Two sets of blood cultures were performed, and within 24 hours all four bottles became positive for β-lactamase-negative 

*M. catarrhalis.* A radiograph of the chest was normal and did not reveal lymphadenopathy or infiltrates. CT of the chest was not obtained. A CT scan of the abdomen showed splenomegaly, and a transthoracic echocardiogram revealed a vegetation on the anterior leaflet of the mitral valve. The erythrocyte sedimentation rate (ESR) was 46 mm/h (normal range, 0–15 mm). Skin tests with PPD and coccidioidin (and a positive mumps control) were non-reactive. Serologic tests for HIV, coccidioidomycosis, *Yersinia enterocolitica,* viral hepatitis, syphilis, and antinuclear antibody were all negative. The level of serum angiotensin-converting enzyme was not determined. Examination of a skin lesion specimen obtained by biopsy showed erythema nodosum. The patient was treated with an intravenous broad-spectrum cephalosporin. Within 48 hours she was afebrile, and over the next few days her skin lesions completely faded.

Because of the unusual finding of *M. catarrhalis* in her blood, the patient was further questioned about her personal habits. She then admitted to frequently putting her fingers in the back of her throat and squeezing her tonsils to get rid of a “cottage cheese” material that she noted on them. She did not vomit while performing this maneuver. However, examination of her pharynx did not show any abnormalities. She promised to try to stop this habit. She was then discharged from the hospital and was asked to complete a course of intravenous antibiotics at home. She has continued to feel well and denies resuming her prior habit of squeezing her tonsils. A repeated ESR was 3 mm/h, and findings on physical examination have remained normal.

**Mycobacterium abscessus Osteomyelitis Following a Plantar Puncture Wound**

Despite the fact that the biological characteristics of rapidly growing mycobacteria have been documented, as have the clinical characteristics of infection due to these organisms [1–3], their role as pathogens in patients who have sustained puncture wounds to the plantar surface of the foot is not widely recognized. We present a case of ostemyelitis due to *Mycobacterium abscessus* (formerly *Mycobacterium chelonae* subspecies *abscessus*) that occurred in a patient who sustained a nail puncture to the plantar surface of the foot.

On 14 July 1994 a 33-year-old healthy male farmer stepped on a nail while wearing tennis shoes. On 1 August 1994 he noted local swelling, pain, and erythema over the dorsal surface of the right third metatarsophalangeal joint, and he sought medical care. His wound was explored, a large amount of pus was drained, and he began a course of treatment with oral ciprofloxacin. Cultures of the pus were negative after 3 days, and the plates were discarded. Because of persistent drainage from the wound, a plain radiograph was obtained on 29 August 1994, which revealed erosion of the proximal head of the phalanx of the right third toe.

On 1 September 1994 the patient’s third proximal phalanx was excised and cultured. After 3 days, a gram-positive rod was isolated and referred to a commercial laboratory for further identification. Despite the fact that the patient underwent surgery and received a 3-week course of oral therapy with amoxicillin/clavulanate, the wound failed to heal.

On 22 September 1994, the patient was referred to Duke University Medical Center (Durham, NC). Physical examination revealed a well-appearing afebrile male. A 3-cm × 1.5-cm wound that drained serous discharge was present on the dorsum of his right third metatarsophalangeal joint. The WBC count was 7,600/mm³.

A radiograph revealed a 1.5-cm erosion of the right distal third metatarsal head (figure 1). Shortly after the patient was admitted to the hospital, the commercial laboratory issued a preliminary report stating that *M. chelonae* had been isolated from the culture performed on 1 September. Partial phalanectomy and excision of the metatarsal head were performed on 23 September 1994. After 4 days, cultures again yielded a gram-positive rod, subsequently identified as *M. abscessus* by Dr. Richard J. Wallace, Jr. (University of Texas Health Center at Tyler, Texas). The patient was treated with oral clarithromycin (500 mg twice daily).

On 16 November 1994, an examination revealed a 5-mm sinus tract and persistent purulence over the distal portion of the incision. Plain radiographs showed no new bony destruction. Ethambutol was added to the patient’s regimen. A smear of the discharge did not reveal acid-fast bacilli, but cultures of this material again

**References**


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We postulate that this patient’s unusual habit of squeezing her tonsils probably caused transient moraxella bacteremia, which then resulted in endocarditis. On admission to the hospital, however, the only abnormalities noted on her physical examination were fever and the presence of erythema nodosum. While there are a number of infectious and noninfectious diseases characterized by these skin lesions, we are not aware of any reports in which *Moraxella* species were responsible for erythema nodosum. We believe that the rapid resolution of both the patient’s symptoms and skin lesions with antibiotic therapy suggests that the erythema nodosum was a direct consequence of *M. catarrhalis* bacteremia.
yielded *M. abscessus*. By 15 December 1994, the sinus tract had completely healed. Antibiotic therapy was continued through 2 February 1995. When the patient was last contacted on 17 November 1995, he continued to be asymptomatic.

*M. abscessus*, which was first isolated in 1952 from a woman with a chronic knee infection [4], has recently been differentiated from *M. chelonae* with use of DNA homology methods [5]. *M. abscessus* is capable of causing chronic pulmonary disease, posttraumatic soft-tissue infections, nosocomial bloodstream and wound infections, abscesses at the site of prior intramuscular injections, infections associated with dialysis shunts, prosthetic cardiac valve endocarditis, and, rarely, disseminated disease [1–3]. Although several cases of osteomyelitis that occurred following plantar puncture wounds have been attributed to *M. chelonae* ([2] and R. J. Wallace, personal communication), to our knowledge, *M. abscessus* has not previously been associated with these infections.

Since Johanson [6] described osteomyelitis due to *Pseudomonas aeruginosa* following puncture wounds to the plantar surface of the foot, most clinicians have become aware of the role of pseudomonads in this setting. However, a broad array of pathogens including staphylococci, fungi, and atypical mycobacteria may cause soft-tissue and bone infections following plantar puncture wounds; such infections are clinically indistinguishable from those due to *P. aeruginosa*. Although surgery is the primary form of therapy for all infections that occur following plantar puncture wounds, medical therapy directed at pathogens isolated in culture is also important [7]. This fact is illustrated by our case, in which the infection did not completely resolve until after the addition of a second antimycobacterial agent, despite the fact that the wound was surgically resected.

As standard antibiotic regimens do not provide coverage for atypical mycobacteria, the diagnosis and successful management of infections due to these organisms require accurate microbiological identification. Rapidly growing mycobacteria appear as nonpigmented colonies on blood agar or chocolate agar after 3–5 days. On gram staining they appear as gram-positive bacilli. Because many laboratories routinely discard wound cultures after 3–5 days of incubation, growth of atypical mycobacteria can easily be overlooked or misinterpreted as contamination with normal skin flora. *M. abscessus* can be distinguished from *Mycobacterium fortuitum* by its failure to reduce nitrate or utilize iron, and it can be distinguished from *M. chelonae* by its ability to grow in the presence of 5% NaCl, its failure to grow on sodium citrate–containing media [8], and its distinct antimicrobial susceptibility pattern [1, 3].

The possibility that atypical mycobacteria are the cause of infection following a puncture wound to the foot should be considered when bone biopsy specimens are sent for culture. The microbiology laboratory should be informed that since the differential diagnosis includes atypical mycobacteria, the culture plates should be incubated for 7 days. Pure growth of aerobic gram-positive rods in the setting of a puncture wound to the foot should not be assumed to represent a skin contaminant until the presence of atypical mycobacteria has been ruled out. Indeed, our case illustrates the importance of such a complete microbiological evaluation and the consequences of both delayed diagnosis and delayed institution of specific antimycobacterial therapy.

**Figure 1.** Plain radiograph of the foot of a patient with osteomyelitis due to *Mycobacterium abscessus*; the film was obtained after excision of the third proximal phalanx and shows a 1.5-cm erosion of the right distal third metatarsal head.

**References**


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Human Granulocytic Ehrlichiosis: Report of a Case in Northern California

Ehrlichiosis is a tick-borne illness caused by an intracellular rickettsia-like coccobacillus that infects animals and humans. Recently, cases of human granulocytic ehrlichiosis (HGE), which are caused by a new species of *Ehrlichia* that infects humans, have been reported [1, 2]. We report a case of HGE acquired in Northern California that was confirmed by PCR and serological tests.

**Figure 1.**

- **A:** Neutrophil (arrow) from a patient with human granulocytic ehrlichiosis. A cytoplasmic inclusion (morula) containing ehrlichial organisms is present. Note the two reactive immunoblastic lymphocytes. (Stain, Wright-Giemsa; original magnification of peripheral blood buffy coat, ×373.)
- **B:** Cytoplasmic inclusion in a neutrophil consistent with morulae containing ehrlichial organisms. (Stain, Wright-Giemsa; original magnification of peripheral blood, ×440.)

A 58-year-old male, status post resection for gastric carcinoma, presented to the hospital with a 5-day history of fever, arthralgias, myalgias, and headaches. The patient resided in a wooded area in Santa Cruz County, California, and did not report recent travel. He recalled ticks on his person but did not notice any bites.

Physical examination revealed a thin, mildly icteric male with an erythematous macular rash involving the chest and abdomen. Laboratory data at admission were significant for thrombocytopenia (blood platelets, $118 \times 10^9/L$), absolute lymphopenia (lymphocytes, $0.37 \times 10^9/L$), neutrophils with a left shift, an elevated bilirubin level ($34.7 \mumol/L$), and an elevated lactate dehydrogenase level ($2,377 IU/L$). Because of suspected ascending cholangitis, therapy with piperacillin/tazobactam and gentamicin was begun. On the third hospital day, a blood film demonstrated neutrophilic cytoplasmic inclusions consistent with the morulae of *Ehrlichia* species (figure 1). These inclusions were absent in all subsequent smears. A worsening clinical picture suggested the possibility of Legionnaires' disease, and iv erythromycin was added to the patient’s therapeutic regimen.

On the fifth day the patient’s WBC count increased to $31.3 \times 10^9/L$ and marked reactive lymphocytosis (lymphocytes, $11.9 \times 10^9/L$) was noted. Flow cytometric analysis revealed an anomalous CD3-positive T cell subpopulation (50% of lymphocytes) that was negative for CD4, CD8, CD16, and CD56 cells; this subpopulation was confirmed by immunohistochemistry to be γδ T cells. Nine days after admission most of the patient’s laboratory values had normalized; he was discharged from the hospital and continued to receive erythromycin therapy (500 mg q.i.d.). One week later, laboratory tests confirmed HGE, and the patient’s therapy was switched to doxycycline.

*Ehrlichia* species infect leukocytes, resulting in cytoplasmic inclusions. These morulae contain tightly packed clusters of up to