



Operative treatment of calcified thoracic disc herniation: a case report on natural fusion method following spinal canal decompression

Operativno lečenje kalcifikovane torakalne diskus hernije: prikaz slučaja lečenog metodom prirodne fuzije nakon dekompresije kičmenog kanala

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Abstract

Introduction. The literature describes several ways to approach the thoracic spinal segment, but there are still many dilemmas regarding what is best to do after a complete discectomy, regardless of the surgical approach chosen. The incidence of postoperative kyphosis is higher if a posterior surgical approach to the spine is performed, and there are no clearly defined indications for the application of intervertebral fusion (IF) after an anterior approach. The aim of the paper was to highlight the low morbidity of the transthoracic multidisciplinary approach, as well as a potential solution for a good, natural IF of the adjacent vertebrae without expanding and prolonging the duration of the surgical procedure itself.

Case report. A 44-year-old woman presented with severe anterior compressive myelopathy caused by a calcified thoracic disc herniation in the space between the T10-11 vertebrae. A minimally invasive, open, transthoracic approach was per-

formed with decompression of the spinal canal at the specified level and IF was achieved with an autologous rib graft during the same procedure. A control examination of the thoracolumbar segment using the magnetic resonance imaging showed that there is no more compression of the spinal cord and also showed a good IF without an increase in the level of kyphosis. **Conclusion.** Significant thoracic disc herniation is a rare and challenging surgical lesion. The anterior mini-open transthoracic approach provides good exposure to the relevant structures and is considered minimally invasive. The benefits of subsequent IF after the transthoracic surgical approach should always be taken into account for each individual patient, thus minimizing the postoperative morbidity.

Key words:

intervertebral disc displacement; spinal cord compression; spinal fusion; neurosurgical procedures; thorax.

Apstrakt

Uvod. U literaturi je opisano nekoliko načina pristupa torakalnom segmentu kičmenog stuba, ali postoji još uvek mnogo dilema u vezi sa tim šta je najbolje učiniti nakon završene diskektomije, bez obzira na izabrani hirurški pristup. Incidencija postoperativne kifoze je viša ako se izvodi posteriorni hirurški pristup kičmenom stubu, a ne postoje jasno definisane indikacije za primenu intervertebralne fuzije (IF) nakon anteriornog pristupa. Cilj rada bio je da se istakne nizak morbiditet transtorakalnog multidisciplinarnog pristupa, kao i potencijalno rešenje za dobru, prirodnu IF susednih pršljenova bez proširivanja i produženog trajanja same hirurške procedure. **Prikaz bolesnika.** Kod bolesnice stare 44 godina nađena je izražena prednja kompresivna mijelopatija izazvana kalcifikovanom torakalnom diskus hernijom u prostoru između pršljena T10-11. Izveden je

minimalno invazivni, otvoreni, transtorakalni pristup sa dekompresijom kičmenog kanala na navedenom nivou i u istom aktu je postignuta IF autolognim graftom rebra. Kontrolni pregled torakolumbalnog segmenta magnetnom rezonancom pokazao je da više nije bilo kompresije kičmene moždine a takođe je pokazao i dobru IF bez povećanja kifoze. **Zaključak.** Velika hernijacija torakalnog diskusa je retka i hirurški veoma zahtevna lezija. Prednji transtorakalni pristup omogućava jasnu ekspoziciju relevantnih struktura i smatra se minimalno invazivnim. Prednosti naknadne IF nakon transtorakalnog hirurškog pristupa uvek treba uzeti u obzir za svakog bolesnika ponaosob, čime se postoperativni morbiditet svodi na minimum.

Ključne reči:

hernija diskusa; kičmena moždina, kompresija; kičma, fuzija pršljenova; neuhirurške procedure; toraks.

Introduction

Thoracic disc herniation (TDH) is rare compared to cervical and lumbar segment degenerative conditions¹. TDH is mainly treated conservatively. However, if indicated, there is a broad spectrum of described surgical techniques in the literature². Calcified discs are typically observed on computerized tomography (CT) or CT-myelography as substantial bony masses extending into the spinal canal from the posterior aspect of the neighboring thoracic vertebra. Preoperative magnetic resonance imaging (MRI) does not consistently reveal calcification in the lesion³. The preferred surgical approach should provide complete access to the TDH, enable good visibility of the spinal cord, and cause minimal morbidity to the patient. Surgical approaches are summarized in the following three groups: posterior approach, lateral extra-cavitary approach, and anterior transthoracic approach. The major factors that determine the surgical approach include the neurological status of the patient, disc size, location, degree of calcification, and amount of spinal cord compression⁴. The anterior transthoracic approach offers the benefit of accessing the herniated disc in front of the compressed spinal cord, thereby avoiding direct manipulation of the cord⁵. There is reasonable doubt that the anterior transthoracic approach can, in some cases, lead to postoperative axial spine pain, progressive kyphotic deformity, and even neurological deterioration. Therefore, some authors recommend additional intervertebral fusion⁵⁻⁸.

The wide range of the above-mentioned and available techniques indicate that a single method may not be suitable for every patient, and surgeons should consider different factors when choosing the appropriate approach. The anterior approach (mini-thoracotomy or thoracoscopic approach), as mentioned, lowers the likelihood of spinal cord injury,

though the risk of lung, pleura, and major vessel damage remains⁶. Destabilization of spinal alignment happens more often with posterior approaches, and there is an apparent need for subsequent fusion⁹. Based on several studies, partial resection of the rib head and postero-lateral part of the vertebral body during the anterior transthoracic approaches does not cause any significant instability⁵⁻⁷. On the contrary, the transition between the thoracic and lumbar region is more susceptible to postoperative kyphosis and can lead to significant axial pain^{10, 11}. The objective of this paper was to describe the surgical technique and outcome of microsurgical removal of TDH *via* the transthoracic approach and subsequent fusion with autogenous rib graft without the use of artificial materials. We would like to emphasize the low morbidity of the transthoracic multidisciplinary approach, as well as optional natural fusion without the need for expansion and prolongation of the surgical procedure.

Case report

A 44-year-old female presented with a six-month history of progressive paresis of the lower extremities, back pain, and numbness along the pelvis and legs. Physical examination revealed a moderate to severe lower spastic paraparesis. The patient could not ambulate independently, and there was decreased sensation below the T11 vertebral distribution with a positive Babinski sign. CT and MRI demonstrated a calcified disc herniation at the T10-11 intervertebral level located centrally with spinal cord compression (Figure 1). The calcified herniated disc occupied a significant volume of the central spinal canal. The mini-open transthoracic approach was performed with decompression of the spinal canal and a fusion with an autogenous rib bone graft. Postoperatively,

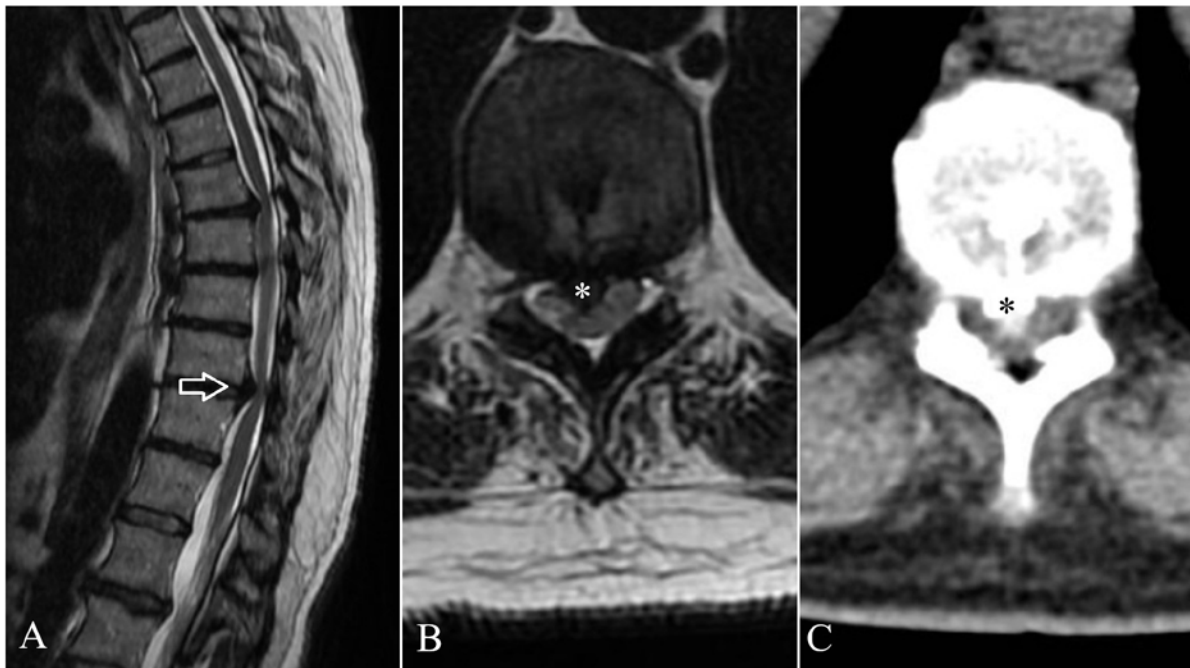


Fig. 1 – (A) Sagittal T2 weighted magnetic resonance imaging (MRI) image of the thoracic segment reveals T10-11 intervertebral disc herniation with myelopathic signal (arrow); (B) axial T2 MRI and (C) computed tomography images show centrally displaced and calcified intervertebral disc with compression on the medulla (asterisk).

the patient had relief from her symptoms and was fully ambulatory on the ninth postoperative day. The patient returned to work six months after her operation, reporting complete recovery with no axial back pain. The control CT and MRI showed no spinal cord compression and good fusion without an increase in kyphosis (Figure 2).

Surgical technique

The patient was placed in the lateral–decubitus position, with the rib cage as the highest point in the center. The thoracic surgeon performed the mini-open thoracotomy and exposure. With the aid of topographic and anatomical orientation, fluoroscopy was used to determine the T10-11 intervertebral level. The rib head related to the T10-11 intervertebral space and vertebral bodies was resected and preserved. The

T11 ipsilateral part of the vertebral body near the pedicle was partially resected using a high-speed drill, and the posterolateral portions of the vertebral bodies above and below the disc space were drilled to expose the spinal canal and disc herniation. Using a neurosurgical microscope, dissector, and rongeurs, the calcified disc was resected and pushed into previously created space without the manipulation of the *dura mater*. Sufficient decompression was achieved, and *dura mater* was observed completely free. Some adhesions to the *dura mater* were noted and dissected, and local haemostatic material was placed over. In the end, the autogenous rib graft was tailored and placed into the drilled cavity, thus achieving good vertebral interbody fusion (Figure 3). During closure, the thoracic drain was placed, and when the pleural effusion decreased to less than 100 mL *per day*, it was removed, and the patient was mobilized out of the bed.

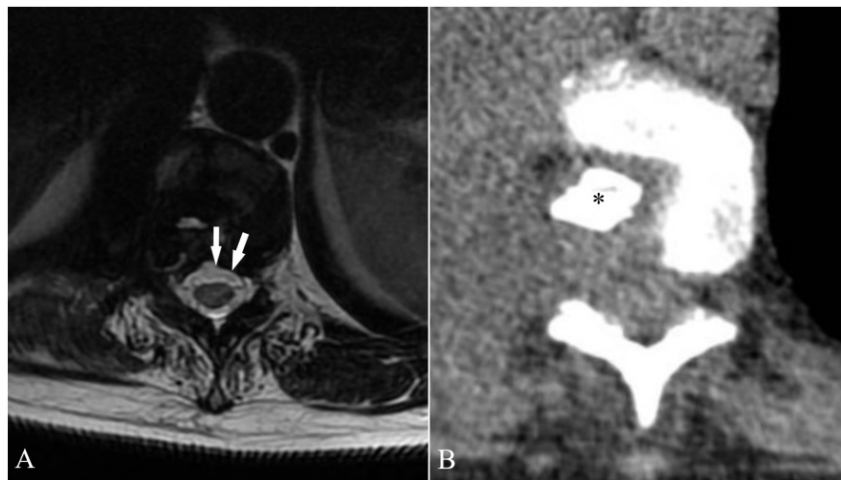


Fig. 2 – (A) Postoperative axial T2 weighted magnetic resonance imaging demonstrates complete decompression of the medulla (arrows) at the T10-11 intervertebral level; (B) correct placement of the autogenous rib graft (asterisk) was confirmed on computerized tomography axial image at the same intervertebral level.

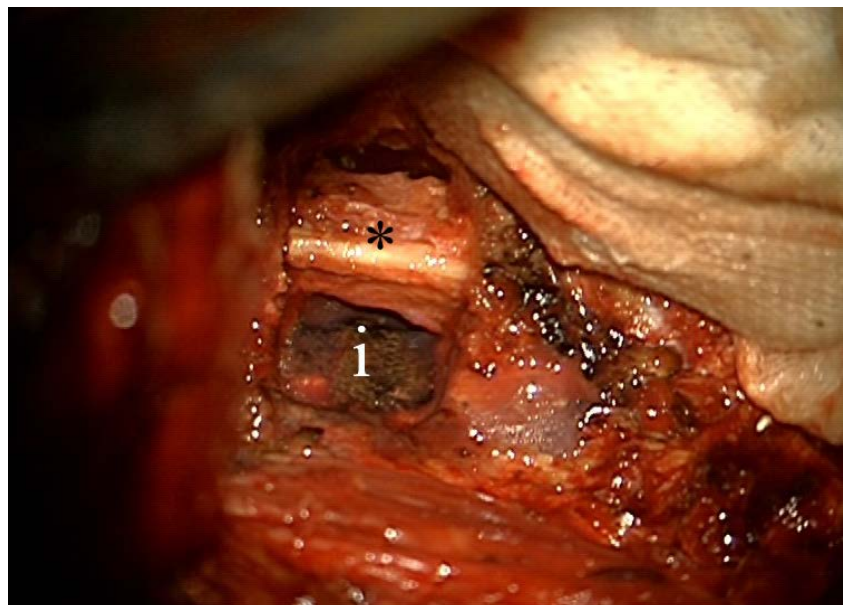


Fig. 3 – Intraoperative image after removal of intervertebral disc showing tailored autogenous rib graft (asterisk) placed into the T10-11 intervertebral space (i).

Discussion

Understanding the symptoms relies on the specific anatomical features of the thoracic spine and the thoracic segment of the cord and its associated vasculature. The kyphosis of the spine brings the cord nearer to the posterior aspect of the vertebral body, restricting its mobility¹⁰. The normal intervertebral height, sagittal alignment, and general vertebral stability are maintained by columns described by Denis¹¹.

A recent study comparing 63 patients, who received anterior decompression, to 123 patients, who underwent posterior circumspinal decompression and spinal fusion for calcified thoracic discs, revealed significantly shorter operation duration, reduced intraoperative blood loss, shorter hospital stays, and lower rates of perioperative and surgery-associated complications in the posterior approach group¹². Operative management of large calcified discs situated medially is best accomplished *via* an anterolateral approach, while a posterior approach may be employed for soft or lateral herniations¹³. Posterior approaches to the thoracic spine involve much bone removal and, therefore, almost always require instrumented fusion¹⁴. Pseudoarthrosis or kyphotic deformity may occur in anterior transthoracic approaches, but these complications are not so frequent because the rib cage provides good support. Furthermore, that can depend on surgical technique and amount of bone drilling, so many authors advise interbody fusion^{6, 7}. Complications observed with this approach included dural tears and cerebrospinal fluid leaks, as well as approach-related issues like pneumothorax, effusion, rib fractures, intercostal neuralgia, and atelectasis¹⁵. These issues can be managed successfully, especially with a multidisciplinary team. Augmented reality has also been documented for enhancing the safety and precision of spine surgery, and it helps with this kind of complex surgical approach¹⁶.

TDH in the region of the thoracolumbar junction, as in our case, is more susceptible to instability, but there are no well-defined indications for interbody fusion or guidelines on how to achieve it in the best possible way. Additional rib

resection for fusion should be avoided, but as a part of the approach, the bone graft can be safely harvested and subsequently used for fusion⁸. Placement of thoracic transvertebral pedicle screws requires additional resources and time^{14, 17}. Fusion using only bone grafts is delayed compared to instrumentation techniques. The middle thoracic segment of the spine has a very limited range of motion, and we think that the rib cage provides the necessary stability for fusion to occur. While the endoscope can function as a minimally invasive technique and save time, its drawbacks may include compromised visualization, inadequate decompression, and challenges during graft placement^{18, 19}. Some authors have recently described a direct transdural posterior approach, noting that careful manipulation of the spinal cord can be used to access the ventral part of the spinal canal²⁰. However, potential drawbacks compared to the anterior approach include excessive manipulation of the cord, which can lead to severe neurological deficits and the challenging repair of the ventral dura within the spinal canal. In such cases, intraoperative neurosurgical monitoring should be mandatory.

The absolute indications for intervertebral fusion still need to be precisely defined through more adequately designed studies. The aim of this paper was to present the relatively straightforward approach and follow-up on the patient who underwent the transthoracic calcified disc resection and good natural fusion. Interbody fusion after the transthoracic approach should always be considered a part of the technique because it significantly reduces axial pain and prevents postoperative deformity^{12, 21, 22}.

Conclusion

Thoracic disc herniation is a rare and challenging surgical lesion. The anterior mini-open transthoracic approach provides good exposure and is considered minimally invasive. As a part of the procedure itself, rib bone grafting in patients undergoing thoracic discectomy should be considered safe. The benefits of subsequent fusion should always be taken into account and individualized.

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