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Treatment of Thoracic Myelopathy Caused by Tuberculous Kyphosis with the Anterior Shifting Decompression Technique via a Posterior Approach: A Case Report

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Study Design: Case report
Objectives: To introduce a novel surgical technique for treating thoracic myelopathy caused by tuberculous kyphotic deformity
Summary of Literature Review: Traditional posterior approaches for thoracic kyphosis have shown mixed outcomes and are associated with significant complications. To address these limitations, anterior decompression via a posterior approach has been reported to be effective for managing severe ossification of the posterior longitudinal ligament (OPLL).
Materials and Methods: A 60-year-old man with recurrent thoracic myelopathy caused by tuberculous kyphosis underwent a novel technique that indirectly decompressed the spinal cord by anteriorly shifting the ossified lesions.
Results: The patient showed significant neurological improvement postoperatively with minimal complications.
Conclusions: Anterior shifting decompression via a posterior approach was found to be effective for addressing thoracic kyphotic deformities, in addition to its utility for thoracic OPLL

Key Words: Thoracic myelopathy, Thoracic kyphotic deformity, Ossification of posterior longitudinal ligament, Anterior decompression

We present a case report of a 60−year−old male patient with thoracic myelopathy resulting from kyphosis secondary to tuberculous spondylitis. The patient underwent anterior shifting decompression through a posterior approach, a novel technique originally designed to treat thoracic ossification of the posterior longitudinal ligament, aimed at achieving anterior decompression without direct removal of ossified lesions. This report details the patient's clinical presentation, surgical technique, and outcomes. The novel approach demonstrated significant improvement in neurological function with minimal perioperative complications, highlighting its potential as an effective surgical intervention for complex thoracic kyphotic deformities.

Introduction

Thoracic deformity is a debilitating condition often caused by various pathologies, including tuberculosis spondylitis sequelae.[1] Traditional surgical approaches, such as posterior decompressive laminectomy or anterior decompression via anterior/posterior approaches, have significant risks of complications and mixed outcomes.[2−4] Anterior shifting decompression through posterior approach, first introduced by through a posterior approach is a novel technique that aims

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to achieve effective spinal cord decompression by shifting the OPLL lesions anteriorly rather than removing them.[5] This case report summarizes the application of this technique in a patient with thoracic myelopathy, detailing the surgical procedure and clinical outcomes.

Case presentation

A 60-year-old male patient initially presented in 2011 with radiating pain and numbness in both thighs and calves. He exhibited knee jerk hyperreflexia and ankle clonus, indicative of pathological reflexes. Computed tomography (CT) imaging of the thoracic level revealed anterior collapse and fusion of T2 to T5 due to tuberculosis sequelae, resulting in a kyphotic lesion. Magnetic resonance imaging (MRI) confirmed cord signal changes at these levels (Fig. 1A). Consequently, in March 2011, the patient was diagnosed with thoracic myelopathy and underwent T 2-3-4-5 anterior interbody fusion with iliac bone grafting (Fig. 1B), which improved the thoracic kyphosis by approximately 8 degrees and alleviated his symptoms, leading to discharge.

However, in 2018, the patient returned with generalized numbness and motor weakness in the lower extremities. Radiologic evaluation indicated an increase in kyphosis, approximately a 10-degree progression from 54 degrees to 65 degrees. MRI confirmed increased cord signal changes compared to the previous scan, leading to a diagnosis of recurrent thoracic myelopathy. To prevent further kyphosis progression and achieve complete fusion, in situ instrumentation and posterolateral fusion were performed at two levels above and below the deformity (Fig. 1C). Postoperatively, the patient's numbness improved, and he was able to walk independently at discharge.

In March 2023, the patient was re-admitted with progressively worsening bilateral leg paralysis. He reported hypoesthesia and numbness below the T2 dermatome, extending to the entire lower extremities, along with significant motor weakness. Radiologic evaluations revealed the kyphotic lesion causing cord compression (Fig. 1D). Based on these findings, a third surgical intervention was planned to address the recurrent thoracic myelopathy.

After surgical treatment using the anterior shifting

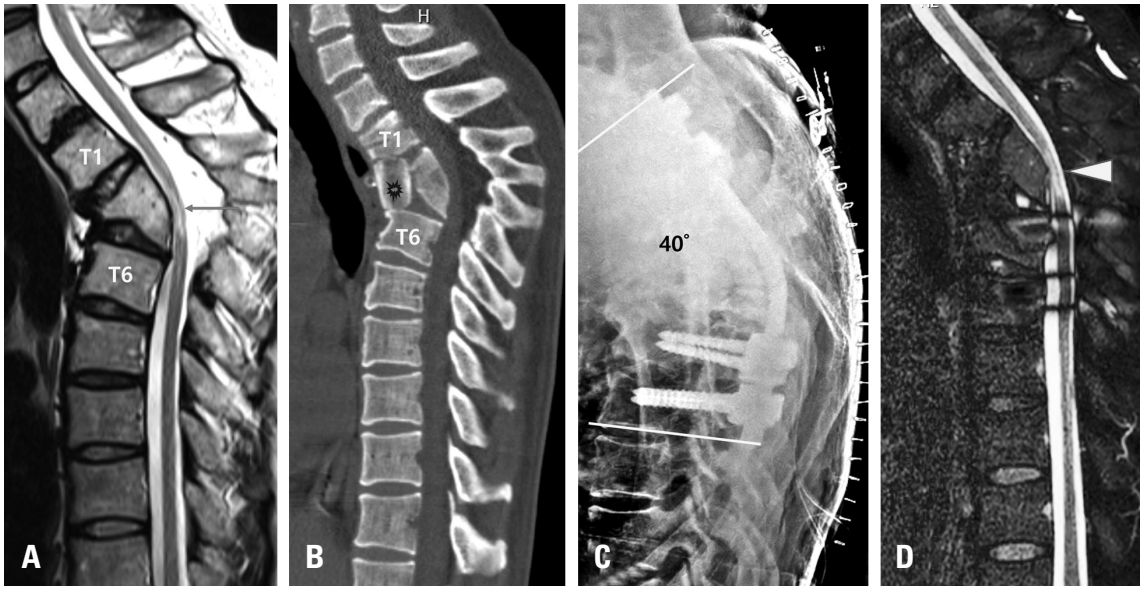

Fig. 1. (A) Initial magnetic resonance imaging showing anterior collapse and fusion of the thoracic vertebrae from T2 to T5 due to tuberculosis sequelae, resulting in a kyphotic lesion. Cord signal changes are noted posterior to the lesion (arrow). **(B)** Postoperative computed tomography scan showing improvement in kyphosis after osteotomy of the anterior portion of the collapsed vertebral bodies and iliac bone grafting (star). **(C)** Thoracic spine simple radiography after the second operation, demonstrating posterolateral fusion and posterior in situ instrumentation to prevent further kyphotic changes. **(D)** Preoperative magnetic resonance imaging before the third operation, showing persistent cord signal changes and absence of cerebrospinal fluid anterior to the spinal cord (arrowhead).

decompression through a posterior approach, the patient showed imprvement in sensory and motor function. Postoperative simple radiogrpahy, MRI and CT scans were performed to evaluated the surgical site (Fig. 2 A–D), and it reveal the kyphotic angle improved from 40 dgrees preoperatively (Fig. 1 C) to 36 degrees postoperatively (Fig. 2 A). During the surgery, there was 1,000 mL of blood loss, but the patient recovered systemic condition without the need for transfusion or other interventions and was discharged without any significant complications.

Surgical techniques[5]

The patient underwent anterior shifting decompression through a posterior approach. The procedure involved the following steps.

1) Positioning and exposure

The patient was positioned prone, and a midline incision was made to expose the posterior elements of the spine.

2) Screw insertion

In this case, the pedicle screws placed during a previous surgery were maintained, requiring only the removal of the existing rod. However, in cases of primary surgery, pedicle screws are inserted as part of the procedure.

3) Preparation

A decompressive laminectomy was performed at the T2–3–4–5 levels. The laminae, facet joints, and transverse processes were removed bilaterally, while the transverse processes and pedicles were partially resected. Prior to resecting the bone on one side, a rod was temporarily inserted into the contralateral screw for transient fixation to ensure stability during the procedure. The same technique of temporary rod fixation was applied when performing the contralateral resection, ensuring controlled and sequential execution of the surgical steps.

In this case, the T2–5 vertebral bodies were fused due to

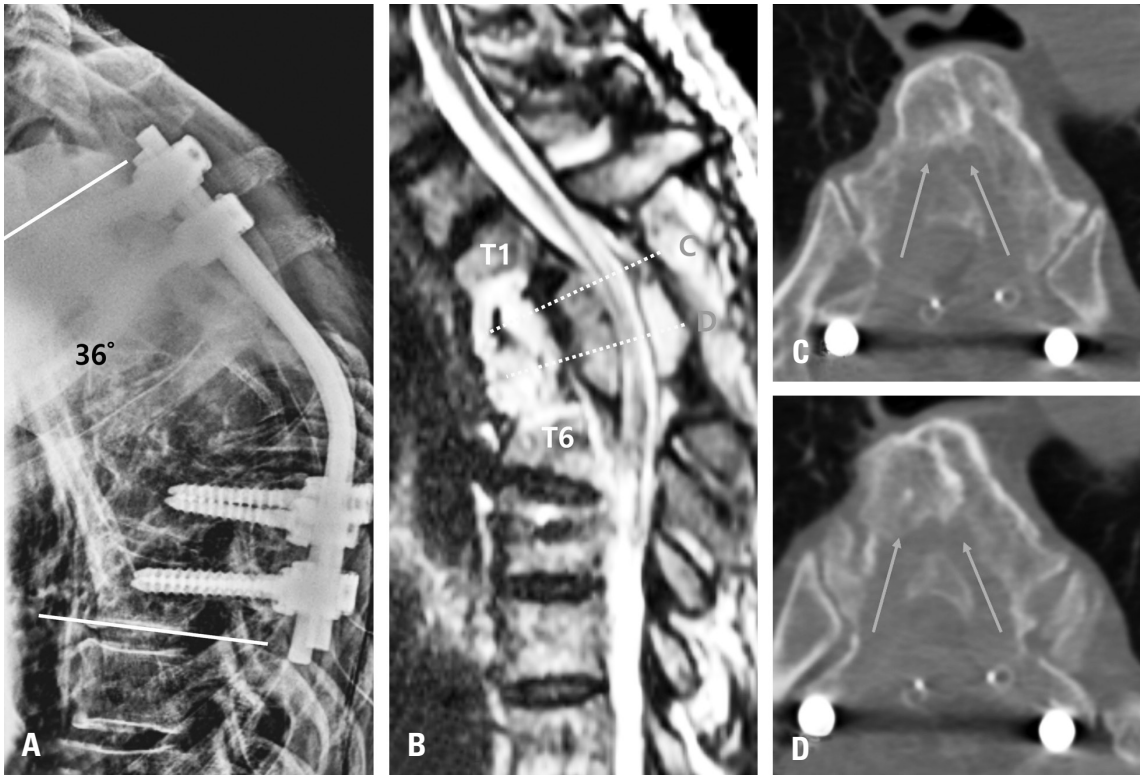

Fig. 2. (A) Thoracic spine simple radiography after the second operation. The Cobb angle was measured at 36°. **(B)** Postoperative magnetic resonance imaging demonstrating the presence of cerebrospinal fluid anterior to the spinal cord, indicating that the kyphotic lesion compressing the cord has been floated. **(C, D)** Postoperative axial computed tomography cuts showing the floating and anterior shifting of the posterior part of the vertebral body.

sequelae of TB spondylitis, so no disc was present during the osteotomy process. The proximal and distal boundaries of the resection were determined based on the pliable site observed on MRI, which were located proximal and distal to the pathologic lesion. The bony areas on both sides of the dural sac were resected using a diamond cutting burr to achieve medial convergence. For the cranial and caudal portions, the bone ventral to the dural sac, including the posterior longitudinal ligament (PLL), was meticulously removed using straight and angled punches, allowing for complete separation of the ventral aspect of the dural sac.

After performing the bony resection with the burr, a threaded saw with a diameter of 0.36 mm was used to confirm completeness and address any inseparated areas.[6]

4) Decompression

After complete separation of the posterior parts of the T2–5 vertebral bodies, the bony fragments naturally migrated anteriorly following the completion of the osteotomy. During this process, the correction of the kyphotic angle was observed on the C-arm.

5) Completion

Rods were connected to the screws with compression to correct kyphotic deformity, and posterolateral fusion was performed using bone grafts. Subsequently, we observed a reduction in tension on the exposed cord, and confirmed the dura pulse flowed from proximal to distal.

Discussion

Thoracic kyphotic deformity poses significant surgical challenges due to the spine's inherent kyphotic curvature.[2] Posterior decompression techniques are less effective in this region compared to anterior approaches because they fail to adequately address anterior spinal cord compression.[2,5] Historically, various anterior decompression methods have been proposed, however, these techniques are often associated with significant risks, including cerebrospinal fluid (CSF) leakage and neurological injury, which has limited their widespread adoption.[2–4]

Anterior shifting decompression via posterior approach technique was previously described in the literature as a method to treat spinal cord compression by floating OPLL lesions and shifting them anteriorly.[5] In this case report, we demonstrated that this approach is not only applicable to simple OPLL lesions but can also be successfully applied to more bulky thoracic kyphotic deformities caused by tuberculosis spondylitis sequelae, resulting in favorable outcomes.

The procedure involves adequate resection of the cranial and caudal portions of the lesions, and if necessary, the sacrifice of structures such as nerve roots, facet joints, and pedicles to avoid spinal cord injury. The ribs, however, do not typically obstruct the curved drill, making their removal optional.

The osteotomy to achieve medial convergence is a key aspect of this technique. To enhance the stability of the surgical site, temporary rod fixation was applied on the contralateral side during the osteotomy. The cranial and caudal boundaries of the resection were delineated at regions with minimal spinal cord compression to reduce the risk of cord injury. When working on the ventral side of the cord, surgical instruments such as reverse curettes or Cohen periosteal elevators were used to protect the cord. Ensuring cord safety and identifying the most secure methods for performing osteotomy remain topics that require ongoing discussion and investigation.

By adopting this approach, surgeons can achieve sufficient anterior decompression through a posterior approach, minimizing the risk of direct spinal cord manipulation and reducing the likelihood of perioperative complications. This case demonstrates that the anterior shifting decompression technique is effective in improving cord compression and kyphotic deformity caused by angular kyphosis.

Conclusions

This case report highlights the successful application of anterior shifting decompression through a posterior approach in a 60-year-old male with thoracic myelopathy caused by tuberculosis kyphosis. The novel technique resulted in significant neurological improvement and minimal complications, underscoring its potential as an effective surgical strategy for complex thoracic kyphotic deformity cases. Further studies are warranted to validate these findings and refine the technique for broader clinical application.

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결핵성 척추 후만증으로 발생한 흉추 척수병증을 후방접근을 통한 전방 이동감압술로 치료한 사례: 증례보고

조원민 • 박민철 • 진한빈* • 김학선

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연구 계획: 증례보고

목적: 흉추부 후만증에 의해 발생한 척수병증 치료를 위한 새로운 수술 기법인 후방 접근을 통한 전방 전위 감압술의 소개.

선행 연구문헌의 요약: 흉추 후만 변형으로 인한 척수병증의 수술적 치료에 사용된 전통인 후방 접근법은 예후가 불확실하고 합병증이 많다는 한계가 있다.

대상 및 방법: 결핵성 흉추 후만증으로 발생한 재발성 척수병증을 가진 60세 남성 환자를 대상으로, 병변을 직접 제거하지 않고 병변을 전방으로 이동시켜 간접적으로 척수를 감압하는 새로운 기법을 시행하였다.

결과: 수술 후 환자는 신경학적 기능이 크게 개선되었고 특이 합병증 없이 퇴원하였다.

결론: 후방 접근을 통한 전방 전위 감압술은 후만 변형 환자에서 발생한 흉추 척수증 치료에 안정된 치료법으로 사용될수 있다.

색인 단어: 흉추 후만 변형, 흉추 척수병증, 후종인대 골화증, 전방 이동 감압술

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