Puncture wound complicated by rare *Mycobacterium septicum* infection: A Case Report

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Statement of Purpose

The *Mycobacterium* genus consists of acid-fast, nonmotile, non-spore forming, aerobic gram-positive bacteria that cause a variety of infections (5). Mycobacterial species can be classified into *Mycobacterium tuberculosis* complex, *Mycobacterium leprae* & nontuberculous mycobacterium (NTM) or atypical mycobacterium (2, 5). In general, NTM infections are uncommon in the literature & even more rare when involving the foot. This case study presents a delayed diagnosis of *Mycobacterium septicum* in a young & healthy patient. On average, NTM diagnosis is delayed up to 10 months due to a lack of distinguishing features and various media & temperature requirements for growth (5). With the accurate diagnosis of NTM, specific species identification is crucial in determining proper antibiotic susceptibility (4). Successful treatment of NTM soft tissue infections occur when adequate debridements are augmented with the appropriate combination of antibiotics (5).

Literature Review

NTM are environmental organisms that can be frequently isolated from animals, soil & water (5, 8). There are various vehicles for NTM transmission, but traumatic injuries, surgical incision sites & contact with contaminated water have been found to be the most common (1, 8). NTM is not typically pathogenic for humans but can behave as opportunists, especially in the setting of immunosuppression (8). NTM infections have mainly been associated with Acquired Immune Deficiency Syndrome & patients with pulmonary disorders but as of recently, an increasing number of NTM infections have been identified in immunocompetent patients (1). NTM can be further divided into slow growing mycobacteria (SGM) & rapid growing mycobacteria (RGM). In general, SGM are more likely to cause infections in human than RGM (5). SGM are more likely to cause pulmonary & lymph nodal infections while RGM primarily affects the skin, bones & joints (8). The three major pathogenic species of RGM include: *Mycobacterium chelonae, Mycobacterium abscessus* & *Mycobacterium fortuitum* (3, 7). Out of all the RGM species, *M. fortuitum* most commonly infects the skin & soft tissues of younger individuals. Cutaneous or subcutaneous infections with *M. fortuitum* usually start off as small erythematous nodules that progress to large, painful, violaceous granulomas over a couple weeks or months. The granulomas may eventually ulcerate, drain serosanguinous fluid & spread to deeper layers of the soft tissues, creating fistula tracts, as was seen in our case (4). In 1990, *Mycobacterium septicum* was first isolated & in 2000, *M. septicum* was recognized as a new species & as a member of the *M. fortuitum* group. The two mycobacterial species are phenotypically similar & closely related but *M. septicum* does not grow at 42 degrees Celsius & is susceptible to Erythromycin, Vancomycin & Tobramycin, unlike *M. fortuitum* (6). Polymerase chain reaction-restriction enzyme analysis, 16S ribosomal ribonucleic acid gene sequencing, multi-gene sequencing & whole genomic sequencing are used to differentiate & identify species that are closely related (2, 4). It is imperative to differentiate & identify closely related Mycobacterial species because they tend to differ in their susceptibilities to antibiotics (2).

Case Study

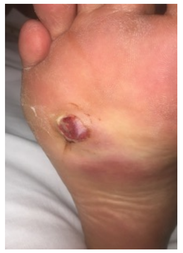

Figure 1. Initial presentation to the podiatry outpatient clinic

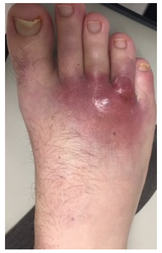

Figure 2. Worsening dorsal forefoot erythema & edema POD 25 s/p I&D

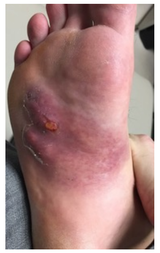

Figure 3. Worsening plantar erythema & edema POD 31 s/p I&D

A 39-year-old male, with a negative past medical history, presented as a referral for a non-healing puncture wound to the plantar aspect of the right foot. 6 weeks prior, the patient was renovating his bathroom, barefoot, & fell onto an exposed toilet bolt. The next day, the patient presented to an express care clinic with a traumatic puncture wound. His tetanus status was updated & radiographs were taken of the right foot. The patient was prescribed a course of Bactrim & Mupirocin ointment & told to follow-up in the outpatient setting. Since the injury, the patient had failed local wound care, offloading & oral antibiotics. On physical exam, he was noted to have a 1.5 cm by 1.0 cm puncture wound to the plantar lateral aspect of the right forefoot, just proximal to the lesser metatarsophalangeal joints (MTPJ) (Figure 1). The depth of the wound was unable to be assessed due to pain but the wound base was noted to hyper-granular. Peri-wound erythema was noted to be extending & coursing towards the plantar medial aspect of the midfoot. No purulence could be expressed. Even though the patient's blood work was within normal limits & there was no growth from the previously obtained wound cultures, the patient was admitted for intravenous (IV) antibiotics & surgical incision & drainage (I&D). Intraoperatively, the plantar foot wound probed 3.5 cm deep & 7 cm proximally. Purulence from the puncture wound was sent for aerobic & anaerobic cultures but not acid-fast bacilli (AFB) or fungal cultures. The wound was left open & packed. 3 days later, the patient underwent his second I&D with delayed primary closure. The wound cultures from the initial I&D grew *Staphylococcus epidermidis* so the patient was discharged with a 2 week course of IV Vancomycin along with a total contact cast. In the outpatient setting & at the patient's second post-operative visit, the plantar incision was noted to be well coapted but a new onset of erythema & edema was noted to the dorsal aspect of the third & fourth MTPJs (Figure 2). There was a concern for a reoccurring abscess since the patient had been off antibiotics. The patient was prescribed oral doxycycline but followed up 6 days later with worsening erythema & edema & a new onset of purulent drainage from the plantar incision site (Figure 3). The patient was directly admitted to the hospital for advanced imaging, IV antibiotics, & a third I&D. Magnetic resonance imaging did not demonstrate any acute

Case Study Continued

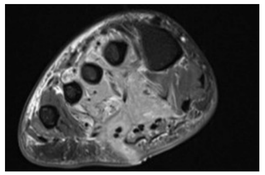

Figure 4. MRI demonstrating phlegmonous changes deep to the flexor tendons

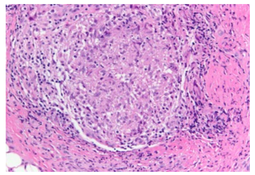

Figure 5. Pathology slide demonstrating non-necrotizing granulomatous inflammation

osseous changes but did note phlegmonous changes deep to the flexor tendons & an abscess to the dorsal aspect of the fourth MTPJ (Figure 4). Intraoperatively, greater than 10 milliliters of white caseous drainage was expressed from the plantar aspect of the foot & from the dorsal aspect of the fourth MTPJ. The drainage was sent for aerobic, anaerobic, fungal & AFB cultures. The incision sites were copiously irrigated, left open & covered with a negative pressure wound therapy system that also allowed instillation therapy. At this time, infectious disease (ID) started the patient on IV Daptomycin & Zosyn. 3 days after the patient's third surgery, he returned to the operating room (OR) for his fourth I&D. Intraoperatively, small, firm granulomatous nodules were noted within the subcutaneous tissues. The excised tissue was sent for aerobic, anaerobic, fungal, & AFB cultures & for pathological examination. 2 days after the patient's fourth surgery, he returned to the OR for his fifth and final I&D with delayed partial closure. Intra-operatively, antibiotic beads containing Vancomycin & Amikacin were placed within the wounds due to a high suspicion for *Mycobacterium*.

Results

Pathology of the granulomatous tissue from the fourth I&D read: "acute, chronic, and granulomatous inflammation with focal polarizable foreign material" (Figures 5 & 6). The cultured drainage from the third I&D & the cultured tissue from the fourth I&D grew RGM, specifically not *M. chelonae-abscessus* complex, on the fungal culture. The patient was discharged with IV Imipenem, IV Amikacin, & oral Azithromycin until the final sensitivities demonstrated RGM resistant to Azithromycin, so the patient was switched to oral Ciprofloxacin. With an accurate diagnosis, the RGM specimen was sent to the University of Texas for species identification, which revealed *M. septicum* as the infecting organism. The patient completed a 3 week course of IV Amikacin, a 10 week course of IV Imipenem, a 32 week course of oral Ciprofloxacin & a 27.5 weeks course of oral Bactrim. The patient's postoperative course was complicated by draining plantar sinus tracts but he ended up healing 332 days post injury. Even though the patient is completely healed, he still has a slowly resolving palpable granuloma to the plantar aspect of his foot along with forefoot numbness. With that being said, the patient has not allowed that to stop him from returning to running & other physical activities.

Discussion

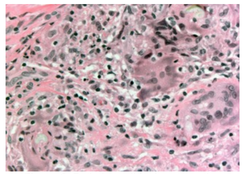

Figure 6. Pathology slide demonstrating giant cells with foreign body material

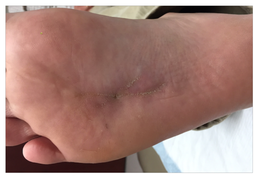

Figure 7. Complete closure was achieved at 332 days post injury

Culturing specimens is the gold standard in diagnosing *Mycobacterium*. If *Mycobacterium* is suspected, aerobic, anaerobic, fungal, & AFB smears & cultures should be ordered, even though routine bacterial cultures typically yield no growth. Smears alone typically only yield elevated neutrophils under microscopy while the sensitivities of AFB smears range between 20 to 80%. Cross contamination can occur which can lead to the wrong diagnosis or a delay in diagnosis, as was seen in our case. Repeat cultures should be obtained if cross contamination is suspected & if the patient's symptoms are failing to improve with treatment (4). Once RGM has been diagnosed, the specific *Mycobacterium* species should then be identified. Susceptibility testing should be performed on all cultures due to various antibiotic susceptibilities among RGM species (3). Initial combination therapy for RGM infections typically involve IV Imipenem, or IV Cefoxitin, with IV Amikacin & an oral macrolide (4). For maintenance therapy, it is recommended that two oral antibiotics be prescribed for a minimum of four months (3). Surgical debridement along with multidrug therapy can help to increase the rate of recovery (4). Eradication depends on proper identification of the infective organism, adequate debridement & long-term antibiotics (3). A high index of suspicion should be had for RGM cutaneous or subcutaneous infections when there is a history of environmental exposure, late onset of symptoms, chronic skin or soft tissue infections following an invasive procedure, unresponsive to conventional antibiotics, negative bacteriological cultures, & negative Gram & AFB staining (4).

References

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