Case Report

Brain abscess caused by *Nocardia asiatica*

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Abstract

**Background:** *Nocardia* infection of the central nervous system leading to brain abscess is a rare condition but has a high mortality rate. Among the species of *Nocardia*, only three cases of brain abscess due to *Nocardia asiatica* infection have been reported.

**Case Description:** A 65-year-old man with a history of autoimmune hemolytic anemia treated with prednisolone (10 mg/day for years) presented to our hospital because of occipital headache. Brain magnetic resonance imaging showed bilateral occipital lesions. The patient underwent craniotomy and resection of the left occipital lobe lesion. *N. asiatica* was identified by 16S rRNA sequencing of the resected specimen. Treatment with trimethoprim/sulfamethoxazole led to a complete resolution of the brain lesion.

**Conclusion:** Because of the different antimicrobial sensitivity patterns among *Nocardia* species, both appropriate subtyping and susceptibility testing of uncommon species such as *N. asiatica* are required for the successful treatment of nocardial infections.

**Key Words:** Brain abscess, *Nocardia asiatica*, 16S rRNA

INTRODUCTION

*Nocardia* infection of the central nervous system (CNS) leading to brain abscess is rare but has a high mortality rate. The recent development of 16S ribosomal RNA (rRNA) sequencing allowed the identification of *Nocardia asiatica* in 2004. Since then, several cases of *N. asiatica* infections have been reported; however, only three cases of brain abscess have been reported. Here, we describe a case of brain abscess due to *N. asiatica* infection in a patient on steroid therapy for autoimmune hemolytic anemia. In addition, we provide a review of the literature on similar cases.

CASE REPORT

A 65-year-old man with a history of autoimmune hemolytic anemia treated with prednisolone (10 mg/day for years) presented to our hospital because of occipital headache of 1-week duration. There was no fever and his neurological examination findings were normal. The results of the laboratory tests performed on admission were normal. Brain magnetic resonance imaging (MRI) showed bilateral occipital lesions. The central part of the mass was hypointense on T1-weighted imaging (T1WI) and hyperintense on T2-weighted imaging (T2WI) [Figure 1a and b]. The peripheral rim was isointense on T1WI and hypointense on T2WI [Figure 1a and b].
For these reasons, 16S rRNA sequencing species are gram-positive, partially acid-fast, and species 

Antibiotic susceptibility. [1,19]

The coalescence of multiple daughter abscesses results in the formation of multiloculated abscesses. [14] Nocardia brain abscess carries mortality rates of 55% and 20% in immunocompromised

**DISCUSSION**

Nocardia species are gram-positive, partially acid-fast, and strictly aerobic branching filamentous bacteria. [9] Nocardia infections occur more frequently in immunocompromised individuals, including those with acquired immune deficiency syndrome, lymphoma, bone marrow transplant, low CD4 T-lymphocytes, and immunosuppressive drug therapy, such as with tumor necrosis factor inhibitors or glucocorticoid steroids. [1,2,9,10] Because of their branching filamentous forms resembling fungal hyphae, Nocardia were previously misclassified as fungi. [9] Because growth on specific media for mycobacteria, acid-fast bacilli, and colony morphology sometimes may result in the confusion of Nocardia and Mycobacterium. [13] 16S rRNA sequencing has been used to differentiate these bacteria. [3] Antimicrobial sensitivity patterns and disease phenotypes also differ among the various Nocardia species. [10] For example, N. farcinica is more resistant to antimicrobial agents and has a higher risk of dissemination and CNS nocardiosis. [1,19] For these reasons, 16S rRNA sequencing combined with antimicrobial susceptibility testing has been used to identify Nocardia subtypes, which is necessary for effective treatment.

CNS nocardiosis most frequently manifests as brain abscesses, however, in rare cases as meningitis or spinal cord infections. [21] Nocardia brain abscess accounts for only 2% of all brain abscesses. [2,14] Their clinical course is typically gradual and insidious over months, or even years, making early diagnosis and identification difficult. [9] The lesions are usually supratentorial (57%) rather than infratentorial. [11] Multiple abscesses are reported in 38% of the patients with CNS nocardiosis. [11] The coalescence of multiple daughter abscesses results in the formation of multiloculated abscesses. [14]
Table 1: Reported cases of brain abscess due to Nocardia asiatica

| Case no. | Author (year) | Patient age, years | Sex | Brain abscess | Other site | Underlying disease | Surgery for brain abscess | Antibiotics administered | Outcome |
|----------|---------------|-------------------|-----|---------------|------------|-------------------|---------------------------|------------------------|---------|
| 1        | Wakui et al. (2008) | 73 | M | Single | No | No | Aspiration→Recurrence after 2 days→Excision | MINO + TMP/SMX | Alive |
| 2        | Ryu et al. (2009) | 44 | F | NR | No | Guillain-Barré syndrome | Excision | IPM/CS + TMP/SMX→Changed to MINO because of DIP | Alive |
| 3        | El-Herte et al. (2012) | 49 | M | Multiple | Anterior mediastinum | Myasthenia gravis, Malignant thymoma | No | TMP/SMX, AMK, IMP | Alive |
| 4        | Present case | 65 | M | Multiple | Lung | Autoimmune hemolytic anemia | Excision | CTRX→TMP/SMX | Alive |

M: male, F: female, TMP/SMX: trimethoprim/sulfamethoxazole, IMP: imipenem, IPM/CS: imipenem/cilastatin, AMK: amikacin, MINO: minocycline, CTRX: ceftriaxone, DIP: drug-induced pneumonia, NR: not reported

and immunocompetent patients, respectively. These rates are higher than those associated with other bacterial brain abscesses (10%). In case of multiple abscesses, the mortality rate rises to 66%.[11]

The standard medical treatment for Nocardia brain abscesses is trimethoprim/sulfamethoxazole.[11] Aspiration or surgical excision may be indicated for abscesses >2.5 cm. Craniotomy and excision of the entire abscess and capsule are more effective than aspiration and drainage, particularly when the abscess is resistant to antimicrobial agents.[11]

Diagnosis is mainly based on bacteriological cultures; 82% of patients are diagnosed with cultures of aspirates from the site of infection, 31% based on the biopsy specimen, and 8.3% following cerebrospinal fluid (CSF) culture.[11] However, the slow growth of Nocardia species and contamination of the cultures by other, faster-growing bacteria frequently lead to a delayed diagnosis.[11,10] Moreover, the demonstration of Nocardia in a CSF culture is usually difficult because empirical therapy is typically initiated before the CSF is collected. Lumbar puncture is contraindicated in patients with brain abscess because of the risk of brain herniation. These features of Nocardia infection support the utility of 16S rRNA sequencing for the rapid identification of Nocardia species.

Sequencing of the 16S rRNA gene of Nocardia has become a valuable tool for accurate species-level identification. In fact, application of this method has resulted in the identification of new species of Nocardia.[14] Of these, N. asiatica was first described in 2004, following its isolation from patients in Japan and Thailand.[17] Since then, N. asiatica has been identified in patients with pulmonary infections, skin infections, and brain abscess; these cases have been documented both inside and outside of Asia.[5,6,8,12,15-18] However, to date, only four cases of N. asiatica brain abscess, including the present case, have been reported in the literature (Table 1).[5,15,18] In three of these patients, including our patient, the capsule was excised. The long-term survival of all patients was achieved by antibiotic treatment, mainly trimethoprim/sulfamethoxazole.

In summary, the appropriate subtyping and susceptibility determination of uncommon species of Nocardia, such as N. asiatica, are necessary for the treatment of nocardial infections.

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Conflicts of interest
There are no conflicts of interest.

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