

## Spinal Epidural Abscess: Three Cases Following Spinal Epidural Injection Demonstrated with Magnetic Resonance Imaging

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SPINAL epidural abscess is a rare infectious process that accounts for only 1:10,000 hospital admissions, but it is important to recognize it quickly because it is treatable.<sup>1</sup> The abscess usually represents a secondary site of infection from either direct extension of vertebral osteomyelitis or hematogenous spread from a primary infection of skin or lungs.<sup>2</sup> Rarely the abscess is secondary to epidural injection, and we report three additional cases in whom the diagnosis was made by magnetic resonance imaging (MRI). The role of MRI in the diagnosis of epidural abscess is reviewed based on the current medical literature.

### Material and Methods

We reviewed the clinical histories and MRI scans of three patients with epidural abscess after epidural injections. The diagnosis was established by MRI in all cases and confirmed by surgery in two. The MRI scans were obtained on three different scanners (GE 1.5T, GE 0.5T, or Phillips 0.5T). Imaging sequences included sagittal T1- and T2-weighted sequences in all cases. Gadolinium-enhanced T1-weighted images were available in one case.

### Case Reports

#### Case 1

A 71-yr-old man presented with claudication and underwent laser thromboendarterectomy for occlusion of the superficial femoral and popliteal arteries. Preoperative coagulation parameters were normal. An epidural catheter was placed uneventfully for anesthesia and was removed after 48 h. Intraoperatively the patient received urokinase and was treated with heparin postoperatively.

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Back pain developed 72 h after the removal of the epidural catheter. This progressed to bilateral lower extremity radicular pain and weakness with urinary retention in the subsequent 48 h. The leukocyte count was 11,900 with 86% polymorphonuclear leukocytes, 1% eosinophils, 4% lymphocytes, and 4% monocytes.

On physical examination the patient was alert with no fever or meningismus. There was marked tenderness to percussion of the lower lumbar spine. A 1-cm circular eschar surrounded the L3-4 site of the prior catheter insertion site. Weakness of the quadriceps and iliopsoas (4 of 5 on the Medical Research Council motor scale) occurred bilaterally with diminished knee jerks (1 of 4); otherwise strength, tendon reflexes, and sensation were normal. Sacral reflexes and function were preserved.

Magnetic resonance imaging revealed an epidural mass that was brighter than cerebrospinal fluid (CSF) on both the T1- and T2-weighted sequences (fig. 1). At surgery, tan, creamy, purulent debris was found within the subcutaneous, subfascial, epidural, and subdural compartments. No evidence of a hematoma in the epidural space was found. A thorough debridement and dural closure was performed. Cultures revealed *Staphylococcus aureus*, which was treated with 6 weeks of intravenous antibiotics. The patient fully recovered.

#### Case 2

An 84-yr-old woman presented with a subacute history of low back pain. The patient had a history of breast cancer with bone metastasis treated with radiation therapy. Her initial evaluation included a computed tomography/myelogram, which revealed a sclerotic sacral metastasis but was otherwise normal. She received an epidural steroid injection for her back pain with good relief of her symptoms.

Two weeks later she returned with worsening back pain, leg weakness, and urinary incontinence. Her examination revealed confusion, marked nuchal rigidity, and fever. Diffuse weakness of all muscle groups of the lower extremities (2 of 5) was present. Magnetic resonance imaging demonstrated a sharply marginated mass in the dorsal epidural space compressing the thecal sac (fig. 2). The lesion was similar to CSF in signal intensity on both the T1- and T2-weighted images, making it difficult to identify.

At surgery an epidural abscess with thick, gelatinous, creamy tan-brown pus was loculated beneath the ligamentum flavum, causing compression from L4 to S2. Subdural pus collections were present also. Debridement and dural closure were performed and cultures grew *S. aureus*. Postoperatively the patient developed third-degree heart block and ventricular tachycardia, and died despite attempts at resuscitation.

#### Case 3

A 67-yr-old man underwent evaluation and treatment for vascular claudication. His medical history was remarkable for diffuse atherosclerotic vascular disease and rheumatoid arthritis, which had been

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**Fig. 1.** On this sagittal T1-weighted magnetic resonance imaging scan the abscess (arrows) can be seen in the dorsal epidural space and appears slightly hypointense relative to cord.

treated with chronic oral steroids. He received epidural anesthesia for laser and balloon angioplasty of the left superficial femoral and popliteal arteries. Heparin was administered intraoperatively and the patient received Coumadin postoperatively. He was discharged home, asymptomatic, on postoperative day 3.

Within 24 h of discharge fever developed, and 4 days later, back pain with incapacitating leg spasms. He was readmitted with a fever of 39.8° C and a leukocyte count of 29,000/cm<sup>3</sup>. He had no radicular pain or myelopathic signs. His neurologic examination results were normal. The thoracolumbar junction was extremely tender to palpation and percussion. Blood cultures grew *S. aureus*.

Magnetic resonance imaging examination of the spine demonstrated

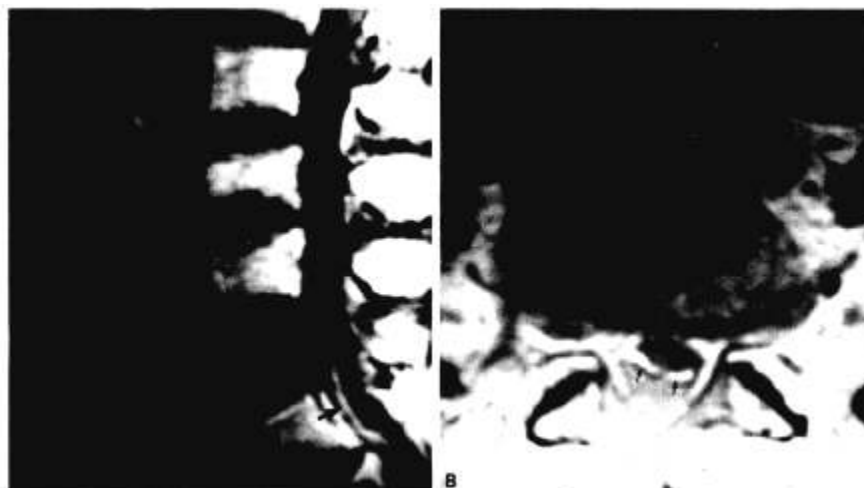
an intraspinal mass extending from L4 to T1. On the T2-weighted sequence mass was of mixed high and low signal intensity. In this case a gadolinium-enhanced study was available on which mildly enhancing margin of the abscess could be seen (fig. 3). Based on this MRI appearance, clinical findings, and blood cultures, he was treated with 6 weeks of antibiotics for epidural abscess. The patient remained neurologically intact.

## Discussion

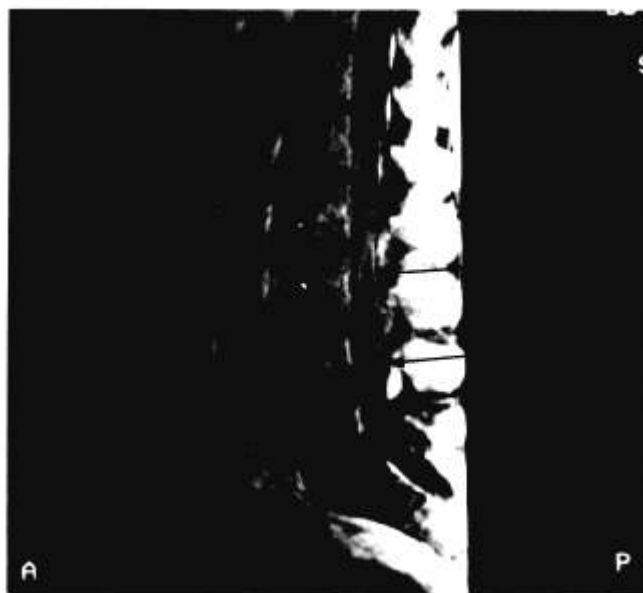
In all three cases the patients presented within 3–14 days of epidural injection with severe back pain and fever. Previous reports describe a similar time frame for symptoms after epidural injection<sup>3,4</sup> with only a few exceptions when presentation was delayed more than 1 month after injection.<sup>5</sup>

*Staphylococcus aureus* was the pathogen in all our cases. It was cultured from the abscess in two and from blood in one. *S. aureus* was also the organism most often cultured from the other reported epidural abscesses after injection<sup>3–7</sup> as well as the most frequent organism in the cases with infection after chronic epidural catheter placement.<sup>8</sup> In previous reports of epidural abscess unrelated to injection of the epidural space, *S. aureus* was also the most common organism, cultured in 19 of 20 cases in one early series.<sup>2</sup> However, in a recent review by Curling *et al.*, *S. aureus* was the infectious agent in only 45% of epidural abscesses with the remainder gram-negative rods, anaerobes, mycobacteria, and fungi. They attribute this variety of organisms to the introduction of antibiotics and the increasing frequency of immunosuppressive diseases.<sup>9</sup> Similar findings were suggested in a review by Kaufman *et al.*<sup>10</sup> Only 19 of the 27 epidural abscesses they report were of bacterial origin. *Mycobacterium tuberculosis*

**Fig. 2.** The epidural abscess in case 2 appeared isointense with CSF on this T1-weighted sagittal scan (A). A line of displaced epidural fat (arrows) indicates the ventral margin of the abscess cavity. On the axial T1-weighted scan (B) the dorsal abscess cavity is better seen with a margin of displaced epidural fat (arrows) interposed between the abscess and the thecal sac.



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**Fig. 3.** The sagittal T1-weighted scan in case 3 demonstrates the lumbar epidural abscess with a thin margin of high signal enhancement at its periphery (arrows).

was the cause in seven. There were four cases in which gram-negative rods were cultured from the abscess. Three of these four patients were drug addicts.

Epidural abscesses are reported to be most commonly located in the dorsal epidural space.<sup>1,11</sup> Presumably the close approximation of the ventral dura and the posterior longitudinal ligament limits extension in the ventral epidural space. Hemorrhage in the dorsal epidural space also is described as more frequent for the same reason.<sup>12</sup> In our three cases, all were dorsal.

The classic description of symptoms of epidural abscess are spinal ache followed by root pain, weakness, and paralysis.<sup>2</sup> The exact mechanism of cord injury is somewhat controversial. Some reports suggested that arterial or venous occlusion occurred early, accounting for those cases in which symptoms exceeded those anticipated based on the size of the abscess at surgery.<sup>1,13</sup> However, experimental work by Feldenzer *et al.* indicated that arterial and venous occlusion only occurred late in the disease after there was significant mechanical compression of the cord.<sup>14</sup> Hlavin *et al.* argue that it is a combination of both compression and ischemia that accounts for the devastating effects of sometimes small epidural abscesses based on their experience with 39 surgical cases.<sup>15</sup>

A commonly cited association with epidural abscess is prior, blunt spine trauma.<sup>1,10,13</sup> It has been suggested that a post-traumatic epidural hematoma forms, which

then becomes infected. This mechanism also has been advanced in cases of epidural abscess following epidural injections.<sup>3</sup> Of the previous reports of epidural abscess after injections, in only one case was direct bacterial inoculation of the epidural space documented.<sup>6</sup> In the two cases that went to surgery in our experience there was no evidence of hemorrhage nor was there evidence of bleeding at the time of catheter insertion in the two cases that received epidural anesthesia.

In cases in which clinical symptoms suggest the possibility of epidural abscess, radiologic studies can play an important role in confirming the diagnosis as well as assessing the extent of the abscess. Plain x-ray images may be abnormal in cases in which the abscess is secondary to spinal osteomyelitis. However, plain films are neither very sensitive or specific in such cases.<sup>15,16</sup> In addition, epidural abscess occurs without osteomyelitis in most cases.<sup>2</sup> Previously, myelography was the mainstay of diagnosis. In two published series the myelogram was reported as abnormal in all cases.<sup>1,8</sup> However, in another review of cervical epidural abscesses there were two cases in which the myelogram was normal.<sup>13</sup> There is some risk in performing myelography from a lumbar route in patients with epidural abscess since there is the potential for inoculation of the subarachnoid space if the abscess is traversed by the spinal needle.<sup>11</sup> In addition, there is some potential for neurologic deterioration after lumbar puncture in a patient who has a complete block at a level cephalad to the puncture.<sup>15</sup> Computed tomography without intrathecal contrast is not sufficiently sensitive to soft tissue densities in the spinal canal to be relied on for this important diagnosis, particularly in the cervical region where artifacts from surrounding bone commonly obscure the canal. Furthermore, computed tomography may be misleading when used for the diagnosis of discitis which may accompany epidural abscess.<sup>17</sup> In their report of four epidural abscesses, Angtuaco *et al.* found MRI superior to enhanced computed tomography in demonstrating the epidural extension of paraspinal and spinal infection.<sup>18</sup>

Recently MRI has been advocated as the primary modality for evaluation of the spine, particularly in cases of suspected infection.<sup>19</sup> This is based in part on the sensitivity of MRI in cases with spinal osteomyelitis and paraspinal infections.<sup>18,20</sup> Because the entire spine can be examined it eliminates the need to do a combined lumbar and cervical puncture in those cases with a complete block. Hlavin *et al.* published the largest

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review of cases of epidural abscess where both myelography and MRI were available. In their experience MRI and myelography in conjunction with computed tomography were equally sensitive for the diagnosis of epidural abscess. Because of the potential risk in performing the myelogram as well as its ability to demonstrate spinal and paraspinal infections, they recommend MRI as the procedure of choice for the diagnosis of epidural abscess.

In all of our cases the diagnosis was made with MRI with sufficient confidence that no myelograms were performed. There are pitfalls when using MRI, as with all imaging techniques, however. One early report suggested that in patients with meningitis and epidural abscess, the margins of the abscess may be obscured.<sup>19</sup> That report preceded the availability of MRI contrast, however. Another concern is the potential for the abscess to resemble CSF as was nearly the situation in our case 2. On the MRI image of that patient the abscess resembled CSF on two of the three pulse sequences, but the correct diagnosis was made based on the appearance on the proton density and axial images. The availability of MRI contrast should further reduce the potential for overlooking these collections since the margin of inflammatory tissue will usually enhance.<sup>21</sup>

While epidural injection and catheterization remains a generally safe and effective procedure, it is important to consider the possibility of epidural abscess in those patients who develop back pain following the procedure. Treatment remains surgical decompression but preservation of spinal cord function demands early diagnosis, before neurologic deterioration. Our experience and that of the literature suggest that MRI should be used as a primary imaging technique to establish this diagnosis.

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