

A case of pulmonary nocardiosis with *Nocardia brasiliensis* spread from a post-traumatic cutaneous infection in an immunocompetent patient

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Abstract

Nocardia is an aerobic Gram-positive bacterium found in the environment, including soil and water. *Nocardia brasiliensis* is reportedly associated with cutaneous infections, and disseminated disease is typically detected in immunocompromised individuals. We present a rare case of disseminated nocardiosis with *N. brasiliensis* in an immunocompetent patient. An 82-year-old male, who had a left elbow injury 2 months prior to the first visit, presented with bilateral multiple lung nodules. *N. brasiliensis* was identified in both sputum and pus specimens, we concluded that the *N. brasiliensis* had spread from the primary cutaneous lesion. The patient was treated with antibiotics and had a favourable clinical course. As the present case report demonstrates, disseminated nocardiosis caused by this species can progress from a primary cutaneous lesion even in immunocompetent individuals, if the initiation of appropriate treatment is delayed. Therefore, careful evaluation is warranted when *Nocardia* species are detected.

KEYWORDS

cutaneous infection, disseminated nocardiosis, *Nocardia brasiliensis*

INTRODUCTION

Nocardia is an aerobic Gram-positive bacterium found in the environment. *Nocardia* species are known as opportunistic pathogens, and many cases have been described in immunosuppressed patients. Organ involvement is diverse; this pathogen may cause skin infections, brain abscesses, pulmonary infections, and disseminated diseases. *Nocardia brasiliensis*, one of these species, is reportedly associated with cutaneous infections, while disseminated disease is normally seen in immunocompromised patients. Here, we report an immunocompetent case of pulmonary nocardiosis with *N. brasiliensis* spread from a cutaneous infection.

CASE REPORT

An 82-year-old male was referred to our department from the orthopaedic clinic due to an abnormal chest radiograph.

He had a history of lumbar compression fracture, osteoporosis, hypertension and hyperuricemia. Two months prior to the visit, the patient fell on an asphalt-paved road, injuring his left elbow. Although his skin was torn, he did not show his skin lesion to the doctor and treated it himself. While the wound exudate gradually resolved, the swelling and pustules persisted. Otherwise, he did not have any other symptoms. He visited his doctor 2 months after the injury to show his skin lesion; a bacterial culture of pus specimen was obtained, and Hainosankyuto, a traditional Japanese herbal medicine, which contains extract of licorice, peony root, ginger root, immature orange, and jujube, was prescribed. A few weeks later, *N. brasiliensis* was identified through bacterial culture. Chest computed tomography (CT) was conducted, revealing multiple nodules randomly distributed throughout the lobes on both sides of the lungs (Figure 1A). He visited our department for further evaluation. Vital signs were unremarkable, and lung sounds were normal. A palpable 2-cm skin nodule was detected on the

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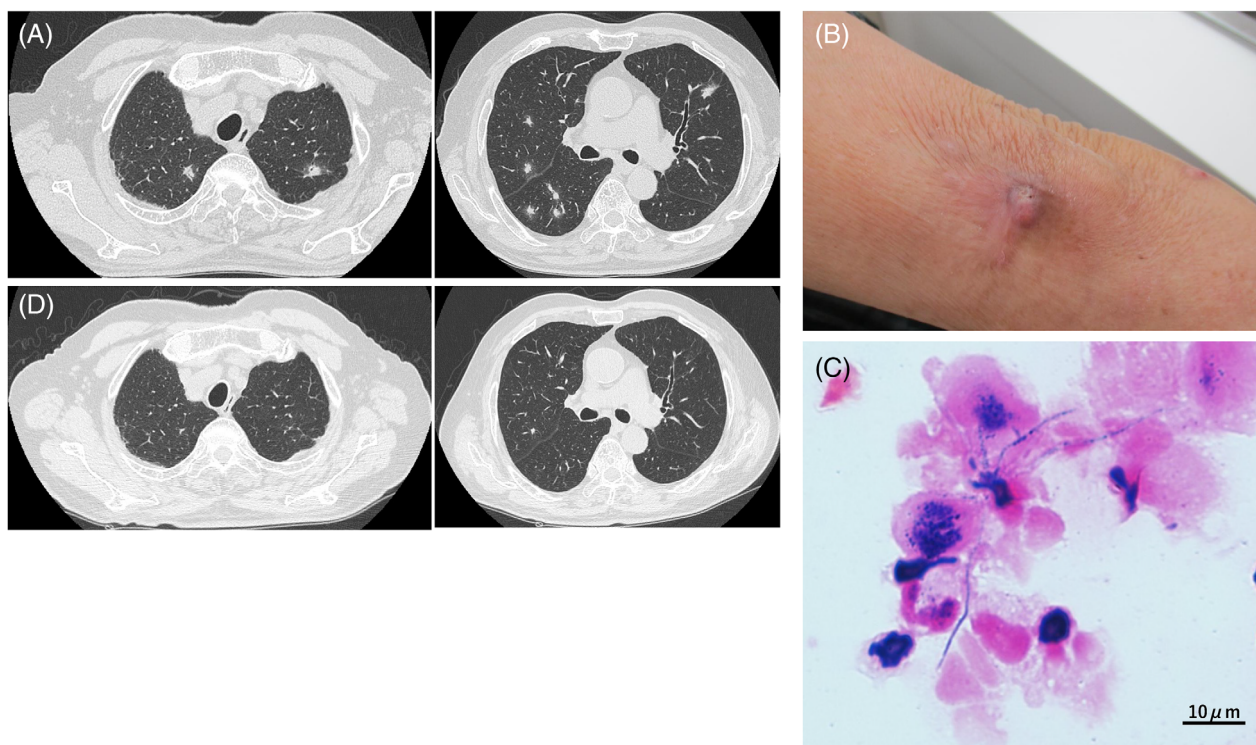


FIGURE 1 (A) Chest computed tomography scan revealing the presence of multiple nodules throughout both sides of the lungs. (B) Clinical feature of the post-traumatic lesion. A nodule with erythema (measuring 2 cm) was observed on the left elbow. (C) Microscopic finding of the branching filamentous Gram-positive rod in the pus specimen (original magnification: $\times 1000$). (D) Multiple nodules had regressed 12 weeks after the initiation of antibiotic treatment.

TABLE 1 Antimicrobial susceptibility pattern for isolated *Nocardia brasiliensis*.

Antimicrobials	MIC ($\mu\text{g/mL}$)	Susceptibility ^a
Amoxicillin-Clavulanate	$\leq 4/2$	S
Ceftriaxone	≤ 8	S
Imipenem	≥ 16	R
Amikacin	≤ 8	S
Tobramycin	≤ 1	S
Clarithromycin	8	R
Doxycycline	4	I
Minomycin	2	I
Linezolid	≤ 2	S
Moxifloxacin	≤ 1	S
Ciprofloxacin	4	R
Trimethoprim-Sulfamethoxazole	$\leq 38/2$	S

Abbreviations: MIC, minimum inhibitory concentration; S, susceptible; I, intermediate; R, resistant.

^aSusceptibility was interpreted according to the Clinical Laboratory Standards Institute guidelines M100-S29.

left forearm (Figure 1B). Laboratory findings revealed leukocyte count of 5.08×10^9 cells/L. C-reactive protein levels were elevated at 2.70 mg/dL. Serum creatinine (SCr) levels were 0.92 mg/dL and liver function tests showed

normal results. The test for human immunodeficiency virus yielded negative findings. Sputum and pus specimens were obtained, and Gram staining revealed the presence of filamentous Gram-positive bacilli (Figure 1C). Matrix-assisted laser desorption ionization-time of flight mass spectrometry identified *N. brasiliensis* in both specimens. Although bacteremia was suspected, there was no bacterial growth observed in the blood culture. A brain CT scan showed no brain abscess. Considering that the condition of the patient was stable, we initiated treatment with trimethoprim-sulfamethoxazole (TMP-SMZ) (10 mg/kg/day) in an outpatient setting (Table 1). However, SCr levels increased to 1.52 mg/dL on day 16. The treatment was discontinued due to renal dysfunction, and a switch was made to intravenous ceftriaxone (2 g/day) and amikacin 400 mg every 12 h for 4 weeks. Subsequently, it was switched to combination therapy with oral amoxicillin-clavulanate (1000 mg/125 mg, twice a day) and moxifloxacin (400 mg/day). At 12 weeks after the initial treatment, a chest CT scan showed marked regression of bilateral lung nodules (Figure 1D). The antibiotic treatment was continued for a total of 29 weeks.

DISCUSSION

We report a rare case of pulmonary nocardiosis with *N. brasiliensis* disseminated from a primary cutaneous

infection in an immunocompetent patient. *Nocardia* is an aerobic Gram-positive bacterium found in the environment. A total of 92 subspecies have been recognized, and at least 54 of those are reportedly pathogenic in humans.¹ Identification of subspecies is important, as antimicrobial susceptibility patterns and pathogenic traits can vary among different species. However, *Nocardia* is known to be difficult to manage and time-consuming to identify due to its slow growth and technical challenges.¹ This pathogen may cause lymphocutaneous infection, brain abscess, pulmonary infection, and disseminated diseases. In cases of disseminated diseases, a combination of 2 to 3 antibiotics based on antimicrobial susceptibility patterns is recommended, and treatment typically lasts for a few months. Side effects or tolerance issues due to prolonged treatment are of particular concern, especially for elderly patients, as we encountered in this case. Disseminated nocardiosis is frequently noted in patients with pulmonary nocardiosis, while spread from a primary cutaneous lesion is uncommon. Prior retrospective studies demonstrated that *N. brasiliensis* causes cutaneous infection in >80% of cases, while pulmonary involvement was found in two patients, and there was no occurrence of disseminated disease.² Only a few cases of systemic nocardiosis with *N. brasiliensis* have been reported in immunocompromised patients. Moreover, disease development in immunocompetent individuals is extremely rare, with only two cases previously reported in the literature.^{3,4} In these cases, there was a delay of 2 months to several years from the onset of symptoms to the initiation of appropriate treatment, as in the present case. This suggests that delay in the initiation of treatment may contribute to the dissemination of *N. brasiliensis* in immunocompetent patients. It is thought that nocardiosis occurs predominantly in immunocompromised patients. However, importantly, it can also develop in immunocompetent individuals. The present case may involve an aged immunity; however, he did not have any immune compromising chronic illnesses. It is noteworthy that pulmonary nocardiosis is associated with a poor prognosis. According to a previous case series, 25% of patients with pulmonary nocardiosis expire within 180 days.⁵ Age greater than 68 years, pulmonary aspergillosis, and resistance to TMP-SMZ were reported to be associated with a worse prognosis.⁵ Recognizing these risks is crucial for effective patient management. In cases in which *Nocardia* infection is suspected, collection of appropriate specimens for laboratory testing is important to confirm the diagnosis. Following the detection of *Nocardia* species, a thorough evaluation should be conducted to determine the

potential involvement of other organs (e.g., lungs or brain), and promptly initiate appropriate treatment.

AUTHOR CONTRIBUTIONS

Masaaki Iwabayashi: Writing-original draft; conceptualization [equal]. **Junji Takiguchi:** Conceptualization [equal]. **Hiromi Tomioka:** Supervision.

CONFLICT OF INTEREST STATEMENT

None declared.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analysed during the current study

ETHICS STATEMENT

The authors declare that appropriate written informed consent was obtained for the publication of this manuscript and accompanying images.

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