

CT-guided minimally invasive treatment for an extensive spinal epidural abscess: a case report and literature review

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Abstract

Purpose We present a case involving an extensive epidural abscess that was successfully treated with computed tomography (CT)-guided percutaneous needle drainage and systemic antibiotic therapy.

Methods A 44-year-old woman with a history of spine injection procedures complained of severe backache and progressive radiating pain in her right lower extremity followed by sensory deficits in her right lower limb. A laboratory examination revealed leukocytosis and hyperglycemia. Magnetic resonance imaging of the lumbar region revealed an extremely large posterior spinal epidural abscess (SEA) extending from L2 to S2. Because the patient did not respond to intravenous antibiotics alone, she underwent CT-guided percutaneous needle drainage and irrigation.

Results *Staphylococcus aureus* was detected in the purulent material from this abscess. Her clinical symptoms were dramatically and immediately relieved after this procedure.

She achieved complete neurological recovery after 2 months of antibiotic therapy.

Conclusion CT-guided percutaneous needle drainage and irrigation may be a rational treatment choice for patients with SEA with the exception of patients with a chronic abscess, an anterior abscess or discitis.

Keywords Spinal epidural abscess · CT-guided · Needle aspiration · Infection

Introduction

Spinal epidural abscess (SEA) is a rare but catastrophic infection that may exhibit a high risk of causing permanent neurological disability. Historically, the incidence of SEA has ranged from 0.2 to 1.2 cases per 10,000 hospital admissions, but this incidence has tended to increase over time, doubling during the prior two decades [1, 2]. The clinical use of advanced technical imaging, particularly high-quality magnetic resonance imaging (MRI), has led to earlier diagnoses of SEA and a higher likelihood of urgent surgical interventions for this condition; nevertheless, the mortality rate for SEA, which has been reported to range from 10 to 20%, has not significantly declined [3, 4].

Overwhelmingly, prompt surgical decompression combined with systemic antibiotic therapy remains the treatment of choice for SEA patients, particularly those with accompanying neurological deficits. However, the optimal management that is minimally invasive but effective for patients has always been expected. Computed tomography (CT)-guided percutaneous needle puncture has previously been used to diagnose malignancies, identify infections, and treat deep intramuscular abscesses [5]. At present, to our knowledge, extremely few studies have described CT-guided

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percutaneous drainage therapy for SEA, and no authors have described the use of this approach for an extensive SEA or elucidated detailed indications for this treatment [6–10] (Table 1).

We present a case involving an extensive SEA that was successfully treated using CT-guided percutaneous drainage procedures and review relevant papers and discussions regarding indications for CT-guided percutaneous drainage in SEA.

Case presentation

In July 2016, a 44-year-old female with a provisional diagnosis of lumbar disc herniation and a tentative diagnosis of spinal infection was referred to the Pain Department of The First Affiliated Hospital of GanNan Medical University (Ganzhou, China) from another regional hospital. She reported a 1-month history of backache (mainly in the lumbosacral region) with pain radiating to her right lower extremity but without fever. She was admitted to the outpatient department of the regional hospital to receive a spinal injection to control her back pain. One week after this injection, the patient experienced progressively more severe lower back pain that radiated to her right lower extremity and was accompanied by a low-grade fever (maximum temperature: 38.4 °C), elevated blood infection indices [total white blood cell count: $15.84 \times 10^9/L$ (normal: $3.5\text{--}9.5 \times 10^9/L$); 88.7% neutrophils (normal: 40–75%); increased C-reactive protein [20 mg/dL (normal: < 0.3 mg/dL)] and high blood glucose (27.59 mmol/L). An initial lumbar CT scan showed only mild disc herniation at the L5/S1 level without remarkable foci in the lumbar bone. Intravenous cefazolin and intramuscular insulin were administered 1 week before the patient's admission to our institution. Although her temperature returned to normal, her lumbosacral pain persisted, and the onset of neurological symptoms was observed. Therefore, the patient was transferred to our hospital.

On admission, the patient could not walk due to severe pain [visual analog scale (VAS) score: 9/10] in the lumbosacral region and the right lower limb. An examination revealed diffuse tenderness over the lumbosacral region and a sensory deficit in the right shank. Power was 4/5 in the right lower extremity but normal in the left lower extremity. The right straight leg raise test was positive at 20°. The patient denied experiencing bowel incontinence, bladder incontinence, or saddle anesthesia. Hematological investigations indicated a peripheral white cell count of $15.12 \times 10^9/L$ with marked neutrophilia (76.3%). The patient's erythrocyte sedimentation rate (ESR) was 105 mm/h (normal value: 0–20 mm/h), and her C-reactive protein (CRP) level was 6.19 mg/L. Her random blood glucose level had decreased to 10.63 mmol/L. Levofloxacin (0.2 g, b.i.d.) and cefazolin (1.0 g every 6 h) were given to control the patient's persistent infection.

An urgent lumbar MRI (Fig. 1) revealed extensive fluid collection in the spinal epidural space from L2 to S2 that was compressing the spinal cord and causing right nerve root involvement.

Given the diagnosis of SEA, no response to the initial treatment with antibiotics alone, and the aforementioned neurological deterioration, the patient underwent urgent CT-guided percutaneous multiple-point needle aspiration and irrigation 24 h after admission. Under CT guidance, a total of four needles were utilized to evacuate and irrigate the patient's deep abscess; in particular, three needles were inserted into the right sides of the L1/2, L2/3, and L5/S1 spinal epidural spaces to decompress the spinal cord and nerve root, whereas the fourth needle was inserted at the L5/S1 right-lateral intervertebral foramen to prevent infection-related fluid from reaching the paravertebral muscle gap (Fig. 2). Gentamicin flushing was performed to irrigate the infected area until the aspirated liquid became limpid, indicating that the pus had been thoroughly evacuated. Bacteriological examination of the purulent material revealed the presence of *Staphylococcus aureus* that was sensitive to levofloxacin. The patient was

Table 1 Reviewed cases of SEA involving computed tomography-guided percutaneous needle drainage

Authors	Number of patients	Year of study (references)	Gender, age	Spine level	Location	Neurological deficits	Outcome
Cassagnou	1	1996 [10]	M, 43 years	L5–S3	Anterior	No	Good
Lyu	1	2002 [11]	M, 48 years	C6–L2	Posterior	Yes	Good
Rust	1	2005 [12]	M, 62 years	C2–C3	Anterior	Yes	Good
Siddiq	7	2006 [13]	–, 55 years	≤ 2	Posterior	Yes (2/7), no (5/7)	Good
Gonzalez-Lopez	1	2009 [14]	M, 50 years	L4–L5	Posterior	No	Good
Gonzalez-Lopez	1	2009 [14]	F, 65 years	L5–S1	Posterior	Yes	–
Gonzalez-Lopez	1	2009 [14]	M, 69 years	L3–L5	Posterior	Yes	Fair

Good, complete recovery; fair, minimal residual symptoms; –, data not provided

Fig. 1 MRI on admission revealed an extremely large right postero-lateral abscess located from the L1 to S2 levels in the spinal epidural space

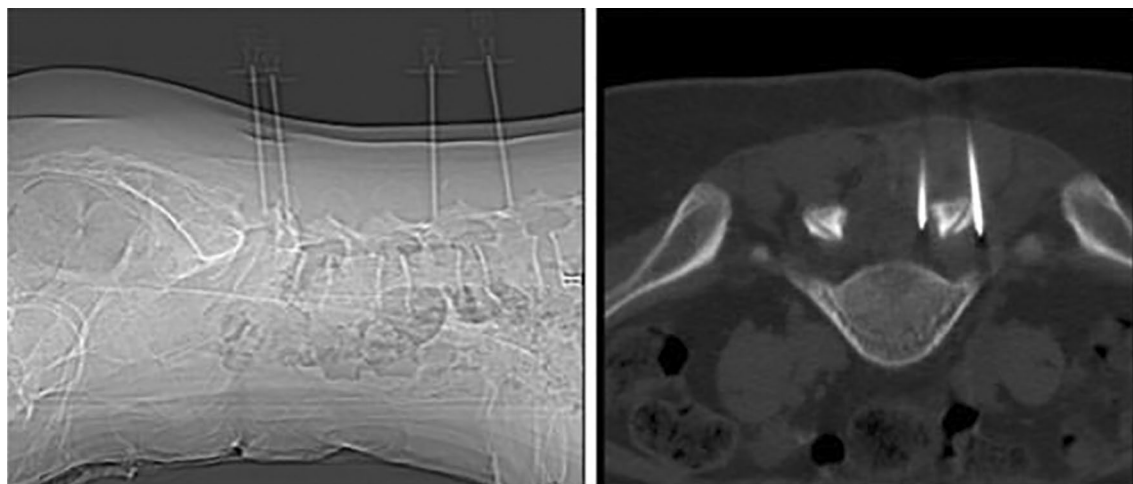
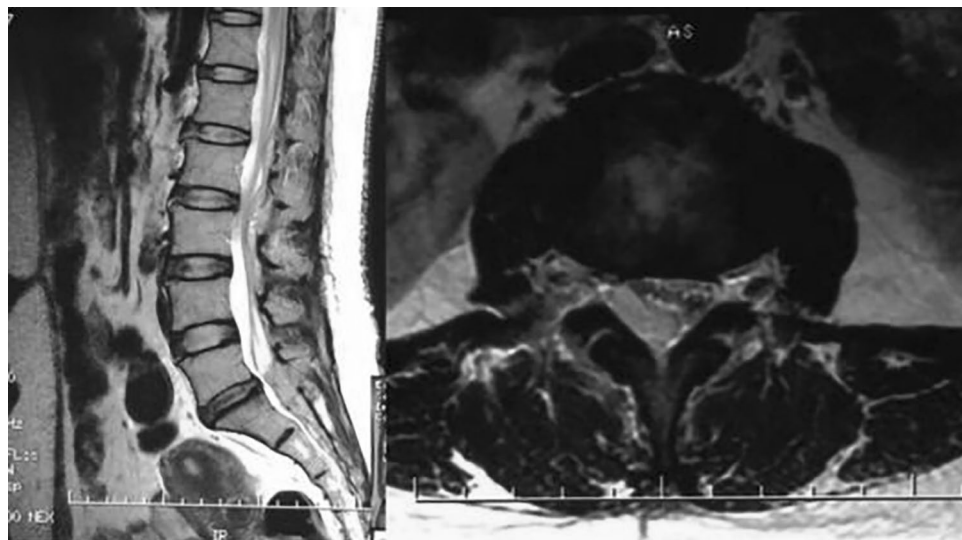


Fig. 2 Computed tomography was used to guide the insertion of four needles into the epidural space to drain and irrigate the purulent material

treated with intravenous antibiotics for 15 days in addition to the antibiotics administered from the time of admission and was subsequently prescribed a 4-week course of oral amoxicillin (0.5 g, t.i.d.) upon her discharge.

Following CT-guided treatment, the patient's clinical symptoms immediately improved, and her VAS score declined to 2/10 (Fig. 3). Repeated laboratory examinations also showed marked decreasing trends in the patient's white blood count, neutrophils, ESR and CRP level, with normal findings obtained 2 months after the CT-guided intervention (Fig. 4). A follow-up MRI study performed 2 months after treatment (Fig. 5) revealed complete resolution of the epidural abscess. The patient maintained neurological stability and had achieved complete recovery without any complications as of her most recent follow-up.

Infection indicators of hematological

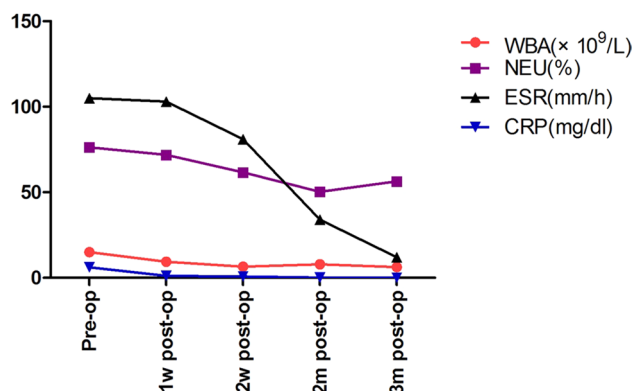


Fig. 3 A line chart indicating laboratory examination results in our case (W week, M month)

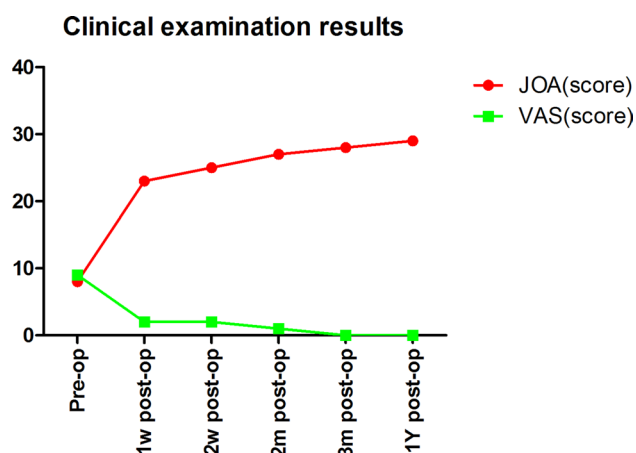


Fig. 4 The patient exhibited complete clinical recovery (W week, M month, Y year)

Discussion

In general, the preferred therapeutic approach for patients with SEA is treatment with a combination of antibiotics and urgent surgical decompression [2, 11]. Recently, this recommendation has been challenged by several studies that have argued that surgical intervention is not necessary for all SEA patients, particularly patients without neurological deficits. These investigations have suggested that conservative management may be a feasible treatment approach for SEA in selected patients, such as patients without neurological deficits or patients in poor condition [7, 10, 12–14]. However, in conservatively treated patients, delays in surgical

decompression may lead to irreversible neurological deterioration, which is difficult to predict and progresses rapidly. Failure rates ranging from 6 to 49% have been reported for the medical management of SEA despite the close monitoring of all clinical changes [3, 11, 15].

In recent years, predictors of the outcome of conservative SEA treatment have received increasing attention and been widely debated [5, 16]. The likelihood of poor outcomes of antibiotic-only treatment regimens is elevated for SEA patients presenting with neurological deficits, diabetes mellitus, infection with MRSA or infection with unidentified organisms as well as for SEA patients over 65 years of age [5, 16].

CT-guided percutaneous procedures on the musculo-skeletal system have been deemed to be beneficial because they can immediately resolve clinical conditions, decrease hospitalization time and cost and are minimally invasive [5, 17]. Reports on SEA cases treated using surgical intervention or antibiotics alone have been commonly published in the neurosurgical and anesthetic-related literature, whereas CT-guided percutaneous drainage in the context of SEA has not been the subject of extensive review.

Our case involved a patient with a history of spinal epidural injection therapy, uncontrolled diabetes mellitus, fever, severe localized backache, prominent tenderness in the lumbosacral region and sensory loss in the right lower extremity that strongly suggested SEA at the lumbosacral level. MRI identified an extremely large abscess extending from L2 to S2 in the right postero-lateral epidural space. Because of her initial lack of response to antibiotic therapy, which is the most common predictor of treatment failure for

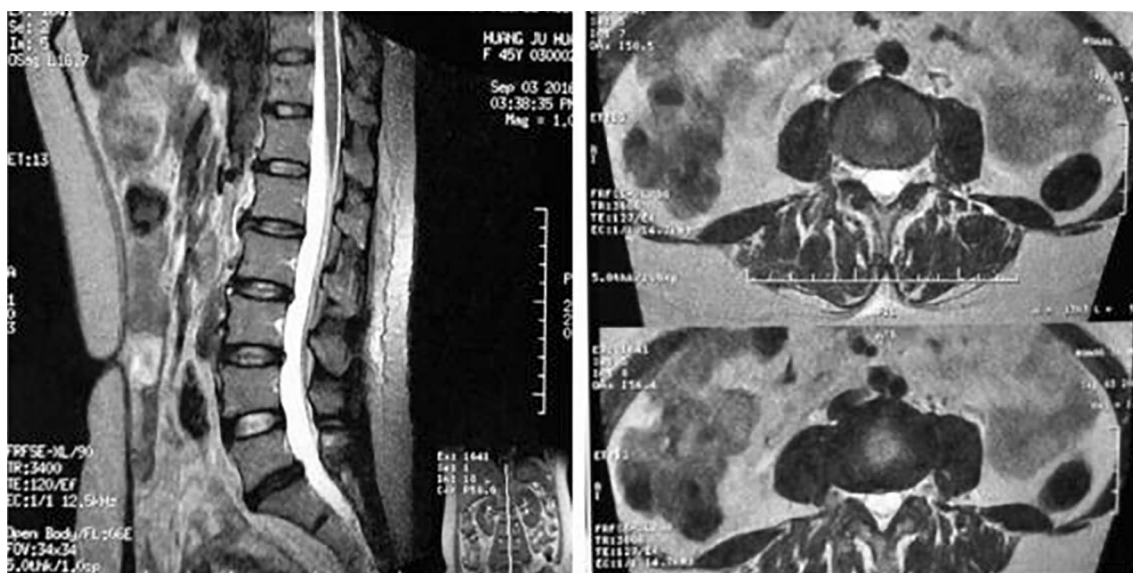


Fig. 5 MRI 2 months after the procedure demonstrated that the epidural abscess had disappeared and that the dural sac and nerve root were decompressed

SEA, she subsequently underwent percutaneous CT-guided needle aspiration and irrigation of the pus. Her back pain was dramatically and immediately relieved after CT-guided treatment was performed. Her laboratory examination results were normal 2 months later, and complete neurological recovery was observed consistent with previous reports [6–10, 18].

Only two instances of needle irrigation to treat SEA have been reported to date; the first patient was treated with saline, and the other patient received gentamicin. Although researchers advocate that an antibiotic regimen should be no shorter than 4 weeks, their recommendation is based on needle aspiration without an irrigate. Tabo [18] treated SEA patients not only with aspiration but also with irrigation; after 2 weeks of antibiotic therapy, the patient achieved a satisfactory outcome. We used gentamicin to irrigate the abscess as well as continuous IV antibiotics for 2 weeks, and the results appear to be beneficial. In our opinion, irrigation with antibiotics may help drain the pus more thoroughly and allow for more direct diffusion of antibiotics in the spinal epidural space. This procedure could permit a shorter antibiotic duration while closely following inflammatory indicators.

The current case report supports the idea that CT-guided percutaneous needle aspiration and irrigation could be a rational alternative to surgical intervention for treating SEA. Although this minimally invasive procedure has evidently been beneficial for patients with SEA, indications for this procedure have not been discussed in detail in prior studies. We hypothesized that determinants of complete recovery for SEA patients include both sufficient neurological decompression and efficient bacterial control. Advanced technologies may provide helpful instruments for guiding precision medicine, which has been characterized as minimally invasive. In SEA patients, CT guidance can be used to directly and precisely insert needles into the spinal epidural space to irrigate the abscess and provide significant neurological decompression. This approach is a relatively low-risk and minimally invasive technique at any level of the spine.

We suggest that the described CT-guided, percutaneous, minimally invasive procedure might be the optimal treatment choice for pediatric SEA patients who exhibit no response to conservative treatment alone and for whom laminectomy may cause a developmental spinal deformity; adult SEA patients in poor condition; and/or SEA patients who present with diabetes or other predictors of poor treatment outcome.

As noted by Walter [19] and Siddiq [9], in cases of SEA, an anterior abscess location, spondylodiscitis, osteomyelitis, and spinal instability should be regarded as relative contraindications for a CT-guided, percutaneous, minimally invasive procedure. Moreover, an acute abscess, defined as an abscess present for less than 16 days that consists of liquid purulent material, can be irrigated via a CT-guided

percutaneous procedure, whereas surgical therapy is appropriate for chronic SEA, which is characterized by granulation tissue in the epidural space that may have persisted for months [12].

Conclusion

CT-guided percutaneous needle aspiration is a safe and minimally invasive procedure that can be regarded as a rational alternative to surgical intervention for the management of SEA in select patients.

Author contributions RB wrote the draft of the manuscript and participated in the follow-up examination of the patient and clinical material. CXR, ZQ and FM participated in the surgical and medical treatment and followed up the patient. They also have been involved in drafting the manuscript or revising it critically. WJ performed the surgery, coordinated and helped to draft and finalize the manuscript. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest There are no conflicts of interest for any authors and no sponsorship regarding this manuscript.

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