



Case report

Miliary cerebrospinal lesions caused by *Nocardia beijingensis* in an immunocompetent patient



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ARTICLE INFO

Article history:

Received 20 February 2020

Received in revised form 27 February 2020

Accepted 27 February 2020

Keywords:

Nocardia beijingensis

Brain abscess

Miliary cerebrospinal lesions

Brain biopsy

16S ribosomal RNA sequencing

ABSTRACT

The genus *Nocardia* usually infect immunocompromised patients. Pulmonary nocardiosis is the most common *Nocardia*-induced infection while central nervous system (CNS) is the most common extrapulmonary site to develop nocardial disease. Approximately 54 % cases of previously reported nocardial brain abscesses were solitary lesions, while 38 % cases had multiple lesions; but miliary-like ring enhancing lesions have not been reported previously.

We present a case of immunocompetent patient with miliary-like cerebrospinal lesions caused by *Nocardia beijingensis*. A 68-year-old Japanese man presented with acute-onset headache, vomiting, and progressive disturbance of consciousness. A contrasted magnetic resonance imaging (MRI) scan showed countless miliary-like ring-shaped enhancing lesions on the patient's whole brain, brain stem, and cervical spinal cord. A brain biopsy was performed and Kinyoun stain suggested that the brain lesions were abscesses caused by *Nocardia* species. 16S ribosomal RNA sequencing identified *Nocardia beijingensis* as the causative microorganism. The trimethoprim/sulfamethoxazole regimen was continued for 7 months and the patient showed good improvement with recovery of consciousness.

Clinical manifestation of *Nocardia beijingensis* infection is poorly studied. Further cases are needed to be accumulated.

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Introduction

The genus *Nocardia* comprise more than 50 species of gram-positive, aerobic bacilli. They usually infect immunocompromised patients and cause nocardiosis, but up to one-third of the patients with nocardiosis are immunocompetent. Pulmonary nocardiosis is the most common *Nocardia*-induced infection, acquired primarily through inhalation of the bacteria, following which, they colonize different tissue by hematogenous dissemination. Central nervous system (CNS) is the most common extrapulmonary site to develop nocardial disease [1].

Nocardia beijingensis was first isolated from soil samples in China in 2001 [2]. Several cases of *N. beijingensis* infection have been reported from Asia, including Japan [3]. We herein present a case of immunocompetent patient with miliary-like cerebrospinal lesions caused by *Nocardia beijingensis*.

Case report

A 68-year-old Japanese man, a former employee of a petrochemical plant presented with a 1-month history of appetite loss and acute-onset headache, vomiting, and progressive disturbance of consciousness. He had no comorbid disease.

On admission the patient was afebrile, with stable vital signs. He had no verbal response but could move to localized pain. His eyes were open and deviated upward, and bilateral light reflex was slow. No other neurological abnormality was noted. Results of laboratory tests showed leucocytosis (white blood cells [WBC], 12,500/mm³), normal renal and liver functions, low sodium level (124 mEq/L), and elevated C-reactive protein level (2.42 mg/dL). HbA1c level was within normal range, and the result of human immunodeficiency virus antibody test was negative.

A contrast magnetic resonance imaging (MRI) scan showed countless miliary-like ring-shaped enhancing lesions on the patient's whole brain, brain stem, and cervical spinal cord (Fig. 1). Computed tomography (CT) scan showed right middle lobe atelectasis (Fig. 2). A lumbar puncture was performed and

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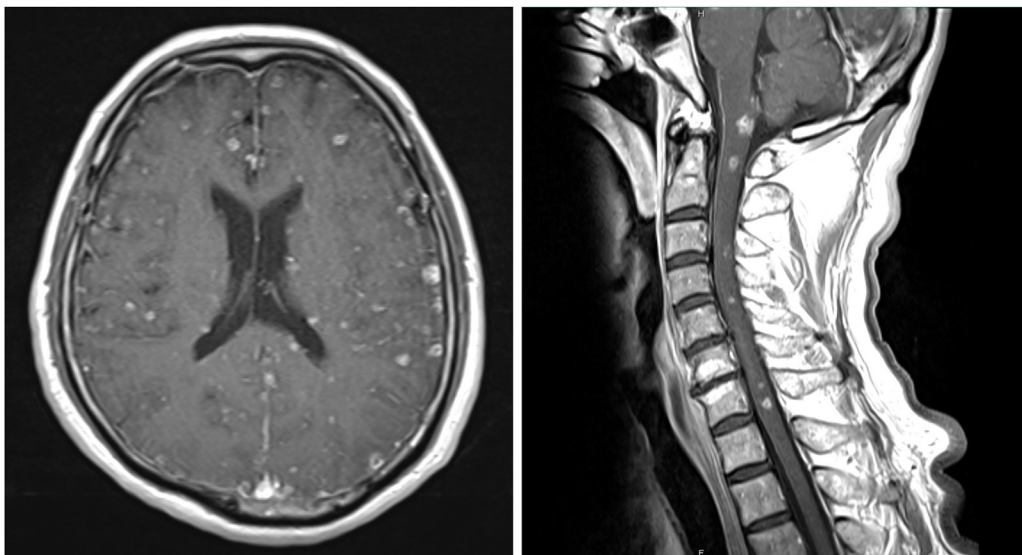


Fig. 1. Gadolinium-enhanced T1-weight imaging showed countless miliary-like ring-enhancing lesions on the patient's whole brain, brain stem, and cervical spinal cord.



Fig. 2. Computed tomography (CT) scan showed right middle lobe atelectasis.

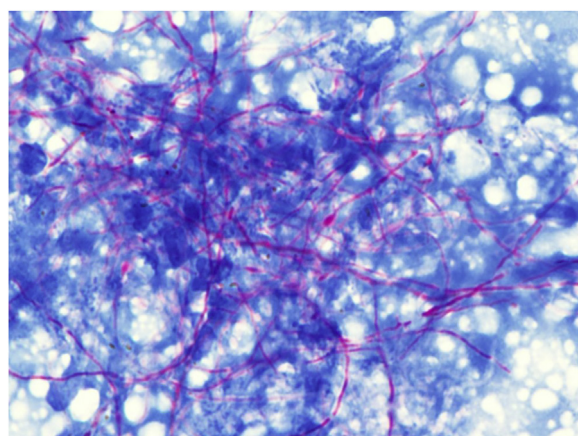


Fig. 3. Kinyoun stain of the brain specimen revealed that the brain lesions were abscesses caused by *Nocardia* species.

analysis of the cerebrospinal fluid (CSF) sample presented the following results: WBC count, $19/\text{mm}^3$; mononuclear cells, 52 %; polymorphonuclear cells, 48 %; protein, 173 mg/dL; and glucose, 73 mg/dL (blood glucose, 161 mg/dL). Results of both gram staining and Ziehl-Neelsen staining were negative.

Empiric antibacterial and antiviral therapy with meropenem, vancomycin, and acyclovir were started despite the idiopathic etiology of the multiple brain lesions. His consciousness improved gradually over the next few days. On day 5, intravenous meropenem and vancomycin administration was discontinued owing to negative results of blood and CSF cultures. However, a follow-up brain MRI scan showed increase in the number of brain lesions. The patient's level of consciousness worsened again, and on day 20, he nearly stopped breathing. He was orotracheally intubated and underwent an urgent brain CT scan, which showed severe brain oedema. Glycerol and methyl prednisolone were administered. On day 25, a brain biopsy was performed. On histopathological examination, the surface of the lesion appeared cream-colored, and Kinyoun stain suggested that the brain lesions were in fact abscesses caused by *Nocardia* species (Fig. 3). The patient was started on meropenem and trimethoprim/sulfamethoxazole. On day 28, the patient was extubated as his level of consciousness

improved gradually. Molecular detection of the pathogen using 16S ribosomal RNA sequencing identified *Nocardia beijingensis* as the causative microorganism, with susceptibility to trimethoprim/sulfamethoxazole. Therefore, the trimethoprim/sulfamethoxazole regimen was continued for an additional 7 months. Although mild confusion and irritability was noted, the patient was discharged to another hospital for long-term care.

Discussion

Approximately 54 % cases of previously reported nocardial brain abscesses were solitary lesions, while 38 % cases had multiple lesions [4]. However, findings of countless miliary-like ring-shaped enhancing lesions have not been reported previously. Similar brain lesions are also seen in patients with miliary tuberculomas. Presumably, the perivascular spread of CSF infection can form one or more lesions, while hematogenous dissemination can result in more diffusely scattered lesions in patients with nocardiosis, similar to that observed in patients with tuberculosis [5]. Differential diagnoses of such lesions include malignancy, toxoplasmosis, tuberculosis, fungal infection, and cysticercosis. A brain

biopsy is essential to confirm the diagnosis and to identify the etiological species of *Nocardia* because some species are trimethoprim/sulfamethoxazole resistant. 16S ribosomal RNA sequencing is useful for species identification.

The patient had previously worked in a petrochemical plant and may have had a risk of inhaling air contaminated with soil bacteria. Clinical manifestation of *Nocardia beijingensis* infection is poorly studied; therefore, miliary cerebrospinal lesions cannot be considered pathognomonic of *Nocardia beijingensis* nocardiosis. Further cases are needed to be accumulated.

Author statement

Hajime Tanaka: Writing – Original Draft.
Katsunari Kiko: Writing – Reviewing and Editing.
Yudai Watanabe: Investigation.
Takashi Yaguchi: Investigation.
Shigeru Oya: Writing – Reviewing and Editing, Supervision.
Toshiaki Shiojiri: Writing – Reviewing and Editing, Supervision.

Patient consent

Patient consent has been obtained for publication of this case report.

Ethical approval

Not required.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of Competing Interest

The authors declare no conflicts of interest associated with this manuscript.

Acknowledgement

This work was partly supported by the National Bio-Resource Project, Japan (<http://www.nbrp.jp/>).

We would like to thank Editage (www.editage.com) for English language editing.

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