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Case Report

Lumbar spondylodiscitis attributed to a rare infection with *Actinomyces Neuii* in a diabetic patient: Imaging findings and clinical follow-up ☆

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ABSTRACT

Spondylodiscitis describes an infection of the vertebral body and disc. Clinical presentation is often nonspecific. As a result, imaging plays a crucial role in establishing the diagnosis. The most common associated organism is *Staphylococcus aureus*. *Actinomyces neuii* is a gram-positive rod that is primarily known to cause soft tissue infections but has rarely been described in association with spondylodiscitis. At the time of this publication, only 1 other case of *A. neuii* has been reported in the literature. We present a case report of a diabetic patient diagnosed with spondylodiscitis with cultures demonstrating *A. neuii* as the most likely causative organism. In our case, no definitive infectious source was identified. The significance of *A. neuii* spondylodiscitis is unclear. At 1 year follow up, this patient had been successfully treated with antibiotic therapy, but did suffer from significant chronic back pain attributed to the infection. Finally, our case highlights important clinical and imaging findings that may illustrate the elusive nature of this diagnosis.

Introduction

Spondylodiscitis is a term used to describe an infectious process involving the disc and adjacent vertebra [1]. In developed countries the incidence ranges from 0.4-2.4 per 100,000 each year [2,3]. It predominantly affects males and it has a bimodal distribution, typically seen in children in the first and second decades of life and then the fifth and sixth decades [2]. *Staphylococcus aureus* is the most implicated organism. Less common sources include *Escherichia coli*, *Proteus mirabilis*, and *Pseudomonas aeruginosa* [2]. Organisms such as *Brucella* and *M. tuberculosis* are still commonly seen in developing countries [4].

Hematogenous spread is the predominant route of infection. Direct penetrating trauma and contiguous spread from surrounding soft tissue infection are less common. Diabetes, immunosuppression, intravenous drug use, prior spinal intervention, cirrhosis, malignancy, and renal failure are key risk factors [2].

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In the pathogenesis of spondylodiscitis, the arterioles of the vertebral end plates are seeded by bacteria, which results in pathogen deposition into the relatively avascular intervertebral disc or adjacent vertebral endplate. This region has relatively poor vascularity which results in a relatively safe haven for seeding bacteria and in consequence often requires prolonged antibiotic treatment [2].

Spondylodiscitis can be challenging to diagnose due to its nonspecific presentation. The most common symptom seen in patients with spondylodiscitis is persistent back pain, with over 90% of patients presenting with chronic pain not relieved by rest or analgesics [4]. Physical exam may demonstrate point tenderness, paraspinal muscle spasm, and reduced spinal movement. Although more uncommon, some patients may also present with signs of neurological compression including weakness, paresthesias, paralysis, or signs and symptoms of a psoas abscess. Fever also may or may not be present but localized back pain with fever should raise suspicion and work up for discitis. Vague symptoms, particularly in the older patient, can often be attributed to pre-existing conditions which can delay diagnosis [2]. Imaging is often key in proper diagnosis because of the nonspecific presentation of spondylodiscitis [1].

The gold standard imaging technique is MRI due to its superior resolution for soft tissue [5]. Common imaging features of spondylodiscitis include endplate destruction, endplate enhancement, marrow edema, and abnormal signal in the disc and/or paraspinal muscles. Imaging can potentially be problematic and nonspecific when the findings are subtle, or the exam was performed without contrast. Thus, it is paramount that the treating physician and radiologist both have a high index of clinical suspicion.

The first-line treatment of infectious pyogenic spondylodiscitis is conservative medical management with a prolonged course of antibiotics. Surgery may be indicated for progressive pain, persistent infection on imaging, deformity or neurologic deficits. Surgical intervention may be associated with significant pain reduction, improved neurologic function, and a high number of patients returning to a relatively normal functional status [6,7].

Actinomyces is a genus of gram positive rods frequently found in normal oral flora, urogenital tract, and the gastrointestinal tract. It is frequently implicated in cervicofacial infections. The genus has a wide range of species with several being implicated in skin-infections, appendicitis, cholecystitis, endocarditis, urinary tract infections, actinomycosis, and, rarely, osteomyelitis [8]. *Actinomyces neuii* is a unique, clinically relevant species which has been mainly implicated with skin abscesses [8]. Unlike other Actinomyces species, *A. neuii* is nonbranching. Cells are gram positive and predominantly diphtheroidal–mainly arranged in clusters, V, or Y forms [9].

In a PubMed search of the literature, there has been only 1 documented case report of *A. neuii* causing vertebral osteomyelitis [10].

Case presentation

A man in his fifties presented to the emergency department with gradually worsening right-sided back pain radiating to the right hip and lower extremity for 6 weeks. He had a past medical history of uncontrolled type II diabetes, an infected ingrown toenail which was removed 2 months prior, and nephrolithiasis complicated with stent infection 2 years prior. The patient had previously sought care in the emergency setting 6 weeks prior to this presentation after the initial onset of pain and was diagnosed with a 3 mm kidney stone. However, upon passing the kidney stone, he continued to have waxing and waning back pain which only improved with rest. The patient had been seen in the emergency department at least 5 times within the 6 weeks since the onset of the current complaint. Additionally, the patient endorsed 1 week duration of cold sweats, chills, and subjective fever. He also reported decreased appetite and weight loss. The patient denied any history of trauma, recent injury, or IV drug use. The patient was noted to have good dentition and was regularly seen by a dentist.

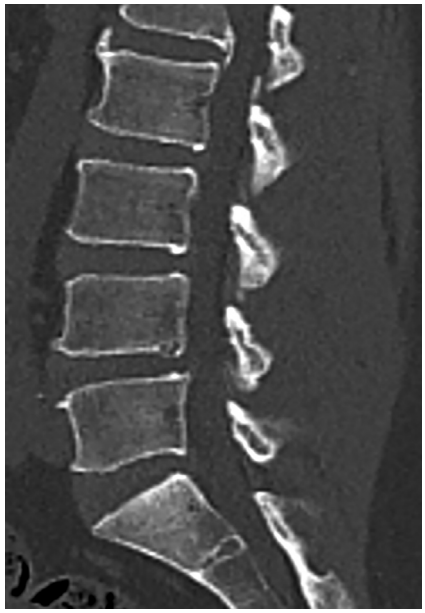

Fig. 1 – Previous unenhanced CT performed before the patient had developed symptoms of back pain. There is degenerative endplate hypertrophic change and osteophyte formation. No overt erosive changes are present at L4-5.

A CT performed 5 weeks prior to diagnosis and prior to symptom onset had demonstrated typical degenerative changes (Fig. 1).

A second CT was performed 18 days later, after symptom onset. This exam was notable for new subtle endplate irregularity at the L4 inferior endplate and was only perceived after retrospective review following completion of the MRI (Fig. 2).

Labs were notable for elevation of serum inflammatory markers. An MRI without contrast of the lumbar spine was requested for further evaluation. Upon radiologist review of the unenhanced images, the decision was made to administer contrast after discussions with the treating physician in the Emergency Department.

This MRI demonstrated ill-defined decreased T1 marrow signal in the L4 and L5 vertebra, increased T2 signal within the

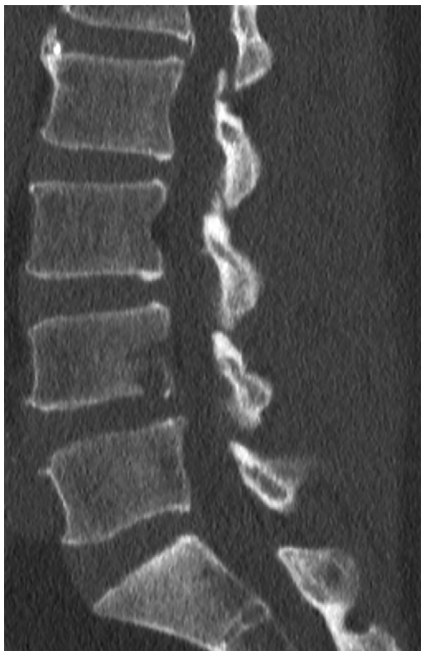

Fig. 2 – Subsequent unenhanced CT performed 18 days later demonstrates subtle new endplate erosive change at posterior aspect of L4. The change in appearance was not perceived by the initial treating team, and is more apparent retrospectively. Of note, this CT was performed approximately 1 month prior to MRI.

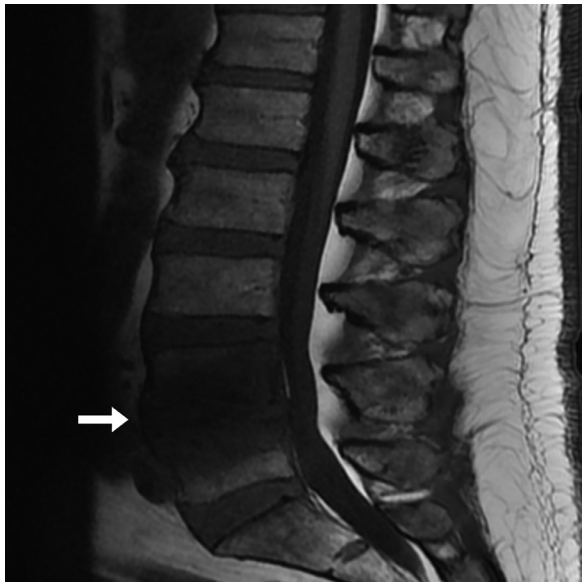

Fig. 3 – Sagittal T1. There is pronounced ill-defined loss of normal T1 signal involving the L4 and L5 vertebral bodies (Arrow).

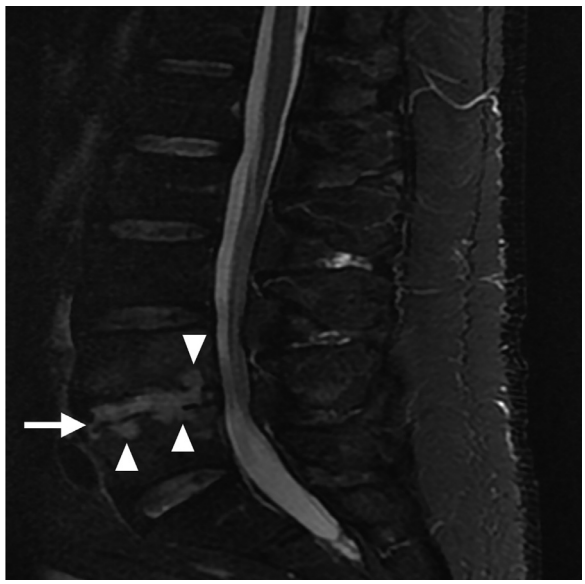

Fig. 4 – Sagittal STIR. Increased T2 signal is present within the L4-5 disc (Arrow), which focally extends into areas of endplate destruction in the inferior endplate of L4 and superior endplate of L5 (Arrowheads).

disc, and irregular globular enhancement centered at the L4-5 disc space (Figs. 3-5). Endplate destructive changes were also present. These findings were consistent with spondylodiscitis involving L4-5 level. Of note, there was also a small amount of abnormal enhancement and increased T2 signal extending into the right psoas muscle and phlegmonous change in the ventral epidural space at L4-5, further increasing confidence in the diagnosis.

The patient was started on empiric antibiotic treatment with Cefepime and Vancomycin. Given his comorbidities and complex medical history, a CT-Guided L4-L5 Intervertebral disc biopsy was performed, and samples were collected for analysis to tailor antibiotic therapy (Fig. 6). Anaerobic culture PCR analysis confirmed *Actinomyces neuii*. Blood cultures also isolated *Actinomyces neuii*. No other organisms were identified by tissue culture or on blood cultures. An echocardiogram demonstrated no evidence of endocarditis. After susceptibility testing, antibiotic therapy was transitioned to intravenous followed by oral amoxicillin. The patient's symptoms improved within 5 days. He was discharged home on intravenous ceftriaxone daily for the next 10 weeks followed by 12 months of amoxicillin 3 times daily. At 1 year of follow up the patient completed the antibiotic regimen.

Over the course of the year following his diagnosis, multiple surveillance MRI exams were performed. The imaging findings demonstrated gradual and overall improved appearance of inflammatory changes at L4-5 (Figs. 7 and 8). Inflammatory markers normalized throughout the duration of his therapy.

The patient has continued to suffer from chronic pain attributed to the infection. He has been unable to return to work due to inability to lift things needed for his job and difficulty sitting and standing for long periods of time. He was referred for physical therapy and pain management to help with his chronic pain and limited mobility.

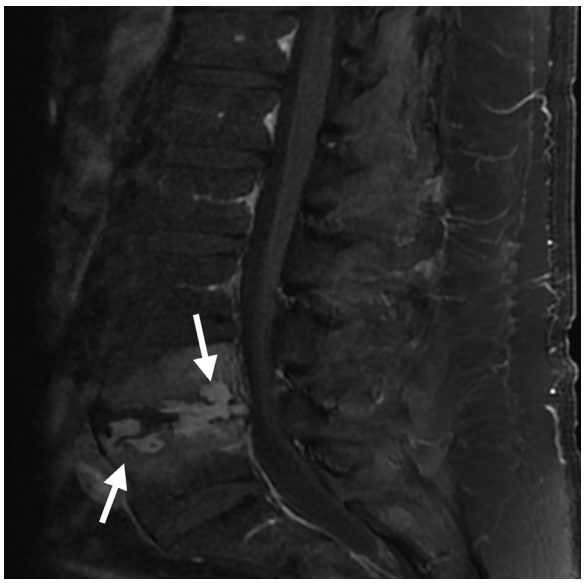

Fig. 5 – Sagittal T1 FS post contrast. There is abnormal globular enhancement of the L4-5 disc also involving the L4-5 endplates (Arrow). The constellation of findings is consistent with spondylodiscitis.

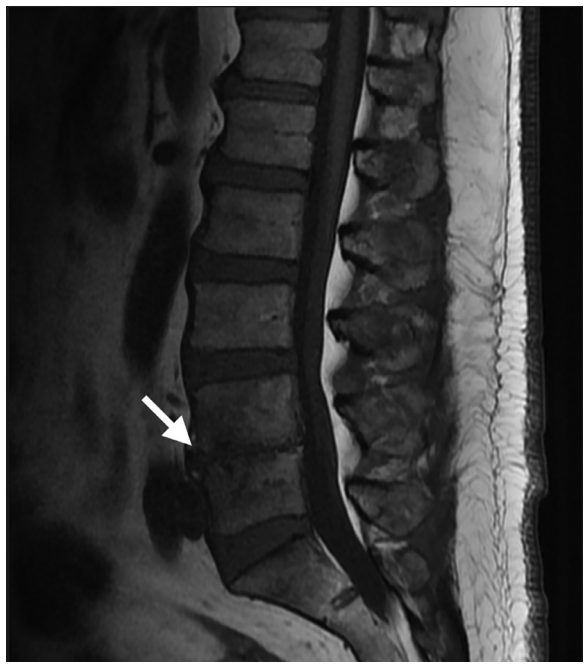

Fig. 7 – Sagittal T1. Surveillance MRI Imaging 1 year following the diagnosis. There is continued disc height loss at L4-5, progressed from the initial exams. The overall marrow signal appears improved from the initial MRI examination demonstrated in Figure 2 (Arrow).

Discussion

Actinomyces neuii is a rarely implicated pathogen in spondylodiscitis. In a search of the literature there has been only 1 documented case of discitis-osteomyelitis with *A. Neuii* to date [10]. Our case is the first reported instance of spondylodiscitis in which *A. neuii* was directly isolated via biopsy of the disc space. In our case, no definitive infectious source was identified.

The patient's treatment course was relatively uncomplicated, with normalization of lab abnormalities and resolution of inflammatory changes on imaging over the course of 1 year.

However, the patient did suffer from chronic back pain and disability attributed to the infection. Complications and lasting disability may prompt physicians to consider tissue sampling for culture and sensitivities early in treatment to opti-

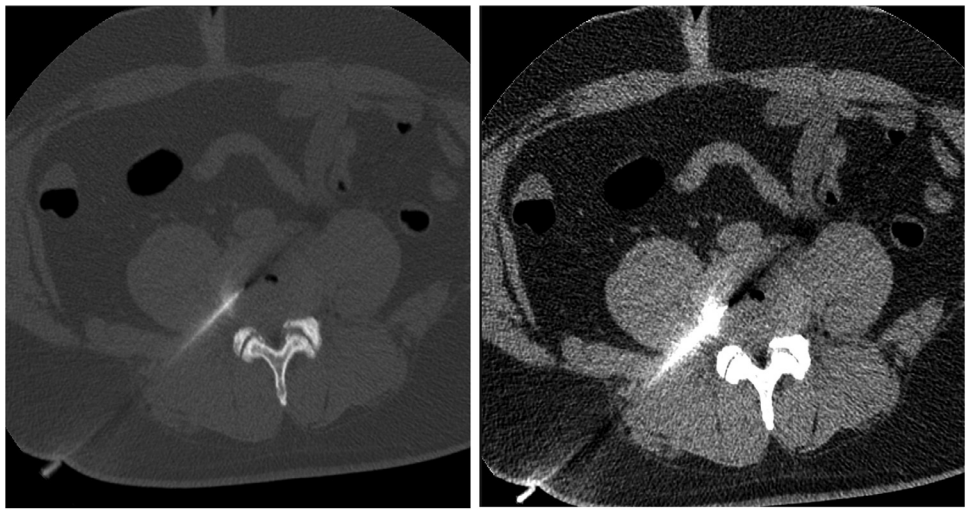

Fig. 6. (A and B) – Axial CT biopsy of lumbar spine. This procedure was performed shortly after the MRI in Figure 2. Samples obtained during this procedure assisted in establishing the causative organism.

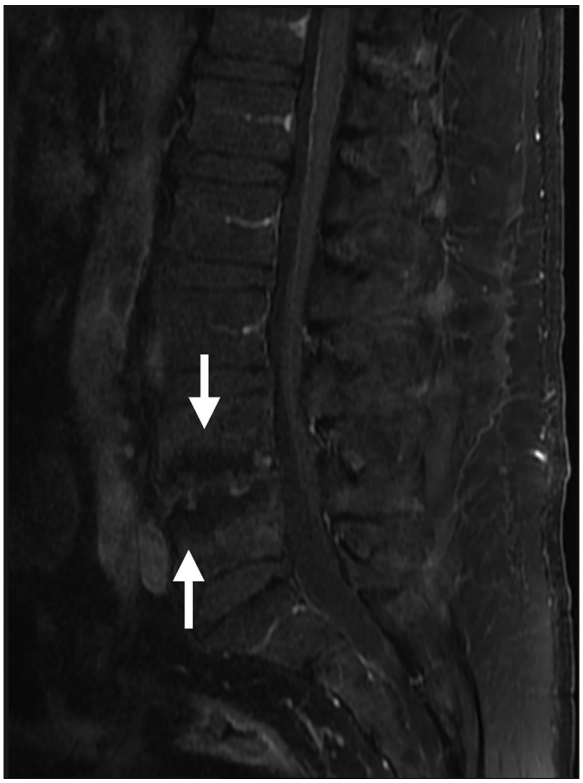

Fig. 8 – Sagittal T1 FS post contrast. Surveillance MRI imaging 1 year following the diagnosis. There is overall improvement of previously visualized discitis/osteomyelitis at L4-L5 with decreased edema and enhancement within the disc, adjacent vertebral bodies, and adjacent paraspinal soft tissues (Arrowheads).

mize treatment. This is especially true if the patient has risk factors for complex or unexpected infections such as diabetes.

A. neuii is a gram-positive bacillus, sometimes reported as a coccoid organism without branching—a feature atypical for *Actinomyces*. *A. neuii* rarely infects humans [8]. In a search of literature, there are 53 results (PubMed Mesh terms "*Actinomyces neuii*" and "infection") of *A. neuii* infections with most cases comprising of soft tissue infections–primarily abscesses. It has also been reported in diabetic foot osteomyelitis, bloodstream infections, native valve endocarditis, pericarditis, genitourinary infections, and biomaterial infections.

In previous reports of chronic osteomyelitis with *A. Neuii*, there were additional different bacterial species present, more consistent with polymicrobial infection [8,10]. This is in counter to our case, in which A. Neuii was the sole organism isolated.

Prior to 1994 *A. neuii* had previously been classified as CDC group 1 coryneform bacteria [8,9]. There is a low sensitivity of Gram staining of samples and frequent coincidence of coryneform bacteria, often considered a contaminant. These unusual laboratory characteristics may have contributed to isolates being dismissed as members of the *Corynebacterium* genus and its incidence in clinical specimens could be underreported. With increasing use of advanced identification systems since 1994 the frequency of reports identifying it as a pathogen in a multitude of infections have increased, however this has not led to an increase in the number of reported cases of spondylodiscitis with *A neuii*.

Imaging is critical in establishing the diagnosis of spondylodiscitis, as the clinical picture is often nonspecific. This proved to be true in our case. Our patient had presented several times to the emergency department before a diagnosis was made. In fact, the patient had been worked up for multiple different causes for back or flank pain in days/weeks prior. Retrospectively, there were subtle imaging and clinical findings present that ultimately proved crucial to making the diagnosis.

MR imaging characteristics associated with spinal infections include T1 hypointense and T2 hyperintense signal in the vertebral body, enhancement or abnormal signal in the intervertebral disc, vertebral endplate destruction with loss of disc height, epidural and/or paravertebral soft-tissue phlegmon, and paraspinal and/or psoas muscle abscess [7]. The psoas sign (T2 hyperintense signal in the psoas musculature) is highly correlated with lumbar discitis-osteomyelitis [7]. Evaluation of the psoas muscles should be integrated into radiologists search pattern, especially if there are abnormal findings in the disc space.

CT may play a complimentary role in ambiguous cases, better depicting osseous anatomy. Given the frequency in which CT is performed in the emergency setting, it is likely that the findings of spondylodiscitis may be initially identified on this modality, potentially on studies performed for an alternative clinical indication. Important CT findings for spondylodiscitis include endplate destruction, erosions, or suspicious fluid collections.

Imaging findings can be elusive and nonspecific in establishing the diagnosis of spondylodiscitis, especially if it is early in the clinical course of the infection. Firstly, many of these imaging features can also be seen with noninfectious causes of back pain such as degeneration or inflammatory spondyloarthropathy. Patients with low back pain almost always have degenerative endplate changes, which may make the interpreting radiologist subconsciously complacent to perceiving subtle endplate destruction. This is compounded by the increasing frequency in which chronic back pain is imaged.

Secondly, lower back pain is often imaged without contrast on MRI, which may also add to decreased sensitivity in detection [7]. Contrast is often not administered for a variety of reasons including vague symptoms, low clinical suspicion, or potential contraindication.

It is critical for interpreting radiologists to have a high index of clinical suspicion. Effective communication between the treating physician and interpreting radiologist is also paramount and may elucidate subtle red flags in patient presentation. All physicians should be on particularly high alert for more significant pathology when a patient returns to the emergency department multiple times in a short interval time period with similar symptoms, as in our case.

In conclusion, there is an unclear clinical significance for spondylodiscitis due to *Actinomyces neuii*. It may have been underreported based on outdated classification systems or dismissed as a contaminant. It may also be more virulent given the chronic symptoms this patient suffered. We may see more reports in the future due to increasing use of the advanced

pathogen identification systems. We seek further cases to be reported so that more insight can be gained into this entity. We also encourage high clinical suspicion for the entity of spondylodiscitis so that proper imaging may be obtained to establish the correct diagnosis. It is especially important that radiologists are highly familiar with this entity since they may be the first to suspect the diagnosis.

Patient consent

Signed consent was obtained from the patient allowing for the case to be published with the patient identity protected.

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