Thoracoscopic Debridement and Stabilization of Pyogenic Vertebral Osteomyelitis

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Abstract: The role of surgical debridement and internal fixation in treatment of vertebral osteomyelitis has been evolving. The standard surgical approach to thoracolumbar vertebral osteomyelitis requiring extensive thoracotomy or retroperitoneal exposure carries significant associated morbidity and postoperative pain. Minimally invasive thoracoscopic spine surgery is designed to improve postoperative morbidity associated with the traditional open surgery. We report a case of a 70-year-old man who developed T11-T12 pyogenic vertebral osteomyelitis 3 months after undergoing posterior laminectomy and microsurgical excision of a herniated thoracic disc. The patient underwent minimally invasive thoracoscopic radical debridement and anterior spinal reconstruction and fusion. Patients with vertebral osteomyelitis may benefit from the decreased postoperative morbidity that is associated with minimally invasive thoracoscopic spinal surgery.

Key Words: discitis, endoscopic spinal stabilization, pyogenic vertebral osteomyelitis, spondylitis, thoracoscopic spinal surgery

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Most patients with pyogenic osteomyelitis can be treated effectively with antibiotics and immobilization.[1,2] Nonoperative treatment is successful in up to 95% of cases.[2] Overall, however, the number of patients with pyogenic vertebral osteomyelitis is increasing and therefore a greater number of patients may fail nonoperative treatment.[3] In addition, patients with antibiotic-resistant sepsis, neurologic deficit, significant bone destruction, and progressive deformities are considered candidates for surgical debridement and reconstruction.[3]

The role of surgery in the treatment of osteomyelitis of the spine is evolving. An increasing number of reports in the literature support the role of anterior spinal surgery for vertebral osteomyelitis.[2–6] To gain appropriate access to the anterior thoracolumbar spine, extensive thoracotomy or a thoracoabdominal exposure of both the thoracic cavity and the retroperitoneal space is the most common technique. Alternatively, a retropleural thoracotomy or a lateral extracavitary approach can be used.[4,7–9] These procedures require extensive incisions, muscle dissection, and rib resections in the thoracic spine to provide adequate exposure.

Minimal access surgical techniques can decrease spinal access morbidity and speed recovery and healing.[10–13] We report the application of a minimally invasive thoracoscopic spinal surgery in the treatment of a patient with pyogenic vertebral osteomyelitis.

CASE ILLUSTRATION

History and Presentation

A 70-year-old diabetic man presented to an outside facility with persistent right-sided flank/groin pain. A magnetic resonance image demonstrated a right-sided T11-12 herniated nucleus pulposus. At the outside facility, he underwent a T11-T12 posterior laminectomy and microsurgical excision of the herniated disc. The patient improved immediately after surgery. Over the next 3 months, however, the patient developed severe back pain and was diagnosed with discitis, which was treated with 3 months of antibiotics. He presented to our clinic with persistent severe back pain. Tests indicated that his erythrocyte sedimentation rate and C-reactive protein level had normalized. Plain x-rays demonstrated severe endplate changes and the magnetic resonance image showed significant enhancement consistent with discitis (Fig. 1). A neurologic examination did not reveal any motor or sensory deficit.

Operative Technique

The patient underwent right-sided thoracoscopic spinal surgery, under single-lung ventilation and general anesthesia. The C-arm fluoroscope was used to outline the lateral spine image and the 4 access sites (portals) on the lateral chest wall. Four access sites (portals) were then outlined around the level of the pathology (Fig. 2). The key anatomic structures (spine, diaphragm, and aorta or vena cava) were identified (Fig. 3). Figure 3 illustrates the right-sided chest anatomy and the inflamed parietal pleura overlying the spinal infection.

A pleural flap was elevated, and the segmental vessels were identified, ligated, and divided. Endoscopic diskectomy and corpectomy were performed in the same steps as in an open procedure. The intervening vertebral body and adjacent discs were incised and removed. For spinal canal decompression, the lateral spinal canal was exposed by removing of the ipsilateral pedicle and the attached rib head. The discs were removed quite easily, but epidural granulation tissue were adherent to the dura mater and required careful dissection. A larger interbody allograft was placed, and modular anterior construct system

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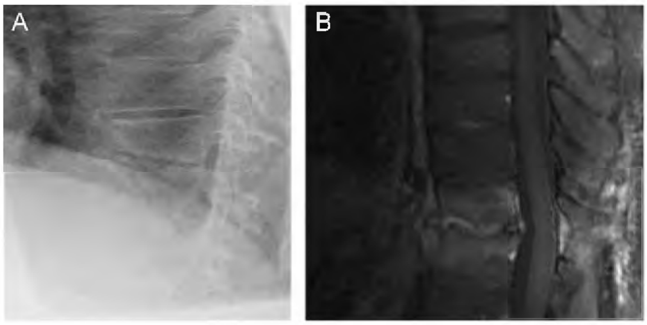

FIGURE 1. Preoperative images of T11-12 discitis and osteomyelitis. A, Lateral x-ray illustrating erosive endplate changes; B, sagittal magnetic resonance imaging scan illustrating enhancement in the disc space.

for the thoracic and lumbar spine system was used for anterolateral stabilization (Fig. 4). A chest tube was placed and the lung was reinflated under direct endoscopic visualization.

Postoperative Care

The patient tolerated the procedure well and was observed overnight in the intensive care unit. The patient was mobilized on the first postoperative day, after the chest tube had been removed, and chest x-rays confirmed the absence of a pneumothorax. He was discharged on postoperative day 2. At 1-year follow-up, the patient is pain-free with well-healed incision and solid fusion on x-rays (Fig. 5).

DISCUSSION

Many patients with spinal infections can be treated with external bracing and antibiotics.[1–3,14] However, patients who fail nonoperative care and those with severe infection associated with deformity and neurologic deficit may benefit from operative management in addition to antibiotic treatment.[3] Potential advantages of operative treatment include the option to obtain tissue for microbiologic evaluation, debridement, anatomic stabilization, and improved functional outcomes associated with early ambulation and return to normal daily activities.[6,14] Although there had been concerns about single-staged debridement and instrumentation of pyogenic spinal osteomyelitis because of formation of glycocalyx on the metal and the possibility of chronic infection, recent studies have reported successful single-staged debridement, reconstruction, and instrumentation of pyogenic spinal osteomyelitis patients without any evidence of chronic infection, rejection, or failure.[15–19]

Open thoracotomy and retroperitoneal or combined thoracoabdominal approaches are commonly recommended for access to thoracolumbar vertebral bodies and intervertebral discs.[2,5,20] A lateral extracavitary

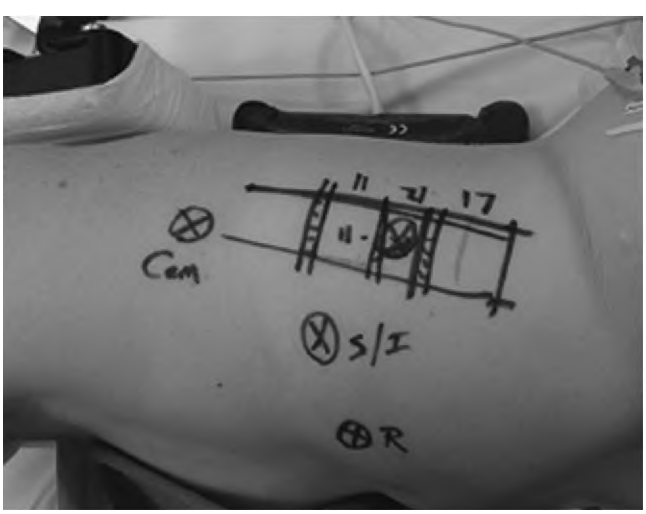

FIGURE 2. Photographs of the patient in the left lateral position with surgical anatomy outlined on the skin using lateral fluoroscopy. The positions of the 4 access channels are indicated by X. (Cam) Camera portal; (S/I) suction/irrigation portal; (R) retractor portal.

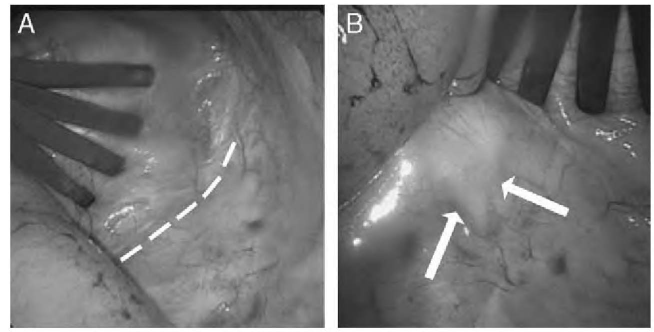

FIGURE 3. Intraoperative views of a right-sided endoscopic approach. A, Insertion of the diaphragm (broken line); B, increased inflammation of the pleura overlying the vertebral osteomyelitis (arrows).

FIGURE 4. Photograph showing direct endoscopic views of the completed endoscopic modular anterior construct system for the thoracic and lumbar spine.

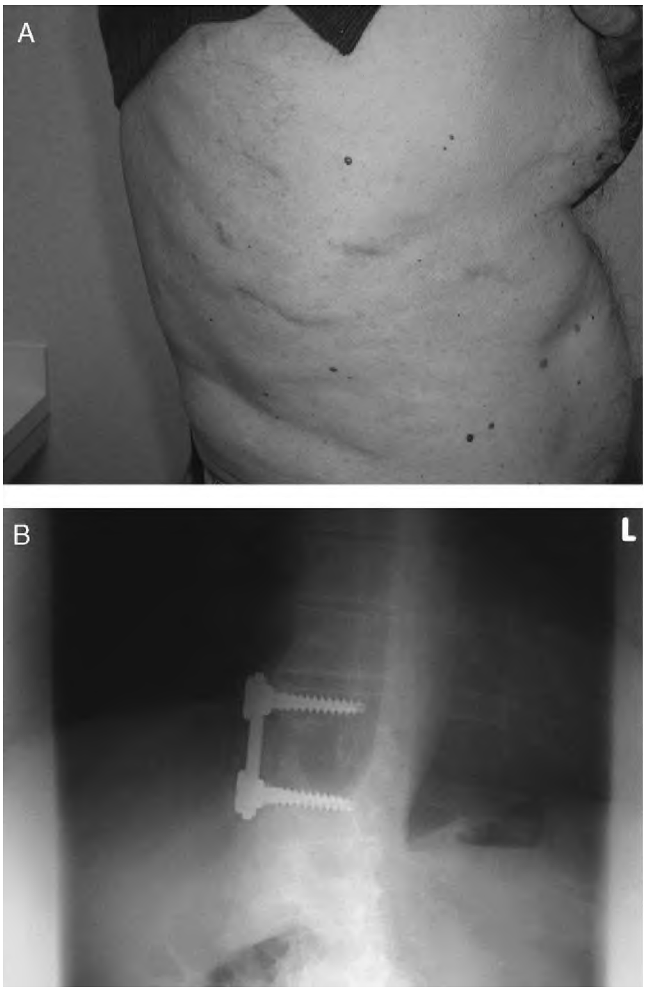

FIGURE 5. One-year postoperative follow-up images demonstrating well-healed incision (A) and solid fusion on anteroposterior x-rays (B).

approach can also be used for corpectomy and placement of posterior instrumentation via a single-stage procedure.[4,7,9,20] All of these approaches require large incisions, extensive soft tissue dissections, and removal of ribs for access. Access morbidity is significant, including infection, muscle atrophy, chest wall dysfunction, shoulder dysfunction, respiratory difficulties, chronic postthoracotomy pain, and incisional pain.[11,21–24] Several studies have documented the benefits of decreasing access morbidity by using minimally invasive approaches including thoracoscopy.[11,25] Thoracoscopic spinal surgery can improve postoperative respiratory function, shorten hospital stay, and promote earlier ambulation by decreasing operative trauma and postoperative pain.[11,21,25,26]

Video-assisted thoracoscopic surgery has been used for cardiothoracic procedures such as mediastinoscopy, pericardectomy, and lung resections.[27] Thoracoscopic anterior spinal surgery was first reported in early 1990s for sympathectomy and thoracic discectomies.[22,23,28,29] Anterolateral plating and stabilization have promoted more frequent thoracolumbar corpectomies and fusion.[11] Further developments in endoscopic plating technology and surgical techniques have led to substantial improvements for thoracoscopic spinal surgery. Thoracoscopic corpectomy and stabilization have been reported for metastatic tumors and spinal fractures.[30,31] An increasing number of reports document the experience of spinal surgeons with thoracoscopy for thoracic diskectomy, adolescent scoliosis correction, hyperhidrosis, and trauma.[12,13,22,23,28,31–33] Thoracoscopic treatment for thoracolumbar trauma involves similar techniques that can be applied to the surgical treatment of vertebral osteomyelitis. Most thoracolumbar spinal surgeries, including diskectomy, corpectomy, interbody reconstruction, and anterolateral stabilization, can be performed endoscopically.[6,11] Thus, morbidity associated with exposure can be substantially decreased, improving patient recovery without compromising safety and efficiency of the surgical procedure. Operative time and blood loss during thoracoscopic treatment are comparable with those of standard open techniques.[6]

Only 2 reports have been published regarding endoscopic spinal surgery for osteomyelitis of the spine. Huang et al[34] reported on a series of 10 patients with tuberculous spondylitis. Their technique consisted of endoscopic debridement without anterior instrumentation. Complications included bone graft subsidence and progressive kyphosis. One patient required open conversion. Muckley et al[6] reported a series of 3 patients treated with thoracoscopic spine surgery and demonstrated the feasibility of a 1-stage anterior debridement, interbody reconstruction, and anterolateral instrumentation. Operative time (150 to 270 min) and estimated blood loss (500 to 850 mL) were comparable with open techniques. During the follow-up period (22 to 24 mo), no recurrent infections, hardware failures, or loss of correction were noted.

Disadvantages of thoracoscopic spinal surgery certainly include the steep learning curve and the need for single-lung ventilation. Patients with severe pulmonary dysfunction may not tolerate the prolonged periods of single-lung ventilation. Such patients might be better served with an extracavitary exposure or an open thoracotomy.

CONCLUSIONS

The minimally invasive thoracoscopic approach for endoscopic diskectomy, corpectomy, spinal canal decompression, interbody reconstruction, and anterolateral fixation in one stage is technically possible. Patients with vertebral osteomyelitis may benefit from the decreased access morbidity that is associated with video-assisted thoracoscopic spinal surgery.

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