

## Case Report

Osteomyelitis in the Left First Toe Due to *Mycobacterium abscessus* after an InjuryYurika Yagi<sup>1)</sup>, Hirotaka Suga<sup>2)</sup> and Akihiko Takushima<sup>1)</sup>

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## Abstract

“Non-tuberculous mycobacteria” (NTM) is a general term for pathogenic mycobacteria other than *Mycobacterium tuberculosis* and *Mycobacterium leprae*. Non-tuberculous mycobacteria are widely present in the natural environment, including soil and water, with over 150 reported species. *Mycobacterium abscessus* is rare among Non-tuberculous mycobacteria, and there are few reports of extrapulmonary lesions due to *Mycobacterium abscessus*. We describe a case of osteomyelitis in an adult woman’s left first toe caused by *Mycobacterium abscessus*. The osteomyelitis developed due to an injury in a public bathing facility. A combination of surgical debridement and multidrug therapy was effective. When antimicrobial agents are ineffective in trauma linked to water or soil, mycobacterial infections, including Non-tuberculous mycobacteria, should be considered as differential diagnoses, and laboratory culture targeted to mycobacteria would be recommended.

## Keywords

non-tuberculous mycobacteria, *Mycobacterium abscessus*, osteomyelitisJ Plast Reconstr Surg 2023; 2(3): 113-117  
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## Introduction

“Non-tuberculous mycobacteria”(NTM) is a general term for pathogenic mycobacteria other than *Mycobacterium tuberculosis* and *Mycobacterium leprae*. There are over 150 reported NTM species, 20 of which are considered human pathogenic. NTM are widely present in the natural environment, including soil and water, and often cause chronic respiratory tract infections. However, NTM can also cause lymphadenitis, skin and soft tissue infections, osteoarticular infections, disseminated infections, and catheter-related infections<sup>1)</sup>. *Mycobacterium avium complex* is reportedly the causative organism for NTM infection, but *Mycobacterium marinum* accounts for 70% of cases if the diseases are limited to skin and soft tissue infections<sup>2)</sup>. *Mycobacterium abscessus* (*M. abscessus*) is a rare species among the pathogenic NTM, and there have been few reports of extrapulmonary lesions associated with *M. abscessus*. We report a case of osteomyelitis caused by *M. abscessus* in a woman’s left first toe, which developed presumably as a result of an injury in a public bathing facility.

## Case Report

The patient was a 55-year-old woman with a history of systemic lupus erythematosus (SLE) and primary antiphospholipid antibody syndrome. She had not taken corticosteroid or other immunosuppressive drugs for the past 10 years (thus, she was not necessarily considered an immunocompromised patient). She injured her left first toe on a broken tile in the bathing facility of a public gym and was treated with minocycline by a local physician. However, the swelling and redness did not improve. She presented to our department on the 15th day after the injury. The initial examination revealed scarring at the interphalangeal (IP) joint of the left first toe and swelling and redness over the first toe (Figure 1a). Blood tests showed no elevated inflammatory response, and there were no abnormal findings on X-ray (Figure 1b).

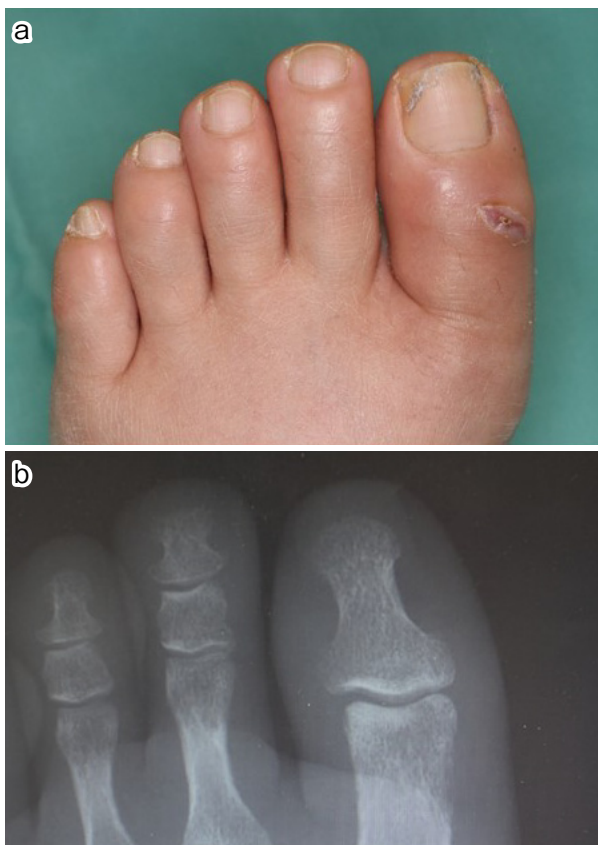
The patient was initially treated with cephalexin for suspected cellulitis caused by a blood circulation disorder associated with collagen disease. However, the swelling and red-

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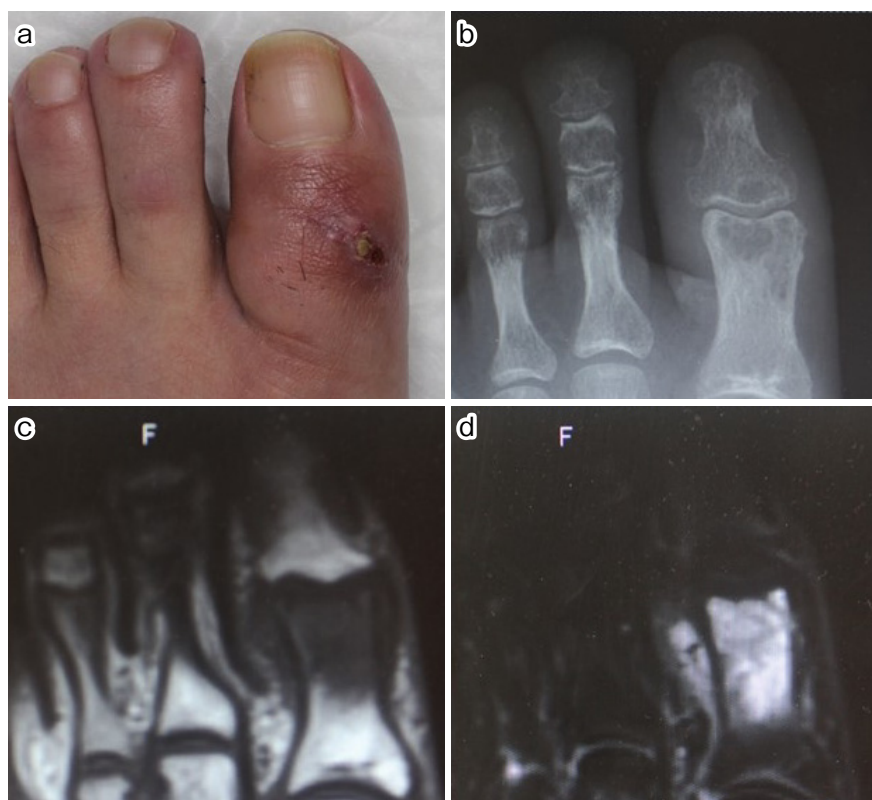


**Figure 1.** Initial examination findings. a: There was scarring at the interphalangeal (IP) joint of the left first toe. b: No abnormal findings were also observed on X-ray.

ness did not improve. Thus, an incision was made on the left first toe on the 14th day after the initial visit (the 29th day after the injury). A small amount of pus was identified, and the bacteriological culture result was *Staphylococcus epidermidis*. The incision wound was treated with povidone-iodine gel, and the cefalexin was continued. The wound was epithelialized, the redness and swelling improved, and the patient followed up.

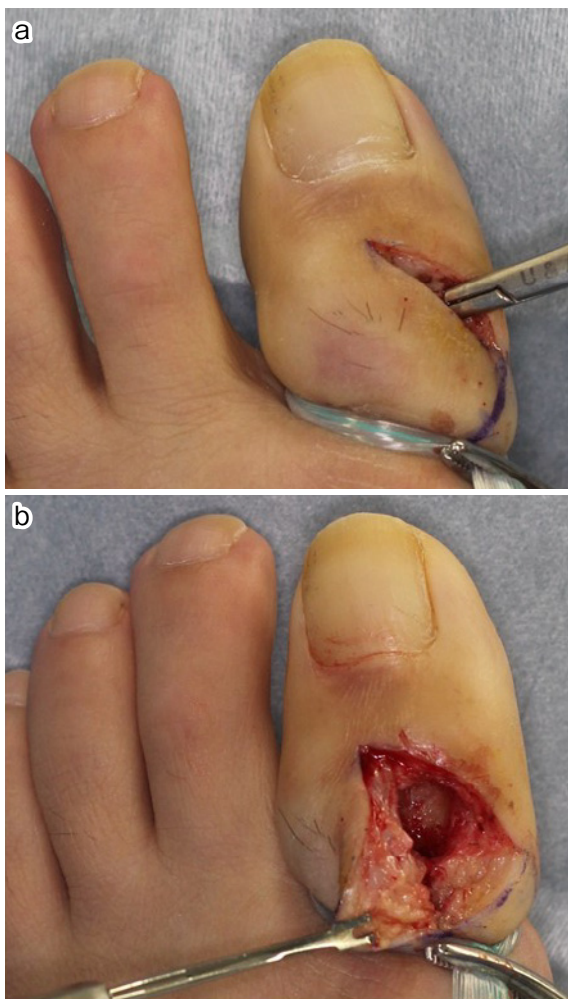
The patient reported planter pain during walking on the 75th day after the initial visit (the 90th day after the injury). The swelling of the left first toe had also flared up. There was a small fistula in the scar area (**Figure 2a**). A second X-ray showed a cystic radiolucent shadow of the proximal phalanx (**Figure 2b**). MRI showed low intensity on T1-weighted images (**Figure 2c**) and high intensity on T2-weighted images (**Figure 2d**). There was a small amount of pus drainage from the fistula. The mycobacterial culture survey detected *M. abscessus*. Clinical findings, imaging studies, and laboratory culture results collectively led us to diagnose left proximal phalanx osteomyelitis due to *M. abscessus*.

On the 113th day after the patient's initial presentation (the 128th day since the injury), she underwent debridement for osteomyelitis in the left first proximal phalanx. The granulation tissue exposed through the fistula was excised, along with the surrounding scar. The fistula was connected to the marrow cavity of the proximal phalanx (**Figure 3a**). The proximal phalanx was partially decayed and necrotic,

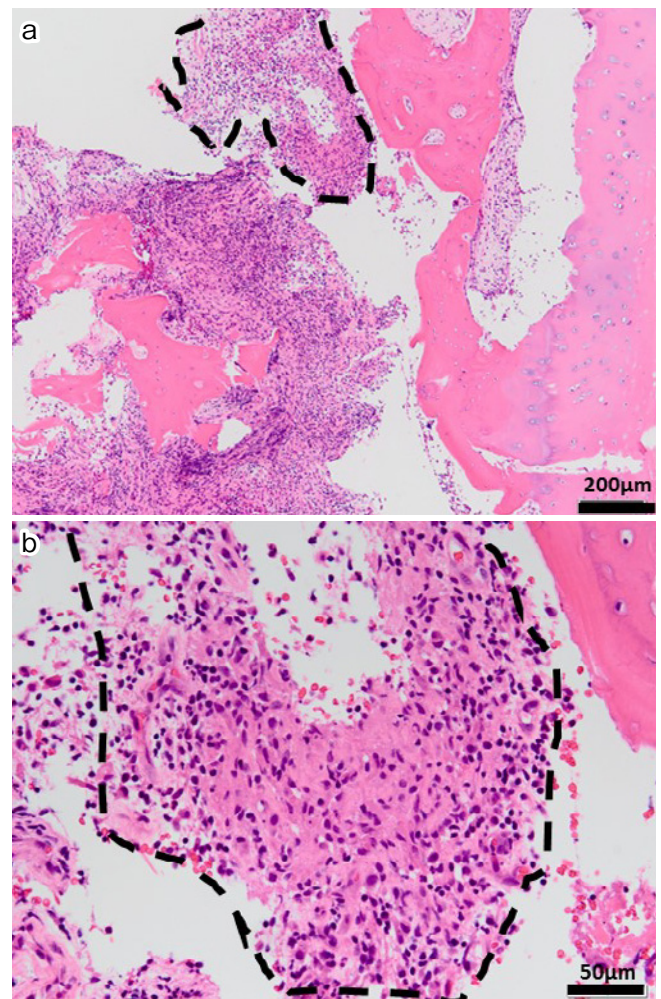


**Figure 2.** At 3 months after the injury. a: The swelling of the left first toe had flared up and formed a small fistula. b: A cystic radiolucent shadow of the proximal phalanx on X-ray. c: Hypo-absorption on T1-weighted images. d: Hyper-absorption on T2-weighted images. Osteomyelitis findings in the proximal phalanx of the left first toe.





**Figure 3.** Operative findings. a: The fistula reached the proximal phalanx marrow cavity. b: All of the decayed bone was removed.



**Figure 4.** Pathology findings. a: Low-power field. b: High-power field. Small epithelioid cell granulomas had formed without necrosis.

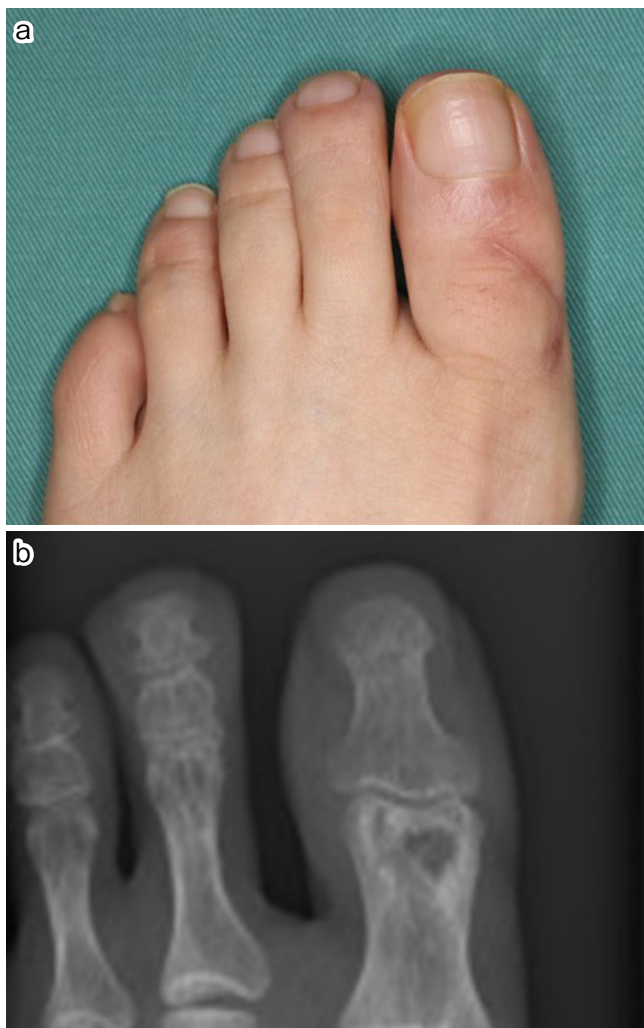
and the intraoperative findings were consistent with the preoperative diagnosis of osteomyelitis. All the decayed bone was removed, and some of the removed bone was submitted for bacterial/mycobacterial cultures and pathology examinations. The wound was left open (**Figure 3b**). Pathology revealed a single epithelioid cell granuloma (**Figure 4**). The patient received topical povidone-iodine gel on the first postoperative day with continued antibiotic therapy. The patient started azithromycin, amikacin, and imipenem, generally considered effective combinations of antibiotics against *M. abscessus*. Azithromycin and amikacin have antimicrobial properties against the *M. abscessus* detected in the previous culture survey.

On postoperative day 22, intraoperative culture results turned out that the detected species of *M. abscessus* was highly resistant to imipenem. Thus the imipenem was replaced with tigecycline, which is effective against  $\beta$ -lactamase-producing species. Subsequently, the patient became stressed and had difficulty continuing hospitalization. The patient was discharged on the 26th postoperative day because the wound progress was good. The antibiotics were changed to oral azithromycin and minocycline, but side effects such as nausea and fatigue appeared. Therefore, the

minocycline was discontinued on postoperative day 30, azithromycin was discontinued on postoperative day 40, and the patient was carefully monitored without antibiotics. On the 45th postoperative day, the wound had epithelialized and the pain during walking had disappeared. Periodic X-rays showed no recurrence of osteomyelitis, and the patient stopped coming to the hospital 1 year after the surgery (**Figure 5**).

## Discussion

Runyon et al. classified NTM into slowly growing mycobacteria (SGM) and rapidly growing mycobacteria (RGM) based on the growth rate of the bacteria; *M. abscessus* is classified as an RGM, as are *M. chelonae* and *M. fortuitum*<sup>2,3</sup>. *M. marinum* infections classified as SGM, transmitted from contaminated water, reportedly account for 70% of NTM infections of the skin. Still, reports of RGM skin infections have increased in recent years<sup>1</sup>. Among these reports, skin infections caused by *M. abscessus* due to inappropriate medical practices such as using contaminated local anesthetics have been identified in several countries<sup>3</sup>. In Japan, rare cases of *M. abscessus* infection due to trauma/in-



**Figure 5.** One year after surgery. a: After epithelialization, the wound did not recur. b: There was no recurrence of osteomyelitis on X-ray.

jury have been reported, just like the present case<sup>2)</sup>. In nature, *M. abscessus* is present in water and soil and often develops subacutely after an incubation period of 3-5 weeks after trauma<sup>4,5)</sup>. Some of the cases reported in Japan had no confirmed history of trauma. The present patient's injury was caused by a broken tile in a public gym's bathing facility, and the wound healing course was subacute. Although *M. abscessus* undetected in the initial culture, NTM should have been suspected from the beginning because of the injury in a water environment and the patient's poor response to antimicrobial therapy. Since the culture conditions of some mycobacteria species (including culture medium and incubation temperature) could differ from those of common bacteria, the surgeon or the physician who suspects mycobacteria should report it to the laboratory personnel.

Immunocompromised or immunodeficient patients are more likely to develop NTM infections. This patient, diagnosed as SLE more than 10 years ago, was not considered immunocompromised because she had not taken corticosteroids or other immunosuppressive drugs for the past 10 years. It is unclear if SLE disease had impaired her immune system, resulting in increased susceptibility to NTM, or if

the extrapulmonary infection of NTM could have occurred even when she was immunologically normal.

RGM is generally multidrug-resistant, and most antituberculosis drugs are ineffective. In addition, *M. abscessus* is also generally resistant to quinolones, which are assumed to affect *Mycobacterium tuberculosis*<sup>6)</sup>. Thus, the selection of antimicrobial agents for *M. abscessus* infections is considered difficult. Combination therapy with two or more antimicrobial agents is recommended for RGM, considering the risk of the resistance acquisition in intractable infections such as osteomyelitis and bacteremia<sup>7,8)</sup>. In vivo, amikacin, cefoxitin, imipenem/cilastatin, linezolid, clarithromycin, and azithromycin are effective<sup>4,9)</sup>. The American Thoracic Society recommends combination therapy with amikacin and cefoxitin for pulmonary lesions caused by *M. abscessus*, but cefoxitin is not available in Japan. A combination of macrolides (clarithromycin and azithromycin), amikacin, and carbapenems is commonly used in Japan<sup>4)</sup>.

For our patient, a combination of azithromycin, amikacin, and imipenem was administered postoperatively. Azithromycin and amikacin have good tissue transfer to skin and muscle tissue, while imipenem has good transfer to skin and bone. Therefore, they are effective antimicrobial choices in terms of susceptibility and tissue transfer. Villanueva et al. compared the responses of *M. abscessus* infections to different therapeutic options: a group treated with surgical resection alone, a group treated with antimicrobial (clarithromycin) alone for 3-6 months, and a group treated with surgical resection and 4 months of antimicrobial therapy. Surgical resection alone resulted in a 32% response to treatment, antimicrobial administration alone resulted in a 23% response to treatment, and both surgical and antimicrobial therapies resulted in a 95% response to treatment<sup>10)</sup>. We believe that both combinations of surgical debridement and the targeted antimicrobial therapy resulted in the treatment response in the present case.

In summary, we treated a case of proximal phalanx osteomyelitis caused by *M. abscessus*, which is rare in Japan. When antimicrobial agents are ineffective in trauma linked to water or soil, NTM should be considered as differential diagnoses. A combination of surgical debridement and antimicrobial therapy could be more effective in treating NTM cases than surgery alone and antimicrobials alone. Multidrug therapy based on antibiotic susceptibility is recommended for antimicrobial chemotherapy.

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**Author Contributions:** Y.Y. wrote the manuscript. H.S. and A.T. supervised the manuscript. All the authors were involved in the treatment of the case.

**Conflicts of Interest:** There are no conflicts of interest.

**Ethical Approval:** Not applicable.

**Consent to Participate, Consent for Publication:** The patient gave her fully provided informed consent to be treated and to publish her case and images.

**Disclaimer:** Akihiko Takushima is one of the Editorial Committee members of Journal of Plastic and Reconstructive Surgery. This author was not involved in the peer-review or decision-making process for this paper.

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