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*Case Report*

# A rare case of cerebellar abscess caused by *Nocardia cyriacigeorgica*

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## ABSTRACT

**Background:** Gram-positive opportunistic bacteria of the *Nocardia* species are responsible for a large spectrum of infections, such as pneumonia, skin infections, and more widespread conditions, including brain abscesses.

**Case Description:** A 67-year-old male patient suffered from headache, gait disorder, and vertigo for a week before admission to our department. An enhanced magnetic resonance imaging scan revealed a mediosagittal hyperintense infratentorial lesion with concomitant compression of the fourth ventricle. The patient underwent surgical treatment with general anesthesia. The frozen section did not reveal any tumoral tissue but rather a purulent content. He was comatose on the 1st postoperative day, and he underwent a follow-up computed tomography (CT) scan, which revealed triventricular hydrocephalus. The external ventricular drain was performed, and a follow-up CT scan revealed significant improvement of hydrocephalus. Matrix-Assisted Laser Desorption Ionization Time of Flight did not reveal any causative agent from the intraoperative content, but the 16s ribosomal DNA method confirmed *Nocardia cyriacigeorgica*. The patient was intravenously treated with ceftriaxone and trimethoprim/sulfamethoxazole and died on the 5th postoperative day.

**Conclusion:** Nocardiosis presents a rare Gram-positive bacterial infection that typically affects immunocompromised hosts. *Nocardia*-caused brain abscesses present a significant challenge in its treatment for its atypical presentation and slow culture growth.

**Keywords:** Brain abscess, Ceftriaxone, Hydrocephalus, *Nocardia*

## INTRODUCTION

*Nocardia* is a Gram-positive aerobic filamentous bacteria, usually found in soil and water. Cerebral infections caused by *Nocardia* are rare and severe, usually presented as cerebral abscess in immunocompromised patients. The most common ways to acquire nocardial infection are inoculation and hematogenous spreading or inhalation.[6]

Its diagnosis is difficult due to various symptoms caused by *Nocardia,* which mimic the true nature of the disease and result in a mortality rate of up to 60%. According to its pathognomonic nature, it is

believed that hematogenous spreading from lung infection leads to cerebral involvement and subsequent brain abscess.[3] *Nocardia* mimics multiple brain-related disorders, such as ischemic stroke, metastases, and primary brain tumors.[11] Among the immunocompromised population, nocardiosis is most frequently an opportunistic infection that can result in both localized and systemic illnesses. *Nocardia cyriacigeorgica* is responsible for 2% of all brain abscesses, indicating that brain involvement is uncommon.[2] Compared to other bacterial causes of cerebral abscesses, the death rate from a *Nocardia* brain abscess is three times higher, at around 50%; men are more likely than women to obtain a Nocardial brain abscess.[7]

The authors present a rare case of cerebellar nocardial abscess in pneumonic patients.

## CASE DESCRIPTION

A 67-year-old patient was admitted to our department due to cerebellar symptoms – gait disturbance, vertigo, and headache. He was thoroughly diagnostically evaluated before admission, and a magnetic resonance imaging (MRI) scan of the brain revealed a hyperintense infratentorial mass lesion at the region of vermis [Figure 1]. The patient was mildly disoriented upon admission, and his Glasgow Coma Scale score was 14; also, according to his medical history, chronic renal disease, arterial hypertension, and depressive syndrome were confirmed as accompanying comorbidities. Recurrent pneumonia was diagnosed in December 2022 and September 2023, but according to its regressive dynamics, lung biopsy was not performed.

Preoperative laboratory findings revealed elevated values of C-reactive protein – 119 mg/L and white blood cells – 14.3 × $10^9$/L. The other laboratory findings were within reference limits.

He was surgically treated with general anesthesia and prone position and was postoperatively admitted to the intensive care unit (ICU). An intraoperative sample of the mass lesion was sent to the frozen section, and no tumor cells were found; the same sample was also sent to microbial laboratory testing. On the 1st postoperative day and during his stay at the ICU, the patient was comatose, and he underwent computed tomography (CT) scan, which revealed a completely removed abscess and subsequent triventricular hydrocephalus [Figures 2a and b]. The authors performed the right-sided external ventricular drain (EVD) regularly; further, a follow-up CT scan in 3 days revealed the appropriate position of EVD and insignificant improvement of hydrocephalus [Figure 2c].

Early laboratory findings of the sample revealed Gram-positive, rod-shaped bacteria that pointed to *Nocardia,* and the patient was treated with ceftriaxone and trimethoprim/sulfamethoxazole, according to the infectologist.

Pathological evaluation of tissue revealed necrotic areas and mixed inflammatory cells surrounded by reactive brain parenchyma and foamy macrophages around the abscess cavity [Figure 3].

During early postoperative care, the chest radiography revealed scarring changes of the lung parenchyma without acute inflammatory and stagnant changes of pulmonary parenchyma. The shape of the cardiovascular shadow appears to be of regular size and maintained tone.

Postoperatively, laboratory findings revealed increased C-reactive protein with a peak in the 3rd postoperative day and a slight decrease in its values in the next 2 days after application of antibiotics. Other laboratory findings were inconspicuous.

Matrix-Assisted Laser Desorption Ionization Time of Flight evaluation did not confirm the same bacteria. Therefore authors sent the sample to 16s ribosomal DNA method, which confirmed *N. cyriacigeorgica*.

Regardless of all measures taken, the patient died a week after the initial surgery for cardiopulmonary arrest.

## DISCUSSION

Our patient suffered from typical posterior fossa symptoms, and preoperative radiological scanning revealed a hyperintense

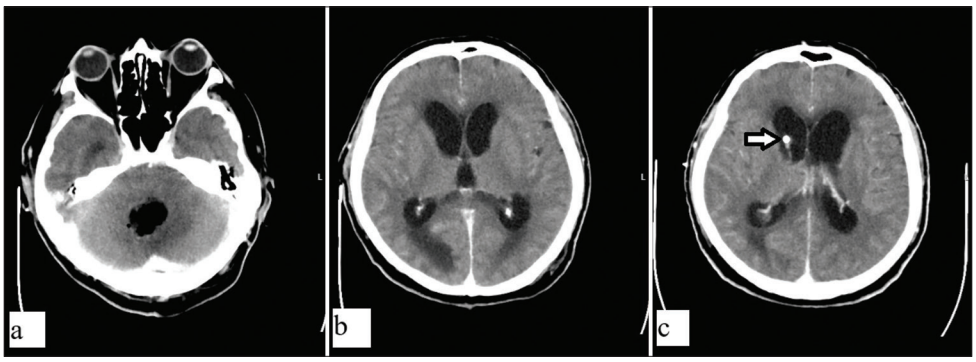


**Figure 1:** T1-enhancedMRI scans of the brain along (a) axial, (b) sagittal and (c) coronal direction revealed hyperintensemidsagittal infratentorial mass lesion.

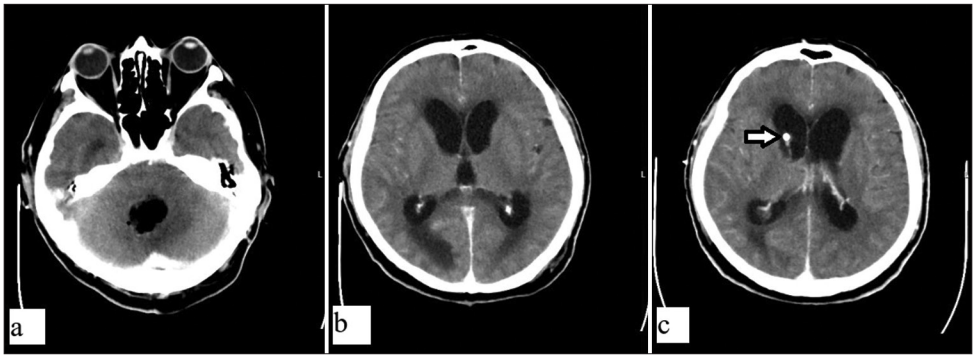


**Figure 2:** Follow-up enhanced CT scans revealed (a) total removal of the abscess and (b) consequent triventricular hydrocephalus. External ventricular drainage (c, arrow) is properly placed in the right-sided frontal horn of the ventricle.

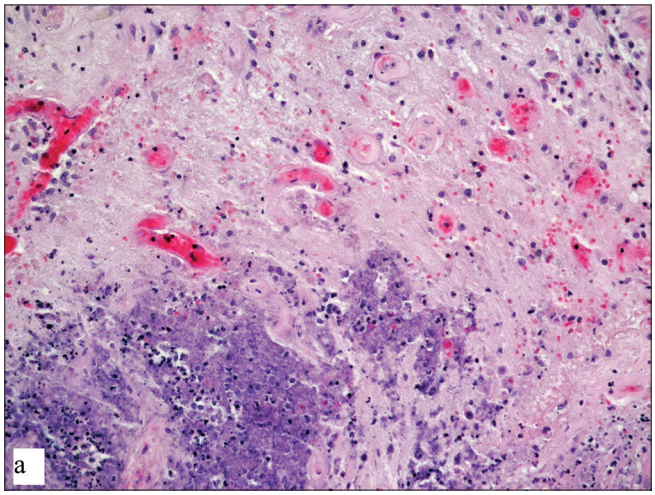


**Figure 3:** Microphotograph of the H&E stained resected sample (a) revealed necrotic areas and mixed inflammatory cells around the abscess cavity surrounded by reactive brain parenchyma and foamy macrophages (Olympus BX41, ×200).

solid and cystic mass, which imitated the brain tumor. Intraoperatively, no solid mass was found, but only purulent fluid, which was thoroughly removed and sent for further microbial analysis. According to his medical history, the authors found pulmonary disease, which was treated for a year before admission to our department; therefore, a possibility of deprivation of his immune system existed, and no apparent clinical signs were found. Nocardial brain abscesses are uncommon in immunocompetent people. Yassin *et al.* originally identified *N. cyriacigeorgica* from a patient suffering from chronic bronchitis in 2001.[12] Several case reports have reported brain abscesses caused by *N. cyriacigeorgica* in patients with compromised immune systems with diabetes mellitus and acquired immunodeficiency syndrome infection as the two primary immunocompromised conditions that increase the risk of brain abscesses;[1,4,5,8-10,12] also transplant organ recipients, patients with malignancies, and long-term steroid use are the most exposed population to acquire nocardial infection.[10]

Most likely, *Nocardia* has a unique affinity for the brain. Up to 45% of patients with systemic infections have involvement of the central nervous system (CNS); original lung infections may be subclinical, and up to 40% of CNS infections look isolated without evidence of infection elsewhere. Meningitis, diffuse cerebral infiltration, and spinal cord infections have been reported, but brain abscesses are the most common symptom of CNS involvement. Unlike other bacterial abscesses, CNS infections are characterized by a wide range of symptoms and indications that are often subtle, without fever or indicators of septicemia. Seizures, non-focal findings, and focal neurological impairments are the most typical symptoms. The results of CT/MRI typically show one or more lesions that enhance contrast. Diagnosis may be delayed if symptoms and radiological findings resemble those of other illnesses such as neoplasms, vasculitis, or stroke.[10]

As an opportunistic source of infection, *Nocardia* species frequently appear in immunocompromised hosts, particularly in patients suffering from disorders that affect T cell-mediated immunity. These individuals frequently have other immunosuppressive diseases or are on lengthy glucocorticoid regimens in addition to other immunosuppressive medications.[9]

Following microbiologic confirmation of nocardiosis, antibiotic therapy is mandatory. However, antibiotics should be begun after microbiological sample analysis if the condition is life-threatening and nocardiosis is suspected based on clinical and/or radiological findings.

In cases of CNS involvement, antibiotic treatment is set up to 12 months with 3–6 weeks of intravenous application. Usually, a multidrug regimen is employed with possible combinations of imipenem cefotaxime or ceftriaxone and amikacin and cotrimoxazole or linezolid. This regimen is established for invasive nocardiosis and its clinical presentation, but before identification of species. In our case, according to the prior microbial identification, intravenous application of sulfamethoxazole/trimetoprim and ceftriaxone was ordered, 2 times/2 g each.[5]

Recently, Mehta *et al*. 2023 reviewed abscesses caused by *N. cyriacigeorgica,* which delineated the paucity of cerebellar abscesses with an emphasis on the compromised immune system in all of the described cases, excluding their case of the pons abscess. According to their review, only two cases out of twelve were originally located infratentorially.[8]

## CONCLUSION

*Nocardia* species are rarely presented as a sole cause of brain abscess, especially among immunocompetent patients. Also, its presentation mimics the real nature of the disease and usually imitates other cerebral diseases. Proper antimicrobial treatment could lead to a salvageable clinical course in such patients. The rarity of nocardial infections raises questions about proper initial antibiotic treatment and its duration. Further studies should investigate the possibilities of genome sequencing or radiologic techniques, which could lead to better individual access to treatment.

### Ethical approval

Institutional Review Board approval is not required.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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### Conflicts of interest

There are no conflicts of interest.

### Use of artificial intelligence (AI)-assisted technology for manuscript preparation:

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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