgical options have been described to date. Laminectomy, which was preferred in the past, has been completely abandoned today due to poor surgical results and high complication rates (1). Newer techniques, such as the transpedicular and transfacet pedicle approaches, have been described, especially for lateral disc treatment (13,14). High complication rates have been reported with these techniques in central disc herniation. Costotransversectomy and lateral extracavitary or classical transthoracic approaches have been described for this type of disc, but these methods also have potential pulmonary and mediastinal complications (6,14). Minimally invasive thoracoscopic techniques that were developed to prevent these complications have a long learning curve. A rarely used method is intradural disc removal (11).

■ MATERIAL and METHODS

Following institutional review board approval from the Bursa Uludag University School of Medicine (2021-19/14), data of all patients who underwent posterior transdural discectomy for TDH were retrospectively evaluated from the medical records.

Patients with thoracic herniation and compression of the spinal cord with symptoms of myelopathy from January 2012 to December 2020 were retrospectively evaluated. The inclusion criteria were TDH, surgical treatment with a transdural posterior approach, complete pre and postoperative documentation of the surgical approach, and neurological and clinical status. Those with diffuse calcification on preoperative CT were excluded from the study. Presenting symptoms, neurological status, intraoperative data, and postoperative clinical status were recorded. The American Spinal Injury Association (ASIA) scale was used to evaluate the clinical status.

Surgical Technique

Surgery was performed under general endotracheal anesthesia. The patient was placed in a prone position. After determining the level with fluoroscopy, a midline skin incision was made. After the bilateral posterior elements were exposed, the disc level was checked again with fluoroscopy. Laminectomy was performed at the appropriate level. Facet joints were preserved. Under the microscope, the dura was opened with a vertical incision from the midline with a microsurgical technique, and the arachnoid bands, if any, were cut for the cerebrospinal fluid (CSF) drainage to obtain a wider surgical area. This procedure also increased spinal cord microcirculation by reducing intradural pressure. The dentate ligament was cut, and the spinal cord was gently removed from the

surgical area. During this time, extreme care should be taken not to damage the spinal cord (Figure 1). Aspiration should be performed at low power with the help of a fine aspirator. The ventral dura was noted between the upper and lower nerve roots. A small vertical incision was made, and the disc fragments were removed with the help of hooks and thin punches. Forcing efforts should be avoided in the disc space. After adequate decompression was achieved, the dorsal dura was closed in a watertight manner, and fibrin tissue glue was applied to it. Since the ventral dura was tightly adhered to the posterior longitudinal ligament and annulus fibrosus, suturing was not required. Intraoperative neuromonitoring was conducted in all cases, and no loss of electrophysiological responses was recorded. The patients were discharged on the 3rd postoperative day after being immobilized for one day.

■ RESULTS

In an 8-year period between 2012 and 2020, seven patients (five men and two women), aged between 17 and 74 years, were included in this study. The characteristics of the patients are summarized in Table I. Numbness is the most common presenting symptom, and two patients complained of urinary incontinence (Table I). All patients were evaluated using thoracic magnetic resonance imaging (MRI) to confirm the diagnosis, and thoracic computed tomography (CT) was performed to detect calcification (Figure 2). T10–11 was the most affected level. All patients underwent at least 6 months of follow-up. There were no postoperative CSF leaks and neurological complications postoperatively. Two patients previously underwent surgery for lumbar disc herniation. There was no multiple-level disc herniation in this study

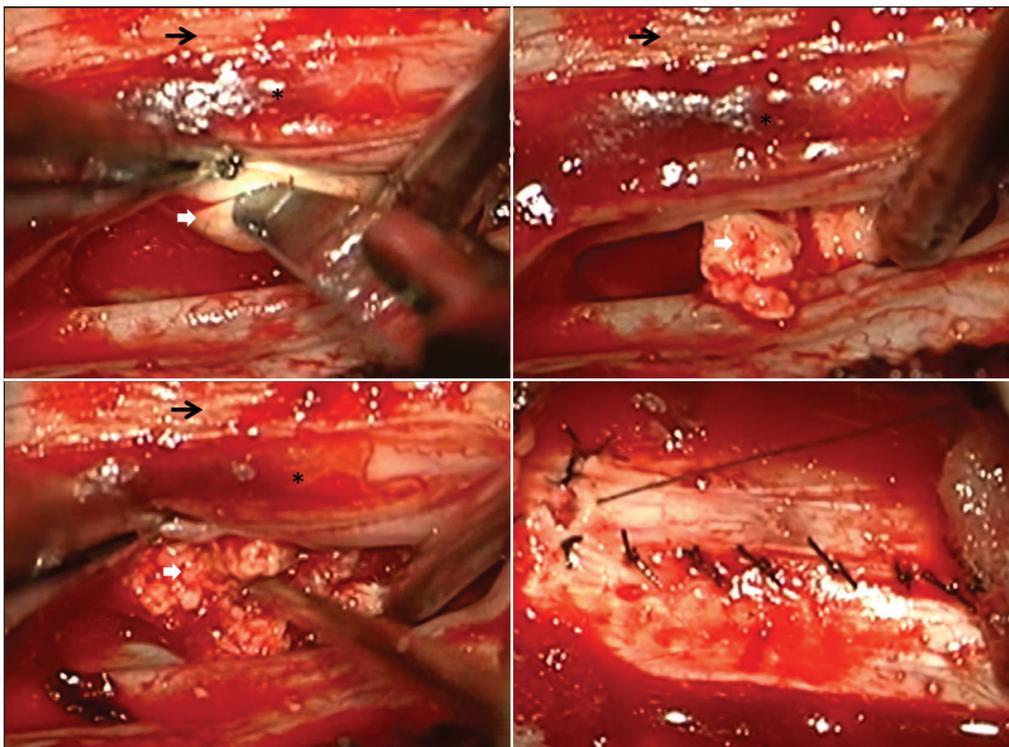


Figure 1: Intraoperative images of patient #3 (Asterisk, spinal cord; white arrow, disc; black arrow, dura mater).

Table I: Patient Characteristics

Case no.	Age/sex	Presenting symptom	Neurological examination	Level of disc herniation	Complication	Follow-up (months)	Nature of the disc
1	54/M	Urinary and fecal incontinence	Total loss of bilateral dorsal flexion of the foot and dorsal flexion of the big toe. Hypoesthesia in T10–12 dermatomes.	T11–12	∅	6	No
2	17/F	Back pain, numbness of the legs, burning sensation on the right leg	Hypoesthesia in T12 dermatome	L1–2	∅	16	Partially calcified
3	60/M	Bilateral numbness of the legs, decreased walking distance, fecal incontinence	4/5 spastic paraparesis. Hypoesthesia that goes up to T10 dermatome.	T10–11	∅	16	Partially calcified
4	71/M	Difficulty in walking	Right leg 4/5, left leg 3/5 paraparesis. Bilateral drop foot. Hypesthesia ascending to T10 on the left and L1 on the right.	T10–11	∅	13	No
5	74/M	Left leg pain	Monoparesis	T7–8	∅	12	Partially calcified
6	43/M	Back pain, bilateral numbness in the legs	Paraparesis hypoesthesia at T9–10 dermatomes.	T8–9	∅	12	Partially calcified
7	41/F	Back and waist pain, numbness of the legs, urinary incontinence, difficulty in walking	Paraparesis hypoesthesia rising to L1 dermatome.	T10–11	∅	18	Partially calcified

group. The pre and postoperative ASIA scores of each patient were recorded, and all patients maintained their baseline neurological status or improved after surgery. No patient had secondary neurological deterioration or a need for further surgical treatment.

DISCUSSION

Surgical management of TDHs remains one of the most challenging issues in spinal surgery. The operative results of disc excision via thoracic laminectomy were unsatisfactory. Neurological deterioration was observed in 35% of patients (8). Manipulations of the spinal cord may cause mechanical damage to the spinal cord during disc ventral removal. With this approach, there may also be problems with the blood supply of the spinal cord (10).

It is not possible to view the ventral surface of the spinal cord adequately with the transpedicular and transfacet approaches. To prevent poor vision, the use of 70° endoscopes is recommended (5).

Posterior laminectomy is no longer preferred for TDH due to limited vision and inevitable manipulation of the spinal cord. In 1955, Horwitz et al. reported that, in ruptured thoracic discs,

after laminectomy, by opening the dura, disc fragments could be observed without causing spinal cord injury (4). Posterior transdural discectomy was first described by Coppes et al. (2). In multilevel cervical spondylotic myelopathy, it is also suitable (11). With excision of the dentate ligament and interruption of CSF drainage, the transdural method provides an sufficient surgical area without spinal cord disturbance. The thoracic spinal cord is ~6.5-mm deep and 8.0-mm wide, and the thoracic spinal canal is ~16.8-mm deep and 17.2-mm wide. The canal is wider at the distal part. Therefore, there is a minimum 9.2-mm space laterally, while a 10.3-mm space in the anteroposterior direction (11). With the help of the microscope and microsurgical technique, the transdural approach maintain direct access to the lesion and allows the removal of particularly soft disc fragments without extreme cord retraction.

The biggest advantages of the transdural method are the short learning curve and the applicability of an already well-known surgical technique (11). The posterior transdural technique provides access to the disc space without significant disruption of the integrity of the facet-pedicle complex. Restricted bone removal with this technique significantly reduces axial pain. This method can reduce morbidity associated with thoracic access. An extremely important advantage is that it

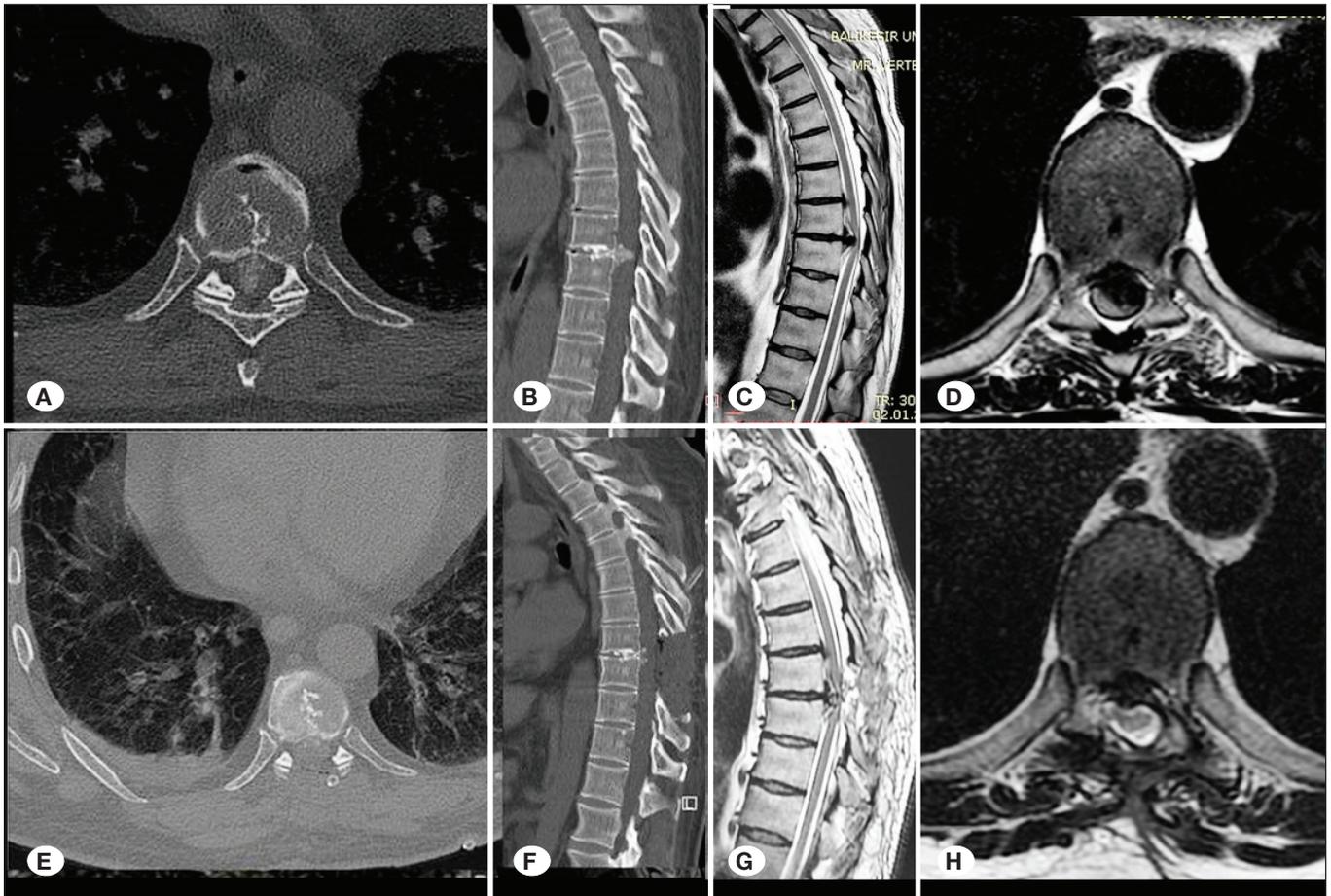


Figure 2: **A)** Axial preoperative computed tomography (CT), **B)** sagittal preoperative CT, **C)** sagittal T2-weighted preoperative magnetic resonance imaging (MRI), **D)** axial T2-weighted preoperative MRI, **E)** axial postoperative CT, **F)** sagittal postoperative CT, **G)** sagittal T2-weighted postoperative MRI, **H)** axial T2-weighted postoperative MRI.

eliminates the need for sternotomy in discs in the upper thoracic distance. CSF leakage and pseudomeningocele are the possible complications of this approach (11). The advantages of this technique are the three-dimensional image obtained using microsurgical methods, removal of calcified discs, the possibility of reaching lateral and centrally located discs, and elimination of the need for fusion.

Attempting to remove hard discs may result in accidental mechanical injury to the spinal cord; so, CT should be performed before deciding on the operative technique. Although Moon et al. preferred the transthoracic approach, especially in central calcific discs that may require excessive spinal cord retraction during surgery, some authors reported successful results in calcific discs (12).

Intraoperative neurophysiological monitoring methods, such as somatosensory-evoked potential, motor-evoked potential, and electromyography, should be used during transdural disc excision. Combined intraoperative neuromonitoring is useful in preventing neurological damage.

CONCLUSION

In paracentral discs, a posterior transdural approach to the thoracic discs provides a more direct vision. Moreover, a large working area can be provided without the need for extreme retraction of the spinal cord. Although the follow-up time and number of patients are small to give definitive results, the posterior transdural approach is a safe procedure that should be considered for lateral and paracentral TDHs.

AUTHORSHIP CONTRIBUTION

Study conception and design: SD

Data collection: PE, RNB

Analysis and interpretation of results: MOT, RNB

Draft manuscript preparation: MOT, PE

Critical revision of the article: MOT, SD

All authors (SD, MOT, PE, RNB) reviewed the results and approved the final version of the manuscript.

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