Case Report

Nocardia araoensis Causing Brain Abscess

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Abstract

Nocardial brain abscess is a rare central nervous system infection with high morbidity and mortality. Most of the human infections, i.e., about 90%, are due to *Nocardia asteroides* group comprising *N. asteroides* complex, *Nocardia farcinica,* and *Nocardia nova*. Other species rarely cause human infections. Here, we report a case of left parieto-occipital abscess caused by a rare species, *Nocardia araoensis*, its diagnosis, treatment options, and review of literature. A 73-year-old male, known case of diabetes mellitus, on prolonged oral corticosteroid for autoimmune hemolytic anemia presented with a 1-month history of memory deficit and gait imbalance. On examination, he had a right inferior quadrantanopia and hemiparesis. Magnetic resonance imaging showed a multiloculated ring-enhancing lesion in the left parieto-occipital region. Navigation-assisted biopsy was done. The organism isolated was *N. araoensis*. He was treated successfully with prolonged course of antibiotics which resulted in complete clinical and radiological resolution. *N. araoensis* is a rare cause of brain abscess and needs to be suspected in immunocompromised individuals. Early diagnosis and prolonged treatment can result in complete clinical and radiological resolution.

Keywords: *Brain abscess, Nocardia araoensis, nocardiosis*

Introduction

Nocardial brain abscess is a rare central nervous system (CNS) infection with high morbidity and mortality. Most of the human infections, i.e., about 90%, are due to *Nocardia asteroides* group comprising *N. asteroides* complex, *Nocardia farcinica,* and *Nocardia nova*. Other species rarely cause human infections. Here, we report a case of left parieto-occipital abscess caused by a rare species, *Nocardia araoensis*, the methods of diagnosis, treatment, and review of literature.

Case Report

A 73-year-old male, known case of diabetes mellitus, was diagnosed as autoimmune hemolytic anemia a year ago and was started on oral steroids at another center. He continued to take these medications for a year, without further consultation or blood tests. He presented to us with a 1-month history of memory deficit and gait imbalance. On examination, he had a right inferior quadrantanopia and a Grade 4 power in his right upper and lower limbs.

Magnetic resonance imaging (MRI) brain with contrast showed multiple, large, predominately cystic lesions in the left parieto-occipital region with significant edema and local mass effect. The contents of the cyst demonstrated restricted diffusion. Following contrast, most of these lesions enhanced in a smooth ring fashion. Some of the ring-enhancing lesions were peripherally placed with dural thickening and enhancement. Susceptibility imaging is showed small areas of low signal within the affected region in keeping with hemorrhagic areas. A diagnosis of multiloculated brain abscess was made. A differential of high-grade glioma was also considered [Figure 1].

Since the lesion was close the motor cortex, he underwent navigation-assisted left parietal burr hole and biopsy of the lesion under general anesthesia. Intraoperatively, the dura was thickened with subdural pus and granulation tissue. Tissue was taken for bacterial and fungal cultures and tuberculosis diagnostic panel.

Postoperative computed tomography scan showed the biopsy tract up to the lesion [Figure 2].

On bacteriological assessment, direct Gram stain of brain abscess showed occasional inflammatory cells, and no organisms were seen. The sample was inoculated on

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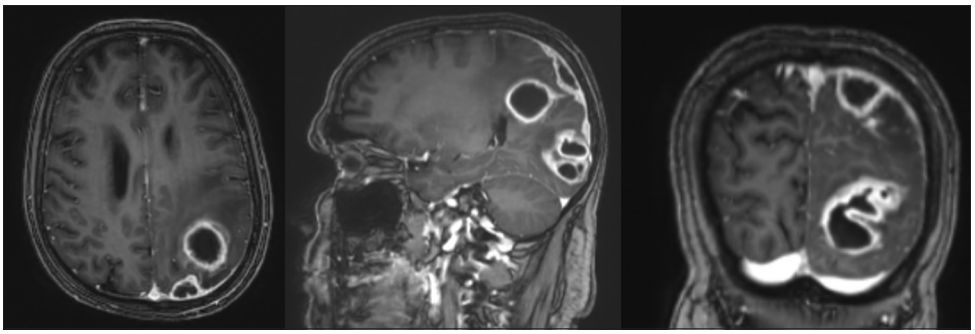

Figure 1: Contrast-enhanced magnetic resonance imaging brain showing multiloculated ring-enhancing lesion in the left parieto-occipital region

nutrient agar, blood agar, MacConkey agar, and brain–heart infusion broth and incubated at 37°C.

Colonies grew on media after 48 h of incubation. On blood agar, chalky white irregular growth of colonies was seen [Figure 3]. Gram stain from colony showed Gram-positive filamentous branching bacilli with beaded appearance [Figure 4]. Acid-fast bacillus stain using 1% sulfuric acid showed pink-colored bacilli of about 4–7 μm × 0.5 μm [Figure 5]. Culture was sent for matrix-assisted laser desorption-ionization–time-of-flight mass spectrometry (MALDI-TOFMS) for identification of the pathogen, which was reported as *N. araoensis*. Mycobacteria were not detected in culture and gene expert. No fungus was isolated from the sample.

The corticosteroids were slowly tapered and stopped. He was started on injection meropenem and combination of oral trimethoprim/sulfamethoxazole for 6 weeks with monitoring of the serum creatinine and complete blood picture. An MRI was repeated at 1 month which showed a minimal reduction in size of the left parieto-occipital abscess. The lobulated lesion had compartmentalized into few discrete ring-enhancing lesions. No new lesions were noted [Figure 6]. He developed altered renal parameters at the 2nd month of oral trimethoprim/sulfamethoxazole combination and was hence switched to amoxicillin and clavulanate. A repeat MRI at 6 months showed the lesion further shrinking in size with reduction of the edema [Figure 7]. The treatment was continued for a period of 12 months. The patient improved clinically to a Grade 5 power in his right upper and lower limbs, and visual assessment also showed complete resolution of the visual field defect.

His MRI at 12 months showed complete radiological resolution of the lesion and the surrounding edema [Figure 8].

Discussion

Nocardiosis of the CNS is a rare infection, comprising 1%–2% of all cerebral abscesses. It is responsible for a higher mortality rate in comparison to other causes of cerebral abscesses (30% vs. 10%).[1]

Most of the human infections, i.e., about 90%, are due to *N. asteroides* group comprising of *N. asteroides* complex, *N. farcinica,* and *N. nova*. Other species rarely cause human infections. It may present as acute, subacute, or chronic infections. It usually affects immunocompromised patients as the index case who was on prolonged oral corticosteroids.[2-6]

N. araoensis (referring to Arao city, where the bacterium was isolated) is an aerobic, Gram-positive, partially acid-fast, nonmotile actinomycete that forms a branched substrate mycelium. It is a ubiquitous organism found in soil, water, decomposing vegetation, and organic matter.

N. araoensis grows at 45°C which is also shown by some other species such as *N. farcinica, Nicotiana africana, Nocardia flavorosea, and Nocardia higoensis,* but based on sugar fermentation, citrate utilization, urea decomposition, and 16s rRNA sequencing/MALDI-TOFMS techniques, *N. araoensis* species identification can be confirmed.[7,8,9,10]

There are only a few case reports with *N. araoensis* causing meningitis[11] and pulmonary[7] and skin diseases.[12] The presentation may vary on the location of involvement. *N. araoensis* caused a large multiloculated cerebral abscess in this immunocompromised patient. The management involves craniotomy and excision in noneloquent locations. However, in this case, since the lesion was multiloculated and involved eloquent cortex, the option of navigation-guided biopsy was chosen to isolate the incriminating organism.

Mamelak *et al*. in their article after reviewing 131 cases reported focal deficits in 42%, nonfocal findings in 27%, and seizures in 30% of cases. They found extraneural nocardia in 66% of the cases; pulmonary (38%) and cutaneous/subcutaneous (20%) locations were the most frequent. Multiple abscesses were found in 38% and 34% were immunocompromised. They encountered a mortality rate of 24% after initial craniotomy and excision, 50% after aspiration/drainage, and 30% after nonoperative therapy. The mortality rate was 33% in patients with single abscesses and 66% in those with multiple abscesses.[13]

Even though the MRI can favor the diagnosis of cerebral abscess, only a biopsy can give a definitive diagnosis. High grade gliomas and tuberculous/cryptococcal abscesses may appear alike on MR imaging and need to kept as the differential. The tendency to initiate empirical

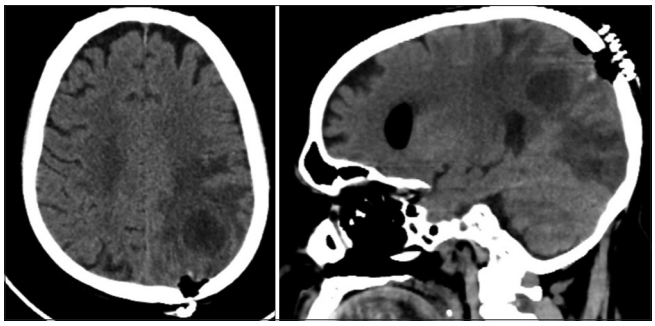

Figure 2: Postoperative computed tomography scan showing the biopsy tract up to the lesion

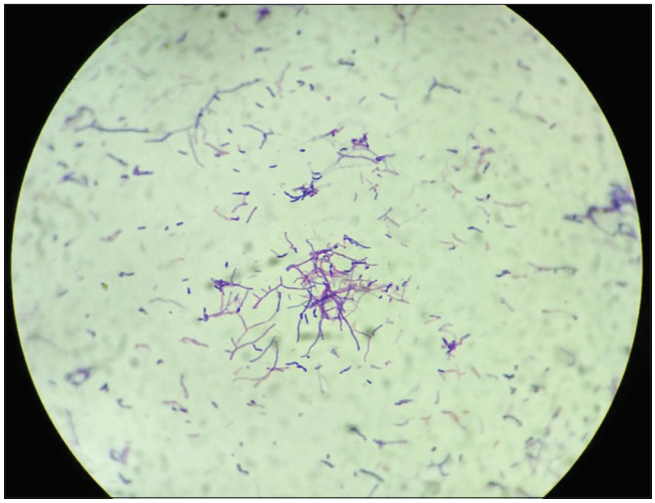

Figure 4: Gram stain showing Gram-positive filamentous branching bacilli with beaded appearance

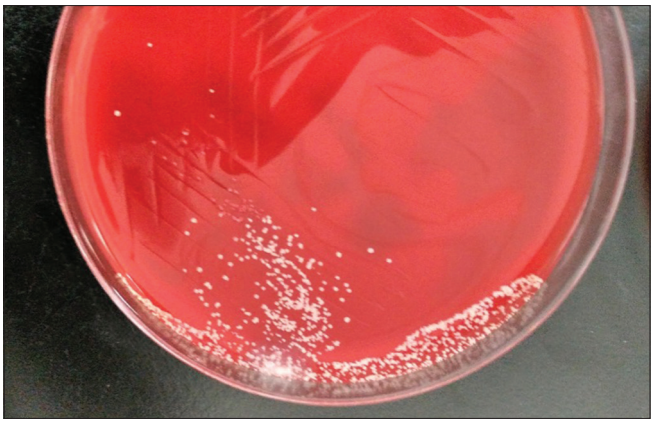

Figure 3: Chalky white irregular growth of colonies seen on blood agar medium

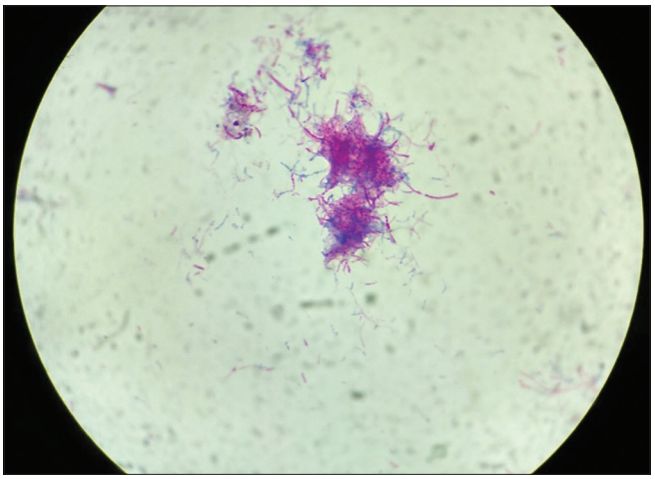

Figure 5: Pink-colored bacilli on acid-fast bacillus stain using 1% sulfuric acid

therapy for suspected tuberculous abscess is very high, especially in multiloculated lesions involving the eloquent cortex. This misdiagnosis will result in progression of the disease and treatment failure and lead to the development of drug resistance. Hence, early tissue diagnosis is essential before the initiation of any treatment.

Conventionally, bacterial infections were isolated on the basis of biochemical, metabolic profiling and confirmed with 16S rRNA and 18S rRNA gene sequencing. However, recently, the MALDI-TOFMS technique has evolved as a novel and potential tool for microbial identification and diagnosis. This process is rapid, sensitive for confirmation of the organism.[9] This technique was used in this case to clinch the diagnosis.

Treatment with sulfonamides in combination with trimethoprim is most effective and should be continued for at least 1 year. However, in cases of allergy or nonresponsiveness to sulfa agents, second-line agents such as minocycline, imipenem, or aminoglycoside in combination with a third-generation cephalosporin may be used with reasonably good success as in our case. We managed this case with a 6-week regimen of injectable meropenem and oral sulfamethoxazole-trimethoprim combination and oral amoxicillin-clavulanate for 12 months, which resulted in complete clinical and radiological resolution of the disease process.

Lee *et al*. suggested that craniotomy and excision is necessary in most cases of nocardial brain abscesses.[14] Patients with comorbid illness or surgically difficult lesions can be successfully managed by a burr-hole aspiration, biopsy, and prolonged course of antibiotics as done in the index case. Whether this is due to the low virulence of the new species, *N. araoensis*, needs to be studied further.

Conclusion

N. araoensis is a rare cause of brain abscess and needs to be suspected in immunocompromised individuals. MALDI-TOFMS techniques are helpful in species characterization. Early diagnosis and prolonged treatment can result in complete clinical and radiological resolution.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have

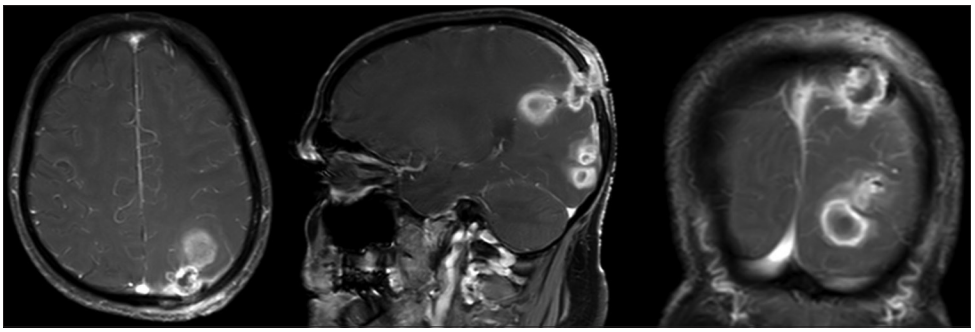

Figure 6: Follow-up contrast-enhanced magnetic resonance imaging showing compartmentalized lobulated lesion with few discrete ring-enhancing lesions and no new lesions

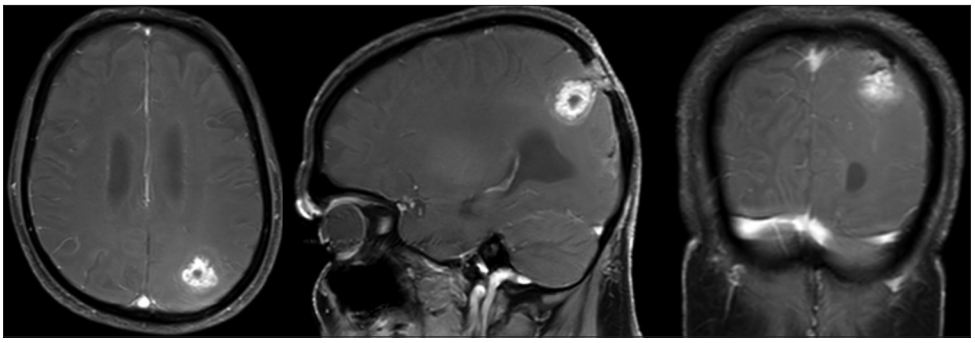

Figure 7: Follow-up contrast-enhanced magnetic resonance imaging at 6 months showing the lesion further shrinking in size with reduction of the edema

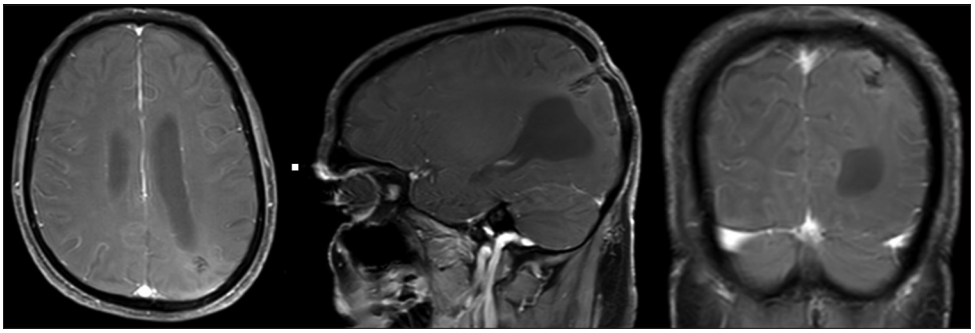

Figure 8: Follow-up contract-enhanced magnetic resonance imaging at 12 months showing complete radiological resolution of the lesion and the surrounding edema

given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Lerner PI. *Nocardia* species. In: Principles and Practice of Infectious Diseases. New York: Churchill Livingstone; 1995. p. 2273-80.
2. Ryan KJ, Ray CG, editors. Sherris Medical Microbiology. 4th ed. New York: McGraw Hill; 2004. p. 460-2.
3. Young LS, Rubin RH. Mycobacterial and nocardial diseases in the compromised host. In: Rubin RH, Young LS, editors. A Clinical Approach to Infection in the Compromised Host. 4th ed. New York: Kluwer Academic; 2002. p. 257-61.
4. Long PF. A retrospective study of *Nocardia* infections associated with the acquired immune deficiency syndrome (AIDS) Infection 1994;22:362-4.
5. Smego RA Jr., Moeller MB, Gallis HA. Trimethoprim-sulfamethoxazole therapy for *Nocardia* infections. Arch Intern Med 1983;143:711-8.
6. Lavalard E, Guillard T, Baumard S, Grillon A, Brasme L, Rodríguez-Nava V, *et al.* Brain abscess due to *Nocardia* cyriacigeorgica simulating an ischemic stroke. Ann Biol Clin (Paris) 2013;71:345-8.
7. Kageyama A, Yazawa K, Mukai A, Kohara T, Nishimura K, Kroppenstedt RM, *et al. Nocardia araoensis* sp. Nov. And *nocardia pneumoniae* sp. Nov. isolated from patients in Japan. Int J Syst Evol Microbiol 2004;54:2025-9.

8. Brown-Elliott BA, Brown JM, Conville PS, Wallace RJ Jr. Clinical and laboratory features of the *Nocardia* spp. Based on current molecular taxonomy. Clin Microbiol Rev 2006;19:259-82.
9. Singhal N, Kumar M, Kanaujia PK, Virdi JS. MALDI-TOF mass spectrometry: An emerging technology for microbial identification and diagnosis. Front Microbiol 2015;6:791.
10. Kumar VA, Augustine D, Panikar D, Nandakumar A, Dinesh KR, Karim S, *et al. Nocardia farcinica* brain abscess: Epidemiology, pathophysiology, and literature review. Surg Infect (Larchmt) 2014;15:640-6.
11. Yamamoto F, Yamashita S, Kawano H, Tanigawa T, Mihara Y, Gonoi T, *et al.* Meningitis and ventriculitis due to *Nocardia araoensis* infection. Intern Med 2017;56:853-9.
12. Akasaka E, Ikoma N, Mabuchi T, Tamiya S, Matuyama T, Ozawa A, *et al.* A novel case of nocardiosis with skin lesion due to *Nocardia araoensis*. J Dermatol 2011;38:702-6.
13. Mamelak AN, Obana WG, Flaherty JF, Rosenblum ML. Nocardial brain abscess: Treatment strategies and factors influencing outcome. Neurosurgery 1994;35:622-31.
14. Lee GY, Daniel RT, Brophy BP, Reilly PL. Surgical treatment of nocardial brain abscesses. Neurosurgery 2002;51:668-71.