Disseminated *Nocardia* infection with a lesion occupying the intracranial space complicated with coma: a case report

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**Abstract**

**Background:** Disseminated *Nocardia* infection is a disease that is easily overlooked in patients with lesions occupying the intracranial space complicated with coma. Early diagnosis and treatment are crucial.

**Case presentation:** A 65-year-old man was admitted to the First Affiliated Hospital of Zhejiang University in October 2018 with weakness in the right limbs for 3 days and altered consciousness for 1 day. Five months earlier, he had been diagnosed with membranous kidney disease and had received cyclophosphamide and prednisone. At admission, the white blood cell count was 1.37 x 10^10/L (with 86.4% neutrophils), and C-reactive protein was 115.60 mg/L. Imaging examinations revealed a lesion occupying the intracranial space, lung infection, and multiple abscesses in the rhomboid muscle. The abscesses were drained. Pus culture confirmed *Nocardia cyriacigeorgica* infection. With antibiotics and vacuum-sealed drainage of the back wound, the patient improved and was discharged from the hospital.

**Conclusions:** This case report shows that infection should be considered during the differential diagnosis of lesions in the intracranial space, especially in patients receiving immunosuppressive treatment. In patients with disseminated *N. cyriacigeorgica* infection, combination antibiotic therapy and surgical drainage of localised abscesses can be effective.

**Keywords:** *Nocardia cyriacigeorgica*, Intracranial occupying lesion, Antibiotic therapy, Surgical drainage

**Background**

*Nocardiosis* is an acute, subacute, or chronic infectious disease that may be localised or disseminated; it is characterised by suppurative or granulomatous inflammation. It is usually diagnosed in adults aged 30–50 years, with male predominance, and mostly affects individuals with severe immune dysfunction [1, 2]. Patients mostly present with non-specific features such as fever, cough with expectoration, chest pain, fatigue, poor appetite, high white blood cell and neutrophil counts, and elevated blood inflammatory indices (C-reactive protein, calmodulin). The diagnosis is therefore easily missed [3]. Confirmation of diagnosis requires isolation of *Nocardia* bacteria from blood, sputum, pus, drainage, tissue, or cerebrospinal fluid specimens. We report a rare case of disseminated *Nocardia cyriacigeorgica* infection in an immunosuppressed man that was successfully managed with a combination of antibiotic therapy and surgery.

**Case presentation**

A 65-year-old man was admitted to the First Affiliated Hospital of Zhejiang University in October 2018, with weakness in the right limbs for 3 days and altered consciousness for 1 day. Five months earlier, he had been diagnosed with membranous kidney disease and had received cyclophosphamide and prednisone. At admission, the white blood cell count was 1.37 x 10^10/L (with 86.4% neutrophils), and C-reactive protein was 115.60 mg/L. Imaging examinations revealed a lesion occupying the intracranial space, lung infection, and multiple abscesses in the rhomboid muscle. The abscesses were drained. Pus culture confirmed *Nocardia cyriacigeorgica* infection. With antibiotics and vacuum-sealed drainage of the back wound, the patient improved and was discharged from the hospital.

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consciousness for 1 day (Fig. 1). Three days earlier, he
developed sudden weakness and numbness in the right
limbs, accompanied by slurred speech and deviation of
the mouth to the left. At that time, he had no disturb-
ance of consciousness, jaundice, headache, or dizziness.
Computed tomography (CT) at the local hospital
showed a circular low-density area in the left thalamus
and midbrain. Acute cerebral infarction was suggested,
and the patient was started on antiplatelet drugs. How-
ever, his condition worsened over the next 2 days and he
developed fever (maximum body temperature, 38.7°C)
and altered consciousness. Skull magnetic resonance im-
ageing (MRI) showed a lesion occupying the intracranial
space (Fig. 2), and the patient was transferred to our
hospital for further management.

The patient had been diagnosed with membranous
kidney disease 5 months earlier and had received cyclo-
phosphamide (cumulative dose, 1.8 g) with prednisone
(48 mg once daily for 4 months, followed by 32 mg once
daily for 1 month). A month earlier, he had been hospi-
talised in a local hospital for treatment of a lung infec-
tion. In addition, he complained of swelling and pain in
his left upper back and neck 5 days prior, and B-mode
ultrasonography at a local hospital revealed multiple ab-
scesses in the left rhomboid muscle.

The patient had cough and expectoration. The phlegm
was white mucilaginous sputum. On auscultation,
laboured breathing in both the lungs, with no dry or wet
rales, was observed. Upon admission to our hospital, his
blood examination findings were as follows: white blood
cell count, 1.37 × 10^10/L (with 86.4% neutrophils); serum
creatinine, 45 μmol/L; urea, 5.77 mmol/L; hypersensitive
C-reactive protein, 115.60 mg/L; procalcitonin, 0.25 ng/
ml; serum albumin, 30.4 g/L; total bilirubin, 23.9 μmol/
L; indirect bilirubin, 17.0 μmol/L; serum glutamic pyru-
vic transaminase, 99 U/L; serum glutamic oxaloacetic
transaminase, 142 U/L; and lactic dehydrogenase, 371 U/
L. The cerebrospinal fluid appeared normal.

Soft fluctuant swellings, 5 cm in diameter with an un-
clear boundary, were present on his right back, left
shoulder, and back. The overlying and surrounding skin
were red. We found multiple abscesses in the muscle
layer on B-mode ultrasonography. The clinical and ultra-
sonographic findings were suggestive of multiple ab-
cases. Under local anaesthesia, a needle was inserted
into the abscess cavity on the back, and greyish-white
purulent fluid was aspirated. Microbiological examin-
ation of the fluid revealed a small number of gram-
positive acid-fast bacterial cells. Samples were incubated
at 35°C on Columbia Blood Agar for 3 days. N.
**Discussion and conclusions**

*Nocardia* is a genus of gram-positive aerobic bacteria belonging to the order Actinomycetes. *Nocardia* is widely distributed in soil and water but is not part of the normal human flora [4]. To date, 92 strains have been found in the genus *Nocardia*, among which the main pathogens are *N. asteroides*, *N. brasiliensis*, and *N. farcinica* [5, 6]. The infection is usually confined to the lungs, followed by the skin and other sites. Infection of the brain is relatively rare [7]. Patients with immunodeficiencies are more likely to develop nocardiosis [7]. In a multicentre study in China, *N. cyriacigeorgica* was the second most common species of *Nocardia* and no cases of intracranial infection were identified [8]. Although intracranial infections caused by *N. cyriacigeorgica* are rare, they are still reported in patients with human immunodeficiency virus infection or diabetes [8, 9].

Antibiotics reported to be effective against *Nocardia* include sulphonamides, aminoglycosides, carbapenems, quinolones, and tetracycline. High-dose, long-course trimethoprim–sulfamethoxazole is the first choice. However, resistance to sulphonamides is being increasingly reported; thus, it should ideally be provided in combination with two or more different kinds of antibiotics. In vitro drug sensitivity tests show that the multi-drug resistant *Nocardia* is sensitive to linezolid and is therefore...
recommended for treatment of patients with severe or disseminated disease, allergy to sulphonamides, or poor response to other drugs [10, 11]. Meropenem was also recommended as the disease has a tendency to progress. Meanwhile, the dose and duration of antibiotic treatment depend on the site of infection and the patient’s immune status. For patients with severe disseminated infection involving the central nervous system, combination treatment should be considered [12]. Three-drug antimicrobial therapy (meropenem, linezolid, and trimethoprim–sulfamethoxazole) was suggested for patients with disseminated Nocardia infection (including lesions occupying the intracranial space) [13]. Prognosis is related to the severity of the underlying disease, the site of infection, the patient’s immune function, the presence of drug resistance, and the timeliness of institution of treatment.

Herein, we report a case of disseminated nocardiosis in China caused by N. cyriacigeorgica. This patient was successfully managed with a combination of antibiotic therapy and surgical drainage. The prognosis of nocardiosis is good with comprehensive treatment. We have summarised several points of experience. First, it is very important to conduct a careful physical examination in the clinic. Second, back abscesses should be punctured and drained in time with a bacterial smear and culture performed. Early diagnosis is crucial. Third, a strong combination of antimicrobial therapy and surgical drainage is very important for treating disseminated Nocardia infection. Finally, Nocardia infection should be considered during the differential diagnosis of a lesion occupying the intracranial space, especially in an immunosuppressed patient.

**Fig. 3** Treatment of the back abscess. **a**: Incision of back abscess; **b**: drainage of back abscess; **c**: appearance of the aspirated fluid. **d**: Gram’s stain of the aspirated pus showing a large number of white blood cells along with a small number of gram-positive bacteria (white arrow). **e**: Weak acid-fast staining (white arrow). **f**: Growth of a large number of colonies on the medium.

**Abbreviations**

CT: Computed tomography; MRI: Magnetic resonance imaging; TMP-SMZ: Trimethoprim–sulfamethoxazole

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**Authors’ contributions**

LJL, MHY, and XXW conceptualised the study and organised the manuscript. JDJ, CLZ, JF, and JQS participated in data collection. MHY, XXW, CLC, and SJT drafted the manuscript. All authors have read and approved the final manuscript.

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**Availability of data and materials**

All data and materials are available in the manuscript.
Ethics approval and consent to participate
This study was part of our clinical work. The study fulfilled the principles of the Declaration of Helsinki. Written informed consent was obtained from the patient.

Consent for publication
Written informed consent was obtained from the patient for publication of this case report.

Competing interests
The authors declare that they have no competing interests.

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References
1. Mahajan KR. Disseminated nocardiosis with cerebral and subcutaneous lesions on low-dose prednisone. Pract Neurol. 2019;19:62–3.
2. Steinbrink J, Leavens J, Kauffman CA, Miceli MH. Manifestations and outcomes of nocardia infections: comparison of immunocompromised and nonimmunocompromised adult patients. Medicine (Baltimore). 2018;97:e12436.
3. Wu J, Wu Y, Zhu Z. Pulmonary infection caused by Nocardia cyriacigeorgica in a patient with allergic bronchopulmonary aspergillosis: a case report. Medicine (Baltimore). 2018;97:e13023.
4. Han HJ, Kwak MJ, Ha SM, Yang SJ, Kim JD, Cho KH, et al. Genomic characterization of Nocardia seriolae strains isolated from diseased fish. Microbiologyopen. 2019;8:e00656.
5. Rahdar HA, Azadi D, Shojaii H, Daei-Naser A. Molecular analysis and species diversity of Nocardia in the hospital environment in a developing country, a potential health hazard. J Med Microbiol. 2017;66:334–41.
6. Takiguchi Y, Ishizaki S, Kobayashi T, Sato S, Hashimoto Y, Suruga Y, et al. Pulmonary nocardiosis: a clinical analysis of 30 cases. Intern Med. 2017;56:1485–90.
7. Woodworth MH, Saullo JL, Lantos PM, Cox GM, Stout JE. Increasing Nocardia incidence associated with bronchiectasis at a tertiary care center. Ann Am Thorac Soc. 2017;14:347–54.
8. Khorshidi M, Navid S, Azadi D, Shokri D, Shojaii H. A case report of brain abscess caused by Nocardia cyriacigeorgica in a diabetic patient. JMM Case Rep. 2018;5:e005133.
9. Barraud G, Deschamps C, Manceron V, Mortier E, Laurent F, Bert F, et al. Brain abscess caused by Nocardia cyriacigeorgica in a patient with human immunodeficiency virus infection. J Clin Microbiol. 2005;43:4895–7.
10. Huang L, Chen X, Xu H, Sun L, Li C, Guo W, et al. Clinical features, identification, antimicrobial resistance patterns of Nocardia species in China: 2009-2017. Diagn Microbiol Infect Dis. 2019;94(2):165–72.
11. Farooqui F, Irfan S, Shaoor S, Zafar A. Antimicrobial susceptibility and clinical characteristics of Nocardia isolates from a tertiary care Centre diagnostic laboratory in Pakistan. J Glob Antimicrob Resist. 2018;15:219–21.
12. Wilson JW. Nocardiosis: updates and clinical overview. Mayo Clin Proc. 2012; 87:403–7.
13. Garcia RR, Bhanot N, Min Z. A mimic’s imitator: a cavitary pneumonia in a myasthenic patient with history of tuberculosis. BMJ Case Rep. 2015;2015: bcr2015210264.

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