Intramedullary spinal cord abscess by *Nocardia*: A case report

**Khaled Alshabani, Joseph Adrian L. Buensalido,
Milagros P. Reyes, Ayman O. Soubani**

ABSTRACT

Introduction: *Nocardia* is a Gram-positive bacteria that usually cause opportunistic infections but can affect the immunocompetent host. The central nervous system can be the primary site of infection in up to 40% of the cases but the involvement of the spinal cord is extremely rare.

Case Report: We present a case of a middle age man with history of alcoholic liver cirrhosis and diabetes mellitus who presented with acute lower back pain that is associated with right leg weakness and numbness. Magnetic resonance imaging (MRI) scan showed a spinal cord intramedullary abscess. The cerebrospinal fluid analysis was consistent with meningitis and the organism was eventually identified with CSF culture as *Nocardia Farcinica*. Patient was treated with prolonged intravenous trimethoprim/sulfamethoxazole and meropenem. No neurosurgical intervention was done and the patient had full neurological recovery in few months.

Discussion: *Nocardia* species are able to cause different kinds of disease in man. Spinal cord abscess are extremely rare and high index of clinic suspicion is required for diagnosis. Initial combination intravenous antibiotics treatment is essential and should be continued for at least three to six weeks. Treatment can be switched to oral and continued for a minimum of six months. Surgical intervention might be indicated in some patients. 16s rRNA gene sequencing allows earlier identification and thus adjustment of antibiotics.

Conclusion: This report illustrates that a diagnosis can be made by neuroimaging and cerebrospinal fluid (CSF) 16s ribosomal RNA sequencing, allowing early and effective antibiotic therapy and obviating the need for a high-risk neurosurgical intervention.

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months. **Discussion:** *Nocardia* species are able to cause different kinds of disease in man. Spinal cord abscess are extremely rare and high index of clinic suspicion is required for diagnosis. Initial combination intravenous antibiotics treatment is essential and should be continued for at least three to six weeks. Treatment can be switched to oral and continued for a minimum of six months. Surgical intervention might be indicated in some patients. 16s rRNA gene sequencing allows earlier identification and thus adjustment of antibiotics. **Conclusion:** This report illustrates that a diagnosis can be made by neuroimaging and cerebrospinal fluid (CSF) 16s ribosomal RNA sequencing, allowing early and effective antibiotic therapy and obviating the need for a high-risk neurosurgical intervention.

Keywords: Gram-positive bacteria, Intramedullary abscess, *Nocardia*, Spinal cord

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Khaled Alshabani¹, Joseph Adrian L. Buensalido², Milagros P. Reyes³, Ayman O. Soubani⁴

Affiliations: ¹MD, Wayne State University, Department of Internal Medicine, Detroit, MI, USA; ²MD, Wayne State University, Department of Internal Medicine, Division of Infectious Diseases, Current affiliation: University of the Philippines - Philippine General Hospital, Section of Infectious Diseases, Manila, Philippines; ³MD, FACP, FIDSA, Professor of Medicine, Wayne State University, Department of Internal Medicine, Division of Infectious Diseases, Detroit, MI, USA; ⁴MD, Professor of Medicine, Department of Internal Medicine, Division of Pulmonary and Critical Care Medicine, Detroit, MI, USA.

Corresponding Author: Khaled Alshabani, 4201 St. Antoine, Suite 2E, Detroit, MI 48201, USA; Tel: 1-313-725-0204; Email: kh.alshabani@hotmail.com

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INTRODUCTION

Nocardia is known to be ubiquitous in the environment and is able to cause different kinds of diseases in man, including skin and soft tissue infections, pneumonia, central nervous system (CNS) infection and bacteremia [1]. *Nocardia* infections commonly affect immunocompromised patients and those who are on corticosteroid therapy. The lungs are usually the first organs that are infected, but the CNS eventually becomes

infected in around 40% of cases if the primary infection is left untreated [2]. Brain abscess formation is the most common presentation of *Nocardia* CNS infection. Spinal cord involvement with intramedullary abscess formation is exceedingly rare. We present a rare case of such a neurological involvement as the initial presentation of *Nocardia* infection. We also review literature (Table 1) for this rare presentation [3–12].

CASE REPORT

A 53-year-old Caucasian male with past medical history of alcoholic liver cirrhosis, diabetes mellitus, and hypertension presented to the emergency department with acute onset lower back pain and inability to walk for two days. He also had numbness and weakness in the right leg, urinary retention and constipation. He had not had preceding respiratory or gastrointestinal illnesses or any sick contact. Physical examination was remarkable for weakness in the lower extremities that was worse on the right side, diminished pinprick and vibration sensation below the mid-thighs bilaterally, and hyporeflexia in both legs. He had mild tenderness over the lower lumbar spine.

Initial blood tests included complete blood count, basic metabolic profile, Erythrocyte sedimentation rate, and C-reactive protein were all within normal limits except for thrombocytopenia.

The patient was admitted to the general medical floor and started on intravenous (IV) dexamethasone. Computed tomography (CT) scan of the spine showed no cord compression. However, given the high clinical suspicion, a magnetic resonance imaging (MRI) showed a signal abnormality and enhancement of the spinal cord, including the conus medullaris, consistent with intramedullary abscess (Figure 1).

A lumbar puncture was performed and cerebrospinal fluid analysis (CSF) showed a red blood cell (RBC) count of 1621 RBCs/ μ L, nucleated cells of 4822 WBCs/ μ L with neutrophilic predominance (84% neutrophils), protein of 306 mg/dL, and glucose < 1 mg/dL. The Gram stain was negative. The patient was then started on broad spectrum IV antibiotics.

The initial CSF culture showed Gram-positive bacilli partially acid fast with some branching. Mycobacterium tuberculosis PCR was negative and patient was initiated on intravenous trimethoprim/sulfamethoxazole (TMP/SMX) and meropenem for *Nocardia* double coverage. Patient was evaluated by neurosurgery and it was decided that it was in his best interest not to intervene on the abscess as the risks outweighed the benefits. On day 10 of admission, and using 16s ribosomal RNA gene sequencing, the organism was identified as *N. farcinica*.

The CSF culture was finalized on day 20 of his admission and showed *Nocardia farcinica*, sensitive to TMP/SMX, amikacin, and imipenem, but resistant to ceftriaxone. Patient weakness started to improve slowly towards the end of his admission. He was eventually

Figure 1: Magnetic resonance imaging scan of lumbar spine showing progression of signal abnormality and enhancement consistent with intramedullary abscess (arrow).

discharged to a subacute rehabilitation center on IV antibiotics. A six-month follow-up MRI scan showed resolution of the intramedullary abscess.

DISCUSSION

Nocardia is a Gram-positive bacteria of the actinomycetes group. It is responsible for nocardiosis, an uncommon infection. *Nocardia* species can cause localized or systemic disease usually in immunocompromised patients as an opportunistic infection, but one third of the cases occur in healthy individuals [13].

Nocardia is defined as a complex that includes *N. asteroides* sensu stricto, *N. farcinica*, *N. nova*, and *N. transvalensis* complex. *Nocardia* species are not part of the human flora. They are known to be ubiquitous in the environment [1]. Inhalation is the most common mode of entry and that explains the lung involvement in a majority of the infections. It can also result from trauma-related introduction of the organism [12].

Immunosuppression is a major risk factor for attracting the disease. HIV, malignancies, corticosteroid therapy, organ and hematopoietic stem cell transplantation are the most common causes of immunosuppression leading to *Nocardia* infections. Diabetes mellitus is a prominent risk factor. Alcoholism and COPD are important risk factors for pulmonary nocardiosis [13].

Nocardia species are able to cause different kinds of disease in man, including skin and soft tissue infections, pneumonia, CNS infection and bacteremia. The most common site of primary infection is the lung (up to

70%) [5]. CNS involvement is common in disseminated nocardiosis, but can also be the primary site [9]. CNS involvement can also occur in up to 40% of untreated primary lung lesions [2]. Brain abscess is the most common presentation of CNS nocardiosis [10]. *Nocardia* epidural abscesses have also been described.

Spinal cord involvement with intramedullary abscess formation is exceedingly rare and only ten cases have been reported in literature [3–12]. Our case is number 11. Yenrudi et al. reported a case of disseminated *Nocardia*, but we excluded it because the spinal cord involvement was secondary to thromboses of several blood vessels supplying the spinal cord resulting in widespread myelomalacia and not by direct infection by the organism [14]. Of these cases, six patients were males. The mean age was 58.27 years (SD +/- 16.11). Comorbid conditions were reported in seven cases besides our patient, and included hypertension, diabetes mellitus (in four patients), end-stage renal disease, renal transplant, liver cirrhosis, chronic obstructive pulmonary disease, and ulcerative colitis. One patient was mistakenly diagnosed with allergic alveolitis, but her symptoms were secondary to the pulmonary nocardiosis as he improved dramatically

with *Nocardia* treatment. Table 1 summarizes the main features of these cases.

Antimicrobial susceptibility patterns are variable between different studies, countries and species. Therefore, formal antimicrobial susceptibility testing is always necessary to ensure optimal therapy. There are rapid tests that can identify the organism much faster than culture and knowing the organism itself with these tests, can allow us to pattern our two empiric antibiotics by relying on studies that show the susceptibility profiles of specific species [1]. 16s ribosomal RNA gene sequencing is also a quicker method for coming up with the specific species of *Nocardia*, and thus allowing an earlier and improved empiric therapy while cultures are pending [15], as we did in our case.

Treatments strategies are based on cumulative retrospective experience, as well as in vitro studies, as no prospective randomized trials have been performed to determine the most effective treatment. Given the variable antibiotics resistance of *Nocardia*, empiric coverage with two or three agents in a patient with severe disease is warranted. TMP/SMX is a first line and standard therapy and should be included in these regimens. Combination

Table 1: Characteristics and summary of *Nocardia* intramedullary spinal cord abscess reported in literature

Author and year reported	Patient's age and gender	Extension of nocardiosis	Type of <i>Nocardia</i>	Diagnosis	Treatment	Outcome
Welsh [3] 1957	38 y/o female	Disseminated: lungs, kidneys, pancreas, abdominal wall, brain and spinal cord	<i>N. asteroides</i>	Sputum and cutaneous abscess culture + autopsy	PO Sulfadiazine+ IM streptomycin	Died on hospital day 20
Kampfl [4] 1992	63 y/o male	Primary CNS: multiple cerebral and cervical spinal cord abscesses	<i>N. asteroides</i>	CSF consistent with bacterial meningitis + high titers of serum <i>Nocardia</i> IgG + complete resolution of radiological findings and partial clinical recovery with treatment	TMP/SMX + amikacin	Partial recovery 3 months after discharge
Hiller [5] 1999	56 y/o female	Disseminated: Lung + brain + single spinal cord lesion	<i>N. asteroides</i>	Spinal cord biopsy (consistent with abscess) + BAL Culture positive for <i>Nocardia</i>	IV TMP/SMX	Partial recovery in two months
Mehta [6] 1999	30 y/o female	Disseminated: Lung + Skin + single spinal cord lesion	Not speciated	CSF suggestive of aseptic meningitis + cutaneous abscess culture	TMP/SMX + amoxicillin/clavulanic acid + amikacin + clarithromycin	Partial recovery in 20 days

Table 1: (Continued)

Author and year reported	Patient's age and gender	Extension of nocardiosis	Type of <i>Nocardia</i>	Diagnosis	Treatment	Outcome
Mukunda [7] 1999	52 y/o male	Primary CNS: single spinal cord lesion	<i>N. asteroides</i>	Laminectomy for abscess aspiration and culture	IV TMP/SMX + imipenem	Full recovery in 16 months
Durmaz [8] 2000	59 y/o male	Primary CNS: Brain and spinal cord lesions	<i>N. asteroides</i>	Craniotomy / laminectomy for abscess aspiration and culture	TMP/SMX + amikacin + ceftriaxone	Died on hospital day-12
Hussain [9] 2004	75 y/o female	Primary CNS: multi-loculated lesions	<i>N. asteroides</i>	Laminectomy for abscess aspiration and culture	IV TMP/SMX + cefotaxime	Partial recovery in 10 days
Samkoff [10] 2008	79 y/o male	Disseminated: lung + cervical spinal cord single lesion	<i>N. farcinica</i>	Laminectomy for abscess aspiration and culture	IV TMP/SMX	Partial recovery in 10 days but died at 8 weeks from cardiac arrest
Lee [11] 2010	82 y/o male	Primary CNS; single spinal cord lesion	<i>N. cyriaciagerogica</i>	Laminectomy for abscess aspiration and culture	IV meropenem followed by IV TMP/SMX	Partial recovery in 7 weeks
Hong [12] 2012	54 y/o female	Primary CNS; multiple spinal cord abscess	<i>N. nova</i>	Laminectomy for abscess aspiration and culture + 16s rRNA sequencing	amikacin + cefotaxime + vancomycin followed by amikacin+ cefotaxime	Full recovery in one year
Current report	53 y/o male	Primary CNS: meningitis + single spinal lesion	<i>N. farcinica</i>	CSF culture	IV TMP/SMX + meropenem	Partial recovery at 3rd weeks

† y/o years old

therapy is warranted in severe infections, defined as CNS involvement, disseminated disease, and infections involving more than one site in immunocompromised patients. Agents available for combination therapy include amikacin, imipenem, meropenem, third generation cephalosporins, minocycline, extended spectrum fluoroquinolones (e.g., moxifloxacin), tigecycline, and dapsone [1, 16].

Initial treatment should be administered intravenously for at least three to six weeks and/or until clinical improvement is documented. Treatment can be switched to oral and continued for a minimum of six months and up to 12 months in immunocompromised patients and those with CNS involvement.

Surgical intervention might be indicated in some situations, such as abscesses that do not respond to antibiotic therapy [12]. Prognosis is good in general, even in disseminated cases, if therapy is initiated early and continued for appropriate duration.

High index of suspicion of *Nocardia* infection is necessary in patients with suggestive neuroimaging. Spinal tap and stains and cultures for *Nocardia* are important part of the work up, but 16s rRNA allows earlier identification of the specific species, allowing adjustment of antibiotics, given the distinctly variable antibiotic susceptibilities of *Nocardia* species. A multidisciplinary approach that includes infectious disease, neurosurgical and neurological specialists is essential for early diagnosis and appropriate management of these patients.

CONCLUSION

This report describes a rare case of *Nocardia* intramedullary spinal abscess. It illustrates that a diagnosis can be made by neuroimaging and CSF 16s ribosomal RNA, with subsequent CSF culture confirmation. Appropriate antibiotic therapy was

effective and resulted in significant recovery and obviated the need for a high-risk neurosurgical intervention.

Author Contributions

Khaled Alshabani – Substantial contributions to conception and design, Acquisition of date, Analysis and interpretation of date, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Joseph Adrian L. Buensalido – Substantial contributions to conception and design, Acquisition of date, analysis and interpretation of date, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Milagros P. Reyes – Substantial contributions to conception and design, Analysis and interpretation of date, Revising the article critically for important intellectual content, Final approval of the version to be published

Ayman O. Soubani – Substantial contributions to conception and design, Analysis and interpretation of date, Revising the article critically for important intellectual content, Final approval of the version to be published

Guarantor

The corresponding author is the guarantor of submission.

Conflict of Interest

Authors declare no conflict of interest.

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