

Nocardial spinal epidural abscess with lumbar disc herniation

A case report and review of literature

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Abstract

Rationale Nocardial spinal epidural abscess is rare. The diagnosis is often difficult to make and, if delayed, poses a high risk of long-term disability. Nocardial spinal epidural abscess with severe lumbar disc herniation has not previously been reported.

Patient concerns A 50-year-old man presented with progressive lumbago and leg pain for 6 weeks after receiving acupuncture therapy, and then the patient suddenly occurred urine retention after walking.

Diagnoses Clinical examination revealed sign of cauda equina syndrome. Magnetic resonance imaging (MRI) revealed a Lumbar(L) 4 to L5 disc herniation, L3 to Sacrum(S)1 epidural abscess, and L2 to S1 paravertebral abscess. The causative organism was *Nocardia farcinica*.

Interventions An urgent paravertebral abscess debridement and right L4 to L5 laminectomy were performed. Simultaneously, the disc tissue protruding into the spinal canal was removed, as well as irrigation and drainage. And antimicrobial treatment was continued for 12 months.

Outcomes Fortunately, the patient was able to walk with a cane and urinate autonomously without a catheter, although this remained difficult 7 days after surgery. After 1 year of treatment, the patient has recovered completely and returned to work.

Lessons Nocardial spinal epidural abscess with severe lumbar disc herniation is extremely rare. Pain from spinal degenerative diseases often masks the early symptoms of spinal infection. It's worth noting that invasive treatment of spine is a way of causing spinal nocardial infection.

Abbreviations: CNS = central nervous system, CT = computed tomography, L = lumbar, MALDI-TOF-MS = matrix-assisted laser desorption/ionization time of flight mass spectrometry, MRI = magnetic resonance imaging, NSAIDs = nonsteroidal anti-inflammatory drugs, S = sacrum, TMP/SMX = trimethoprim/sulfamethoxazole.

Keywords: case report, lumbar disc herniation, nocardia, spinal epidural abscess

1. Introduction

Nocardia species belong to the class Actinomycetes, which are gram-positive, aerobic, weak acid-fast, rod-shaped bacteria first reported by Nocard in 1888.^[1,2] As an opportunistic pathogen, *Nocardia* often infects an immunosuppressed host. Nocardial spinal epidural abscess is rare, and a PubMed search revealed only 10 other cases over the past

50 years.^[3–12] We report an unusual case of a patient with severe lumbar disc herniation combined with a nocardial spinal epidural abscess. We were faced not only with the difficulty of diagnosing the infection but also the challenge of treating it.

2. Case presentation

Our patient was a 50-year-old man with a 5-year history of diabetes mellitus. Two years earlier, at another hospital, he had been diagnosed with a lumbar disc herniation and treated with nonsteroidal anti-inflammatory drugs (NSAIDs) for analgesia. Six weeks before admission he was again treated with NSAIDs and also acupuncture for progressively worsening low back pain and pain in his right leg. However, 2 weeks later, the back pain was continuing to increase; it seemed to differ from the earlier and was accompanied by an intermittent low-grade fever. Computed tomography (CT) of the lumbar spine and hematology laboratory examinations were conducted at the other hospital. An L4 to L5 disc herniation was found and the patient's white blood cell count was $>10.0\text{K}/\mu\text{L}$, but there appeared to be no infection of the lumbar spine. After another week of treatment at the hospital (the specific medications are unclear), the pain was partly relieved and patient's temperature was back to normal. After discharge, the back and leg pain returned. Subsequently, the patient was

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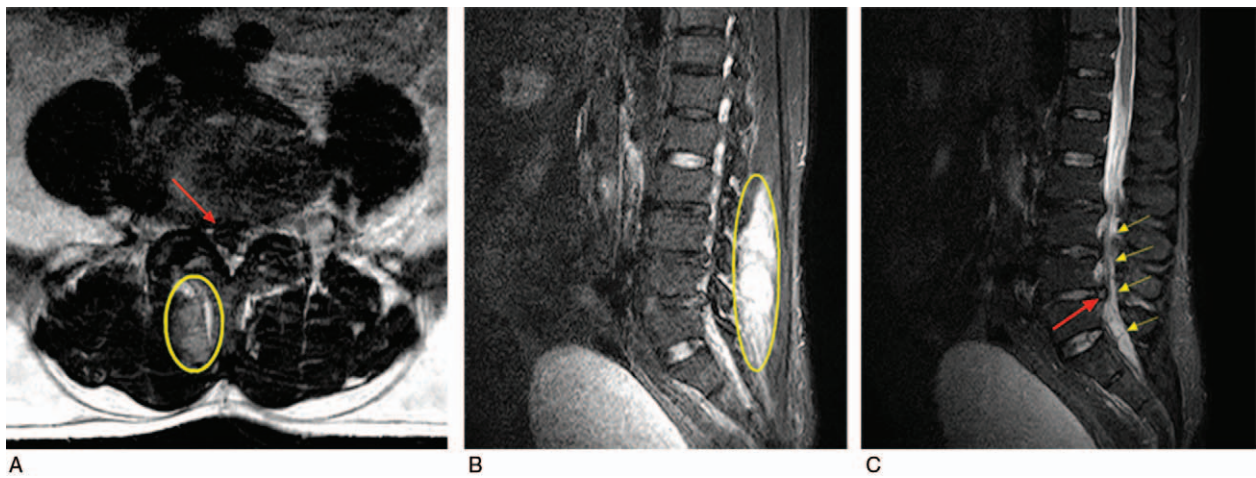


Figure 1. The urgent imaging examination. Axial (A) MRI shows L4 to L5 lumbar disc herniation, and sagittal (B and C) MRIs show epidural and paravertebral abscesses at the L3 to S1 vertebral levels. (Red arrow, yellow circle, and yellow arrow indicate lumbar disc herniation, paravertebral abscess, and epidural abscess, respectively.). MRI=magnetic resonance imaging.

admitted to our hospital with a complaint of urinary dysfunction, but he had no fever or chills at this point.

After the patient's admission, a careful physical examination was performed. It was difficult for the patient to walk, and movement of the lumbar spine was limited. There was obvious lumbar and right paraspinal tenderness, and mild compression induced severe pain. Radiculopathy and weakness of the right lower extremities, with a positive Lasegue sign. Perianal sensation was decreased, contractility of anal sphincter was decreased, and the patient was unable to urinate autonomously. His temperature was 36.5°C.

Magnetic resonance imaging (MRI) of the entire spine was performed immediately after admission, pointing to a L4 to L5 disc herniation, L3 to S1 epidural abscess, and L2 to S1 paravertebral abscess (Fig. 1). Chest radiography and anteroposterior and lateral lumbar spine radiography yielded no

significant results. Analysis of peripheral blood revealed a leukocyte count of $14.0 \times 10^3/\mu\text{L}$, an erythrocyte sedimentation rate of 120 mm/h, and a C-reactive protein of 68.4 mg/L. Multiple blood cultures were uniformly negative both before and after the patient's surgery.

An urgent paravertebral abscess debridement and right L4 to L5 laminectomy were performed. Simultaneously, the disc tissue protruding into the spinal canal was removed, as well as irrigation and drainage. The incision was sutured in layers. The patient was then immediately treated with levofloxacin and ceftriaxone after operation, both broad-spectrum intravenous antibiotics. The biopsy specimens were inoculated on blood plate medium after operation. Three days after surgery, the yellowish colonies were found on the medium (Fig. 2). A Gram stain was performed and the Gram-positive rod was observed. The acid-fast stain showed partially acid-fast bacilli (Fig. 3). The bacterial

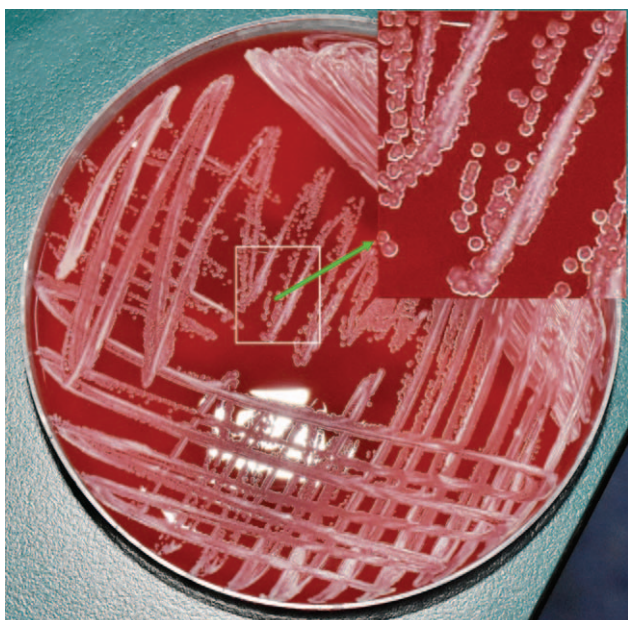


Figure 2. Yellowish colonies were found on the blood plate medium.

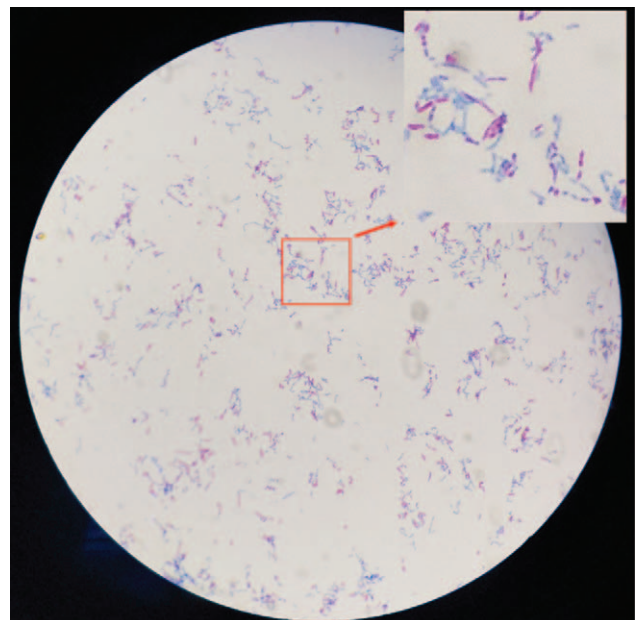


Figure 3. The acid-fast stain showed partially acid-fast bacilli.

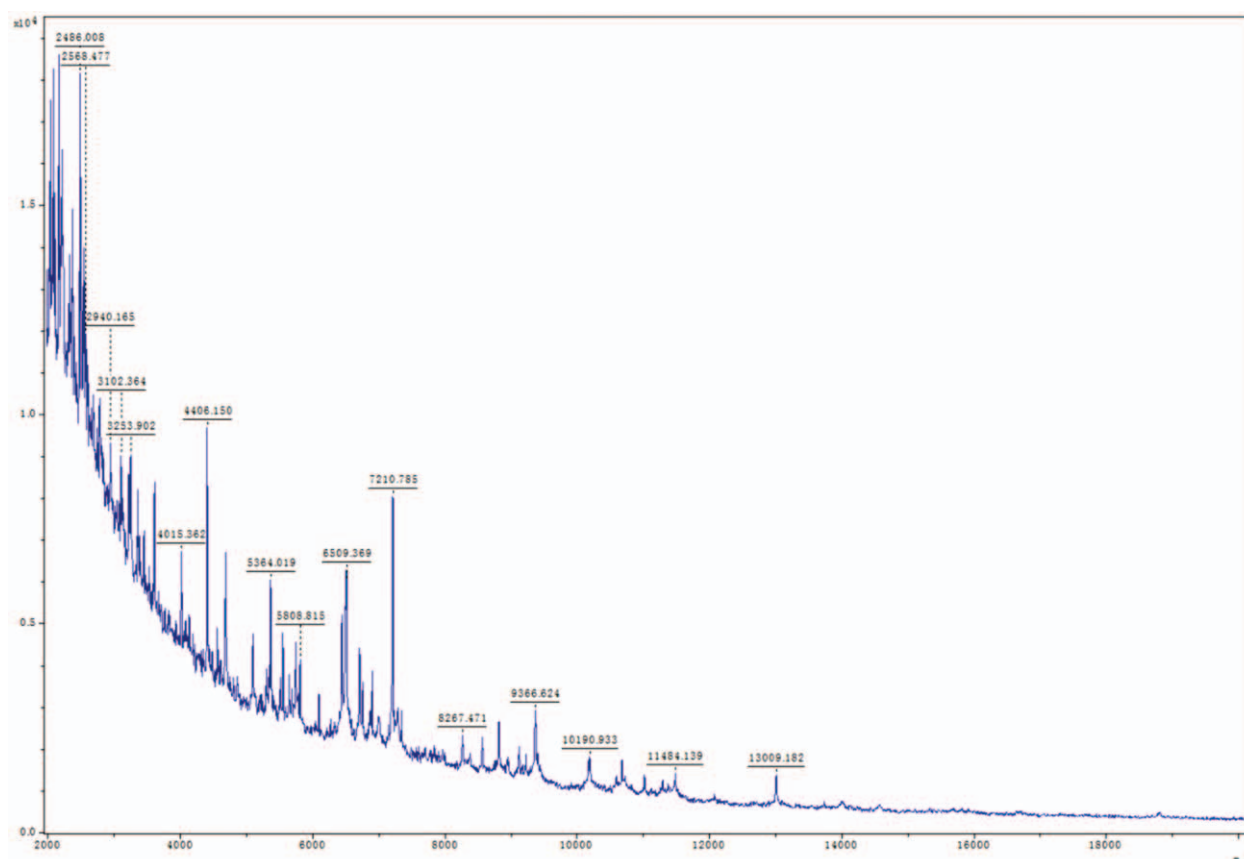


Figure 4. The bacterial protein spectra obtained were analyzed by MALDI-TOF-MS. MALDI-TOF-MS=matrix-assisted laser desorption/ionization time of flight mass spectrometry.

protein spectra obtained were analyzed by the matrix-assisted laser desorption/ionization time of flight mass spectrometry (MALDI-TOF-MS) (Fig. 4) revealed that the causative organism was *Nocardia farcinica*, the antibiotics were switched to intravenous trimethoprim/sulfamethoxazole (TMP/SMX) and levofloxacin for 2 weeks. Oral TMP/SMX and levofloxacin were then continued for the next 2 months. Oral TMP/SMX alone was continued for the last 10 months in a 1-year treatment course.

Fortunately, the patient was able to walk with a cane and urinate autonomously without a catheter, although this remained difficult 7 days after surgery. At the 6-month follow-up, the leg pain was fully relieved, with only mild lower back pain remaining. There was also complete recovery of perianal sensation and the patient was able to urinate normally. No residual abscesses were found on follow-up imaging (Fig. 5). After 1 year of treatment, the patient has recovered completely and returned to work. The patient gave his permission for publication of the case.

3. Discussion

Nocardia is a gram-positive aerobic bacterium; it is partially acid-fast and widely found in soil and rotting plants, but rarely a cause of human infection.^[1,13,14] Since *Nocardia* is an opportunistic pathogen, infections usually occur in immunocompromised hosts who may also have cancer, diabetes, undergone organ or stem cell transplantation, alcoholism, and/or other comorbidities.^[1,2,15] The most frequent sites of primary *Nocardia* infection are the

lungs, infected by inhalation; the central nervous system (CNS) is the most frequent site of nocardial metastasis.^[16] In general, however, nocardial infections are relatively rare.^[8] A report published in 1980 stated that about 500 to 1000 new cases of nocardiosis were found every year in the United States,^[13] but the current prevalence is unclear. A literature review revealed that *Nocardia asteroides* was responsible for most nocardial infection of spine, and *Nocardia brasiliensis*, *Nocardia farcinica*, and *Nocardia beijingensis* were also reported.^[8,16] Currently, *Nocardia* is composed of approximately 86 species, but only one-half of the recognized species are considered pathogenic for humans.^[17]

An epidural abscess due to *Nocardia* is extremely rare. We have seen only 10 case reports from PubMed over the past 50 years (Table 1),^[3–12] and 9 of these 10 patients had potential comorbidities or histories of previous nocardial infections. Alcoholism was present in 3 patients,^[4,6,7] diabetes mellitus and renal transplant were present in 1 patient,^[3] intravenous heroin abuse occurred in 1 patient,^[10] and long-time prednisone use occurred in 1 patient.^[8] Our patient also had a comorbidity of diabetes mellitus. Spinal nocardiosis usually occurred through hematogenous dissemination or a direct spread. Four of the patients in the literature review had histories of previous nocardiosis, which included pulmonary, cutaneous, and soft tissue nocardiosis, created a secondary spine infection.^[3,4,8,9] Most noteworthy, the other 2 patients were diagnosed with nocardial spinal epidural abscess after invasive treatments for degenerative diseases of the lumbar spine.^[11,12] Similarly, our

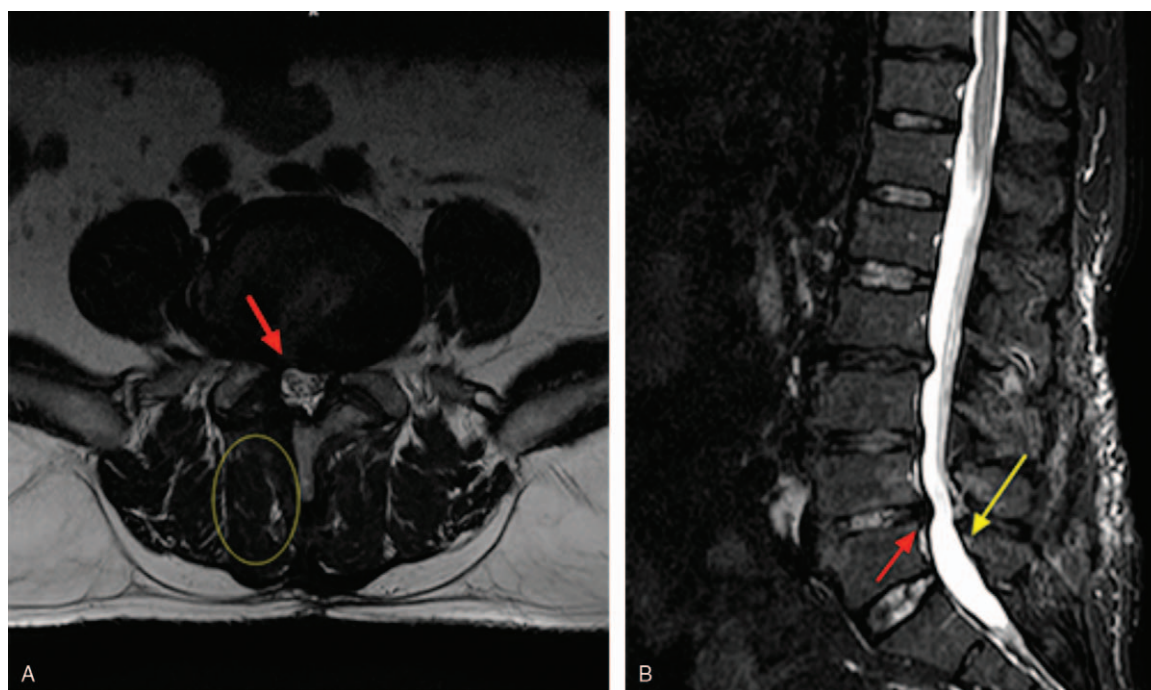


Figure 5. At 6-month follow-up, axial (A) and sagittal (B) MRIs show herniated lumbar disc has been removed and no residual abscess. (Red arrow indicates herniated disc has been removed. Yellow circle and yellow arrow indicates no residual abscess). MRI=magnetic resonance imaging.

patient underwent the acupuncture therapy 6 weeks before admission, and later was diagnosed with paravertebral abscess and nocardial spinal epidural abscess without a positive blood culture. In addition, the lesion location was just within the region

of the acupuncture. It is highly likely that the infection was caused by the acupuncture. Therefore, invasive treatment should be considered as a cause of nocardial spinal epidural abscesses. Also of note, pain from spinal degenerative diseases often masks the

Table 1

Cases of nocardial spinal epidural abscess reported in the literature.

Case	Age/gender, comorbidities and history	Spinal lesion area	Presentation	Surgical procedures	Antibiotics and time	Follow-up and outcome
Awad et al ^[4]	53/M, alcohol dependency, pulmonary nocardiosis	T2–T4 osteomyelitis and epidural abscess	Productive cough, back pain, and leg weakness	T2–T6 laminectomy and T3–T5 fusion	Ampicillin and sulfadiazine for 12 months	Complete neurological function recovery at 12 months follow-up
Siao et al ^[10]	57/M, intravenous heroin abuse	C3–C4 osteomyelitis and C2–C5 epidural abscess	Neck pain and quadriparesis	C2–C4 laminectomy	Minocycline, more than 4 months	No neurological function recovery at 4 months follow-up
Graat et al ^[6]	54/M, alcohol abuse, chronic liver disease, depression, and hypertension	L1–L2 spondylodiscitis, psoas abscesses, and epidural abscess from T11 to L3	Back pain and leg weakness	Multiple partial laminectomies from T11 to L3. laminar hooks from T6 to L3	Ciprofloxacin, sulfadiazine, and fluconazole, more than 2 years	Complete neurological function recovery 3 years after operation
Atalay et al ^[3]	51/M, DM, renal transplant, chronic liver failure and COPD, subcutaneous nocardial	C2–T8 muscles abscess that extended to the epidural space over the third thoracic vertebra	Back pain and leg weakness	Percutaneous catheter	Imipenem and Bactrim for 6 months	Partial neurological function recovery at 6 months follow-up
West et al ^[12]	70/F, lumbar invasive therapies for degenerative disk disease	L3–S1 epidural abscess and paravertebral abscess	Back pain	Left L5 laminotomy	Based on the sensitivity but unclear for 1 year	14 years follow-up
Johnson et al ^[8]	69/M, skin abscesses, long time Prednisone	T1–T9 epidural abscess and thoracic spine vertebrae osteomyelitis	Back pain and stiffness of legs	T3–T8 laminectomy	Minocycline and bacterim for 1 year	No neurological function recovery at 1 year follow-up
Awad et al ^[4]	50/F, no comorbidities	C7–T3 vertebrae osteomyelitis and epidural abscess	Back pain, leg weakness, and cough	Laminectomy	Tetracycline and sulfisoxazole for 1 year	Partial neurological function recovery at last follow-up
Harvey et al ^[7]	39/M, alcoholism	L4 vertebrae osteomyelitis and epidural abscess	Low back pain and cauda equina syndrome	Laminectomy	Amikacin for 8 weeks, ceftriaxone for 6 months, and sulfisoxazole for 1 year	Partial neurological function recovery at 1 year follow-up
Lakshmi et al ^[9]	20/F, multiple subcutaneous back abscesses	Thoracic spinal epidural abscess and paravertebral abscess	Back pain and leg weakness	No surgery was performed	Bactrim	Loss follow-up
Tokumoto et al ^[11]	43/F, L4 to L5 laminectomy for disc herniation	L3 to L5 osteomyelitis and epidural abscess	Leg weakness and pain	Enlarged laminectomy	Amikacin and erythromycin for 1 year	Complete neurological function recovery at 1 year follow-up

C=cervical, F=female, L=lumbar, M=male, S=sacrum, T=thoracic.

early symptoms of spinal infection. So the immunocompromised patients with spinal degenerative disease, who underwent invasive treatment and then presented a pain differ from earlier and an unexplained fever, should be suspected of having a spinal infection.

A nocardial epidural abscess is difficult to diagnose because of its long latency and atypical clinical manifestations. It is generally not found until a neurological deficit ensues. A literature review of 10 cases of nocardial epidural abscess revealed that 9 cases (90%) were accompanied by various degrees of neurological impairment.^[3–11] Nocardiosis in 9 patients was cured after surgery and medical procedures,^[3–8,10–12] but only 3 made complete neurological recoveries (33.3%)^[4,6,11] with high levels of remaining disability. So early diagnosis and timely surgical intervention are extremely important in the management of a nocardial epidural abscess. The pathogenic bacterium is often difficult to identify, although MRI makes the diagnosis of epidural abscess relatively straightforward. The culture is the main method of diagnosing nocardial infection; a positive result is usually obtained within 3 to 5 days without the application of antibiotics. Genotypical identification by amplification and sequencing of a deoxyribonucleic acid fragment coding rRNA 16S and MALDI-TOF-MS may provide us more fast and reliable methods for the diagnosis of *Nocardia*.^[15,16,18]

Once a nocardial epidural abscess is found, immediate surgical treatment is essential.^[19] Although, wide laminectomy and debridement are the most common and effective surgical procedures.^[7] It was reported that part laminectomy or puncture drainage was also effective.^[3,10,12] Our patient presented urinary retention after a short walk. The MRI revealed that the herniated disc occupied half of the space of the spinal canal at the L4 to L5 disc level (Fig. 1). The sudden occurrence of cauda equina syndrome may have been caused by compression due to the abscess, the herniated disc, or both—we cannot be sure. During the surgery, we found that the pus was not sticky and could drain out of the spinal canal easily after part laminectomy. The disc protruded into the spinal canal, which compressed the dura sac and right L5 nerve root. Therefore, right L4 to L5 laminectomy was performed, then the disc tissue protruding into the spinal canal was removed. As a result, satisfactory decompression of the spinal canal and effective abscess drainage were achieved. On the other hand, the spinal stability was preserved and the use of internal fixation was avoided. The patient also achieved good results at the follow-up.

The use of antimicrobial agents is vitally important, whether or not surgical treatment is performed. Sulfonamides have been used for many years as classic antibiotics for the treatment of nocardiosis. Studies reported 10 patients who underwent treatment with sulfonamides; however, one proved to be allergic to this agent and the outcome for another is unknown.^[10,12] It is worth noting that TMP/SMX is active against most *Nocardia* species, but adverse reactions are frequent in the long-term therapy.^[2] Moreover, antimicrobial susceptibility test is crucial for the application of antibiotics. *N farcinica* is susceptible to ciprofloxacin, linezolid, and imipenem.^[17] But it's occasionally resistant to TMP-SMX and commonly resistant to ampicillin, broad-spectrum cephalosporins, clarithromycin, and most of aminoglycosides.^[2,17] Amoxicillin-clavulanic acid is moderately active against many strains of *N asteroides*, *N farcinica*, and *N brasiliensis*, which are the most common species in spine infection.^[1,8,20] Combination therapy is commonly used in the initial treatment of severely ill patients.^[3,6,8] Seven of 10 patients underwent combination therapy according to the previous

report.^[3–8,11] Currently, long-term therapy is the rule, although the optimal duration of treatment is uncertain.^[2] Immunocompetent patients with pulmonary or systemic nocardiosis (non-CNS) should be treated for at least 6 months.^[2,15] Patients with CNS infections, nocardial epidural abscess, and those who are immunocompromised should continue on antimicrobial treatment for at least 12 months.^[2,4–6,15]

In particular, our patient had a spinal epidural abscess accompanied by severe lumbar disc herniation and no imaging findings of vertebrae or intervertebral space infection. In this patient, the posterior longitudinal ligament was disrupted by the herniated disc, which causes a severe compression of the lumbar nerve root and cauda equina. A local nucleotomy was performed to achieve satisfactory decompression during the surgical procedure. However, if the posterior longitudinal ligament is normal and spinal canal decompression can be obtained after laminectomy, nucleotomy should not be performed in order to avoid a secondary disc space or vertebrae infection.

In conclusion, Nocardial spinal epidural abscess, an unusual infection, poses a high risk of neurological impairment. A preliminary diagnosis can be achieved by means of spinal MRI and bacterial culture. Genotypical identification and MALDI-TOF-MS provide us more reliable methods for the diagnosis of *Nocardia*. Timely surgical debridement and a long time of antibiotic therapy were also recommended as before. Antimicrobial susceptibility testing is vitally important for the selection of antibiotics. We reported an extremely rare case with nocardial epidural abscess with severe lumbar disc herniation. We believe this case report can provide some advice for future management.

4. Consent statement

The patient has provided informed consent for publication of the case.

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Writing – review & editing: Chao Tang, De Jun Zhong.

References

- [1] Lerner PI. Nocardiosis. Clin Infect Dis 1996;22:891–903.
- [2] Wilson JW. Nocardiosis: updates and clinical overview. Mayo Clin Proc 2012;87:403–7.
- [3] Atalay B, Azap O, Cekinmez M, et al. Nocardial epidural abscess of the thoracic spinal cord and review of the literature. J Infect Chemother 2005;11:169–71.
- [4] Awad I, Bay JW, Petersen JM. Nocardial osteomyelitis of the spine with epidural spinal cord compression—a case report. Neurosurgery 1984;15:254–6.
- [5] Epstein S, Holden M, Feldshuh J, et al. Unusual cause of spinal cord compression: nocardiosis. N Y State J Med 1963;63:3422–7.

- [6] Graat HC, Van OA, Day GA, et al. *Nocardia farcinica* spinal osteomyelitis. *Spine (Phila Pa 1976)* 2002;27:E253–7.
- [7] Harvey AL, Myslinski J, Ortiz L. A case of nocardia, epidural abscess. *J Emerg Med* 1998;16:579–81.
- [8] Johnson P, Ammar H. *Nocardia brasiliensis* vertebral osteomyelitis and epidural abscess. *BMJ Case Rep* 2013;2013:pii: bcr2012008400.
- [9] Lakshmi V, Sundaram C, Meena AK, et al. Primary cutaneous nocardiosis with epidural abscess caused by *Nocardia brasiliensis*: a case report. *Neurol India* 2002;50:90–2.
- [10] Siao P, McCabe P, Yagnik P. Nocardial spinal epidural abscess. *Neurology* 1989;39:996.
- [11] Tokumoto N, Jacobs RA. Case report: nocardia osteomyelitis. *Am J Med Sci* 1994;307:428–33.
- [12] West KR, Mason RC, Sun M. *Nocardia* spinal epidural abscess: 14-year follow-up. *Orthopedics* 2012;35:e128–31.
- [13] Curry WA. Human nocardiosis: a clinical review with selected case reports. *Arch Intern Med* 1980;140:818–26.
- [14] Palmer DL, Harvey RL, Wheeler JK. Diagnostic and therapeutic consideration in nocardia *acteroideis* infection. *Medicine* 1974;53:391–401.
- [15] Peeters I, Casselman JW, Vandecasteele SJ, et al. Multiple nocardial abscesses of the brainstem and spinal cord diagnosed after an open biopsy through a cervical partial central corpectomy: case report. *J Neurosurg Spine* 2015;23:290–3.
- [16] Rigotti S, Marocco S, Angheben A, et al. The first case of *Nocardia beijingensis* isolated infection to lumbar spine. *J Neurosci Rural Pract* 2015;6:462–3.
- [17] Brown-Elliott BA, Conville PJr, Wallace RJ. Current status of *Nocardia*, taxonomy and recommended identification methods. *Clin Microbiol Newsl* 2015;37:25–32.
- [18] Marín M, Ruiz A, Iglesias C, et al. Identification of *Nocardia* species from clinical isolates using Maldi-T-of Mass spectrometry. *Clin Microbiol Infect* 2018;24:1342.e5–8.
- [19] Graziano GP, Sidhu KS. Salvage reconstruction in acute and late sequelae from pyogenic thoracolumbar infection. *J Spinal Disord* 1993;6:199–207.
- [20] The National Committee for Clinical Laboratory Standards. Susceptibility testing of mycobacteria, nocardiae, and other aerobic actinomycetes. Approved standard. M24-A; 2011.