Case report

Disseminated life threatening *Nocardia otitidiscaviarum* infection in a young female with newly diagnosed systemic lupus erythematosus, case report and review of literature

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ABSTRACT

Infection due to *Nocardia* is reported mainly in immunocompromised patients. It usually presents as a pulmonary or disseminated disease with a predilection for the brain. Infections are a rare etiology of intracranial vascular aneurysms. Herein we report a case of disseminated *Nocardia otitidiscaviarum* (*N. otitidiscaviarum*) in a young female newly diagnosed with systemic lupus erythematosus (SLE) complicated by the development of an infectious intracranial aneurysm. To the best of our knowledge this is the fourth case of nocardial infection-related intracranial aneurysm and the second case of *N. otitidiscaviarum* infection to be reported in a patient with systemic lupus erythematosus. Features of previously reported *N. otitidiscaviarum* related intracranial aneurysm are reviewed.

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Introduction

Nocardiosis is considered an opportunistic infection affecting immunocompromised patients. The species *N. otitidiscaviarum* was considered a soil saprophyte until the first human infection was described 50 years after the identification of the species. Diabetes mellitus, human immunodeficiency virus (HIV) infection, and post-transplant status were the most common risk factors identified in previously described *N. otitidiscaviarum* infections. Only one reported case of infection due to this unusual species was associated with systemic lupus erythematosus (SLE).

To date, there are only 3 reported cases of intracranial artery aneurysm caused by nocardial infection. We are reporting a case of *N. otitidiscaviarum* infection in a young female with SLE presenting with disseminated nocardiosis. She had multiple complications including rupture of a cerebral artery aneurysm and pneumothorax.

Case presentation

A 29-year-old female was newly diagnosed with systemic lupus erythematosus (SLE). She had multi-organ involvement including autoimmune hemolytic anemia, cerebritis, lupus nephritis, cardiomyopathy with an ejection fraction of 33% and non-specific interstitial pneumonia. The patient was started on mycophenolate mofetil 1000 mg twice daily, hydroxychloroquine 200 mg once daily, and prednisolone 40 mg daily which was planned to be tapered over 8 weeks. She had to stay in hospital for 2 weeks due to the involvement of multiple organs and the slow response to treatment. Two weeks after her discharge from the hospital she started to experience a dry cough followed by fever, progressive shortness of breath, generalized body aches, nausea, vomiting, and skin rash. On examination, she looked thin and malnourished, with severe alopecia. Examination showed a temperature of 39.4 °C, heart rate 147 beats/minutes, respiratory rate of 24 cycles/minutes and blood
pressure 137/88 mm Hg. There were multiple skin pustules of different ages scattered over the upper limbs, lower limbs, back and abdomen (Fig. 1-A). Chest auscultation revealed reduced air entry at the right lung base and abdominal examination showed right upper quadrant tenderness. Investigations revealed normocytic normochromic anemia (hemoglobin level 6.8 g/L, normal range 12.0–15.0 g/L), leukocytosis (17.1 × 10^9/L, normal range 4.0–10.0 × 10^9/L) with neutrophilia (16.2 × 10^9/L, normal range 2.0–7.0 × 10^9/L), elevated C-reactive protein levels (218.7 mg/L, normal range 0.0–5.0 mg/L) and high procalcitonin (7.17 ng/mL). Anemia work up showed haptoglobin 518 mg/dL (normal range 30–200 mg/dL), lactic acid dehydrogenase 372 U/L (normal range 135–214 U/L), reticulocytes 1.5%. Regarding lupus disease activity, double stranded DNA antibodies was positive with titer of 25.00 IU/mL while complement 3 was 0.68 gm/L (normal range 0.90–1.80 gm/L) and complement 4 was 0.08 gm/L (normal range 0.10–0.40 gm/L). Chest X-ray showed consolidation with cavitation and pleural effusion in the right lower zone (Fig. 1-B). The fluid from skin pustules as well as sputum and blood samples were sent for microbiological studies. All cultures from sputum, broncho-alveolar lavage (BAL), skin pustules pus showed on gram stain branching, fine, delicate filaments with fragmentation, beaded gram-positive bacilli (Fig. 1-C). The modified Ziehl–Neelsen staining revealed partially acid-fast bacilli. *N. otitidiscaviarum* was identified by Matrix-Assisted Laser Desorption/Ionization-Time of Flight (MALDI-TOF). Epsilometer test (E test) was done to detect Minimum Inhibitory Concentration (MIC) of different antibiotics. The results were interpreted using the Clinical and Laboratory Standards Institute (CLSI) document M24. *N. otitidiscaviarum* isolate was susceptible to trimethoprim-sulfamethoxazole (TMP-SMX) (MIC 1 μg/mL), amikacin (MIC 2 μg/mL), ciprofloxacin (MIC 0.5 μg/mL), moxifloxacin (MIC 0.25 μg/mL) and linezolid (MIC 0.094 μg/mL). It was resistant to amoxicillin-clavulanate (MIC 32 μg/mL), ceftriaxone (MIC32 μg/mL) and clarithromycin (MIC 12 μg/mL). The MIC for meropenem was 0.38 μg/mL, but CLSI did not provide interpretation for meropenem in *N. otitidiscaviarum*.

A computed tomography (CT) scan of the chest showed necrotizing pneumonia with lung abscess and pneumothorax in the left lung (Fig. 2-A). Few septic emboli also were visualized in left lung (Fig. 2-B). The images also revealed multiple collections in the liver spleen and kidneys (Fig. 2-C). Magnetic resonance imaging (MRI) of the brain showed numerous supra and infratentorial brain micro-abscesses with the largest involving the cerebellar vermis and the left para-median cerebellar hemisphere. These abscesses showed central diffusion restriction, peripheral enhancement, and internal enhancing septations (Fig. 3-A). A diagnosis of disseminated nocardiosis was taken and the patient was started on intravenous meropenem meningal dose, TMP-SMX and amikacin. Imipenem was not available in the hospital pharmacy. The MIC for meropenem was low and previous Nocardial isolates from our hospital had shown good clinical response to regimens having meropenem. Hence decision was taken to include meropenem in treatment regimen after discussion with microbiologist. Three days later, the patient’s condition rapidly deteriorated with a decrease in her level of consciousness with a Glasgow coma scale (GCS) of 6/15, there was no neurologic deficit. Elective intubation was performed, and she was put on mechanical ventilation. A repeat imaging revealed intracranial hemorrhage and right frontal vascular malformation of 6 mm of diameter with a feeding vessel from the distal portion of the anterior cerebral artery and draining into a cortical vein (Fig. 3-B). The neurosurgery team was involved and they decided to do a life-saving decompressive craniectomy and insertion of an external ventricular drain (EVD). The patient received intravenous antibiotics for a total of eight weeks and was then shifted to oral moxifloxacin and TMP-SMX which is planned for 10 months to complete 1 year of treatment. A CT of the brain done after 6 months of treatment showed complete resolution of the brain abscesses and a repeat

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**Fig. 1.** (A) Pustules on abdomen and little finger of right hand (B) Chest Xray. (C) Gram Stain showing Nocardia.

**Fig. 2.** (A) CT showing pneumonia with lung abscess and pneumothorax (B) CT showing Septic Emboli in Lung (C) CT showing lesions in Liver and Spleen.
Fig. 3. (A) MRI showing abscesses involving the cerebellar vermis and the left para-median cerebellar hemisphere (B) right fronto-vascular malformation of 6 mm diameter with a feeding vessel from the distal portion of the anterior cerebral artery and draining into cortical vein (C) Chest X ray after 6 months of treatment.

chest Xray (Fig. 3-C) showed clearance of the initial changes. Despite the initiation of appropriate antibiotics and all supportive measurements, the patient continued to have low GCS level and remained ventilator-dependent, tracheostomized, and fed through a nasogastric tube.

Discussion

Nocardia is a genus of aerobic bacteria in the order Actinomycetales. More than 100 species of Nocardia are identified [1]. The name Nocardia is derived from Edmond Nocard (1850–1903), a French veterinarian who first isolated members of this taxon [2]. Nocardia species (N. Spp) are weakly acid-fast bacilli. They are classified as gram-positive, but many strains have alternating positive and negative areas giving them a faint beaded appearance. They exhibit a characteristic filamentous branching with fragmentation into bacillary or coccoid forms. The species N. otitidisaviarum was first identified in 1924 and was considered a soil saprophyte [3]. The first human infection due to N. otitidisaviarum was reported in 1974 and was previously named Nocardia caviae [4,5]. N. otitidisaviarum is an infrequent cause of human Nocardial infections. In some series of human nocardial infections, it accounted for only 0.3–2.9% of all Nocardia infections [5]. This rarity has been attributed to its low virulence and low prevalence in the soil as compared to other Nocardia [6]. N. spp is ubiquitous in soil, decaying vegetable matter, and aquatic environments. A study from Iran reported isolation of Nocardia in the water and soil samples of 19 out of 30 studied hospitals [7]. They can become airborne, and inhalation is the most common route of infection. Ingestion and cutaneous spread have also been reported as routes of entry. N. spp causes various diseases in humans as well as animals. More than 54 species have been reported to be clinically significant [8].

Many risk factors predisposing to nocardial infections have been reported in the literature. Immunosuppression due to glucocorticoid therapy, malignancy, solid organ transplant and advanced HIV infection are the leading causes of nocardiosis [10–13]. In addition, diabetes mellitus, alcoholism, chronic granulomatous disease, structural lung disease, tumor necrosis factor-alpha inhibitor therapy, inflammatory bowel disease, chronic obstructive pulmonary disease and tuberculosis have been reported as risk factors for nocardial infection [14]. However, an increasing number of cases of nocardiosis have been reported in apparently immunocompetent individuals [9]. It is possible that they may have an unidentified underlying immunodeficiency.

Nocardia species can infect different organs. Nocardial infection usually presents as pneumonia, lymphocutaneous infection, mycetoma, brain abscess, or disseminated infection [15]. There are reports of septic arthritis [56] and bacteremia [16,21] caused by Nocardia. In a large series, isolated pulmonary involvement was the most frequent presentation accounting for 39% of all cases while 34% had

Table

| Case number | Age | Sex | Comorbidity | Immunosuppressive drugs | Presentation | Coexisting pathology | Diagnostic method | Site of aneurysm | Subsequent procedure | Antibiotic regimen |
|-------------|-----|-----|-------------|-------------------------|-------------|---------------------|------------------|------------------|---------------------|---------------------|
| 1           | 60  | Male| None        | None                    | Abscess     | Stereotactic aspiration of the abscess | Internal carotid aneurysm | Underwent drainage of the abscess with subsequent resection of the infected aneurysm | 6 weeks of ceftriaxone and high-dose trimethoprim–sulfamethoxazole (TMP-SMX) | (TMP-SMX,15 mg/kg/day) and ceftriaxone (4 g/day) followed by TMP-SMX (15 mg/kg/day) and minocyclin (400 mg/day) 12 month |
| 2           | 69  | Male| Multiple myeloma | Bortezomib Lenalidomide Dexamethasone | Thoracic empyema alteration of consciousness with grade 3/5 right upper and lower extremity weakness | Subarachnoid hemorrhage and multiple scattered small rim-enhancing lesions | Emergency clipping of the aneurysm which revealed necrotic aneurysm and thrombus exclusion at the left middle cerebral artery | Left middle Cerebral artery | | |
| 3           | 28  | Female | SLE | Prednisolone | Headache irritability nuchal rigidity | Cerebritis | Biopsy of Lesion | Right middle cerebral artery | Surgical excision of aneurysm with Bye pass | TMP-SMX 3 week Cefotaxime + amikacin 2 weeks Doxycycline 4 weeks |
Table 2
Reported cases of human infection with N. otitidiscaviarum.

| Authors/year of publication | Age/gender | Risk factors | Affected site | Imaging modality/findings | Treatment /duration | Steroid use | Outcome | Reference |
|-----------------------------|------------|--------------|---------------|---------------------------|---------------------|------------|---------|-----------|
| Princess I et al. 2018      | 51/M       | Asthma       | Lung          | consolidation of the left lung with destruction of the left lung | TMP-SMX + imipenem  | +          | Died    | [20]      |
| Tajima K et al. 2018        | 66/M       | Lymphoma     | Lung + Meninges | Multiple nodular lesions in the lung | TMP-SMX+ linezolid  | –          | Recovered | [21]      |
| Throuveugadame S et al.,2017| 65/M       | None         | Lung          | infiltrative lesions in the middle zone of both lungs | TMP- SMX x 3 months | –          | Recovered | [22]      |
| Liu C et al. 2017           | 58/M       | hepatitis B virus Smoker | Lung          | presence of nodules, masses, patchy consolidations, and bilateral pleural effusion | TMP-SMX + Amikacin + imipenem | –          | Died    | [23]      |
| Sah R 2020                  | 61/M       | Nephrotic Syndrome | Lung + Skin    | consolidation (mass-like lesion 3.5 × 3.5 cm) in the right upper lobe with right-sided pleural effusion and cystic lesion in the left upper lobe | TMP-SMX             | +          | Recovered | [24]      |
| Sadamatsu H et al. 2017     | 72/F       | Asthma       | Lung          | USG of thigh: pus collection in the right thigh irregularly shaped solid opacity in the right middle lobe, a cavitary mass in the left lower lobe and bronchiectasis in both lower lobes | Minocycline 4 weeks | +          | Recovered | [25]      |
| Deepa R et al. 2016         | 14/F       | Rheumatic heart disease | Lung          | right lower lobe consolidation and right sided pleural effusion | Death Prior to identification | –          | Died    | [26]      |
| Jiang Y et al. 2016         | 37/M       | None         | Lung          | consolidation in the upper lobe of right lung, multiple nodules in both lung and right pleural effusion. | Minocycline TMP-SMX | –          | Recovered | [9]       |
| Simmons BP et al. 1992      | 60/M       | Heart transplant | Lung + skin and soft tissue | Only abstract accessible | Imipenem/clastatin and TMP-SMX and doxycycline | –          | Recovered | [27]      |
| Castelli et al., 1994       | 31/M       | HIV, Trauma  | Skin and soft tissue + brain | Hypodensity in the right fronto- temporal and in the left temporo-parietal areas of probable inflammatory origin | TMP-SMX             | –          | Died    | [28]      |
| Clark et al., 1995          | 86/M       | Trauma       | Skin          | Vertebral Fracture | TMP-SMX x 10 weeks | +          | Recovered | [29]      |
| Suzuki et al., 1995         | 78/F       | Asthma       | Skin + lymph node | None | Minocycline + Doxycycline | +          | Recovered | [30]      |
| Morghetti et al., 1997      | 31/M       | Trauma       | Skin          | There were no radiological sign of osteomyelitis. | TMP-SMX +imipenem x 3 weeks, Then TMP-SMX x 3 weeks | –          | Recovered | [31]      |
| Sandre et al., 1997         | 59/M       | HIV          | Chest wall + Lung + Abdomen | large septated extraperitoneal mass crossing both inside and outside the left thoracic and abdominal wall | Surgery, TMP+SMA + amikacin x 6 weeks | –          | Recovered | [32]      |
| Tanguichi et al., 1998      | 76/M       | Tuberculosis | Lung          | Diffuse reticulonodular shadows on both lung fields a multilocular expanding process in the right frontal lobe with edema and some displacement of the midline structures | TMP-SMX x 6 months | –          | Recovered | [33]      |
| Hartmann et al., 2000       | 50/F       | Renal Transplant | Lung          | Meopenem + rifampicin X 6 weeks. Oral ciprofloxacin + rifampicin for 2 months. | –          | Recovered | [34]      |
| Duren et al., 2001          | 21/M       | IV drug      | Brain         | upper-posterior parietal right-sided cystic mass | Imipenem + TMP-SMX  | +          | Recovered | [35]      |
| Wada et al., 2002           | 69/F       | Trauma       | Skin+ Lyph nodes | None | TMP-SMX | –          | Recovered | [36]      |
| Jennier et al., 2002        | 77/M       | Rheumatoid arthritis, chronic bronchitis, Hypertension,truma | Skin          | None | Minocycline+ Clarithromycin 6 months | +          | Recovered | [37]      |
| Díezmooy et al., 2004       | 65/M       | None         | Lung          | multiple cavitary+non-cavitary nodules throughout the right lung and a large consolidation consisting cavitating areas on the lower two-third of the left lung | IV Amikacin + TMP-SMX x 1 month | –          | Recovered | [38]      |
| Hemmersbach et al., 2004    | 44/M       | Renal Transplant, Diabetes | Brain         | 3 contrast enhancing lesions with enhancement localized in the frontal lobe, parietal lobe and the cerebellum | TMP-SMX 4 month | –          | Died    | [39]      |
| Yoshida et al., 2004        | 69/M       | Rheumatoid arthritis | Lung          | also showed the presence of fluid encap-sulated by an irregularly thickened pleural membrane | TMP-SMX + Levofloxacin + Gentamicin | +          | Recovered | [40]      |
| Fabre et al., 2005          | 70/M       | Rheumatoid arthritis, Inflammmab Sickle Cell, End Stage Renal Disease | Skin          | CT head and Lung Normal multiple pulmonary nodules scattered throughout both lung fields | Ofloxacin + Clindamycin | –          | Recovered | [41]      |
| Sharma et al., 2007         | 36/F       |kening Disease | Lung Blood    | OXAMKIN + GIATLINOXIN | –          | Recovered | [16]      |

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| Authors/year of publication | Age/ gender | Risk factors | Affected site | Imaging modality/findings | Treatment/duration | Steroid use | Outcome | Reference |
|-----------------------------|------------|--------------|---------------|---------------------------|-------------------|------------|---------|----------|
| Thoms et al. 2007           | 55/M       | None         | Skin          | A computed tomographic scan confirmed muscle or bone involvement in the left leg. | TMP-SMX + Amikacin | Recovered | Died    | [42]     |
| Pelaez et al. 2009          | 85/F       | Ch/XO Pulmonary Disease | Lung | Lung, brain | Interstitial distribution of multiple pulmonary nodules, fluid in the major fissure, and a small pleural effusion. | TMP-SMX + Imipenem | Recovered | Died    | [43]     |
| Betran et al. 2010          | 57/M       | Diabetes, Thrombocytopenia | Lung | Lung | Chest X-ray revealed increased bronchovascular markings in the para-hilar region with emphysematous changes. | TMP-SMX + Imipenem | Recovered | Survived | [44]     |
| Chen et al. 2011            | 51/M       | None         | Skin, Soft tissue | MRI revealed extensive inflammatory change with multiple focal fluid collections. Some of these lesions showed a central hypointense focus. | TMP-SMX PO x 1 year | Recovered | Survived | [45]     |
| Ramamoorthi et al. 2011     | 36/M       | None         | Lung         | Peripheral pleural-based thin-walled cavitory lesion with irregular inner margins, measuring 4.3 cm x 2.4 cm. | TMP-SMX x 6 months + Moxifloxacin | Recovered | Survived | [46]     |
| Pra even et al. 2014         | 60/M       | Chronic obstructive pulmonary disease, Trauma | Lung | Lung, Brain | Chest X-ray revealed increased bronchovascular markings in the para-hilar region with emphysematous changes. | TMP-SMX x 3 months + Imipenem | Recovered | Survived | [47]     |
| Scheffel-Czubbell et al. 2019 | 80/F       | Diabetes, Malignancy | Lung | Lung | Chest X-ray revealed increased bronchovascular markings in the para-hilar region with emphysematous changes. | TMP-SMX x 3 months + Imipenem | Recovered | Survived | [48]     |
| Paredes-Castellanos et al. 2019 | 70/M       | Diabetes, Chronic obstructive pulmonary disease | Lung | Lung | Chest X-ray revealed increased bronchovascular markings in the para-hilar region with emphysematous changes. | TMP-SMX x 3 months + Imipenem | Recovered | Survived | [49]     |
| Malagon et al. 2013         | 5/M        | None         | Brain        | No involvement of the bone. | Ceftriaxone 2 g IV twice daily + Amikacin 500 mg IV twice daily + Ciprofloxacin 500 mg orally twice daily. | Recovered | Survived | [50]     |
| Yi-Chun Chen et al. 2013    | 47/M       | Diabetes Mellitus | Lung | Lung | Chest X-ray revealed increased bronchovascular markings in the para-hilar region with emphysematous changes. | TMP-SMX x 3 months + Imipenem | Recovered | Survived | [51]     |
| Chung-Hao Huang et al. 2015 | 42/M       | Cirrhosis    | Lung | Lung | Chest X-ray revealed increased bronchovascular markings in the para-hilar region with emphysematous changes. | TMP-SMX x 3 months + Imipenem | Recovered | Survived | [52]     |
| Talwar et al. 1989          | 50/F       | None         | Brain        | No involvement of the bone. | Isoniazide + Rifampin | Recovered | Died    | [53]     |
| Torre et al. 1991           | 75/M       | Diabetes     | Knee         | No involvement of the bone. | Ceftriaxone 2 g IV twice daily + Amikacin 500 mg IV twice daily + Ciprofloxacin 500 mg orally twice daily. | Recovered | Survived | [54]     |
| Mufti et al. 1995           | 36/10 days | Male         | Lung         | No involvement of the bone. | Ceftriaxone 2 g IV twice daily + Amikacin 500 mg IV twice daily + Ciprofloxacin 500 mg orally twice daily. | Recovered | Survived | [55]     |
| Eren et al. 2016            | 69/F       | None         | Brain        | No involvement of the bone. | Isoniazide + Rifampin | Recovered | Died    | [56]     |
| Alteras et al. 1986         | 39/F       | None         | Foot         | No involvement of the bone. | Isoniazide + Rifampin | Recovered | Survived | [57]     |
| Min-Hui et al. 2012         | 71/M       | SLE          | Foot         | No involvement of the bone. | Ceftriaxone 2 g IV twice daily + Amikacin 500 mg IV twice daily + Ciprofloxacin 500 mg orally twice daily. | Recovered | Survived | [58]     |
| Girouard et al. 1987        | 60/M       | None         | Finger       | No involvement of the bone. | Isoniazide + Rifampin | Recovered | Survived | [59]     |
| Saksena et al. 2020         | 70/F       | None         | Lung         | No involvement of the bone. | Ceftriaxone 2 g IV twice daily + Amikacin 500 mg IV twice daily + Ciprofloxacin 500 mg orally twice daily. | Recovered | Survived | [60]     |

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disseminated disease involving two or more organs and the central nervous system (CNS) was involved in 44% of those with disseminated disease. Isolated CNS and cutaneous infection accounted for 9% and 8% of cases respectively. [15] The most common manifestation of CNS infection is brain abscess. There have been three reported cases of *Nocardia causing* aneurysms in intracerebral arteries [17–19]. One of these three patients had a background of SLE and was getting steroids while another one had multiple myeloma. All three of them responded well to surgical management along with a combination of antibiotics. The characteristics of these three cases are summarized in (Table 1). To the best of our knowledge, there are 54 reported cases of human infections due to *N. otitidiscaviarum*. The details were reviewed and summarized in (Table 2).

There are many challenges in managing nocardial infection. On one hand, differentiating *Nocardia* species using biochemical characteristics is time-consuming and unreliable. On the other hand, genotypic methods of identifying *N. spp* including 16s ribosomal RNA sequencing and MALDI-TOF are fast, sensitive, and highly reliable. However, the non-availability of these facilities in many centers can delay the identification of causative agents. The treatment of *Nocardia* is challenging in the absence of prospective randomized trials to decide the most effective therapy for nocardiosis. The choice of antimicrobials is based on cumulative retrospective experience, results of investigations in animal models, and in vitro antimicrobial activity profiles. Antibiotics that are typically effective against *N. spp* include trimethoprim-sulfamethoxazole (TMP-SMX), amikacin, imipenem, and linezolid and a combination of these agents may be used as empirical therapy. The Infectious Diseases Community of Practice of the American Society of Transplantation has published Guidelines on *Nocardia* infections in solid organ transplantation [69]. In the absence of other guidelines, the recommendations of this guideline can be extrapolated to other groups of patients with nocardiosis. They recommend TMP-SMX as first-line therapy in all patients with nocardiosis. Monotherapy is recommended for cutaneous as well as stable pulmonary disease. Imipenem, ceftriaxone, or linezolid are recommended agents when TMP-SMX cannot be used due to allergy or other causes. At least two agents (imipenem + amikacin or TMP-SMX) are recommended for initial therapy in severe pulmonary infection, CNS involvement, and disseminated disease. This guideline states that the use of three drugs for life-threatening diseases can be considered as a weak recommendation. They recommend at least 12-month therapy for cerebral nocardiosis and to ensure resolution of lesions radiographically prior to stopping therapy. Surgical intervention may be needed in several settings in nocardiosis. For instance, cerebral abscesses, empyema, and mediastinal fluid collections are some conditions necessitating surgical intervention. Brain abscess of greater than 2.5 cm size is considered as an indication for aspiration. A clinical pathway published in 2014 recommends craniotomy for nocardial brain abscess in those with systemic infections and multiple brain lesions [70]. Literature shows few cases of *Nocardia* that had a benign course for years despite not receiving appropriate treatment [42,45,52,68].

**Conclusion**

Disseminated *N. otitidiscaviarum* is an uncommon presentation. This is the fourth reported case of intracranial aneurysm reported due to *Nocardia*. Possibility of intracranial aneurysm has to be considered while managing patients with nocardial infections.
Our patient presented relatively late, had a complicated course requiring multiple procedures, and a poor outcome despite proper antibiotics use and supportive care. Physicians managing patients with SLE need to be aware of the possibility of uncommon infections with unusual presentation. Patients with SLE should be educated about their immunosuppressed state and the need to present early to health care facilities.

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**References**

1. IPSN - List of prokaryotic names with standing in nomenclature, [Online]. Available from: (https://ipsn.dsmz.de/genus/nocardia/).
2. Nocardia E. Note sur la maladie des boeufs de la Guadeloupe connue sous le nom de farcin. Ann Inst Pasteur 1888;vol.2:293–302.
3. Snijders EP. Verslag van het wetenschappelijk vergezellen de vergadering van der afdeling Sumatra's oostkust. Geneesk Tijdschr Ned Indië 1924;64:75–7.
4. Causey WA, Arnett P, Brinker J. Systemic antibiotics use and supportive care. Physicians managing patients to the research, authorship, and/or publication of this article.

![Image](https://i.imgur.com/3Q5Q5Q5.png)

**CRedIT authorship contribution statement**

**Jabeed Parengal**: Conceptualization, Visualization, Writing – original draft, Data curation. **Seham Mohsin Aalebi**: data collection, data analysis, writing manuscript. **Manal Mahmoud Mohamed Hamed**: Investigation. **Hosam Mohammed Alqatami**: Investigation, Resources. **Fatma Ben Abid**: Conceptualization, Writing – review & editing, Supervision, Project administration.

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**References**

1. LPSN - List of prokaryotic names with standing in nomenclature, [Online]. Available from: (https://ipsn.dsmz.de/genus/nocardia/).
2. Nocardia E. Note sur la maladie des boeufs de la Guadeloupe connue sous le nom de farcin. Ann Inst Pasteur 1888;vol.2:293–302.
3. Snijders EP. Verslag van het wetenschappelijk vergezellen de vergadering van der afdeling Sumatra's oostkust. Geneesk Tijdschr Ned Indië 1924;64:75–7.
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**CRedIT authorship contribution statement**

**Jabeed Parengal**: Conceptualization, Visualization, Writing – original draft, Data curation. **Seham Mohsin Aalebi**: data collection, data analysis, writing manuscript. **Manal Mahmoud Mohamed Hamed**: Investigation. **Hosam Mohammed Alqatami**: Investigation, Resources. **Fatma Ben Abid**: Conceptualization, Writing – review & editing, Supervision, Project administration.

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**References**

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2. Nocardia E. Note sur la maladie des boeufs de la Guadeloupe connue sous le nom de farcin. Ann Inst Pasteur 1888;vol.2:293–302.
3. Snijders EP. Verslag van het wetenschappelijk vergezellen de vergadering van der afdeling Sumatra's oostkust. Geneesk Tijdschr Ned Indië 1924;64:75–7.
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**Jabeed Parengal**: Conceptualization, Visualization, Writing – original draft, Data curation. **Seham Mohsin Aalebi**: data collection, data analysis, writing manuscript. **Manal Mahmoud Mohamed Hamed**: Investigation. **Hosam Mohammed Alqatami**: Investigation, Resources. **Fatma Ben Abid**: Conceptualization, Writing – review & editing, Supervision, Project administration.

**Declaration of conflict of interest**

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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**References**

1. LPSN - List of prokaryotic names with standing in nomenclature, [Online]. Available from: (https://ipsn.dsmz.de/genus/nocardia/).
2. Nocardia E. Note sur la maladie des boeufs de la Guadeloupe connue sous le nom de farcin. Ann Inst Pasteur 1888;vol.2:293–302.
3. Snijders EP. Verslag van het wetenschappelijk vergezellen de vergadering van der afdeling Sumatra's oostkust. Geneesk Tijdschr Ned Indië 1924;64:75–7.
4. Causey WA, Arnett P, Brinker J. Systemic antibiotics use and supportive care. Physicians managing patients to the research, authorship, and/or publication of this article.

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