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Thoracoscopic discectomy for herniated thoracic discs

Torasik disk hernilerinin tedavisinde torasik diskektomi

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Objectives: Thoracoscopic discectomy is a relatively new and technically demanding minimally invasive procedure. In this study, we presented our clinical experience with thoracoscopic discectomy.

Patients and methods: The medical records of 49 consecutive patients (30 men, 19 women; mean age 48.5 years; range 28 to 68 years) who underwent thoracoscopic discectomy from March 1997 to October 2004 were retrospectively reviewed. All the patients suffered from myelopathy (n=44) or intolerable radiculopathy (n=5). The mean follow-up period was 52 months (range 3 to 94 months).

Results: Preoperative radiologic studies showed soft disc herniation in 21 patients and hard calcified disc herniation in 32 patients. The most common involvement was at T_{6-7} with nine patients (18.4%), followed by T_{8-9} with six patients (12.2%), and T_{3-4} (n=5, 10.2%), T_{7-8} (n=5), T_{9-10} (n=5), and T_{10-11} (n=5). The mean operation time was 182 minutes (range 100 to 420 minutes). The mean blood loss was 340 ml (range 150 to 1,500 ml). Of 44 patients with myelopathy, 41 patients (93.2%) showed neurologic improvement, and three patients (6.8%) had a stabilized neurological status. All the patients with radiculopathy had complete recovery. Postoperative complications included intercostal neuralgia, delayed hemopneumothorax, prolonged air leakage, and pneumonia in four patients, respectively.

Conclusion: Although the learning curve is steep, thoracoscopic discectomy is a safe and effective minimally invasive procedure for symptomatic thoracic disc herniations.

Key words: Diskectomy/methods; endoscopy/methods; intervertebral disk displacement/surgery/radiography; thoracic vertebrae/surgery; tomography, X-ray computed.

Amaç: Torakoskopik diskektomi nispeten yeni, ancak teknik olarak zor bir minimal invaziv cerrahi girişimdir. Bu çalışmada, torakoskopik diskektomi ile ilgili klinik deneyimimiz sunuldu.

Hastalar ve yöntemler: Mart 1997-Ekim 2004 tarihleri arasında torakoskopik diskektomi uygulanan ardışık 49 hasta (30 erkek, 19 kadın; ort. yaş 48.5; dağılım 28-68) geriye dönük olarak değerlendirildi. Tüm hastalarda miyelopati (n=44) ya da konservatif tedaviyle iyileşmeyen radikülopati (n=5) vardı. Ortalama izlem süresi 52 ay (dağılım 3-94 ay) idi.

Bulgular: Ameliyat öncesi radyolojik incelemelerde 21 hastada yumuşak disk herniasyonu, 32 hastada sert ve kalsifiye disk herniasyonu saptandı. En sık tutulum dokuz hastada (%18.4) T_{6-7} düzeyinde görüldü; bunu altı hastayla (%12.2) T_{8-9} ve beşer hastayla (%10.2) T_{3-4}, T_{7-8}, T_{9-10}, ve T_{10-11} izlemekteydi. Ortalama ameliyat süresi 182 dakika (dağılım 100-420 dakika); ortalama kan kaybı 340 ml (dağılım 150-1500 ml) bulundu. Miyelopatili 44 hastanın 41'inde (%93.2) nörolojik düzelme sağlandı; üç hastanın (%6.8) nörolojik durumu stabil seyretti. Radikülopatili tüm hastalarda tam iyileşme sağlandı. Ameliyat sonrası dönemde komplikasyon olarak dört hastada sırasıyla interkostal nöralji, geç dönem hemopnömotoraks, uzun süreli hava kaçağı ve pnömoni gelişti.

Sonuç: Öğrenme eğrisi dik olmasına rağmen, torakoskopik diskektomi, semptomatik torasik disk herniasyonlarında güvenli ve etkili bir minimal invaziv cerrahi girişimdir.

Anahtar sözcükler: Diskektomi/yöntem; endoskopi/yöntem; intervertebral disk deplasmanı/cerrahi/radyografi; torasik vertebra/cerrahi; bilgisayarlı tomografi.

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Thoracic disc herniation occurs much less frequently than lumbar and cervical disc herniation. The diagnosis of thoracic disc herniation may be difficult due to the lack of a characteristic clinical presentation. The use of computed tomography (CT) and magnetic resonance imaging (MRI) has resulted in a significant increase in the detection and diagnosis of this lesion. The prevalence of thoracic disc herniation as detected by CT and MRI was reported to be 11.1% to 14.5%.[1,2] Symptomatic thoracic disc herniations account for less than 1% of all vertebral disc operations.[3]

The surgical management of thoracic disc herniation has evolved over the past several decades. Classically, transpedicular discectomy, thoracotomy, and costotransversectomy are commonly used open approaches.[4-6] However, these open surgeries require general anesthesia, the dissection of muscle, and the removal of bone. A long postoperative recuperation and hospitalization are also needed for these traumatic surgeries.

Thoracoscopy was first introduced by Jacobaeus in 1910 as a method of obtaining the same exposure as provided by the transthoracic route, without the need for a large thoracotomy incision.[7] In 1994, Horowitz et al.[8] demonstrated the successful use of video-assisted thoracoscopic surgery in performing thoracic discectomy in both cadaver and porcine models. In recent years, the thoracoscopic approach has gained popularity because of reduced morbidity rates compared with those in open thoracotomy. There have been several clinical reports of successful thoracoscopic spine surgery.[8-16] Yet, it requires a sufficient amount of laboratory practice and has a steep learning curve. In this study, we presented our clinical experience with thoracoscopic discectomy for symptomatic thoracic disc herniation.

PATIENTS AND METHODS

Between March 1997 and October 2004, 49 consecutive patients underwent thoracoscopic discectomy at our hospital. There were 30 men and 19 women with a mean age of 48.5±12.6 years (range 28 to 68 years). The inclusion criteria for the study were as follows: *(i)* the presence of intractable radiculopathy or functionally disabling myelopathy; *(ii)* thoracic disc herniation confirmed by CT scan and MRI; *(iii)* unresponsiveness to a minimum of six months of conservative treatments. When any doubt existed as to the diagnosis and the cause of the symptoms, the patient was examined by an internist to rule out other causes of thoracic pain. The mean follow-up period was 52±28.6 months (range 3 to 94 months).

Surgical technique

Details of the surgical technique were previously reported.[9-13] Under general anesthesia with one-lung ventilation, the patient is placed in the lateral decubitus position, with the side of access facing upward and flexed at the thoracolumbar junction to obtain a widened intercostal space. We favor the right-side approach because there is no interference with the aorta. But, in the presence of a left-lateralized pathology or one below the T_{10-11} level, the left-side approach is chosen. We feel that marking the skin using a C-arm before skin preparation is an essential step, because imprecise port sites pose difficulties at the operation (Fig. 1). Instead of the axillary line, we use a new imagery line based on the anterior and posterior vertebral body to establish a more accurate site for port insertion, especially for the main working port and endoscopic port (Fig. 2). Three or four trocar insertions are needed. We always use a 30- or 45-degree angled endoscope during spine procedures, its advantage being enhanced visualization of the disc space without causing a crowding of instruments. The site of the pathology is confirmed with internal rib counting and a marking needle inserted under C-arm guidance (Fig. 3a). The pleura is incised over the proximal rib and disc space, and

Fig. 1. Skin marking using a C-arm for level identification.

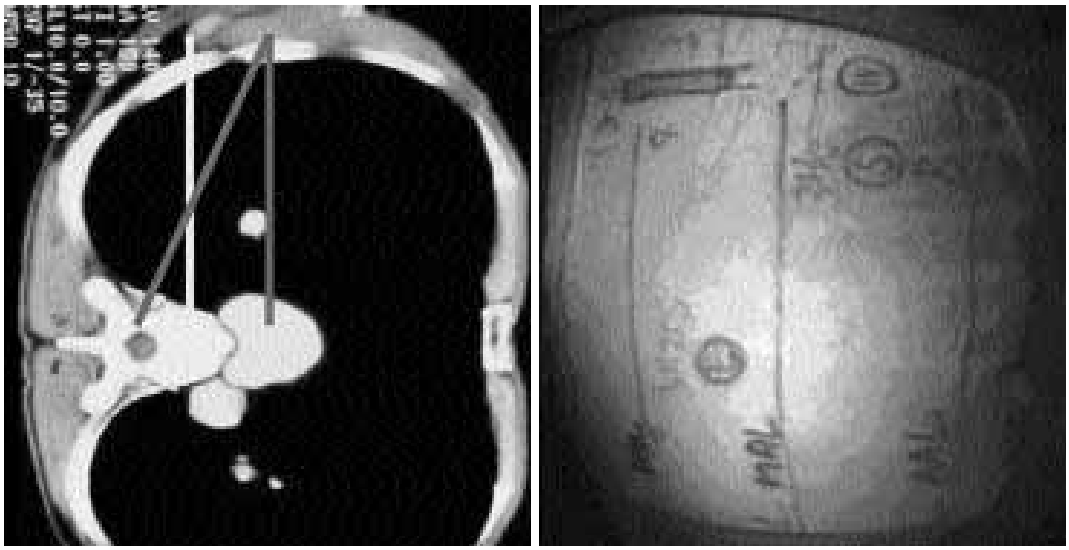

Fig. 2. The imagery line and determination of the port site.

segmental vessels are mobilized and ligated when necessary. The proximal 1.5-2 cm of the rib is removed and the pedicle, neural foramen and disc space are identified (Fig. 3b). The first step of decompression is the identification of the anterolateral dura to maintain surgical orientation of the spinal cord (Fig. 3c). The second step is the preparation of working space at the dorsal disc space to remove compressed disc material away from the epidural space. The width and shape of the working space depends on the size and character of the disc pathology. The width and depth of the cavity

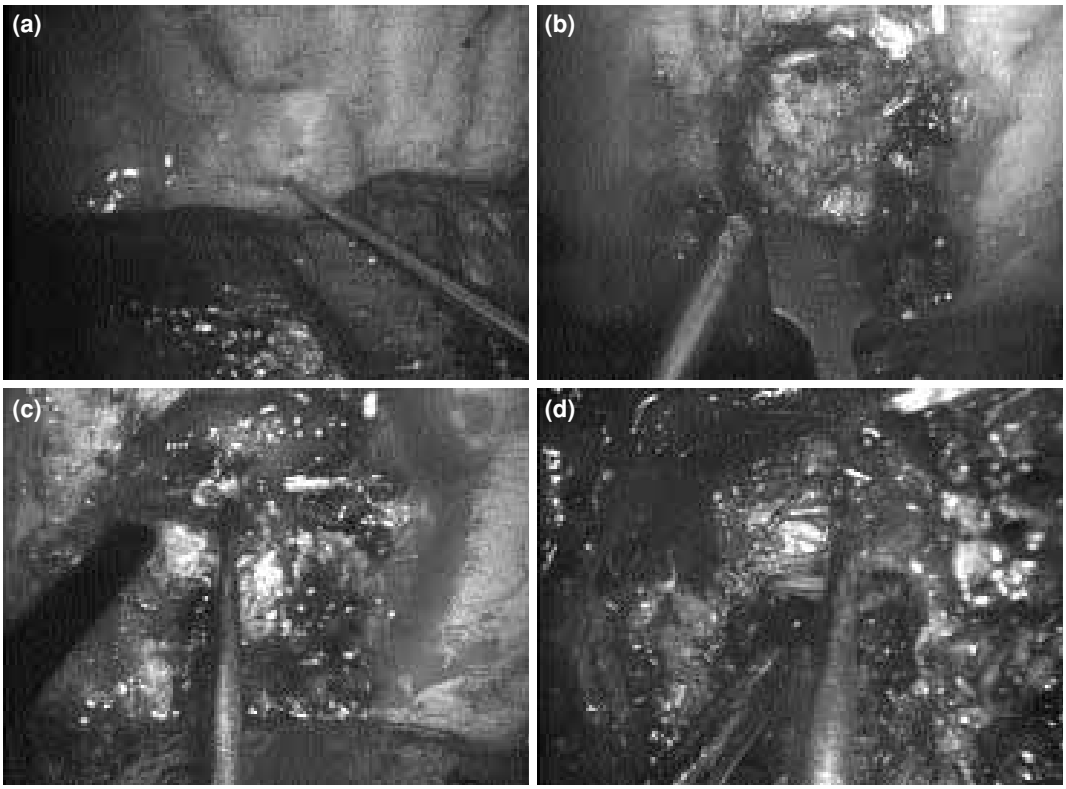

Fig. 3. (a) A marking needle is inserted to the disc level; **(b)** removal of the rib head; **(c)** exposure of the lateral surface of the dura, **(d)** ventral surface of the dura after decompression.

should be adequately determined so that the uncompressed normal dura is exposed, reaching the contralateral pedicle to visualize the entire ventral surface of the dura. The last step is the removal of the compressed disc material (Fig. 3d). This step is critical because there is possibility of mechanically induced cord damage, an unnecessary amount of dura tearing, and incomplete decompression. After epidural hemostasis, irrigation of the thoracic cavity, and reinflation of the lung, the incisions are closed. Maintenance of the chest tube is not needed in some patients.

RESULTS

Forty-four patients presented with myelopathic signs and symptoms while five patients had incapacitating thoracic radicular pain without myelopathy. Preoperative radiologic studies showed soft disc herniation in 21 patients and hard calcified disc herniation in 32 patients (Fig. 4, 5). The most common involvement was at T_{6-7} with nine patients (18.4%), followed by T_{8-9} with six patients (12.2%), and T_{3-4} (n=5, 10.2%), T_{7-8} (n=5), T_{9-10} (n=5), and T_{10-11} (n=5) (Table I). The mean operation time was 182 minutes (range 100 to 420 minutes), showing a slight decrease with increased

TABLE I

Distribution of the levels involved

Level	No. of patients	%
T_{3-4}	5	10.2
T_{4-5}	2	4.1
T_{5-6}	4	8.2
T_{6-7}	9	18.4
T_{6-7}, T_{7-8}	1	2.0
T_{6-7}, T_{9-10}	1	2.0
T_{7-8}	5	10.2
T_{8-9}	6	12.2
T_{8-9}, T_{9-10}	1	2.0
T_{9-10}	5	10.2
T_{10-11}	5	10.2
T_{10-11}, T_{11-12}	1	2.0
T_{11-12}	3	6.1
T_{12}-L_1	1	2.0

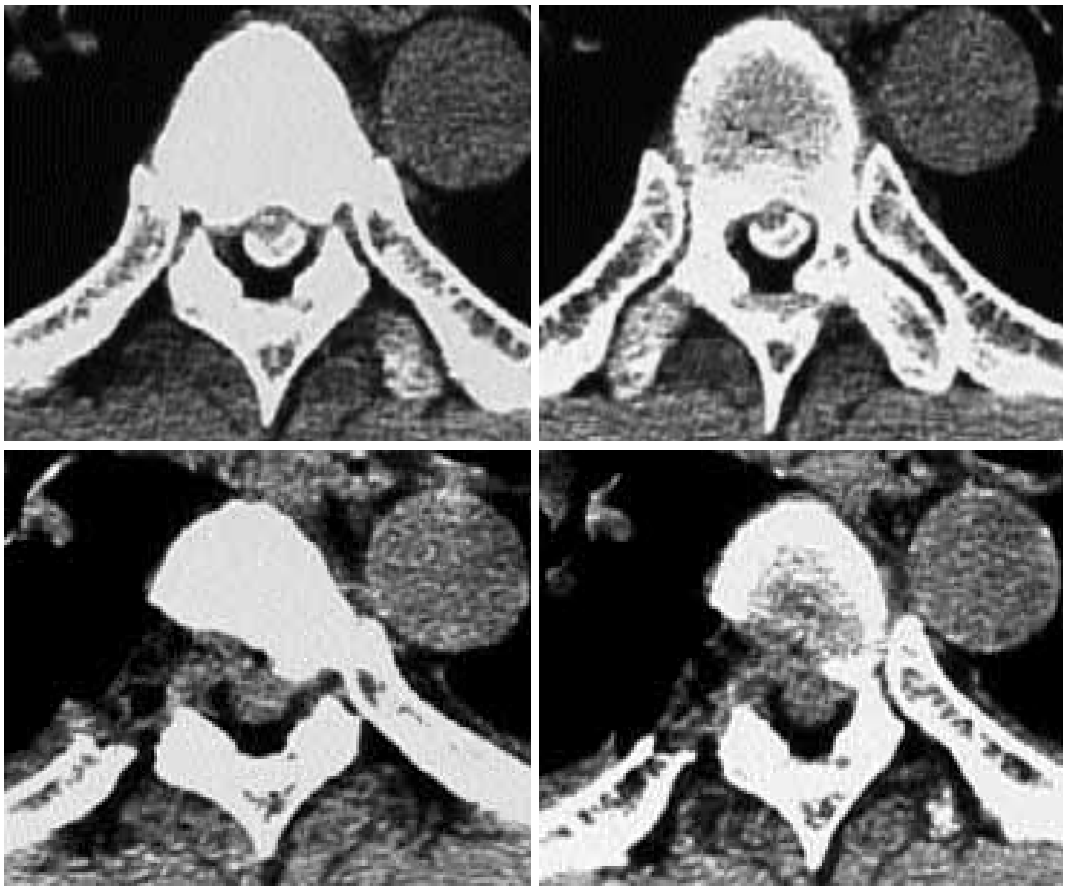

Fig. 4. A case of soft disc herniation (T_{6-7}) with myelopathy.

experience. The mean blood loss was 340 ml (range 150 to 1,500 ml) and it remained unchanged throughout the patient recruitment.

Neurologic outcomes were good. Of 44 patients with myelopathy, 41 patients (93.2%) showed neurologic improvement, and three patients (6.8%) had a stabilized neurological status. All the patients with radiculopathy had complete recovery. Postoperative complications included intercostal neuralgia, delayed hemopneumothorax, prolonged air leakage, and pneumonia in four patients, respectively.

DISCUSSION

The advantage of thoracoscopic microdiscectomy over standard thoracotomy is that it is associated with markedly reduced postoperative pain and less morbidity.[16] Yet, safety of this procedure and a successful result depend on the surgeon's skills and experience. Intraoperative conversion to mini-open thoracotomy may sometimes be necessary for safety when anatomical orientation is obscured by severely thickened pleural fat or a bloody surgical field in an obese patient, or when the surgical procedure cannot be performed adequately in calcified, large broad-based and transdural thoracic disc herniations, because most spine surgeons are more familiar with the use of microscopic vision and standard instruments than that of endoscopic vision and long narrow instruments.

Complications that are frequently encountered include atelectasis, pleural fluid accumulation, and intercostal neuralgia. Atelectasis can be avoided by intermittent intraoperative lung inflation and adequate endotracheal suctioning. If cerebrospinal fluid (CSF) leakage occurs, prolonged chest tube maintenance is needed, but it can also be overcome by performing lumbar CSF drainage with early chest tube removal; thoracentesis may be needed when large amounts of pleural fluid collection

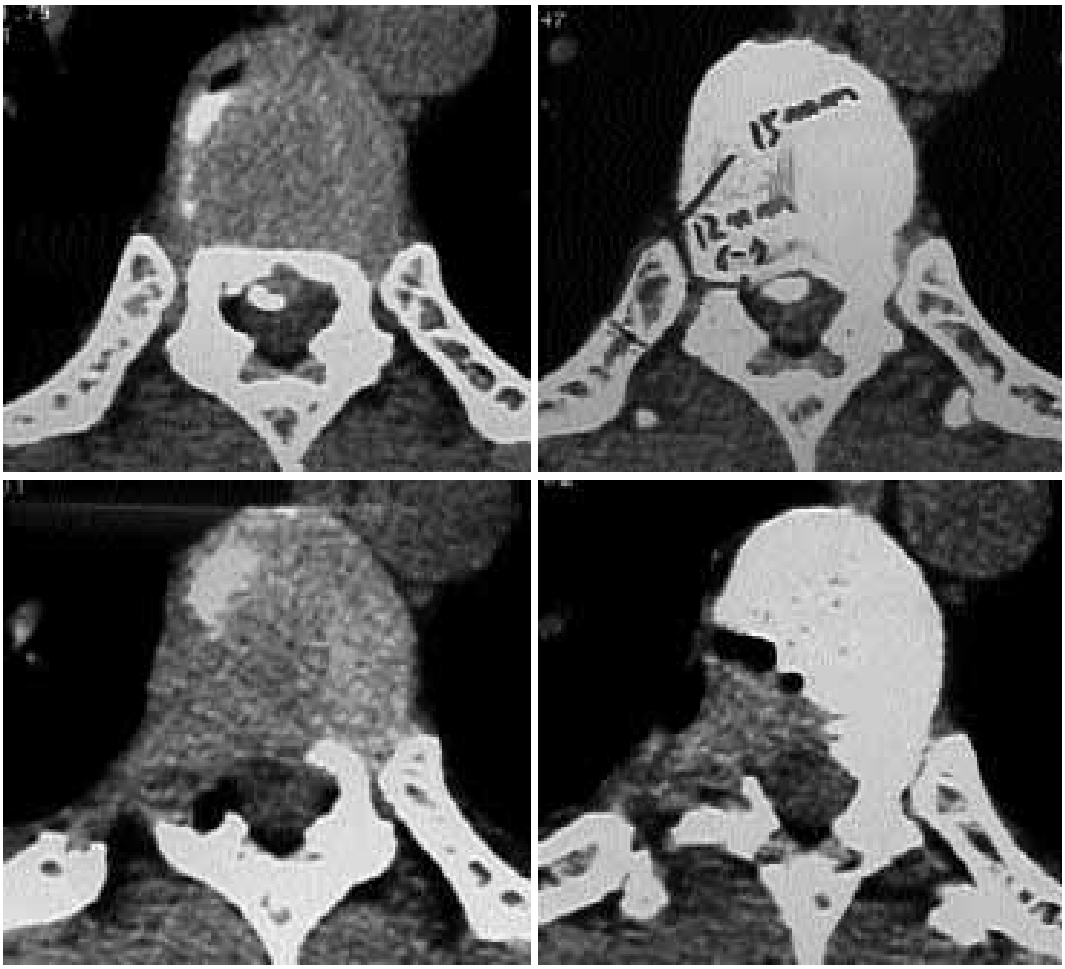

Fig. 5. A case of hard disc herniation (T_{8-9}) with myelopathy.

occur. Intercostal neuralgia is a transient and minor problem; it can be avoided by minimizing nerve contusion through a sufficient amount of dissection at the site of port insertion and handling of surgical instruments directly without a trocar or at least with the use of a flexible trocar.

The major problem is incomplete discectomy, which arises from insufficiency in depth perception or from cessation of the procedure because of an intraoperative spinal cord injury.[17] Incomplete discectomy can be avoided by pre- and intraoperative measurements and intraoperative confirmation using a radiopaque marker (Fig. 4, 5). We surmise that three-dimensional endoscopy may be helpful to perceive depth better. It is true that thoracoscopic spine surgery has a steep learning curve, but in our experience, it may turn to be a steady curve after having experience with about 10 cases. For further progression in thoracoscopic spine surgery, we need additional operating set up. The spinal cord monitoring system (NMEP) and three-dimensional endoscopy should result in an increased degree of safety.[18]

In conclusion, thoracoscopic discectomy of the herniated thoracic discs is a new minimally invasive technique which enables surgeons to treat herniated thoracic discs directly. However, thoracoscopic surgery requires experimental experience for the anterior thoracic region and an adequate degree of training for the safe and effective use of thoracoscopic instruments. Thoracoscopic discectomy may be an alternative method to conventional techniques.

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