Thoracolumbar Junction Disc Herniations: Clinical Features and Surgical Approaches

Hyo Sang Lee, M.D., Dong Ah Shin, M.D., Do Heum Yoon, M.D.,
Hyun Cheol Shin, M.D., Keung Nyun Kim, M.D.

Department of Neurosurgery, Yonsei University College of Medicine, Spine and Spinal Cord Institute, Seoul, Korea

Objectives: To evaluate the clinical features of thoracolumbar junction (TLJ) disc herniations and to determine appropriate surgical approaches.

Materials and Methods: A retrospective analysis of 33 patients with single level TLJ disc herniations undergoing operations was performed. Medical records, operative findings, and radiologic data were assessed. TLJ was defined as the level from T11-12 to L2-3. The mean follow-up period was 21.0 months.

Results: Mean age was 47.3 years. Affected disc levels were T11-T12 in 5 patients, T12-L1 in 2 patients, L1-L2 in 6 patients, and L2-L3 in 20 patients. Soft disc herniations were detected in 24 patients, while the remainder showed hard disc herniations such as a bony spur or calcification. Thirty-one patients presented with pain as their chief complaint and radicular pain was the most common symptom (n=14). Various neurologic deficits including upper motor neuron syndrome, lower motor neuron syndrome, and radiculopathy were observed in 27 patients and were not related to the affected levels. Twenty-four patients with lateral disc herniations or central soft disc herniations underwent partial hemilaminectomy and facetectomy, and the remaining patients (n=9) with central disc herniations or severely calcified disc herniations underwent total facetectomy and subsequent posterior fusion. There were 7 cases with complications including dural tear, mild motor and sensory deficits, and bladder and bowel dysfunction without permanent morbidities.

Conclusion: TLJ disc herniation shows variable symptoms and signs due to its unique anatomy. It can be safely managed by the correct surgical approach as determined by the location and type of disc herniation.

Key Words: Herniated disc • Lumbar vertebrae • Thoracic vertebrae • Operative procedures

INTRODUCTION

The thoracolumbar junction (TLJ) is a transitional zone between the spinal cord and the cauda equina and between the rigid thoracic spine and the flexible lumbar spine. While this area is vulnerable to trauma, it is not susceptible to disc degeneration. Indeed, it is known that disc herniation of the TLJ is relatively rare compared with the low lumbar region. Clinical features and surgical approaches are variable due to its unique anatomy and, unfortunately, little is known about them.

The aim of this study is to characterize the clinical features of TLJ disc herniation and to evaluate appropriate surgical interventions.

MATERIALS AND METHODS

1. Demographics

The TLJ was defined as the level from T11-12 to L2-3 in this study. Among patients with TLJ disc herniations treated surgically at our institute between March 1998 and December 2006, 33 patients who had single level disc herniation and whose follow-up period was more than 6 months were included in this study. Medical records, operative findings, and radiologic data were assessed. The surgical outcome was evaluated by the Prolo scale. Patients with spondylotic stenosis, ossification of the ligamentum flavum, ossification of the posterior longitudinal ligament, and multiple disc herniations in the low lumbar region were excluded from this study. The mean follow-up period was 21.8 months and ranged from 6 to 64 months.
2. Operative technique

Patients were placed in the prone position under general anaesthesia. A posterior midline incision was performed, the paravertebral muscles were split and retracted laterally, and the lamina and facet joints were exposed. Lateral herniated discs were sufficiently exposed by partial hemilaminectomy and successful decompressions were achieved. After the partial hemilaminectomy was performed, centrally herniated soft discs were removed without difficulty, using down-bite curette or up-bite pituitary forceps. However, patients with central disc herniations or severely calcified disc herniations underwent total facetectomy and subsequent posterior fusion. With the exception of soft discs, centrally herniated discs were safely removed via lateral to central trajectory with total facetectomy. To ensure visualization of the anatomy, total facetectomy was performed in cases with severely calcified lateral disc herniations. In posterior spinal fusion, pedicle screw fixation and autologous bone grafts were used (Fig. 1). After complete hemostasis, the wound was closed in layers according to standard practice.

3. Statistical analysis

The Mann–Whitney U test was performed using SPSS 12.0 (SPSS, Chicago, IL). A p value of <0.05 was considered significant.

RESULTS

1. Demographics

Fifteen patients were men and 18 were women. Their ages ranged from 20 to 84 years with a mean age of 47.3 years. Affected disc levels were T11-T12 in 5 patients, T12-L1 in 2 patients, L1-L2 in 6 patients, and L2-L3 in 20 patients (Fig. 2). Central disc herniations were observed in 18 patients and lateral disc herniations in 15 patients. Eleven patients had hard disc herniations such as a bony spur or calcification.

2. Clinical features

The clinical features of patients with TIJ disc herniations are summarized in Table 1. Back and leg pain presented in 20 and 31 patients, respectively. Motor weakness developed in 17 patients, including 2 patients with T11-12 disc herniation with upper motor neuron type weakness. Sensory changes developed in 23 patients. Among the 29 patients with leg pain, only 15 showed a typical affected dermatomal radicular pattern. Among the remaining 14 patients, 2 showed diffuse leg pain and 12 showed lower lumbar radicular leg pain. Bladder dysfunction presented in 5 patients, 2 with T12-L1 and 3 with L1-2 disc herniation.

3. Surgical approach

All patients underwent a discectomy via a posterior approach.
Table 1. Clinical features of patients with single level thoracolumbar junction disc herniation

<table>
<thead>
<tr>
<th>Level</th>
<th>Symptom</th>
<th>Neurologic deficit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Back pain</td>
<td>Radicular pain</td>
</tr>
<tr>
<td>T11-12</td>
<td>1(20%)</td>
<td>3(60%)</td>
</tr>
<tr>
<td>T12-L1</td>
<td>1(50%)</td>
<td>2(100%)</td>
</tr>
<tr>
<td>L1-L2</td>
<td>5(83%)</td>
<td>5(83%)</td>
</tr>
<tr>
<td>L2-L3</td>
<td>15(75%)</td>
<td>19(95%)</td>
</tr>
</tbody>
</table>

Fig. 4. The mean value of pre- and post-operative Prolo scales. There was a statistically significant difference (p<0.01).

were 7 surgical complications including decreased bladder function in 1 patient, transient motor weakness in 3 patients, and dural tear in 3 patients. The transient motor weakness improved shortly after surgery, dural tears were repaired directly in the operating room and bladder dysfunction improved during the outpatient department follow-up period. The mean values of the Prolo scale were 5.2 in the peroperative state and 7.9 in the postoperative state. This was statistically significant (p<0.01) (Fig. 4).

DISCUSSION

Disc herniation in the TLJ is rarely reported in the literature. There are reports of upper lumbar disc herniations at the L1-2 to L3-4 levels but they represent no more than 5% of all disc herniations<sup>2,7,12</sup>. Similarly, 1% of all disc herniations are located at the TLJ.

In a cadaveric experiment, repetitive cycling loading produced compressive damage to the vertebral body endplate which led to structural disruption of the intervertebral disc, with discs 50 to 70 years of age being most affected<sup>9</sup>. In our data, the incidence was higher in younger patients, as the third and fourth decades were the most common (40%). The TLJ is a vulnerable area to trauma and such trauma can cause endplate injury and can subsequently initiate degeneration of the intervertebral discs<sup>9</sup>. Trauma, including traffic accidents and sports injuries, has been increasingly observed in young adolescents, which might explain why TLJ disc herniation is more commonly observed in our data.

TLJ disc herniation shows a variety of nonspecific symptoms and neurological signs due to anatomical complexity and spinal cord, cauda equina, and nerve root compression.

after partial or total resection of the facet joints. Twenty four patients received partial facetectomy and laminectomy. Nine patients underwent unilateral or bilateral total facetectomy and required posterior fusion (Fig. 3). Nine patients showed posterior apophyseal ring fracture, bony spurs, or calcification that could be removed successfully with a downsire curette or chisel extradurally. Due to limited exposure and work space in those cases with bony spurs or calcification, total facetectomy was performed.

Fig. 3. MRI shows disc herniation at the level of L1-2 (A). MRI shows lateral disc herniation (B). Partial facetectomy and laminectomy were performed (white arrow) (C).

4. Surgical results

Leg pain was improved in all patients except for 4. There
Sometimes lower thoracic disc herniation mimics acute lumbosacral radiculopathy. Tokuhashi et al. reported that the neurologic findings and symptoms of TLJ disc herniation had relatively highly distinct differences among herniated disc levels. Our data also demonstrated that the upper TLJ disc herniations showed neurological deficits whereas lower herniations showed radicular pain more commonly. Paatzor et al. reported that herniation of the upper lumbar discs is characterized by a higher frequency of parcsis and autonomic disorders than lower lumbar disc herniations.

It is believed that T10-11 and T11-12 disc herniations are upper neuron disorders of the spinal cord, T11-L1 disc herniations are lower neuron disorders of the spinal cord, L1-2 disc herniations are combined disorders of the cauda equina and radiculopathy, and L2-L3 disc herniations are radiculopathy. Several diseases that can produce anterior thigh pain, such as avascular necrosis of the hip joint, muscle strain, stress fracture, isolated femoral nerve injury, and diabetic amyotrophy, must be excluded from the diagnosis.

In our data, 15 (48.3%) patients showed a typical affected dermatomal radicular pattern, and 16 (51.6%) patients presented with diffuse or lower radicular pain. Because clinical symptoms and neurological findings are nonspecific, imaging studies including CT or MRI are essential to accurate lesion diagnosis. Unfortunately, routine lumbar MRI is frequently performed without involving the TLJ, but as lower lumbar lesions cannot be differentiated from TLJ lesions, the TLJ should be included.

Patients with disabling leg pain which did not respond to conservative treatment and patients with neurological deficits due to neural compression were candidates for the operation. The key determinants in selecting a surgical approach are anatomic features such as level, location, calcification or hard disc, the general health of the patient, and the surgeon's experience. The given options were the posterior approach, lateral extracavitary approach, or anterior approach. Posterior approaches include transpedicular decompression, costotransversectomy and the transfacetral approach. Anterior approaches include open surgery and an endoscopic or laparoscopic approach. An anterior procedure is often preferable at the level of the spinal cord and for central calciﬁed dis herniations, while a posterior procedure is preferable at the level of the cauda equina and for lateral soft disc herniations. Some surgeons prefer anterior (including transforaminal) approaches as they are useful for achieving complete discectomy without dural manipulation. However, this approach is more difficult than a posterior procedure, resulting in increased blood loss and longer operating time. These added difﬁculties informed our decision not to perform anterior approaches. Posterior approaches are less invasive and easily decompress the nerve root directly. The transfacetral approach allows for complete disc removal with limited spinal column disruption and soft-tissue dissection and spare the pedicle. For our data, all patients were treated with a unilateral or bilateral posterior approach. Unilateral partial facetectomy or laminectomy was selected in 24 patients. Total or subtotal facetectomy with posterior fusion was selected in 11 patients. Central disc herniations and bony spurs can be removed effectively using a small chisel or curette extradurally. In these short segments, posterior fusion with pedicle screws and autologous bone grafts was necessary. In lateral or soft disc herniations, partial facetectomy or laminectomy was preferred, while in central or hard disc herniations, total or subtotal facetectomy with posterior fusion was preferred. The transfacetral approach is known to be safe and effective and cause no serious complications. Although there are disadvantages to using the posterior approach, such as risking the injury of the cauda equina while the dura is being retracted, there were no serious complications related to surgery in our data. The surgeon's familiarity with this approach is another advantage.

CONCLUSION

TLJ disc herniation shows variable symptoms and signs due to its unique anatomy. It can be safely managed by the
correct surgical approach as determined by the location and
type of disc herniation.

REFERENCES

1. Adams MA, Freeman BJ, Morrison HP, Nelson IW and Dolan P: Mechanical initiation of intervertebral disc
3. Black P: Laminotomy medial facet approach in the excision
of thoracic disc herniation. Neurosurg Focus 9:e6, 2000
4. Fontanesi G, Tartaglia I, Cavazzuti A and Gianccecchi F: Prolapsed intervertebral disc at the upper lumbar level:
6. Hidalgo Ovejero AM, Garcia Mata S, Martinez Grande M, Maravi-Petri E and Izco-Cabezón T: L5 root compres-
8. Ido K, Shimizu K, Tada H, Matsuda Y, Shikata J and Nakamura T: Considerations for surgical treatment of
24:416-418, 1999
13. Stillerman CB, Chen TC, Day JD, Couldwell WT and Weiss MH: The transfacet pedicle sparing approach for
thoracic disc removal: Cadaveric morphometric analysis and preliminary clinical experience. J Neurosurg 83:971-
976, 1995