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CASE REPORT

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A modified minimally invasive surgery for thoracic pyogenic spondylitis: Percutaneous pedicle screw fixation in combination with a vertebral debridement in a separate posterolateral approach—A case report

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Abstract

In this report, we present a successfully treated case of intractable thoracic pyogenic spondylitis using one-step curettage/bone grafting of spinal anterior segment and less-contaminated percutaneous spinal posterior fixation via separated posterior approaches, which was not compatible with conventional spinal instruments.

KEYWORDS

minimally invasive surgery, percutaneous pedicle screw, pyogenic spondylitis

1 | INTRODUCTION

Since infectious spondylitis usually affects the vertebral bodies and intervertebral disk(s), curettage of those lesions and anterior spinal fusion have been the treatment of choice.[1] In the thoracic spine, thoracotomy is the standard approach for this surgical purpose; however, the procedure may exert considerable stress on lung function. Anterior debridement through a posterolateral approach was first described by Capener as "lateral rhachotomy" for tuberculous spondylitis in 1954.[2] We also reported good surgical outcomes following a single-stage combination of lateral rhachotomy and posterior spinal fusion using a compression hook system for tuberculous spondylitis.[3]

Recently, a percutaneous pedicle screw (PPS) system has enabled a minimally invasive but rigid posterior spinal fusion for infectious spondylitis outside the infected lesion.[4] Percutaneous pedicle screws can be inserted in a separate tract from the curettage site of lateral rhachotomy, preventing contamination of the implants. Then, we devised a minimally invasive surgical method for intractable thoracic pyogenic spondylitis: a single-stage posterior PPS fixation in combination with curettage and autogenous iliac bone grafting of the vertebral bodies with bilateral, separated

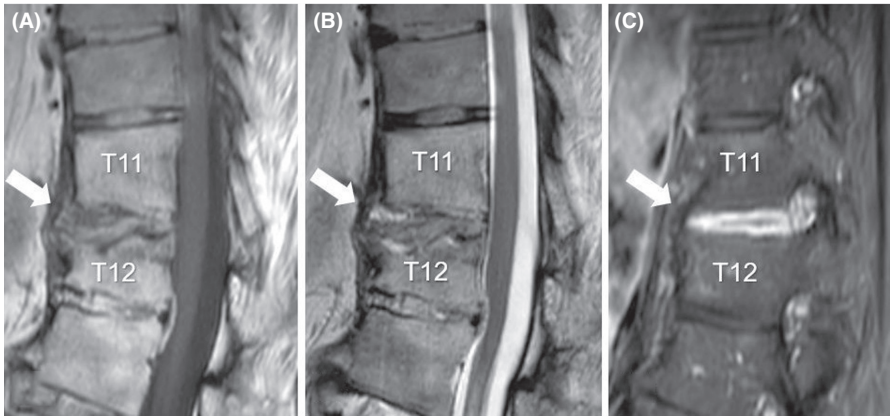

FIGURE 1 Sagittal MRI of the thoracolumbar junction at the initial visit to our department: (A) T1-weighted image, (B) T2-weighted image, and (C) gadolinium-enhanced T1-weighted image. The arrows indicate continuity of anterior segment between T11 and T12 vertebral body.

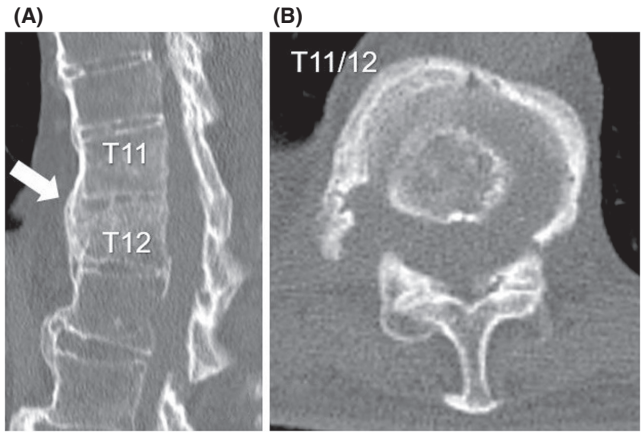

FIGURE 2 Computed tomograms at initial visit to our department; (A) sagittal section, (B) axial section. The arrow indicates ankylosed vertebral bodies by ossification of anterior longitudinal ligament between T11 and T12 without remarkable bone destruction.

posterolateral approaches. The aim of this report was to introduce the detailed surgical methods and its usefulness.

2 | CASE PRESENTATION

A 72-year-old man was diagnosed with pyogenic spondylitis, low back pain, and fever. After unsuccessful control of the inflammation with the use of antibacterial medication for more than 12 months, the patient was referred to our department. At the first visit to our department, the patient had no fever, low back pain, or abnormal neurological deficits.

Plain radiographs showed spinal ankylosis from T4 to T11 and from T12 to L1. Sagittal MRI demonstrated that the T11–12 vertebral bodies showed heterogeneously high signal intensity on both T1-weighted images (WI) and T2WI. The intervertebral disk at T11–12 was clearly enhanced on gadolinium (Gd)-enhanced T1WI (Figure 1). Sagittal reconstructed computed tomograms (CT) showed diffuse idiopathic skeletal hyperostosis between T9 and L3 without obvious vertebral destruction (Figure 2). T11 and T12 vertebral bodies indicated osteosclerosis. A chronic pyothorax was also found on a chest CT scan but was not indicated for therapeutic intervention by a respiratory physician. Computed tomogram (CT)-guided biopsy of the T11–12 intervertebral disk revealed a negative culture study with a histopathological diagnosis of chronic inflammation. The antibiotic medication was discontinued because the patient was asymptomatic, and the patient's serum C-reactive protein (CRP) value ranged between 1 and 2 mg/dl.

One year later, the patient was admitted to the Department of Respiratory Medicine with rapidly deteriorating pyothorax and pneumonia. Thoracic drainage was performed, and *Pseudomonas aeruginosa* was detected. Computed tomograms showed marked destruction of the T11–12 vertebral bodies, which indicated "rim enhancement" on Gd-enhanced T1WI MRI (Figure 3). We diagnosed the patient with progressive pyogenic spondylitis and planned surgical treatment after the improvement of pyothorax and pneumonia.

3 | TREATMENT

Single-stage lateral rhachotomy and posterior spinal fusion with PPS were performed. First, the PPS was inserted from T8–10 to L1–3 (Figure 4). The skin incisions for PPS installation were placed medial to the common insertion point to avoid violating the posterolateral approach for curettage. Each PPS was inserted perpendicularly to the body surface. Posterolateral approaches to the T11–12 vertebral bodies were performed bilaterally. An 8-cm longitudinal skin incision was made at the center of the T12 transverse process, which was confirmed by fluoroscopy. After costotransversectomy of T12, the lateral cortex of the T12 vertebral body was

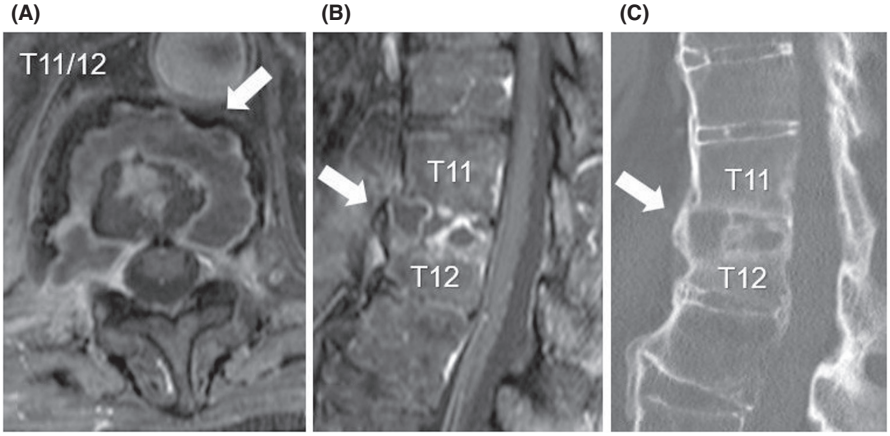

FIGURE 3 MRI/computed tomograms at one year after onset: Axial (A) and sagittal (B) sections of Gadoliniumenhanced T1-weighted images. The arrows indicate intervertebral abscess formation. (C) Sagittal section of computed tomogram. The arrow indicates disrupted anterior fusion between T11 and T12 vertebral body due to bone destruction.

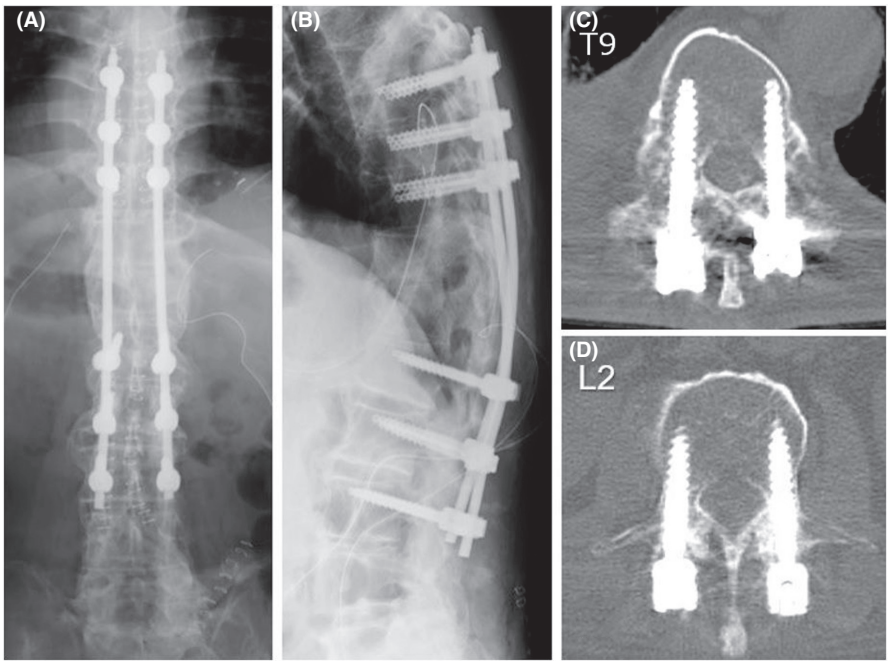

FIGURE 4 Postoperative radiograms and computed tomograms (CT): (A) anteroposterior radiogram, (B) lateral radiogram, (C) axial section of CT at T11–12 level, (D) axial section of CT at L2. Percutaneous pedicle screw was inserted vertically and the rod was placed medially compared to the conventional method.

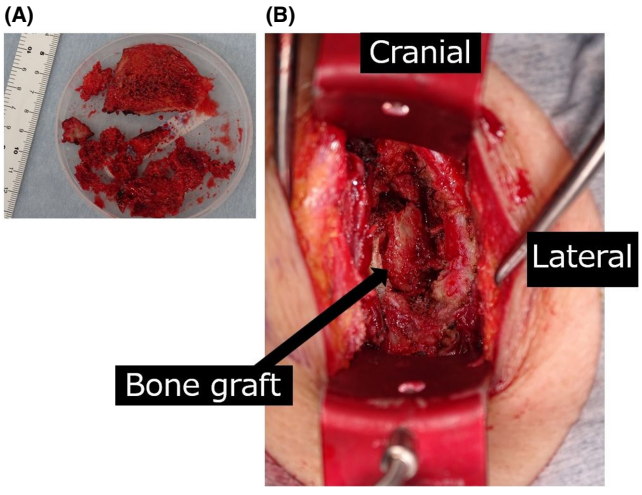

FIGURE 5 Autologous iliac bone grafting: (A) harvested iliac bone block and chips, (B) transplantation of the iliac bone block and chips into the curetted area isolated from spinal instrumentation.

exposed. Then, the cortex was drilled away by a high-speed burr, and the infected lesion was curetted. The outside was hard sclerotic bone, and the inside was scar tissue. The T11 vertebral body and T11–12 intervertebral disk were also curetted. Finally, autologous iliac bones were transplanted into the curetted area (Figure 5). A 5.5-mm-diameter titanium-alloy rod was percutaneously connected to the PPS.

4 | OUTCOME AND FOLLOW-UP

Six months after surgery, plain radiography and CT revealed bony union between T11 and 12 (Figure 6). Antibacterial medication was terminated as the inflammatory reaction, and C-reactive protein turned negative. The patient had no symptoms or recurrence of inflammation at 3-year postoperation.

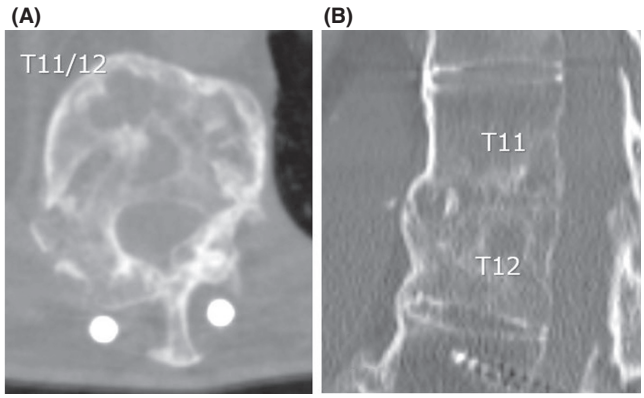

FIGURE 6 Computed tomography at 6 months after surgery: (A) axial section at T11/12 level, (B) sagittal section. The bone union was achieved between vertebral bodies of T11 and T12.

5 | DISCUSSION

The principle of surgical treatment for pyogenic spondylitis is curettage of the infected lesions with spinal fusion.[5] Anterior curettage and bone grafting combined with posterior instrumented fixation have demonstrated good results in maintaining local spinal alignment.[6] However, a combined anterior and posterior approach is highly invasive. Thoracotomy has been reported to be strongly associated with respiratory complications,[7] particularly in older patients. Because the patient in the present case was an elderly person and had a long history of pyothorax, the patient's pleura and vessels were expected to be severely adhered to the vertebrae using the transthoracic approach, thereby increasing the difficulty and risk of surgery. Therefore, single-stage posterior fixation with PPS in combination with curettage of the vertebral bodies using the separated posterolateral approach was selected for treatment.

We previously reported a lateral rhachotomy and posterior spinal fusion with compression hooks for thoracic tuberculous spondylitis.[3] The drawbacks of this method were relatively weak fixation compared with pedicle screw systems.[8] Percutaneous pedicle screw fixation is more rigid than the hook system. In addition, PPS is assumed to reduce the risk of instrument contamination compared with the hook system, which requires conventional spinal exposure. In an analysis of 10 reports of pyogenic spondylitis treated with single-stage debridement and spinal instrumentation using an open, identical approach, Przybylski et al.[9] reported that seven of 106 cases demonstrated recurrent infection. In the present case, spinal fixation with PPS and curettage were independent approaches. The PPS was placed closer than usual to the midline, so that screw heads and rods were isolated from the infected lesion. A thick muscular septum between the posterior instruments and infected vertebral lesion is expected to prevent the instruments from bacterial contamination.

6 | CONCLUSION

Our novel surgical method, one-step posterior instrumentation using PPS combined with debridement via a separate posterolateral approach, could be a radical surgery with less-contaminated spinal fixation in cases of intractable thoracic infectious spondylitis that requires debridement and bone grafting.

AUTHOR CONTRIBUTIONS

YS, KH, MM, YO, HK, KT, and TO were involved in study conceptualization, data curation, and writing–original draft. NY, YM, DC, and MK contributed to writing–reviewing & editing. TA worked on writing–reviewing & editing, and supervision.

ACKNOWLEGMENTS

None.

DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

CONSENT

The authors confirm that informed consent was obtained from the patient for the publication of this case report.

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