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A case report of combined septic spondylitis with intravertebral leakage of bone cement after ertebroplasty

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Abstract: *In this case report, we describe a rare instance of intradiscal leakage accompanied by septic spondylitis following vertebroplasty, which can potentially lead to severe complications, including paraplegia and other neurologic deficits. Such cases of septic spondylitis accompanied by intrathecal cement leakage are rare in the current medical literature. We present the clinical details of a 68-year-old female who underwent percutaneous vertebroplasty (PVP) at a local hospital for osteoporotic fractures of the thoracic vertebrae, which were sustained while lifting heavy objects. Postoperatively, the patient experienced intradiscal cement leakage in conjunction with septic spondylitis. Based on the patient's condition, we performed a unilateral two-channel endoscopic decompression of the spinal canal and a percutaneous posterior pedicle screw and rod internal fixation. Postoperatively, the patient was treated with cefoperazone sodium-sulbactam sodium for a 6-week period of sedation.She exhibited a favorable recovery and was able to walk approximately 1 kilometer with the aid of a support device by the six-month mark. The patient expressed a high degree of satisfaction with the therapeutic outcome.*

Keywords: *vertebroplasty; cemented intravertebral leakage; septic spondylitis; PVP*

1. Introduction

Percutaneous vertebroplasty (PVP) involves the percutaneous injection of Polymethylmethacrylate (PMMA) into compromised or collapsed vertebral bodies with the aim of enhancing spinal stability and alleviating pain[1]. The rate of cement leakage following vertebroplasty is documented to range from 19% to 65%, with the highest reported incidence reaching 73%. Leakage is categorized by site into puncture channel leakage, intervertebral disc leakage, paraspinal soft tissue leakage, paraspinal vein leakage, intradural epidural leakage, nerve root leakage, etc[2-4]. Septic spondylitis as a complication of vertebroplasty is an exceedingly rare occurrence, and when it coincides with cement leakage, it can result in heightened pain, neurological impairment, and potentially fatal outcomes for patients. Determining the standard of care for this uncommon condition is challenging, and there is an ongoing debate regarding the clinical efficacy of conservative versus surgical management, with no consensus on clear guidelines currently available. We report herein an uncommon case of septic spondylitis associated with intradiscal cement leakage following vertebroplasty.

2. Case report

A 67-year-old female patient presented with chest and back pain, as well as reduced mobility, following a fall while carrying heavy objects. She was diagnosed with severe osteoporosis and a T10 vertebral compression fracture. She subsequently underwent percutaneous vertebroplasty (PVP) at a local hospital. Postoperatively, by the third day, the patient developed low back pain and experienced weakness and numbness in both lower limbs. Despite pharmacological treatment, there was no significant improvement, and her symptoms progressively deteriorated. Twenty days post-surgery, the patient developed tenderness and pressure pain at the T10 spinous processes and paraspinous regions, accompanied by a progressive decline in muscle strength of both lower limbs, rendering her unable to walk. She was admitted to the hospital due to the exacerbation of the aforementioned symptoms. On admission, physical examination revealed approximately 0.5 cm incisions on the thoracic back post-thoracic spine surgery, tenderness and pressure pain at the T10 spinous processes and paraspinous

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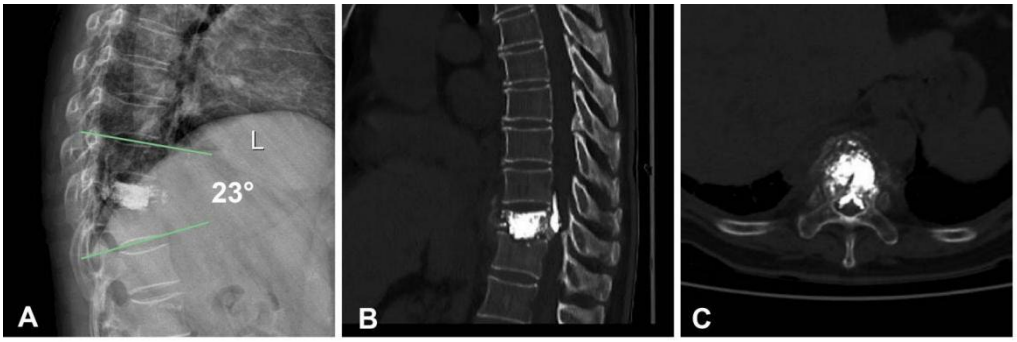
regions, and a sensation of binding at the bilateral thoracic ribs. The muscle strength of the left lower limb's quadriceps was grade 3, the tibialis anterior grade 2; That of the right lower limb's quadriceps was grade 2, the tibialis anterior grade 1. The muscle strength of the upper limbs was normal. Complete blood and biochemistry panels indicated the following: CRP=43.22 mg/L, ESR=80 mm/L, PCT=0.428 ng/mL, WBC=7.2x10^9/L. Imaging studies, including digital radiography (DR), computed tomography (CT), and magnetic resonance imaging (MRI), were conducted, revealing the following: DR showed postoperative changes with cement within the T10 vertebral body, along with a reduction in vertebral body height and kyphotic deformity (see Figure 1A). CT scans revealed multiple chronic inflammatory changes in the lower lobes of both lungs and cement occupying the T9-10 spinal canal (see Figure 1B, C). MRI indicated postoperative infection at the T10 vertebroplasty site, with paravertebral abscess formation, stenosis of the corresponding spinal segment, and compressive degeneration of the spinal cord (see Figure 2). Based on the patient's medical history, physical examination, and imaging findings, the following diagnoses were confirmed: (1) post-T10 vertebroplasty infection; (2) intravertebral cement leakage (T9-T10); (3) thoracic postoperative kyphosis deformity; (4) severe osteoporosis; (5) moderate anemia; (6) hypoproteinemia; (7) bilateral lower lung pneumonia.



A: The thoracic spine DR shows T10 vertebral body collapse combined with kyphosis deformity, with a deformity angle of 23°; B,C :the thoracic spine CT shows intravertebral canal leakage of cement at the T10 level in the shape of a long bar

Figure 1: DR, CT scan showing cemented intravertebral canal leakage

A: the thoracic spine MR shows intravertebral canal occupation and compression of the spinal canal; B,C:MR shows infection with paraspinal abscess formation, stenosis of the corresponding segment, and compression and degeneration of the spinal cord after T10 vertebroplasty (The dashed line box encloses a paravertebral abscess.)

Figure 2: MR shows vertebral canal occupation combined with paravertebral abscess.

Following consultation and discussion by the spinal team and the Department of Pharmacy, and after excluding relevant contraindications to surgery, the family opted for surgical treatment, which included spinal endoscopic unilateral two-channel T9 and T10 decompression, tissue biopsy of the T10 lesion, and posterior percutaneous T8, 9, 11, and 12 endoprosthesis with pedicle rods.

The surgical procedure is detailed below:

After successful induction of anesthesia, the patient was positioned prone. Fluoroscopic guidance with a C-arm machine was utilized to identify and mark the T9/10 intervertebral space for fixation. Following routine disinfection and draping, an aseptic film was applied. Two incisions of approximately 0.8 cm in length were made on the right lateral aspect of the T9/10 intervertebral space,

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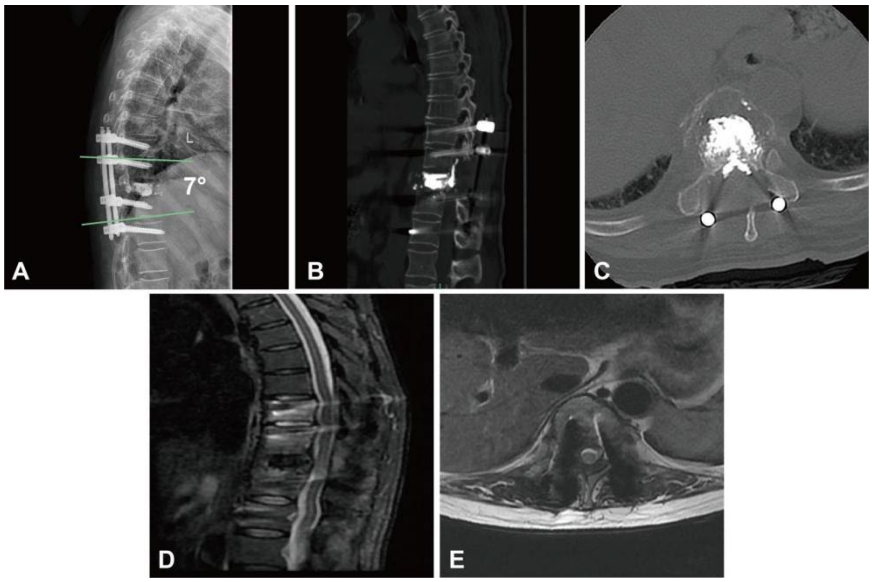
1.0 cm apart. Dilators were sequentially introduced to establish the arthroscopic working channel under fluoroscopic guidance, ensuring its position at the T9/10 intervertebral level. The lens was installed, and the high-definition display video system was balanced and activated. The channel was opened at the level of the T9/10 vertebral plate, and the lens and high-definition display video system were installed, with white balance adjusted. Following standard operative procedures, a T9/10 interlaminar decompression was performed, extending caudally to the T10/11 interlaminar space. The hyperplastic and hypertrophic ligamentum flavum was identified and its peripheral bone removed. Hemostasis was achieved using a plasma electrocoagulation system. The dura mater was gradually exposed, revealing edematous nerve roots. The sphenoid process and the contralateral dorsal aspect of the ligamentum flavum were removed. The contralateral nerve root was probed and loosened, with particular attention given to heavy adhesions, which were carefully dissected. Radiofrequency ablation was applied to the intervertebral disc tissue, lifting the nerve root compression and relaxing the nerve root canal, followed by irrigation and distraction of the interspace. Incisions were made bilaterally at T8, 9, 11, and 12, overlying the pedicle entry points. A puncture needle was advanced into the pedicle, the inner stylet was removed, and a positioning needle was inserted. Fluoroscopy confirmed the needle tip's position at the anterior-middle third junction of the vertebral body, aligning with the pedicle projection. Sequential soft tissue dilators were used to expand the tract, and universal pedicle screws were inserted, with fluoroscopic confirmation of proper positioning. A connecting rod guide slot was then implanted. The connecting rod was inserted into the guide groove and secured with a nut. Fluoroscopy confirmed the internal fixation's proper positioning. The nail end was contoured, and the nail was seated flush. The right T10 pedicle foramen was localized using fluoroscopy with a C-arm. Under C-arm fluoroscopic guidance, a puncture needle was advanced through the pedicle entrance and along the pedicle into the vertebral body at an angle of approximately 10-15 degrees. Biopsy forceps were used to obtain an adequate tissue sample, which was sent to an external hospital for testing and to the hospital laboratory for culture to identify the pathogenic bacteria. The wound was sutured, and three drains were left in situ. The arthroscopic system was then dismantled, and the wound was closed.

Postoperative adjunctive tests indicated that the deformity correction achieved an angle of 16°, decompressed the posterior aspect of the spinal canal, and increased the spinal canal's spaciousness compared to preoperative status (see FIGURE 3). Postoperative histopathological examination of the T10 lesion tissue revealed features consistent with an abscess. Cefoperazone sodium-sulbactam sodium, 3g, was administered intravenously three times daily for 6 weeks. Bilateral fasciculations resolved by the second postoperative day. The patient was able to walk approximately 20 meters with support by the end of March following surgery and, by six months postoperatively, could walk 1 kilometer with the aid of a waist circumference support.



A :the thoracic spine DR shows that the postoperative posterior convexity deformity is 7° after correction; B,C: CT shows that the decompression of the posterior lamina of T10 is complete, and there is no compression of the posterior aspect of the spinal canal; D,E: MR shows that the posterior aspect of the spinal canal is spacious, and there is no compression of the spinal cord.

Figure 3: Postoperative imaging suggests improved kyphosis, no spinal cord compression, and improved paravertebral abscesses

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3. Discussion

Septic spondylitis of the vertebrae following PVP is an uncommon complication, with an incidence ranging from 0.04% to 1.02%[5-7]. Although the incidence is low, once it occurs patients are in severe pain and have a high mortality rate of 12.5%-33.3%[5].The most likely causes of septic spondylitis after PVP are the introduction of infection by the surgical operation, the presence of infectious lesions in the patient preoperatively, and the patient's immunocompromised status; the main infectious causative organisms leading to infection are Staphylococcus aureus and Streptococcus species[8, 9].

Cement leakage to the spinal canal is a serious complication after PVP. A small amount of cement leakage has no obvious clinical symptoms, and when it causes a serious displacement in the spinal canal, it can lead to nerve root compression of the dural sac or even spinal cord injury leading to paraplegia[10, 11].The main cause of spinal cord injury from intravertebral leakage of bone cement is the direct compressive effect of the cement on the dura mater and spinal cord and the thermal effect of cement polymerization[12].Symptomatic intravertebral cement leakage should be completely decompressed by an appropriate surgical approach in order to restore the patient's spinal nerve function and improve his or her symptoms[13, 14].

At present, the treatment of the disease of cemented intravertebral leakage combined with septic spondylitis has not been standardized, and the treatment options are still ontroversial. The main indications for conservative treatment of this disease are: no neurologic deficit, no severe instability or deformity, and no abscess or effusion in the spine[15].Urgent surgical exploration and decompression is required for patients with combined neurological impairment, ineffective conservative treatment, and spinal instability[16]. Surgical approaches are categorized into anterior surgery, posterior surgery, combined anterior and posterior surgical approaches, and posterior minimally invasive surgery. Anterior surgery allows radical debridement, direct decompression and reconstruction of the anterior column, and facilitates the restoration of vertebral height. Posterior surgery is suitable for patients with vertebral body infection combined with kyphosis. Anterior debridement as well as posterior fusion often results in prolonged intraoperative operative time, increased intraoperative bleeding, prolonged postoperative recovery time, and increased postoperative-related complications[17, 18].In recent years, minimally invasive surgery has developed rapidly and has also achieved good efficacy in the treatment of septic spondylitis. The authors believe that spinal endoscopic unilateral dual-channel technique can be used to perform debridement, drainage and direct access to the lesion; it can reduce the amount of bleeding and complications and shorten the hospitalization time and recovery time compared with traditional surgical open surgery. According to related literature, in patients with septic spondylitis combined with kyphosis, the combination of posterior long segment fusion and sensitive antibiotics can correct the kyphosis, reduce the symptoms and complications of the patients, and 70% of the patients return to normal movement after the operation[19].The choice of surgical approach depends on the patient's symptoms, imaging, and intraspinal occupancy. In the author's opinion, minimally invasive surgery is an appropriate choice for patients with more comorbid symptoms and poor general condition.

This case report is of a patient with septic spondylitis after T10 vertebroplasty combined with an intraspinal space that presented as a “long strip” of leakage in the spinal canal to the T10-T11 level. This patient presented with severe spinal nerve injury due to the combination of thoracic kyphosis and intraspinal space in the spinal canal caused by septic spondylitis, with loss of muscle strength and sensory loss in both lower extremities. The reason was considered to be that the bone cement was thinner and less viscous when pushed in and entered the posterior part of the spinal canal through the vertebral fracture. As well as the patient's own low immunity led to primary infection of the vertebral body. Therefore, spinal endoscopic unilateral two-channel decompression of the spinal canal and posterior pedicle root nail rod internal fixation combined with sensitive antibiotics were adopted and achieved good therapeutic effects.

4. Conclusion

This case represents a rare instance of cemented intravertebral leakage accompanied by septic spondylitis following vertebroplasty. Early diagnosis relies predominantly on symptomatology, complemented by CT, MRI, and inflammatory biomarkers. Presently, treatment options for such cases are variable, having reviewed an extensive body of relevant literature, we conclude that in cases like this, posterior minimally invasive decompression and fixation can be executed to debride the wound, facilitate drainage, and reestablish vertebral stability, and this approach is complemented by standardized antimicrobial therapy.

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