



Technical modifications and decision-making to reduce morbidity in thoracic disc surgery: An institutional experience and treatment algorithm



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ABSTRACT

Background: Symptomatic thoracic disc herniation (TDH) is an uncommon condition with significant treatment risks.

Objective: To evaluate strategies to avoid and manage complications from thoracic disc surgery.

Methods: All TDH cases by the senior author were retrospectively reviewed from 2000 to 2012. Complications were recorded, together with avoidance and management strategies. To reduce access-related morbidity, a thoracoscopic-tubular retractor approach was developed later in the series.

Results: 64 patients were treated for TDH, the majority undergoing an anterior minimally-invasive approach. Complications occurred in 15 patients (23%). Three patients with intercostal neuralgia persisting for >3 months had pain resolution after intercostal nerve blocks and radiofrequency lesioning. Five of the six patients with dural tears during anterior surgery had no further events following dural repair, lumbar drain insertion, and placement of chest tube to water seal. One case of persistent CSF leakage was successfully treated with a laparoscopically-mobilized omental flap. Preoperative metallic marker placement was effective at guiding correct-level surgery. For anterior operations, no pneumothorax occurred with routine chest tube placement. Our approach and techniques evolved based on early experience, allowing us to reduce surgical morbidity. The thoracoscopic-tubular retractor approach was associated with low morbidity (no complications among 13 cases other than temporary intercostal neuralgia).

Conclusions: Several strategies may reduce morbidity from thoracic disc surgery: careful approach selection, preoperative level marking, use a tubular retractor with thoracoscopic guidance, rib resection at the mini-thoracotomy site, routine chest tube placement for anterior operations, and routine lumbar drain insertion in the event of a dural tear. Prospective comparative studies are needed to assess the efficacy of these techniques.

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1. Introduction

Surgical management of thoracic disc herniation (TDH) has evolved over the past fifty years. Laminectomy was the mainstay of treatment until the 1960s, but devastating neurologic complications led to its abandonment [3,17]. Other approaches were developed and can be placed into three groups: *posterolateral approaches* (transpedicular-transfacet and transfacet pedicle-sparing), *lateral approaches* (costotransversectomy and lat-

eral extracavitary), and *anterior approaches* (open thoracotomy, mini-thoracotomy, and thoracoscopy). Tubular retractors can be utilized in all approaches and have been reported to lower the treatment risk [11,32,37].

Despite these advances, thoracic disc surgery is associated with a 20–30% complication rate [10,21]. Any approach can be complicated by a dural tear, neurologic deterioration, loss of mechanical stability, wound infection, or wrong-level surgery. Anterior and lateral approaches can be complicated by intercostal neuralgia, pneumothorax, hemothorax, pleural effusion, or great vessel injury [4,7,38,39]. Over the past decade, we have adopted several strategies in an attempt to reduce perioperative morbidity and maintain good outcome. This paper describes the evolution of our decision-making and technique when confronting these challenging lesions.

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2. Methods

2.1. Preoperative planning

All patients had a thoracic spine CT and MRI (or CT myelogram in patients unable to undergo MRI). Thoracolumbar X-rays with a rib series were obtained to facilitate level counting. One or two days before all anterior operations, the patient went to the interventional radiology suite for placement of a metallic marker into the rib head corresponding to the level of TDH.

2.2. Selection of approach

A posterolateral approach was chosen for all paracentral/foraminal TDHs and the subset of central TDHs that were both small and soft. The posterolateral approaches were performed with or without tubular retractors using standard techniques [4,7,38,39]. Central TDHs that were large or calcified were selected for an anterior approach. Standalone thoracoscopy, open transpleural thoracotomy, and retropleural thoracotomy were performed as described in the literature [2,34,40]. Because of complications with these approaches, later in the series we sought to reduce approach-related morbidity, improve visualization with a shorter distance to the target, and perform safer dissection. To achieve these goals, we utilized a tubular retractor with thoracoscopic guidance and the operating microscope for all anterior operations in the last 4 years of the series [42]. We administered 10 mg intravenous dexmedetomidine at the beginning of all operations and raised mean arterial blood pressure to >80 mmHg during disc dissection. Intraoperative monitoring with motor and somatosensory evoked potentials was utilized in all cases.

2.3. Thoracoscopic-tubular retractor approach

The patient was positioned in the lateral decubitus position with the table flexed to widen the intercostal space. Cross-table X-rays were obtained to identify the metallic marker inserted preoperatively. The working port was placed in the intercostal space overlying the appropriate disc space at and slightly behind the posterior axillary line [42]. An exploratory thoracoscopy was carried out using one or two 1 cm incisions in the anterior axillary line above and below the working port. An internal rib count was carried out using a 5 mm zero-degree angled endoscope through 5 mm soft ports. The pleura was opened over the appropriate rib head, and a clip was placed on the pleura over the disc space. To verify the correct spinal level, the clip and preoperative metallic marker were visualized on cross-table X-ray. A fan retractor was placed to protect the lung and great vessels as necessary. The incision over the working port was enlarged to 3–5 cm, and a 3 cm segment of rib was removed sharply. A tubular retractor (XLIF, Nuvasive) was deployed to the disc space under continuous endoscopic visualization (Fig. 1). The retractor was expanded and fixed to a table-mounted holder. The microscope was brought into position and thoracic discectomy was performed using standard techniques. Following discectomy, the piece of rib removed at the working port was re-attached with mini-plates. The wound was closed in standard fashion, and a chest tube was placed routinely.

2.4. Postoperative assessment

Patients were examined by the treating surgeon (N.I.P.) 6 weeks, 3 months, 6 months, and 12 months postoperatively, and as needed thereafter. Plain X-rays and CT scans were obtained in patients undergoing fusion. MRI was obtained in patients with new or persistent symptoms.

Table 1
Symptoms and neurologic impairment at presentation and at last follow-up.

Symptom	n (%) at presentation	Status at last follow-up
Axial pain	47 (73%)	Improved in 32, unchanged in 14, worse in 1
Radicular pain	22 (34%)	Improved in 20, unchanged in 2
Leg weakness	38 (59%)	Improved in 28, unchanged in 8, worse in 2
Balance problems	23 (36%)	Improved in 15, unchanged in 6, worse in 2
Leg numbness	25 (39%)	Improved in 19, unchanged in 2, worse in 4
Leg pain	12 (19%)	Improved in 8, unchanged in 4
Bladder symptoms	11 (17%)	Improved in 8, unchanged in 3
Bowel symptoms	2 (3%)	Improved in 1, unchanged in 1
	n at presentation	n at last follow-up
<i>ASIA score</i>		
A	0	0
B	0	1
C	3	1
D	35	25
E	26	37
<i>Nurick index</i>		
I	39	47
II	13	9
III	2	3
IV	10	5

2.5. Data collection

Following institutional review board approval, our operative log was searched for all TDH cases by the senior author (N.I.P.) between 2000 and 2012. The medical record was retrospectively reviewed for neurologic signs and symptoms before surgery and at last follow-up. Nurick and American Spinal Injury Association (ASIA) scores were recorded. Operative details including disc level and approach were noted. The incidence, management, and natural history of complications were recorded. Persistent intercostal neuralgia was defined as new or worsened radicular pain around the chest wall persisting more than 3 months after surgery. Transient intercostal neuralgia (resolving within 3 months) was not classified as a complication.

3. Results

3.1. Clinical data

64 patients were treated for symptomatic TDH between 2000 and 2012 (mean age: 52, 38 women and 26 men). Table 1 summarizes their symptoms and neurologic impairment at presentation and at last follow-up. Five patients had two discs treated, for a total of 69 disc operations. 46 patients underwent decompression alone while 18 had decompression and fusion. Most presenting symptoms improved by last follow-up (mean 32 months after surgery).

3.2. Approach selection, technique, and decision-making

The majority of patients had large central disc herniations with spinal cord compression. Consequently, an anterior approach was chosen for most patients (Table 2: 55 anterior, 9 posterolateral).

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