SSR Institute of International Journal of Life Sciences
ISSN (O): 2581-8740 | ISSN (P): 2581-8732
Siddiqui *et al*., 2026
doi: 10.21276/SSR-IIJLS.2026.12.1.20

Case Series

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Unusual Cutaneous Manifestations of Nocardiosis: Clinical Insights from a Case Series

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Received: 18 Aug 2025/ Revised: 29 Oct 2025/ Accepted: 25 Dec 2025

ABSTRACT

Background: Nocardiosis is an uncommon yet clinically significant infection caused by aerobic, Gram-positive, partially acid-fast filamentous bacteria of the genus *Nocardia*. Cutaneous nocardiosis is rare and often underdiagnosed because its clinical presentation frequently mimics bacterial, fungal, or mycobacterial infections. This overlap may lead to delayed diagnosis and inappropriate treatment. The disease can affect both immunocompetent and immunocompromised individuals and exhibits a broad spectrum of clinical manifestations.

Methods: We report a case series of three patients presenting with unusual cutaneous manifestations of nocardiosis, emphasizing diagnostic challenges, microbiological findings, treatment strategies, and outcomes. The cases included: (i) a 22-day-old neonate with multifocal cervicofacial abscesses, (ii) a 47-year-old post-COVID female with a disseminated *Nocardia farcinica* infection presenting as an intramuscular thigh abscess, and (iii) a 42-year-old immunocompetent farmer with a primary cutaneous abscess over the upper back. Diagnosis was established through direct microscopy using Gram staining and modified Ziehl–Neelsen staining, followed by culture confirmation.

Results: All cases demonstrated characteristic microbiological features of *Nocardia* species, including branching Gram-positive, partially acid-fast filaments and dry, chalky white colonies on culture. Management consisted of surgical drainage combined with prolonged antimicrobial therapy, primarily trimethoprim–sulfamethoxazole, with adjunctive agents such as imipenem or amikacin in severe or disseminated disease. All patients showed complete clinical resolution without recurrence on follow-up.

Conclusion: This series underscores the diverse cutaneous presentations of nocardiosis across different age groups and immune statuses. Early recognition, timely microbiological diagnosis, and prolonged targeted therapy are critical to reducing morbidity and preventing dissemination or relapse.

Key-words: Cellulitis cutaneous nocardiosis, Nocardia species, Nocardiosis, Neonatal nocardiosis

INTRODUCTION

Nocardia species are aerobic, Gram-positive, weakly acid-fast filamentous bacteria that are ubiquitous in soil, decaying vegetation, and organic matter. Infections caused by *Nocardia* are relatively uncommon but clinically significant, especially due to their chronicity and potential for dissemination.[1,2] Cutaneous nocardiosis is a rare manifestation and usually occurs following direct inoculation of the organism into the skin through minor trauma, insect bites, or occupational exposure to soil and organic matter.[3] Agricultural workers, gardeners, and construction workers are particularly vulnerable due to frequent exposure to contaminated environments.[4] Clinically, primary cutaneous nocardiosis presents in various forms, including localized abscesses, cellulitis, mycetoma, or a lymphocutaneous (sporotrichoid) pattern, and it may mimic bacterial, fungal, or

How to cite this article
Siddiqui AH, Sachan T, Saxena S, Ahmad J, Umair R. Unusual Cutaneous Manifestations of Nocardiosis: Clinical Insights from a Case Series. SSR Inst Int J Life Sci., 2026; 12(1): 9106-9112.

Access this article online
https://iijls.com/

doi: 10.21276/SSR-IIJLS.2026.12.1.20

mycobacterial infections often lead to misdiagnosis and treatment delays.[5,6]

In neonates and immunocompetent adults, the infection is uncommon but has been increasingly reported.[7] Immunosuppression—such as corticosteroid therapy, malignancy, organ transplantation, or uncontrolled diabetes—is a recognized risk factor for disseminated disease, but many cases still occur in individuals without predisposing comorbidities.[8]

Early diagnosis depends on a high index of suspicion combined with microbiological confirmation using Gram staining, modified Ziehl-Neelsen staining, and culture techniques. Trimethoprim-sulfamethoxazole (TMP-SMX) remains the mainstay of therapy, either alone or in combination with other antimicrobials like amikacin, imipenem, or linezolid in severe or disseminated cases.[9,10]

Here, we present three diverse cases of nocardiosis: a 22-day-old neonate with a cervicofacial abscess, a 47-year-old post-COVID female with an intramuscular nocardial abscess secondary to prior pulmonary nocardiosis, and a 42-year-old farmer with a primary cutaneous abscess on the upper back. These cases emphasize the variable clinical spectrum of nocardiosis, the importance of early microbiological diagnosis, and the role of prolonged targeted therapy in preventing relapse.

Case 1

A 22-day-old male neonate presented to the paediatric outpatient department with multiple swellings over the left side of the face and neck. Father gave a history of lesions appearing over the left upper eyelid about 10 days earlier, initially small, and painless, for which the parents applied some ointment (Fig. 1A). Over the next few days, swellings appeared sequentially—first over the left cheek and later the neck—each gradually increasing in size, becoming tender, and associated with purulent discharge on both sides. (Fig. 1B) There was no history of fever, respiratory symptoms, trauma (other than the above handling), or prior hospitalization. The patient was born at term via an uncomplicated vaginal delivery, and both perinatal and family histories were unremarkable.

On examination, the neonate was alert and active, with stable vital signs: pulse rate 128/min and temperature 98.4°F (36.9°C). Local examination revealed multiple erythematous, tender, fluctuant swellings—one over the left eyelid, another over the cheek extending toward the periorbital region, and a third over the upper neck—with overlying induration and purulent discharge. Systemic examination findings were within normal limits. Blood culture, CBC, and CRP were sent to the lab.

Laboratory investigations showed haemoglobin 11 g/dL, total leukocyte count 16,000/µL, and platelet count 1.10 lakh/µL. C-reactive protein was markedly elevated at 79 mg/L. Serum urea (13 mg/dL), creatinine (0.34 mg/dL), and electrolytes were within normal limits. An incision and drainage were performed, and pus samples were sent for Gram stain and culture. On admission, the patient was already on metronidazole, cefpodoxime, and T-Bact ointment. Post-admission, the antibiotic regimen was modified to include amikacin and piperacillin–tazobactam.

Given the unusually severe and multifocal presentation of soft-tissue infection in a neonate, the clinician suspected an underlying immunodeficiency and advised neutrophil oxidative burst (NBT) testing, along with T cells, B cells, CD4, and CD8. NBT could not be done due to economic constraints, whereas the other lab tests reported normal values.

On day 2, the pus sample grew dry, white, powdery colonies. Gram stain revealed Gram-positive, branching filamentous structures that were partially acid-fast. (Fig. 2) Based on these findings, the antibiotic regimen was revised, and the patient was started on injectable trimethoprim–sulfamethoxazole (TMP-SMX) for 4 days, followed by oral TMP-SMX for a total of 6 weeks. The neonate showed steady improvement, with gradual resolution of all swellings and discharge. Complete healing was achieved by the end of therapy, and no recurrence was observed during a one-year follow-up period.

doi: 10.21276/SSR-IIJLS.2026.12.1.20

Fig. 1: (A): Lesion over the left upper eyelid, **(B):** Subsequent swellings over the left cheek and neck

Case 2

A 47-year-old female patient presented to the hospital with complaints of pain and swelling in the right thigh for 10 days, associated with difficulty in walking. The swelling was gradually progressive, tender, and warm to the touch. There was no history of trauma or prior injections at the site. The patient had a history of COVID-19 infection with post-COVID-19 nocardial pneumonia. On examination, the patient was afebrile, hemodynamically stable (pulse rate 86/min, BP 130/78 mmHg, respiratory rate 18/min, SpO_2 97% on room air), and appeared weak but well oriented. Local examination revealed a diffuse, tender, erythematous swelling over both thighs, measuring approximately 6 cm×5 cm, with localized induration and fluctuation suggestive of an abscess. Systemic examination findings were unremarkable. Laboratory investigations showed hemoglobin 10.2 g/dL, total leukocyte count 14,800/µL with neutrophilic predominance, platelet count 2.3 lakh/µL, and elevated C-reactive protein (72 mg/L). Serum urea, creatinine, and electrolytes were within normal limits. Ultrasonography of the thigh revealed a well-defined intramuscular abscess within the rectus femoris muscle. Pus was aspirated aseptically and sent for culture. Gram staining of the aspirate showed thin, branching, Gram-positive filamentous bacilli. Modified Ziehl–Neelsen staining using 1% H_2SO_4 demonstrated partially acid-fast branching filaments, suggestive of *Nocardia* species (Fig. 2). The sample was cultured on blood agar and, after 72 hours of incubation, revealed dry, chalky white colonies consistent with *Nocardia*. Species identification by MALDI-TOF MS confirmed *Nocardia farcinica*.

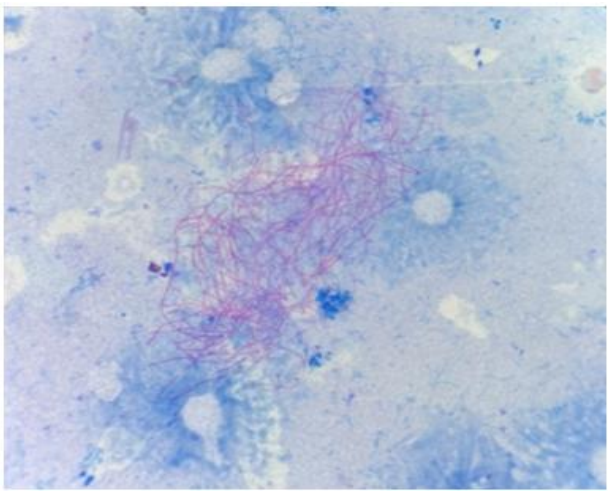

Fig. 2: Modified acid-fast stain showing branching filamentous acid-fast bacilli

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Initially, the patient was started empirically on intravenous imipenem, and after culture confirmation, trimethoprim–sulfamethoxazole (TMP-SMX) was added to the regimen. Drainage of the abscess was performed under ultrasound guidance on three occasions over two weeks. The patient demonstrated gradual clinical improvement, with complete resolution of swelling and normalization of inflammatory markers.

She was discharged on oral TMP-SMX therapy, which was continued for a total of four months. On follow-up 3 months later, the patient was asymptomatic, and a repeat ultrasound showed complete resolution of the abscess without recurrence.

Case 3:

A 42-year-old male farmer from rural Uttar Pradesh presented to the surgical outpatient department with a painful swelling over the upper back for the past month. The swelling progressively increased in size and was associated with localized tenderness, but without spontaneous discharge. The patient reported a history of frequently carrying harvested crops on his back but denied any history of penetrating trauma. There was no history of diabetes, hypertension, tuberculosis, recent steroid use, or immunosuppressive therapy, and family history was non-contributory. On examination, the patient was afebrile, alert, and hemodynamically stable, with a pulse rate of 92/min, BP of 124/78 mmHg, and SpO_2 of 98% on room air. Local examination revealed a 5×4 cm erythematous, tender, fluctuant swelling with mild surrounding induration over the upper back; no discharging sinuses or regional lymphadenopathy were noted.

An incision and drainage procedure was performed, and pus was sent for Gram stain and culture sensitivity testing. Gram staining demonstrated thin, branching, Gram-positive filamentous bacilli, as shown in Fig. 3, which was confirmed by modified acid-fast staining (1% H_2SO_4) as acid-fast branching filaments, consistent with *Nocardia* spp.

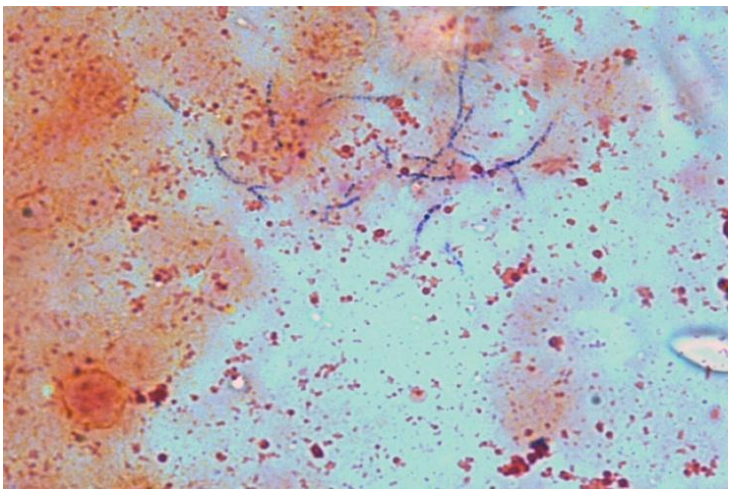

Fig. 3: Gram stain showing branching filamentous Gram-positive bacilli

The patient was started on oral trimethoprim-sulfamethoxazole (TMP-SMX) (160/800 mg twice daily) based on culture sensitivity results. Supportive care, including analgesics, wound dressing, and nutritional supplementation, was provided. Within two weeks, the swelling regressed significantly, and by the six-week follow-up, complete healing was noted without sinus formation or recurrence. The patient was advised to continue TMP-SMX for 12 weeks to minimize relapse risk.

DISCUSSION

Our cases highlight clinical heterogeneity of nocardial infections, ranging from rare neonatal disease to cutaneous and disseminated involvement in both immunocompetent and immunocompromised hosts. The first case, involving a 22-day-old neonate, underscores the exceptional rarity of cervicofacial nocardiosis in this age group. Neonatal nocardiosis is scarcely reported in the literature and typically manifests with systemic dissemination rather than localized disease. [11,12] In our patient, however, infection was restricted to the cheek

doi: 10.21276/SSR-IIJLS.2026.12.1.20

and periorbital region, likely due to direct inoculation during perinatal exposure or handling. The favorable outcome following incision and drainage, coupled with prolonged trimethoprim–sulfamethoxazole (TMP-SMX) and linezolid therapy, highlights the effectiveness of combined surgical and pharmacologic management, consistent with previous reports of isolated neonatal cutaneous nocardial abscesses [13-15].

The second case illustrates delayed dissemination of *N. farcinica*, presenting as an intramuscular abscess months after recovery from post-COVID pulmonary nocardiosis. The interplay of post-COVID immune dysregulation and prior corticosteroid therapy likely predisposed the patient to both the initial pulmonary disease and subsequent extrapulmonary spread. Similar reports have described *N. farcinica* causing late soft-tissue or systemic dissemination, particularly among immunosuppressed patients [12,16,17]. In our patient, timely ultrasonography-guided drainage combined with imipenem and targeted cotrimoxazole therapy ensured full recovery, underscoring the importance of early recognition and susceptibility-guided management in preventing disease progression.

The third case represents primary cutaneous nocardiosis in an immunocompetent farmer following occupational soil exposure. Localized abscess formation was likely triggered by unnoticed trauma during field work. Such presentations are well documented among agricultural workers, especially in endemic regions like India, where *Nocardia brasiliensis* is the predominant pathogen [6,18,19]. Inamadar and Palit reported a similar cluster of cases among farm workers, demonstrating variable clinical manifestations—ranging from cellulitis and abscesses to mycetoma and lymphocutaneous lesions—all of which responded favourably to prolonged TMP-SMX therapy [18].

Taken together, these cases reinforce several important clinical principles. First, nocardiosis affects a wide spectrum of hosts—from neonates to immunosuppressed adults—necessitating a high index of suspicion in non-healing cutaneous and systemic infections. Second, although pulmonary nocardiosis remains the most common form, primary cutaneous disease is not uncommon in individuals with direct soil exposure, and delayed dissemination can occur months after apparent recovery, particularly in immunocompromised patients. This justifies prolonged follow-up. Third, prompt culture-based diagnosis and species identification remain central to guiding therapy, given interspecies variability in drug susceptibility.

From a microbiological perspective, Gram staining remains a rapid and sensitive diagnostic tool, revealing thin, beaded, filamentous, branching Gram-positive bacilli, while modified Ziehl–Neelsen or Kinyoun stains confirm partial acid-fastness [20,21]. Routine culture media may support growth, but selective media and prolonged incubation are often required, as colonies may take up to two weeks to appear. Advances in molecular methods, including PCR, 16S rRNA sequencing, and MALDI-TOF MS, have improved species identification and resistance prediction, thereby enhancing both clinical management and epidemiological surveillance [22-24].

Therapeutically, TMP-SMX remains the cornerstone of treatment due to its broad efficacy across most clinically significant species [13-15,25,26]. However, treatment must be individualized. Severe or disseminated infections, particularly those caused by *N. farcinica*, often require initial combination regimens with agents such as amikacin, imipenem, third-generation cephalosporins, or linezolid until susceptibility results are available [16,25]. Linezolid, in particular, has demonstrated excellent activity, favorable tissue penetration, and oral availability, making it an attractive option in refractory or pediatric cases. [14] Surgical drainage or debridement should accompany pharmacologic therapy whenever abscesses are present to reduce microbial burden and obtain diagnostic material.

The duration of therapy is another critical determinant of outcome. While superficial cutaneous disease in immunocompetent patients may respond to several months of therapy, disseminated or CNS disease generally requires prolonged treatment (6–12 months or more) to prevent relapse [27,28]. Relapses have been documented with shorter regimens, highlighting the importance of individualized treatment duration guided by disease severity, host immune status, and microbiological response [29]. Special consideration is needed in neonates and children, where prolonged courses must be balanced against risks of drug toxicity, particularly with linezolid (hematologic, neurologic) and aminoglycosides (nephrotoxicity, ototoxicity) [30].

Equally important, these cases highlight the critical role of close collaboration between clinicians and microbiologists in achieving optimal outcomes.

doi: 10.21276/SSR-IIJLS.2026.12.1.20

Continuous communication between the treating physician and the microbiology team allows for early identification of *Nocardia* species, timely interpretation of culture and susceptibility results, and rapid modification of the antimicrobial regimen based on laboratory data. Such coordinated efforts are particularly vital in infections with atypical or delayed presentations, where empirical therapies may fail. Early diagnostic input from microbiologists not only expedites targeted therapy but also helps prevent complications, reduce hospital stay, and minimize the risk of recurrence or dissemination [31].

CONCLUSIONS

In conclusion, our case series emphasizes that nocardiosis, though rare, presents with diverse clinical manifestations across age groups and immune backgrounds. Primary cutaneous nocardiosis should be suspected in non-healing lesions with a history of trauma or environmental exposure, while disseminated forms must be considered in immunocompromised hosts. Early microbiological confirmation, multidisciplinary coordination, prolonged targeted therapy, and careful follow-up are key to achieving favorable outcomes.

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