CASE REPORT
Extensive Spinal Epidural Abscess Resulting in Complete Paraplegia Treated by Selective Laminectomies and Irrigation

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Background: Spinal epidural abscess (SEA) is an uncommon clinical entity that is often subject to delayed diagnosis and suboptimal treatment. Untreated disease leads to compression of the spinal cord, resulting in devastating complications.

Case Presentation: A 56-year-old man visited our hospital for progressive lower back and lower extremity pain of several days’ duration. Significant pyrexia (39.5°C) and elevated C-reactive protein (89.2 mg/L) were detected during admission, but no positive neurological examination findings were observed. Magnetic resonance imaging revealed pyogenic discitis at L3–4. Despite the administration of directed antibiotic therapy, the patient’s condition rapidly deteriorated, culminating in complete paraplegia secondary to an extensive SEA from L4 to C7. Emergency spinal decompression surgery was canceled due to his poor clinical condition and refusal of informed consent. After further deterioration, he consented to two-level selective laminectomies and irrigation.

Conclusions: In contrast with prior case reports, this case illustrates the natural history of an extensive SEA during conservative and late surgical treatment. Early diagnosis and timely surgical decompression are of great importance for extensive SEA.

Key words: irrigation; laminectomies; neurological infection; paraplegia; spinal epidural abscess

Introduction
Spinal epidural abscess (SEA) is defined as extensive when it involves more than five vertebral levels. Several decades ago, the incidence of SEA was approximately 1 per 10,000 hospital admissions1,2. Recently, the incidence of SEA has increased to approximately 5.1 cases per 10,000 admissions3. The increasing incidence is multifactorial, relating to aging, improved diagnostics, and different study populations4. To the best of our knowledge, the predisposing factors for SEA include diabetes mellitus, concomitant infection, intravascular drug use, alcohol use, and immunocompromise.

Because SEA does not have a characteristic clinical presentation, it may initially be misdiagnosed. Without rapid diagnosis and treatment, SEA may progress to spinal cord compression, leading to acute flaccid paralysis and eventually, death. Upon diagnosis of SEA, the major dilemma is the choice of treatment; most studies support surgical decompression combined with systemic antibiotics5. Patients with acute complete loss of neurological function secondary to SEA achieve good recovery with surgical debridement. Non-surgical treatment is preferred in patients with no or minimal neurological impairment, smaller abscesses, and prohibitive operative risk factors.

This report presents a rare case of a patient with extensive SEA treated with antibiotics and late surgical decompression and drainage6,7. Unfortunately, due to
uncontrollable factors, the SEA resulted in complete and permanent paraplegia.

**Case Report**

**History and Examination**

Written informed consent was obtained from the patient and his family for the publication of this case report and accompanying images.

A 56-year-old Chinese man with an unremarkable medical history initially presented with lower back pain for 8 days. He was admitted to our hospital with a suspected lumbar muscle sprain or spondylodiscitis. He reported no lower extremity pain and was apyrexial. Lumbar spine computed tomography showed non-specific degenerative changes. Outpatient physiotherapy and analgesia were recommended. However, the patient was readmitted after 2 weeks due to progression of his lower back pain, decreased range of motion in the lumbar spine, and new-onset lower extremity pain. Neurological examination findings were normal.

Two hours after admission, pyrexia (39.5°C) and tachycardia were noted. His blood pressure was 148/92 mm Hg. Laboratory tests showed a hemoglobin level of 138 g/L and white blood cell (WBC) count of 12.2 \( \times 10^9 /L \) with 80% neutrophils. The C-reactive protein level was 89.2 mg/L; erythrocyte sedimentation rate (ESR), 61 mm/h; albumin, 30.9 g/L; alanine transaminase, 58 U/L; aspartate transaminase, 47 U/L; and blood glucose level, 10.8 mmol/L. Echocardiography did not show evidence of endocarditis. However, magnetic resonance imaging (MRI) of the lumbar spine revealed pyogenic discitis at L3–4 and abscesses disseminated throughout the anterior, right lateral, and epidural spaces of L3–4 (Figure 1(A),(B)). Suspecting *Staphylococcus aureus* infection, empirical intravenous antibiotic therapy with vancomycin (1000 mg twice daily) was administered before obtaining blood culture results. The trough concentration of vancomycin was monitored. Given the extent of the abscess, surgery was determined to be unsuitable until neurological deterioration was noted.

The results of blood culture and sensitivity testing revealed methicillin-resistant *S. aureus* sensitive to vancomycin. Thus, intravenous vancomycin was continued. After 1 week of intravenous vancomycin treatment, intermittent pyrexia up to 39°C was still noted, and laboratory tests revealed a hemoglobin level of 127 g/L and WBC count of 17.74 \( \times 10^9 /L \). The C-reactive protein level was 132.68 mg/L; ESR, 85 mm/h; albumin, 23.5 g/L; alanine transaminase, 108 U/L; and aspartate transaminase, 110 U/L. Lower back pain and diffuse lower extremity pain progressed, but no lower extremity weakness was noted until 12 days post-admission, when the patient

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**Fig. 1** (A) Sagittal and (B) axial T2-weighted magnetic resonance images show pyogenic discitis at L3–4 and abscesses (white arrows) disseminated in the anterior, right lateral, and epidural space of L3–4. (C) T2-weighted sagittal magnetic resonance image of the whole spine shows progressing epidural abscess predominating anteriorly continuous from L4 to T1. The white dotted line indicates T1–2 and the blue dotted line indicates L3–4, at which levels axial images are shown in (D) and (E), respectively. T2-weighted axial image at (D) T1–2 and (E) L3–4 levels show the huge epidural abscess (white arrows) is located in the ventral part of the spinal canal, critically compressing the spinal cord toward the posterior side.
complained of bilateral lower extremity paresthesia. The muscle strength of the lower extremities had decreased to grade 3, without evidence of pyramidal tract involvement or meningitis. Cervical, thoracic, and lumbar spine MRI (Figure 1(C)) showed progression of the SEA, predominating anteriorly and continuous from L4 to T1. Laboratory tests revealed a hemoglobin level of 84 g/L; WBC count, 9.75 × 10^9/L; C-reactive protein level, 103.5 mg/L; ESR, 97 mm/h; albumin, 22.3 g/L; alanine transaminase, 102 U/L; and aspartate transaminase, 68 U/L. Due to his neurological deterioration, emergency surgical decompression was suggested to the patient and his family, which was refused. The vancomycin trough concentration was 5.9 μg/mL (recommended trough concentration, 15–20 μg/mL). Consequently, the dosage of intravenous vancomycin was modified to 1000 mg every 8 h.

Thirteen days after admission, the muscle strength of both lower extremities decreased to grade 0 with no sensation below the nipple line and continued intermittent pyrexia up to 38.5 °C. However, the patient and his family persisted in refusing surgical decompression. Based on the trough concentrations, the administration of intravenous vancomycin was increased to 1000 mg every 6 h. Seventeen days after admission, grip strength of the left hand decreased to grade 3. Repeat MRI of the cervical, thoracic, and lumbar spine showed extensive SEA continuous from L4 to C7. Postcontrast T1-weighted MRI showed enhancement of the margins of the abscess, with no enhanced contents (Figure 3(A),(B)). Laboratory tests revealed a hemoglobin level of 82 g/L; WBC count, 8.85 × 10^9/L; C-reactive protein, 22.79 mg/L; ESR, 44 mm/h; albumin, 27.5 g/L; alanine transaminase, 103 U/L; and aspartate transaminase, 57 U/L. After extensive discussion with the patient and his family, they finally consented to surgery.

**Operation**

Two separate midline longitudinal incisions were made over the cervicothoracic and mid-lumbar areas. Laminectomies were performed at T1–2 in the thoracic spine and L2–3 in the lumbar spine. Liquid pus was suctioned from each laminectomy (Figure 2(A)). Subsequently, a ventricular catheter was inserted caudally into the epidural space from the thoracic level down toward the lumbar area. Another ventricular catheter was inserted cranially into the epidural space from the lumbar level up toward the thoracic area. The two catheters met at the level of T8–9. Normal saline was slowly injected through the catheter to irrigate the epidural abscess (Figure 2(B)). The intraspinal length of the catheters was approximately the length of the spine from T2 to L2 (Figure 2(C)). During irrigation, both ends were assessed for egress of irrigation fluid and pus. The dura was gently pulled at the opposite end to assist the egress of fluid. Approximately 3 L of normal saline was used for irrigation until clear fluid was obtained. Subsequently, debridement of the L3–4 disc space was performed, and pedicle screws were used to facilitate fusion. Samples were obtained and sent for Gram staining and culture. Two irrigation tubes were inserted...
into the epidural space, and two drainage tubes were left in the operative area for 7 days postoperatively (Figure 2(D)).

Postoperative Care

The microbiological examination of samples showed methicillin-resistant S. aureus with sensitivity to vancomycin. Postoperatively, the patient received neurotrophic drugs and actively strengthened his upper extremity through ball-holding training. His paraplegia was managed through massage and passive exercises. Four weeks after the operation, the strength of the upper extremity returned to normal with no sensory deficits, and MRI confirmed the resolution of the SEA (Figure 3(C)). Intravenous vancomycin administration was continued for 6 weeks. The postoperative ESR decreased to 5 mm/h. Unfortunately, his lower limb weakness did not significantly improve, despite treatment in a rehabilitation hospital for 2 months, and he became wheelchair bound. At the 1-year follow-up, muscle strength in the lower extremities was unchanged while sensory function had improved.

Discussion

The characteristic clinical features of SEA are back pain, fever, and neurologic deficit. However, they only present in a minority of patients. In this case, lower back pain was the initial presentation. Given the ubiquity of back pain, our patient was initially misdiagnosed. Presently, MRI allows diagnosis in >91% of cases. Typically, SEA shows low or intermediate intensity on T1-weighted images and high or intermediate intensity on T2-weighted images. Gadolinium-enhanced MRI can aid in defining the consistency (liquid pus or granulated tissue) of the abscess. Liquid pus is associated with an area of low signal intensity on T1-weighted images and enhancement of the margins of the abscess after contrast injection. In our case, an enhanced margin of the abscess was noted in the postcontrast T1-weighted images of the spine, indicating liquid pus, described as the “double spinal cord sign” (Figure 3(B)).

The timing of surgical decompression is of great importance for extensive SEA. Although controversial, the first-line treatment for extensive SEA or SEA presenting with complete
Group G streptococcus T6-L3 M/81y Fever, back pain, and Gram-positive coccus From C2 to the Methicillin-susceptible reported two patients with extensive SEA who reported that percutaneous epidural drainage, which is only suitable for skin abscesses located behind the dura mater, or in patients in a poor clinical condition. To ensure adequate irrigation and drainage, preoperative spine MRI should be used to visualize the distribution of the abscess and to identify segments for skip decompression. According to the preoperative MRI, the apex of the thoracic spine was at the level of T8–9, and the spinal curvature from T2 to T8–9 and from L2 to T8–9 was almost straight. Preoperative MRI also indicated liquid pus in the SEA. Thus, the irrigation catheter could be inserted to the level of T8–9, and the pus could be washed out. Considering that the resistance of a single irrigation tube across the whole spine is relatively large, the irrigation tube must be rigid, but because of this, it can easily damage the spinal cord. Thus, we used two relatively soft ventricular tubes to meet at the apex of the thoracic vertebra. The ventricular catheter, being flexible, is suitable to prevent mechanical injury to the spinal cord.

In conclusion, this report presents a rare case of extensive SEA treated with antibiotics and late surgical decompression and drainage. Considering that the progress of neurological impairment and infection is unpredictable, minimally invasive selective laminectomy and irrigation can be considered early for patients in a poor general condition.

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Conflict of Interest
There are no conflicts of interest for this case report.

Author Contributions
Tongshuai Xu: conceptualization, investigation, writing of original draft, resources. Yukun Du: conceptualization,
writing—review and editing. Jianwei Guo: methodology. Jianyi Li: data curation. Changfang Shi: visualization. Xianfeng Ren: conceptualization, writing—review and editing, supervision. Yongming Xi: funding acquisition, supervision.

Authorship Declaration

All authors listed in this manuscript meet the authorship criteria according to the latest guidelines of the International Committee of Medical Journal Editors, and all authors are in agreement with the manuscript.

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