Rapidly Growing Mycobacterial Infections After Pedicures

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Background: Rapidly growing mycobacteria (RGM) can cause a variety of cutaneous and systemic diseases. The causative organisms are typically *Mycobacterium fortuitum* or *Mycobacterium chelonae* (also known as *Mycobacterium abscessus*). Primary cutaneous lesions may develop after a variable latent period, from weeks to several months, and usually result from direct inoculation after trauma, from injections, or during surgery via contaminated medical instruments. Recently, investigators from the Centers for Disease Control and Prevention, Atlanta, Ga, and the California Department of Health Services, Berkeley, documented a large, unprecedented outbreak of community-acquired RGM infection, during which more than 100 patrons of a northern California nail salon contracted furunculosis in their legs as a result of exposure to whirlpool footbaths that were contaminated with *M. fortuitum*.

Observations: We report the clinical and epidemiological findings in 3 cases of lower extremity RGM infections that occurred after similar whirlpool footbath exposure at several different nail salons in southern California. These infections typically presented as recurrent furunculosis, causing considerable morbidity as a result of scarring, delayed diagnosis, and the need for long-term polymicrobial therapy.

Conclusions: Rapidly growing mycobacterial infections related to pedicures may continue to occur in a sporadic fashion. Clinicians should consider the possibility of RGM infection and inquire about recent pedicures in a patient with recurrent lower extremity furunculosis and abscesses that are unresponsive to conventional antibiotic therapy.

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REPORT OF CASES

CASE 1

A 25-year-old white woman presented with a 4- to 6-week history of 2 subcutaneous, nonpainful, red nodules of insidious onset on the lower part of her legs. Physical examination revealed bilateral erythematous, subcutaneous nodules located on the anterior aspect of the lower area of the legs. The lesion on the right leg was a 0.4-cm, ill-defined, non tender swelling, and the lesion on the left leg was a 1.5-cm, firm, ten-
der, erythematous, ulcerated nodule (Figure 1). The results of the rest of the physical examination were unremarkable. A punch biopsy specimen from the left leg showed suppurative and necrotizing granulomatous dermatitis, perifolliculitis, and panniculitis (Figure 2). Numerous acid-fast bacilli were noted within dermal and subcutaneous abscesses (Figure 3). Tissue cultures were positive for *Mycobacterium chelonae* at 3 days. Sensitivity results revealed high in vitro susceptibility to clarithromycin and ciprofloxacin hydrochloride, with intermediate sensitivity to trimethoprim-sulfamethoxazole. The patient was treated with ciprofloxacin and clarithromycin for 8 weeks after consultation with the Infectious Disease Division of the Naval Medical Center San Diego, San Diego, Calif. After 2 weeks of antibiotic therapy, the lesion on the right leg resolved and the size of the lesion on the left leg was reduced by 75%. At 10 weeks, however, the nodule on the right leg rapidly enlarged and suppurated, requiring incision and drainage (Figure 4). Cultures again yielded *M chelonae* at 3 days. Subsequently, extensive debridement of all necrotic tissue down to the anterior compartment muscle fascia of both legs was performed. Histopathologic examination of the debrided tissue showed follicular abscess formation, suppurative granulomas, and sinus tracts (Figure 5 and Figure 6). Numerous acid-fast bacilli were visualized with Fite stains. After 6 months of antibiotic therapy with clarithromycin, ciprofloxacin, and trimethoprim sulfate-sulfamethoxazole, the lesions resolved, and since then, there has been no recurrence (10 months). Before the onset of the disease, the patient had received pedicure treatments at a local nail salon (salon A) once a month for 3 months. She noticed that the disease had developed within 1 week of her last pedicure appointment. She also noted that she had shaved her legs with a razor blade before each appointment. This case was investigated by the County of San Diego Office of Public Health, San Diego, Calif, and the California Department of Health Services, Berkeley. On April 2, 2001, environmental specimens were collected from 4 of salon A’s whirlpool footbaths for mycobacterial culture. The laboratory examination of these specimens by the County of San Diego Office of Public Health found that all 4 whirlpool footbaths were contaminated with RGM. Footbath isolates identified as
M. chelonae and Mycobacterium fortuitum were sent to the Centers for Disease Control and Prevention, Atlanta, Ga, for molecular comparison with an M. chelonae isolate from the patient. Pulsed-field gel electrophoresis revealed that more than 1 strain of M. chelonae was present in the whirlpool footbaths; several of the M. chelonae isolates from the footbaths (salon A) were indistinguishable from the patient’s isolate (Figure 7). After documenting this link between patient disease and salon A, the County of San Diego Office of Public Health canvassed local physicians in attempt to find other cases that might be related to this salon. No other cases were identified at that time, but over several months, 5 additional cases of RGM furunculosis related to pedicures (including 3 not described herein, 2 of which were M. fortuitum infections) were reported, including 2 involving women who frequently received pedicures at salon A.

CASE 2

A 32-year-old white woman was referred from her primary care provider with a 9-month history of papules and nodules on the lower part of both legs (Figure 8). A previous punch biopsy specimen obtained by her primary care provider at another hospital was evaluated and recorded as a deep dermal abscess and panniculitis, with erythema nodosum as a possible cause. On the patient’s presentation to our clinic, a 5.0-mm, nontender, erythematous, dermal papule on the lateral aspect of the lower part of her right leg was examined. A punch biopsy specimen of this lesion revealed granulomatous dermatitis, with a follicular abscess and panniculitis, with 1 acid-fast ba-

![Figure 5](image1.png)

Figure 5. Low-power photomicrograph of debrided tissue showing sinus tracts and suppurative granulomas (hematoxylin-eosin, original magnification ×40).

![Figure 6](image2.png)

Figure 6. Medium-power photomicrograph of follicular abscess and necrosis (hematoxylin-eosin, original magnification ×100).

![Figure 7](image3.png)

Figure 7. Pulsed-field gel electrophoresis patterns of *Mycobacterium chelonae* isolates. DNA was digested with XbaI. Lane 1, ATCC 23007 (reference strain); lane 2, patient isolate; lanes 3 through 5, footbath isolates that are indistinguishable from patient isolate; lane 6, footbath isolate with different pattern; and lane 7, DNA size standard (48.5-kilobase ladder).

![Figure 8](image4.png)

Figure 8. Patient 2. Multiple erythematous plaques and nodules, with scars from previous wounds, on the lower part of the right leg.
cillus found on Fite stains (Figure 9). Tissue cultures were negative for acid-fast bacilli. Over the course of several weeks, the patient noted occasional serosanguineous drainage from the lesion on the lower part of her right leg and a new nodule on the inferior aspect of her left knee. Examination of a punch biopsy specimen of the lesion on the left knee revealed a superficial perivascular and periadnexal lymphocytic infiltrate. The tissue cultures were negative for organisms. The patient was subsequently unavailable for follow-up and did not receive antibiotic therapy. Approximately 6 months later, she presented with a new nodule on her left shin and was noted to be 13 weeks’ pregnant. She reported that during the 6-month period before presentation, several small pustules had developed on the lower part of both legs but that the pustules had spontaneously resolved. Cultures of tissue from the nodule were positive for M. fortuitum at 7 days. After consultation with the Infectious Disease Division of the Naval Medical Center San Diego, the patient was placed on an empirical regimen of trimethoprim-sulfamethoxazole and azithromycin dehydrate. Sensitivity results revealed in vitro susceptibility to clarithromycin and trimethoprim-sulfamethoxazole only, and the azithromycin therapy was subsequently discontinued. Approximately 7 weeks later, another ulcerated nodule developed on the medial surface of the left lower leg area (Figure 10). A punch biopsy specimen showed necrotizing suppurative granulomas, but acid-fast bacillus stains and tissue cultures were negative for organisms. The lesions were allowed to heal by secondary intention and healed slowly over 8 weeks. Because of the patient's pregnant status, she has been treated with trimethoprim-sulfamethoxazole alone for 3 months; no new nodules have developed. On interview, she reported regular visits to 2 nail salons (different from those mentioned in case 1) before the onset of her lesions. Both salons used whirlpool footbaths during pedicure procedures, and the patient regularly shaved her legs with a razor blade before each visit to the salons. She decided to stop taking the prescribed antibiotic after 3 months and is currently asymptomatic.

A 12-year-old girl, the daughter of patient 2, presented with a 2-week history of an enlarging painful nodule on the anterior aspect of the lower part of her left leg. She denied preceding trauma to the area and was otherwise asymptomatic. She reported a history of regular visits for pedicures to the same nail salons that her mother had frequented, but because of her mother’s recent diagnosis, which was presumptively related to pedicures, she had discontinued her visits 2 months before the nodule developed. Although she stated that she usually shaved her legs with a razor blade, she was unsure if she had shaved before her pedicures. Physical examination revealed a 1.4 x 1.0-cm erythematous nodule on the anterior aspect of the lower part of her left leg. The nodule was mildly tender and fluctuant, with approximately 1.0 cm of surrounding induration. There was no palpable lymphadenopathy. The patient also had a 2.0-mm, excoriated, nontender, erythematous papule on the medial aspect of the proximal surface of her left calf. During a punch biopsy of the nodule on the left leg, approximately 0.5 mL of purulent material was expressed, and the underlying fat appeared necrotic. Histologic examination of the specimen revealed only subacute spongiotic dermatitis, with sparse acute and chronic dermal inflammation and absence of subcutaneous fat. Periodic acid–Shiff and Fite stains were negative for organisms; however, tissue culture yielded M. fortuitum at 10 days. Antibiotic sensitivities revealed in vitro susceptibility to clarithromycin, amikacin, ciprofloxacin, and trimethoprim-sulfamethoxazole. Because of the patient’s age, she was started on a regimen of clarithromycin and trimethoprim-sulfamethoxazole; after 3 weeks, she developed a generalized erythematous papular eruption, with fever and chills, and the trimethoprim-sulfamethoxazole therapy was promptly discontinued. The bi-
opsy site subsequently healed after 8 weeks of treatment with clarithromycin, and the small papule on the upper calf area resolved without sequelae. No new nodules have developed.

**COMMENT**

Both *M fortuitum* and *M chelonae* belong to group IV of the Runyon classification of nontuberculous mycobacteria. These RGM are ubiquitous in soil and water and are known as “rapid growers” because of their ability to produce mature growth on solid media after 3 to 7 days in subculture with optimal incubation temperatures ranging from 25°C to 40°C.\(^3\to^6\)

Clinically, *M fortuitum* and *M chelonae* cause a large spectrum of diseases, including primary cutaneous and soft tissue infections, as well as extracutaneous manifestations such as meningitis, keratitis, osteomyelitis, endocarditis, and bacteremia.\(^6\) Skin lesions may present as cellulitis, furunculosis, ulcers, painful nodules, or draining sinus tracts with either purulent or serosanguineous discharge and usually arise within 1 to 2 months after inoculation.\(^7\) Of interest, latency periods of up to 15 years have been reported.\(^8\) In a large outbreak of RGM in northern California that was related to pedicures, the median onset of symptoms was 3 weeks, but some cases involved presentations that were delayed as long as 4 months after exposure.\(^2\) In immunocompetent patients, superficial cutaneous infections are usually caused by direct inoculation after localized trauma and tend to follow a chronic course that results in scarring with occasional fistula formation during the protracted healing process.\(^9,^10\) Disseminated cutaneous involvement usually occurs in immunocompromised patients, although there has been a reported case of disseminated primary cutaneous infection with *M fortuitum* in an immunocompetent patient without a history of trauma.\(^7\)

Histopathologic examination of the lesions reveals suppurative granulomas and polymorphonuclear abscesses. Necrosis is thus present but caseation is not seen. Suppurative folliculitis was prevalent in the biopsy specimens that were examined in the large series recently described by Winthrop et al.\(^2\) The organisms readily stain with acid-fast stains. Acid-fast bacilli may be detected but are often absent in sections that are devoid of acute inflammation.\(^6\) Isolates of *M fortuitum* are usually susceptible to antibacterial agents such as amikacin, imipenem-cilastatin, quinolones, and sulfonamides, with varying susceptibility to doxycycline, clarithromycin, and cefoxitin.\(^11\) *Mycobacterium chelonae* is typically sensitive in vitro to clarithromycin, which has been shown to be effective in treating cutaneous lesions.\(^12,^13\) Because variability in drug susceptibility may exist in these RGM species, susceptibility testing is useful when choosing the agents that will be most efficacious in eradicating these organisms after initial empirical therapy. Clinicians may wish to avoid single-drug therapy to combat drug resistance. Acquisition of quinolone resistance has previously been demonstrated in single-agent quinolone treatment of *M fortuitum* infection.\(^14\) Resistance to standard antituberculous drugs is common, and these drugs are of little use in the treatment of RGM infections.\(^11\) The optimal duration of treatment for uncomplicated cutaneous lesions is presently unknown, but extended therapy, for several months or longer, is usually necessary.\(^15\) Surgical debridement combined with antimicrobial therapy may be required in more recalcitrant cases involving deep soft tissue infection and abscess formation. Wallace et al.,\(^16\) in a study of 123 patients with nonpulmonary infections due to RGM, found that 13 patients underwent spontaneous resolution. Antibiotics were administered to 63 patients, 50 (79%) of whom were treated with single-drug therapy for a mean of 10.6 weeks and 32 (50%) of whom also required surgical debridement. Thirty-four patients had extensive disease and required debridement and polymicrobial therapy for 4 to 6 months. Wallace\(^17\) later noted that 10% to 20% of RGM infections will resolve spontaneously within a few months. In a large outbreak of postinjection abscesses due to *M chelonae* involving 205 patients, 148 patients were treated with combination surgical resection and clarithromycin, with a cure rate of 95% after a mean of 3 months of antibiotic therapy.\(^12\) In contrast, therapy was successful for fewer than one third of the patients who were treated with surgery alone or with clarithromycin alone. The aggressive surgical approach required in that study may have been related to the more fulminant course that is typically seen with *M chelonae* infections.

Rappaport et al\(^18\) have recommended treatment guidelines for skin and soft tissue RGM infections. The treatment involves initial incision and drainage of abscesses and empirical 2-agent antibiotic therapy. For aggressive infections with necrosis and deep abscess formation, subsequent treatment involves wide excision of the entire wound. The excision should include all abscesses, fistulae, and granulation tissue down to and including the fascia if it is involved. Secondary-intention healing or delayed grafting is preferred, and antibiotic therapy, based on sensitivities, should be continued for a minimum of 3 months.\(^18\) Other authors have recommended adjunctive surgery for extensive infections and antibiotic therapy for at least 6 weeks after clinical resolution of the primary infection.\(^19,^20\) These case studies and isolated reports suggest that debridement or antibiotic therapy alone may be effective for localized disease, but in cases involving abscesses, necrosis, or widespread disease, wide resection combined with long-term antibiotic therapy may be necessary.\(^19,^24\) Immunocompromised patients with RGM infections typically require more aggressive debridement and longer periods of polymicrobial therapy.

Our patients all had good clinical outcomes despite different therapeutic regimens. Patient 1 was treated aggressively with 2 to 3 antibiotics for 6 months and extensive surgical debridement owing to a fulminant course with deep abscesses. Patients 2 and 3 were treated with single-agent antibiotics for 3 and 2 months, respectively, because of milder disease with folliculitis and follicular abscesses. The treatment in case 1 may also have been more aggressive owing to infection with *M chelonae*, an RGM that is typically more aggressive and less responsive to antibiotic therapy. Further research is necessary to define the optimal treatment and natural history of such lesions. In discussion with the health care providers managing the care in 2 of the other 3 identi-
fied cases of pedicure-associated RGM infections that were not seen at our institution, we found out that both patients presented with similar chronic recurrent lower extremity folliculitis and furunculosis. These 2 cases were also successfully managed, albeit with scarring, with similar long-term oral antibiotic regimens and surgical debridement. Follow-up information on the third case was not available.

CONCLUSIONS

We present the clinical and epidemiological features in 3 cases of RGM infection that appear to be related to whirlpool footbaths used within nail salons. The findings further support the idea that these salon-associated RGM infections occur in sporadic fashion and are likely underrecognized in the medical community. This sporadic presentation is exemplified by the fact that at least 3 different salons were involved in the 6 cases that were reported to the County of San Diego Office of Public Health. Clinicians should be aware of potential nail salon infections and inquire about a history of whirlpool footbath exposure in any patient with prolonged lower extremity soft tissue infection. There is need for further studies to elucidate optimum treatment regimens for RGM infections. As previously documented, leg shaving with a razor blade before pedicure increases the risk of infection from contaminated whirlpool footbaths. At least 2 of our 3 patients reported shaving their legs with a razor blade prior to pedicure and footbath exposure. Shaving can result in small epidermal and follicular abrasions, potential portals for mycobacterial inoculation from contaminated footbath exposure. Two of our patients also showed conclusive evidence of follicular infection; perhaps the other patient may have shown similar follicular involvement if a biopsy specimen had been obtained sooner in the disease course. While efforts to increase patient awareness and education regarding the hidden dangers of undergoing such seemingly harmless cosmetic procedures such as pedicures should be undertaken, efforts should also be made to ensure the safety and clean operation of whirlpool footbaths within this fast-growing service industry. The footbaths in at least 1 of these 3 nail salons were not being regularly disinfected between clients. Patrons may wish to avoid shaving their legs before utilizing such whirlpool footbath treatments. Clinicians should consider the possibility of RGM infection and inquire about recent pedicures in a patient with recurrent lower extremity furunculosis and abscesses that are unresponsive to conventional antibiotic therapy.

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