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Spinal Epidural Abscess After Radiofrequency Denervation of the Lumbar Facets: Case Report

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Background: Spinal epidural abscesses (SEAs) are rare with an estimated annual incidence of 0.2-2.8/10,000. Risk factors include immunosuppression, intravenous drug use, diabetes mellitus, HIV, trauma, tattooing, and bacteremia. Presenting symptoms are typically nonspecific with malaise, fever, back pain, and possible neurological deficits.

Case Report: We present a case of SEA following radiofrequency ablation (RFA) in a patient with no known risk factors, in a 59-year-old man with axial lower back pain. The patient underwent an L4/L5 laminectomy and was started on antibiotics. His blood cultures grew Actinomyces and he was discharged with an extended course of antibiotics.

Conclusions: While there have been reported SEAs after certain chronic pain procedures, they have not been reported after RFA to our knowledge. This is a novel presentation of an epidural abscess occurring solely after RFA, which should alert clinicians to the possibility of this complication.

Key words: Spinal epidural abscess, radiofrequency ablation, chronic pain, actinomyces

BACKGROUND

Spinal epidural abscesses (SEAs) are rare with an estimated annual incidence of 0.2 to 2.8 per 10,000 individuals (1). The incidence may be rising as a result of the growing use of invasive spinal procedures (1,2). Abscesses may arise from various sources, including contiguous spread from vertebral osteomyelitis, hematogenous dissemination, or direct inoculation during surgical procedures (2). Risk factors include immunosuppression, intravenous drug use (IVDU), diabetes mellitus, HIV, trauma, tattooing, and bacteremia (1-3). Frustratingly, the clinical presentation is often nonspecific and may include symptoms, such as malaise, fever, back pain, and, in some cases, neurological deficits. SEAs produce a mass effect on the underlying spinal cord or nerves, leading to pain, and in some cases, neurologic impairment (2-4). Given the significant risk of permanent neurological deficits that SEAs pose, prompt recognition, evaluation, and treatment are critical when this condition is suspected.

SEAs have been reported following certain chronic pain procedures, including epidural steroid injections and medial branch blocks (MBB) (5-8). However, to our knowledge, there are no previously documented cases of SEAs exclusively following radiofrequency ablation (RFA). RFA is a versatile technology whereby radio waves are used to heat tissue. It is a common intervention for neck or back pain secondary to facet arthropathy, a common etiology for axial pain in these regions, afflicting the zygapophyseal joints which stabilize the spine (9).

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Specifically, electrodes are used to percutaneously heat and ablate the medial branches innervating the facet joints. In the lumbar spine, medial branches run lateral to the facet joint, notably dorsal to the ligamentum flavum or epidural space. Under fluoroscopic guidance, specialized needles are positioned at the junction of the superior articular process and the transverse process in parallel orientation. Notably, the epidural space is not intentionally accessed during RFA, therefore leaving SEAs a rare and unexpected complication. Here, we present the case of a 59-year-old man who developed SEA following lumbar RFA despite having no identifiable risk factors for this condition.

CASE REPORT

This case report does not contain patient-identifiable information and is exempt from institutional review board review requirements as per institutional policy. The patient provided consent for publication. A 59-year-old man with a medical history of a remote traumatic brain injury (50 years ago), hypertension, hyperlipidemia, and hypothyroidism initially presented to the pain treatment center for axial lower back pain. His pain was present for over a year and located over his lower lumbosacral spine without radiation to his legs. On examination, he reported left paraspinal tenderness as well as positive facet loading (left > right). In terms of conservative management, he had completed a course of physical therapy and undergone trials of acetaminophen and nonsteroidal anti-inflammatory drugs without relief. Magnetic resonance imaging (MRI) showed disc bulges at L3/L4 and L4/L5, which narrowed the central canal and right and left foramina, in addition to L5-S1 facet arthropathy. Based on his history, exam findings, and imaging, a decision was made to proceed to the RFA pathway. The patient endorsed > 80% pain relief with both long- and short-acting diagnostic MBB, therefore verifying candidacy for RFA. Of note, prognostic blocks were performed at the intersection of the superior articular process and transverse process, without violation of the facet joint capsule.

Subsequently, bilateral RFA was performed at L3/L4, L4/L5, and L5/S1, each side a week apart. RFA was performed under fluoroscopic guidance (Fig. 1) with 20G RF cannulas; lateral images confirmed proper dorsal position of needle tips. Sensory and motor testing at 50 Hz and 2 Hz, respectively, did not provoke pain or paresthesia outside of expected areas. Sterile techniques (i.e., masks, sterile gloves, and cleansing with chlorhexidine gluconate/isopropyl alcohol) were observed by the physician and staff throughout the procedure.

Ten days after RFA was completed, the patient began to experience increased pain with radiation down his right leg. Pain was not controlled with over-the-counter medications, including acetaminophen and ibuprofen. He contacted the clinic and was instructed to present to the emergency department, denying bladder and bowel incontinence at the time. His exam showed full strength in upper and lower extremities, and intact sensation to light touch in L4-S1 dermatomes. Laboratory testing demonstrated elevated erythrocyte sedimentation rate (39 mm/h) and C-reactive protein (13.4 mg/L) with a normal white count (8.3 K/uL). MRI demonstrated a new posterior paraspinous curvilinear fluid collection with adjacent paraspinal and iliopsoas edema, in addition to ventral epidural fat effacement (Fig. 2). The MRI report stated that "if there was concern for infection, these findings could represent a perifacet abscess with associated myositis and epidural phlegmon."

Neurosurgery was consulted, and the following day the patient underwent an L3-L5 laminectomy and was started on vancomycin and cefepime. Operative report revealed an inflamed right L4-L5 facet capsule with purulent material and right-sided epidural abscess extending from L3-L4 to L5-S1. His blood cultures and surgical cultures grew Actinomyces neuii and he was discharged with an extended course of ampicillin, which was later switched to amoxicillin. Follow-up 4 months postoperatively demonstrated improved standing/walking with no improvement in his lower back pain; after one year, the patient exhibited full strength in his lower extremities, but persistent pain upon palpation of the lower lumbar paraspinal muscles.

He recently elected to undergo another RF denervation treatment.

DISCUSSION

The incidence of infections after interventional spine procedures (excluding implanted devices) is < 1% and mainly attributed to epidural steroid injections (10). SEAs are rare occurrences despite the relative increase in procedural interventions. There have been reported SEAs after chronic pain procedures, including interlaminar and transforaminal epidural steroid injections (5,8), facet joint injections (6,11), and MBB (7), but not following RFA to our knowledge. Intraarticular facet injections may constitute a unique risk due to the proximity of the ventral joint capsule to the ligamentum flavum (12), a

possible nidus for infection. In fact, in a retrospective review and novel case series of patients with facet joint septic arthritis, Ross et al (13) found that epidural abscesses were present in 56% of patients. There is a recent report (14) of spinal abscess occurring in a patient with diabetes mellitus undergoing epidural catheter placement followed by pulsed RF for herpes zoster. There are no larger case series of pain intervention-related SEAs, suggesting the rarity of this specific complication.

While SEAs can develop in healthy patients, there are risk factors that render a patient susceptible to abscess development. These risk factors include those who are immunocompromised (as the patient in the case of SEA after MBB), IVDU, diabetes mellitus, trauma, and bacteremia. In our case, our patient has no known risk factors for

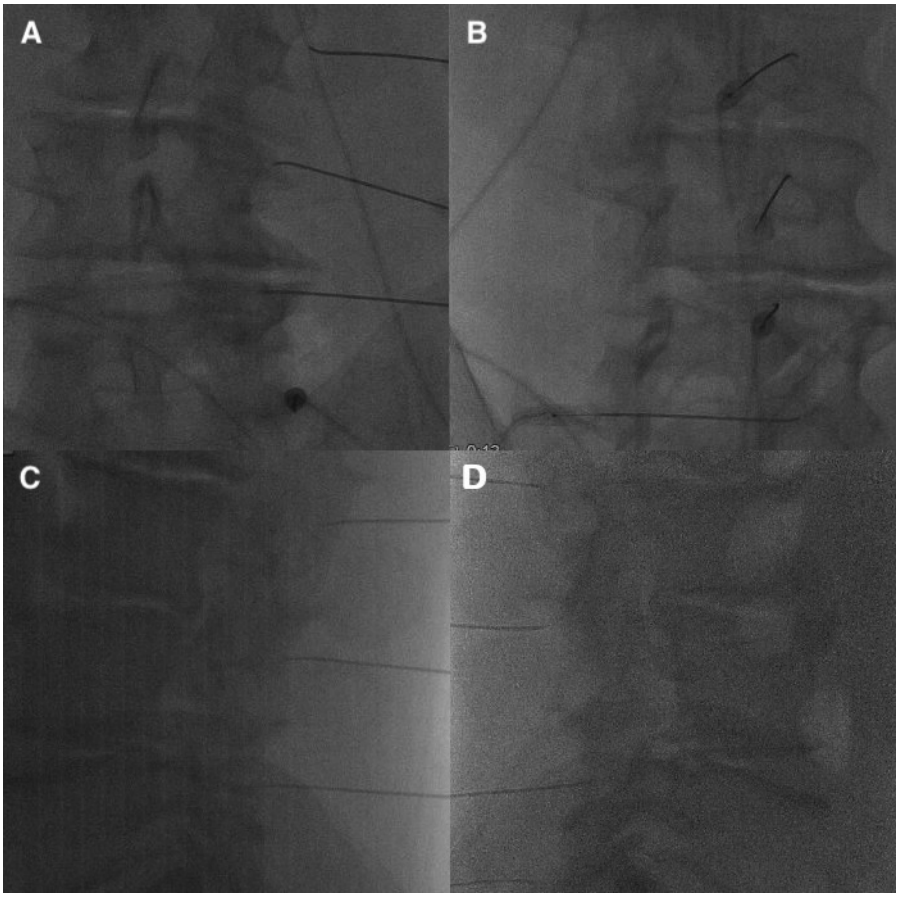

Fig. 1. Final needle placement for RFA (right-sided procedure), anterior-posterior (A), oblique (B), and lateral (C) views. Lateral view for left-sided procedure also shown, with needle placement dorsal to the neural foramen (D). RFA, radiofrequency ablation.

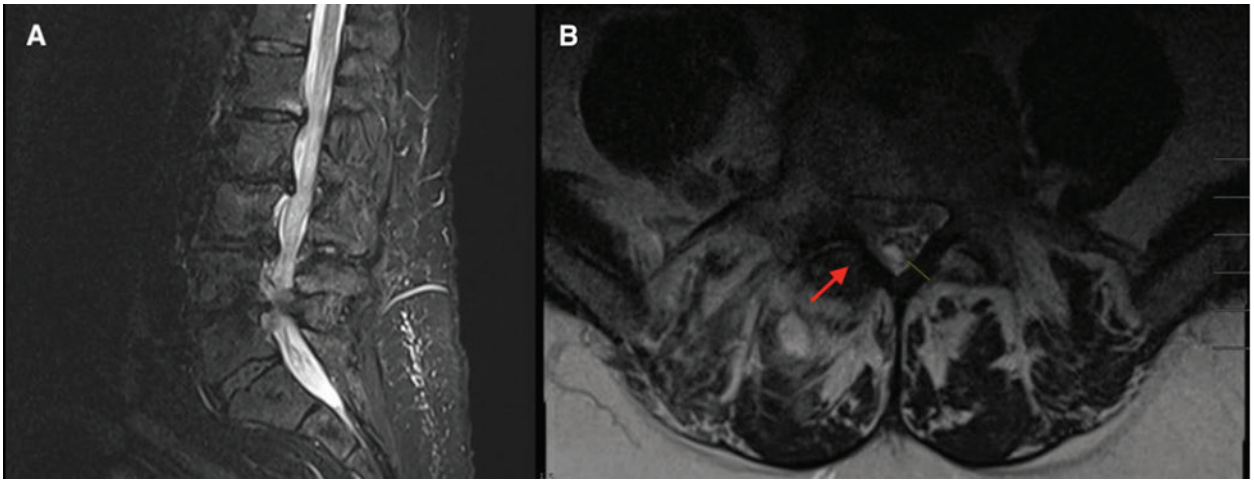

Fig. 2. MRI demonstrated paraspinal and psoas muscle edema at multiple areas from L1 to L5, in the setting of advanced facet degeneration and degenerative central canal stenosis (A). Notably, a large fluid collection was seen extending into paraspinal tissue at L4-L5, thought to be extending into the central canal at L5, and ultimately compressing the L5 nerve root (B). MRI, magnetic resonance imaging.

developing SEA, which occurs may form from hematological dissemination, contiguous spread from surrounding vertebral osteomyelitis, direct contamination via surgical intervention, or simply idiopathic processes (2). The abscess in this case developed at levels corresponding to those targeted during the RFA. However, the RFA needles, placed under fluoroscopic guidance, did not breach the epidural space. Sensory and motor testing suggested that needles were appropriately distanced from nerve roots or dorsal root ganglia. Possible potential mechanisms for SEA formation include using excessive amounts of local anesthetic prior to RFA, which may have facilitated spread from the intervertebral foramina to the epidural space. Alternatively, hematogenous seeding remains a possibility, particularly as contrast dye is not utilized during RFA to rule out vascular uptake. Importantly, the MRI performed upon the patient's presentation to the emergency department showed no evidence of vertebral osteomyelitis.

Gadolinium-enhanced MRI is the imaging modality of choice for SEA (1,2). The presence of paraspinal edema in noncontrast MRI has the highest sensitivity for SEA compared to psoas, bone marrow, and disc edema. The MRI obtained when the patient presented to the emergency department demonstrated paraspinal and iliopsoas edema on the right side from L3 through to L5 and a posterior paraspinous curvilinear fluid collection that extended to the dorsal right lateral aspect of the canal. The location of the abscess can be anterior, posterior, or circumferential, which can be a clue to the source of infection (2). In this case, the posterior location of the abscess suggested that hematogenous spread may have played a role vs vertebral osteomyelitis, which would likely result in an anterior abscess.

Adding to the uniqueness of this case is the rarity of Actinomyces as a causative infectious organism for SEAs, which are more commonly attributed to Staphylococcus aureus species (1,3). Both blood cultures and surgical abscess cultures from this patient revealed Actinomyces neuii, an organism typically associated with infections following dental procedures or surgeries involving areas where it constitutes part of the normal flora, such as the gastrointestinal tract (15,16). Epidural involvement by Actinomyces typically arises from contiguous spread rather than hematogenous dissemination (15). A review of Actinomyces in central nervous system infections revealed that most cases involved brain abscess (55%), with only 16.1% of cases involving the spinal cord (17). Dental procedures and infections were noted to be the most common predisposing features in this series, followed by head trauma or otitis media. However, as noted earlier, no evidence of vertebral osteomyelitis was found on MRI, and the patient had no recent dental issues, trauma, or other surgical procedures between the RFA and SEA presentation, thus further obscuring cause of the infection.

For most patients, treatment consists of surgical decompression followed by 4-6 weeks of antibiotics (4,18). In a large retrospective case series of 128 cases (3), early surgical intervention improved neurological outcomes compared with surgery that was delayed by a trial of medical management. Delay in the diagnosis of SEA can result in residual weakness or permanent neurologic deficits (2), thus underscoring the importance of prompt recognition, evaluation, and treatment when suspected. While rare in clinical practice, effects upon patients can be devastating and lifelong.

Of note, this patient continued to have lower back pain (likely secondary to existing facet arthropathy) after this complication. He elected to undergo the RFA (L4-L5 and L5-S1) bilaterally again earlier this year and endorsed significant benefit from the procedure, fortunately without any further complications.

CONCLUSIONS

This case illustrates an extremely rare complication of SEA after RFA; to our knowledge, it is the first report of an abscess exclusively after uncomplicated RF denervation, without known violation of ligamentum flavum or dura. With the increased utilization of invasive spinal procedures, knowledge of risk factors, clinical presentation, and diagnosis of SEA is paramount, given its significant risk of permanent neurological damage. This case illustrates the importance of caution and clinical suspicion in addressing potential complications of a commonly performed procedure.

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