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HOW I DO IT - SPINE DEGENERATIVE

A rare case of giant calcified thoracic disc herniation, OPLL and OLF: how I do it

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Abstract

Background Thoracic myelopathy can have different aetiologies. Based on the location and on the nature of spinal cord compression, different surgical approaches may be indicated.

Method We present a rare case of thoracic myelopathy caused by the coexistence of a giant disc herniation, OPLL and OLF, and we describe the surgical approach, with a focus on technical nuances and strategies to avoid complications.

Conclusion Careful presurgical planning and microsurgery are fundamental in achieving a satisfactory spinal cord decompression. IONM, endoscopy-assisted microsurgery and intraoperative navigation can enhance the safety of surgery and the extent of safe surgical decompression.

Keywords Giant · Thoracic disc herniation · OPLL · OLF · Thoracic myelopathy

Abbreviations

OLF Ossification of ligamentum flavum
OPLL Ossification of posterior longitudinal ligament
TDH Thoracic disc herniation

Introduction

Thoracic disc herniation (TDH), ossification of posterior longitudinal ligament (OPLL) and ossification of ligamentum flavum (OLF) are distinct entities that can cause dorsal spinal canal stenosis and medullary compression [2]. It is extremely rare, with only one case being reported in literature [7], for all three pathologies to coexist simultaneously. Therefore, the exceptionality of this case represents a challenging and complex spinal surgical case.

This article is part of the Topical Collection on *Spine degenerative*

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Relevant surgical anatomy

An initial CT and MRI study (Fig. 1) revealed a voluminous calcified D10–D11 disc herniation in association with D10–D12 OPLL and D11–D12 OLF, conditioning severe spinal canal stenosis and severe medullary compression, despite only mild myelopathy signs (mJOA 16). Further pre-operative study using angiography showed the artery of Adamkiewicz arising at D7–D8 on the left side. Potential infiltration of the ventral dural layer by the calcified herniation must be considered during surgery for the high risk of dural violation [6].

Description of the technique

The patient was put in prone position. Continuous intraoperative neurophysiological monitoring was adopted. The entire surgical procedure was performed with the aid of spinal navigation based on intraoperative imaging performed by O-Arm® system (Medtronic Sofamor Danek, Minneapolis, MN): navigation was used to confirm the surgical level, surgical anatomical landmarks and to define the extension of corpectomy, especially in the blind spots. Under microscopic view, with the use of drilling and Kerrison Rongeurs, decompression started with a bilateral extraforaminal approach at D10–D11 and D11–D12, in order to control the dural sac from a lateral to medial direction. Once decompression of

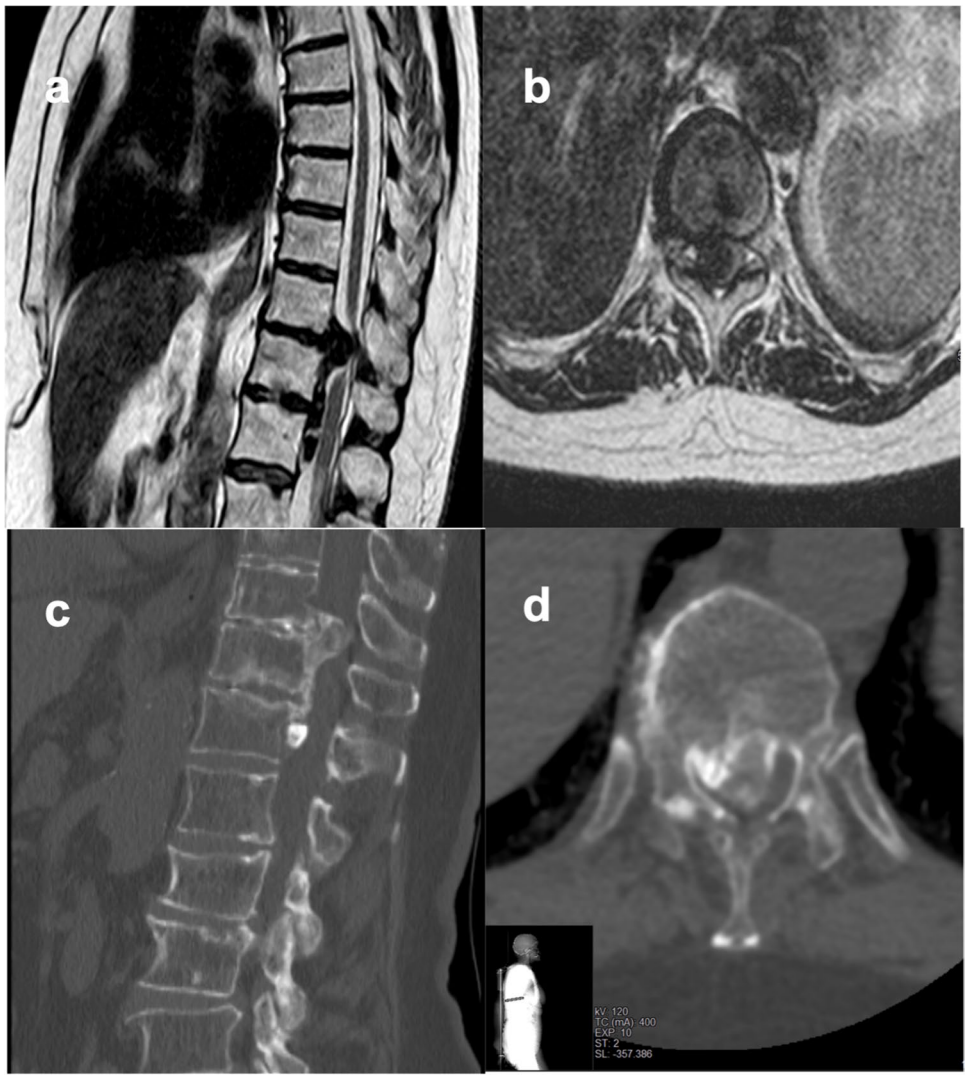

Fig. 1 Pre-operative sagittal and axial MRI study (**a–b**) and CT study (**c–d**) reveal a giant calcified thoracic disc herniation at D10-11 with OLF and OPLL

the cranial and caudal levels was completed, D11 lamina was drilled in an "open-door laminoplasty" fashion technique. After opening of the lamina on the midline, posterior decompression was achieved with progressive lateral subluxation of both hemilaminae, together with OLF. During these manoeuvres a dural breach was observed, and it was closed with a dural patch as a temporary measure until definitive repair was later carried out during the final step of surgery. Afterwards, a bilateral transpedicular partial corpectomy of T10 and T11 with partial discectomy was performed so that the calcified herniation could be progressively tractioned anteriorly and laterally and separated from the dura using the "eggshell" technique. Sub-total removal of the TDH was then achieved working from both sides using angled hooks and ultrasound suction. To minimize spinal cord mobilization and to reveal blind angles, bed tilting was used throughout surgery, and an angled endoscope was used to assist hernia dissection from ventral dura (Fig. 2). Once spinal cord decompression was completed, as confirmed by CT scan (Fig. 3), a second

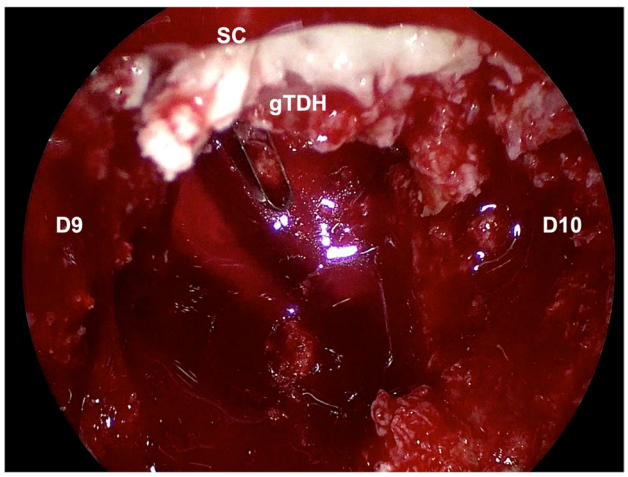

Fig. 2 A 60° angled endoscope is inserted to unblind the ventral area where the giant thoracic disc herniation (gTDH) is extremely attached to spinal cord (SC)

dural breach was detected with the endoscope, on the anterior aspect of dura, and was sealed with biological glue, TachoSil (Takeda Pharma A/S, Roskilde, Denmark), and a fat graft. Finally, a T10–T12 pedicle-screw fixation and posterolateral fusion with a bone autograft were performed. At the end of the procedure, an external lumbar drain was positioned in order to further reduce the risk of CSF fistula.

Indications

Surgery is indicated whenever a patient develops neurological and functional symptoms. In the absence of clear symptoms, the presence of myelopathy on an MRI can anticipate the appearance of irreversible clinical deficits and therefore represents indication for surgery.

For median giant calcified TDH, an anterolateral approach is usually performed. However, in this unusual scenario, the concomitant association of multi-level OPLL and OLF pushed our neurosurgical team to choose a posterior transpedicular approach. Furthermore, the anterolateral approach, especially in the lower thoracic levels, is far more invasive, since it requires the interruption of the diaphragmatic pillars and carries a higher rate of complications. Two further important factors to be considered were the age of the patient (75 years old) and the need to minimize hospital stay due to the COVID-19 pandemic.

Fig. 3 Post-operative MRI (**a–b**) shows satisfactory spinal cord decompression and the fat autograft positioned on the dural breach. Post-op CT scan (**c–d**) shows the bilateral transpedicular approach with partial corpectomy and the almost complete excision of the giant calcified herniation

Limitations

The main limitations are related to the unfavourable working angle while performing ventral dissection of the hernia from the spinal cord and the possible intradural extension of the herniated disc. Ventral dural sheath preservation is at risk, and its repair is highly challenging from a surgical standpoint.

How to avoid complications

Before surgery, a CT and MRI studies must be performed in order to decide the most appropriate approach. Angiography, or less invasive high field spinal MR angiography [10], is required to identify the artery of Adamkiewicz [1]. Intraoperative use of microscopic dissection techniques and a wide dural exposition are mandatory to achieve safe spinal cord decompression, and the use of an angled endoscope with angled instruments is recommended [3]. Intraoperative monitoring with motor and sensory evoked potentials are essential for detecting real-time neurological deterioration during surgery [9]. Spinal navigation based on intraoperative imaging is a useful tool as it allows the surgeon to verify the different steps of the surgery in real time, thus enhancing the anatomical orientation. Moreover, intraoperative CT scanning helps define the appropriateness of bony structure removal and, indirectly, spinal cord decompression [4]. To reduce the risk of post-operative neurological deterioration, it is essential to maintain an average blood pressure over 85 mmHg during and after surgery [8], and high doses of steroids should be administered before surgery. The "eggshell" technique is the safest technique for reducing dural violation and surgical morbidity. If a CSF leak is observed, the breach must be sealed using a direct suture whenever possible, or via the use of a dural substitute, biological glue and a subsequent filling of the dead spaces with a muscle or fat graft. A 10–20 ml per hour should be drained via a lumbar drain in order to reduce CSF pressure. Whenever a transpedicular approach is used, it is also mandatory to perform a posterior fixation.

Specific information for the patient

The patient must be informed that no matter which approach is used, a small percentage of patients manifest temporary and sometimes permanent post-operative deterioration of their neurological condition [5]. The most at-risk patients are those with a giant calcified TDH. Furthermore, the patient must be made aware of the fact that a radical excision of the calcified disc herniation might be not feasible, since there might be an intradural component, and that a dural tear is a frequent complication.

Summary

TDH, OPLL and OLF are possible causes of degenerative thoracic myelopathy. A combination of the three is a very rare condition.

Surgery is indicated if neurological signs and symptoms appear or if the MRI displays signs of myelopathy.

Pre-operative planning is crucial in order to obtain adequate decompression and reduce the risk of complications. CT and MRI studies are routinely performed as is angiography to identify the artery of Adamkiewicz.

Different surgical approaches may be used. Among them is the posterior transpedicular approach, indicated for both posterior and anterior compression; however, it is demanding.

The use of microscopic dissection is mandatory. The endoscopic-assisted technique and intraoperative navigation are valuable complementary options that can make surgery safer, decrease the blind angles and enhance the extension of surgical decompression.

The "eggshell technique", along with leaving a layer of calcified hernia on the spinal cord, reduces the risk of dural tears and makes surgical decompression safer.

Intraoperative neurophysiological monitoring is mandatory as it can identify early neurological deterioration and modify successive surgical steps.

There is a significant risk for post-operative temporary or permanent neurological deterioration. Early steroid administration and peri-operative blood pressure management are crucial in reducing this risk.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s00701-021-04887-z.

Declarations

Conflict of interest The authors declare no competing interests.

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