

## CLINICAL CASE OF THE MONTH

# A 57-Year-Old Man With Diabetes and a Toe Infection

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### CASE REPORT

A 57-year-old man with type 2 diabetes mellitus presented to the emergency department for evaluation of a red swollen leg. One week prior to presentation, the patient was walking barefoot on a shell beach when he sustained an injury to his right great toe. Later that day, he felt that a piece of shell was imbedded in his foot and therefore attempted to extract the object with tweezers. After multiple unsuccessful attempts, he self-treated with an unknown over the counter antibiotic ointment. The toe became progressively erythematous and indurated over the next few days. The foreign body sensation persisted and the erythema spread superiorly, which prompted him to seek evaluation. He reported subjective fevers, but denied pain, numbness, tingling, or symptoms of claudication.

His past medical history was significant for type 2 diabetes mellitus, congestive heart failure, hypertension, chronic kidney disease, and hyperlipidemia. His medications included aspirin, carvedilol, furosemide, lisinopril, atorvastatin, and metformin. He had no known drug allergies. His surgical history and family history were non-contributory. He had a 50 pack-year history of tobacco use. He was a reformed alcoholic. He occasionally used insufflated cocaine, and his last use was approximately five weeks prior to presentation.

On physical examination the patient had a temperature of 100.2° Fahrenheit, a blood pressure of 168/93 mmHg, a heart rate of 89 beats/minute, and a respiratory rate of 20 breaths/minute. The patient was obese with a body mass index of 40.

His right lower leg was edematous from the foot to the knee and had a lesion on the plantar aspect of his hallux with purulent discharge (Figure 1). The erythema extended from the lesion and ascended to the level of the knee. The affected areas on his extremity were warm and painful with manipulation. His femoral pulse was normal. His popliteal flow and dorsalis pedis pulses were nonpalpable; however, dorsalis pedis was present by Doppler ultrasound. Range of motion of both his ankle and knee joints was limited secondary to induration and pain.

His laboratory work-up was significant for a white blood cell count of 13,000 cells per cubic millimeter. A plain radiograph of his right foot revealed degenerative changes with a triangular-shaped radiopaque foreign body in the subcutaneous tissue of the plantar surface (Figure 2).



**Figure 1.** Cellulitis. Notice the first digit has severe erythema in close proximity to where the foreign body punctured his foot.



**Figure 2.** X-ray demonstrating the retained foreign body in the patient's foot (arrow).

## INTRODUCTION

Foot infections are common complications in individuals with diabetes.<sup>1</sup> Diabetic foot infections represent the largest number of diabetes-related hospital stays and are the most frequent cause of non-traumatic amputations.<sup>2,4</sup> Among diabetic patients, the prevalence of foot ulceration is approximately 4%-10% with an estimated lifetime risk of up to 25%.<sup>1</sup> Over half of all diabetic foot wounds will ultimately become infected.<sup>3</sup> Diabetic foot infections are responsible for about 60% of all lower extremity amputations, and 15%-27% of all diabetic foot ulcers result in the surgical removal of bone.<sup>4,5</sup>

Considering the prevalence of diabetic foot infections and the associated morbidity, the purpose of this case report and discussion is to review pathophysiology and a basic approach to treatment.

## PATHOPHYSIOLOGY

The propensity of diabetic patients to develop lower extremity soft tissue infections is multifactorial in etiology and includes associated neuropathy, vasculopathy, and immune dysregulation.<sup>6,7</sup> Peripheral neuropathy occurs in 30%-50% of diabetic patients.<sup>8</sup> A peripheral sensory neuropathy causes the loss of protective sensation for temperature and pain leading to impaired awareness to local trauma.<sup>8</sup> Furthermore, disruption in autonomic nerve fibers cause decreased sweating and excessive skin dryness, which predispose to skin breakdown and susceptibility to infection.<sup>5</sup> In addition to sensory and autonomic neuropathies, motor neuropathy and neuro-osteoarthropathic deformities occurring in diabetes causes abnormal foot anatomy and biomechanics.<sup>2,5</sup> This creates areas of increased pressure that are susceptible to ulceration.<sup>2</sup> Peripheral arterial

atherosclerotic disease is another known complication of diabetes causing decreased tissue perfusion and viability.<sup>5</sup> In addition, the hyperglycemia seen in poorly controlled diabetes causes impaired function and proliferation of leukocytes, decreasing the body's natural defense against infection.<sup>5</sup> Both peripheral arterial disease and persistent hyperglycemia lead to a hindrance of the body's ability to fight infection and heal.<sup>9</sup>

## Approach to Lower Extremity Infections in Diabetic Patients

The diagnosis of a lower extremity skin and soft tissue infection must be made clinically based on the presence of purulent drainage or at least two of the classic signs of infection including erythema, pain, tenderness, warmth, or induration.<sup>2</sup> The extent, severity, and microbial etiology of the infection should be determined to direct the appropriate treatment.<sup>2</sup> First, the wound should be cleaned, debrided of purulent or necrotic material, and probed for foreign bodies, sinus tracts, and deeper tissue involvement.<sup>8</sup> Next, wound cultures should be obtained from the ulcer base via tissue biopsy, curetting, or aspiration.<sup>8</sup> Swabbing wounds for culture is not recommended.<sup>8</sup> Osteomyelitis often complicates chronic soft tissue infections in diabetics. The diagnosis of osteomyelitis should be considered for any ulcer that is deep or extensive, non-healing after appropriate therapy, or overlying a bony prominence.<sup>2</sup> Visible or palpable bone upon probing is strongly suggestive of osteomyelitis.<sup>8</sup> Other laboratory findings that support the diagnosis include an elevated erythrocyte sedimentation rate of greater than 70 mm per hour or an elevated white blood cell count.<sup>8</sup> If osteomyelitis is suspected clinically, diagnostic imaging with plain radiography, magnetic resonance imaging (MRI), or a bone scan is indicated.<sup>8</sup> If the diagnosis of osteomyelitis is still in question after imaging, a bone biopsy is helpful in making a diagnosis and guiding antibiotic treatment.<sup>8</sup>

If the skin or soft tissue does not appear clinically infected based on the criteria listed above, antibiotic therapy is not recommended.<sup>2</sup> Local wound care measures with close follow up should suffice.<sup>2</sup> Antibiotics, in this setting, do not promote or speed healing, but only increase the risk of drug related adverse effects and local antibiotic resistance.<sup>2</sup> However, if soft tissue infection is apparent clinically, antibiotic therapy should be tailored toward common bacterial pathogens, while also taking into account the severity of the infection.<sup>2</sup>

Previously untreated acute soft tissue infections in diabetics are usually monomicrobial, with *Staphylococcus aureus* and the beta-hemolytic streptococci (groups A, B, C, and G) being the most commonly isolated pathogens. If an infection is mild to moderate in severity, targeted therapy with antimicrobial medications aimed at aerobic-gram positive cocci is appropriate. Local resistance patterns, especially the prevalence of methicillin resistant *S. aureus* infections, must be taken into account when

considering empiric antimicrobial coverage. Dicloxacillin, clindamycin, cephelexin, trimethoprim-sulfamethoxazole, and amoxicillin/sulbactam have been recommended as initial oral therapy for mild infections.<sup>2</sup> Chronic wounds are more likely to contain a more diverse polymicrobial colonizing flora. Enterococci, various enterobacteriaceae, and other aerobic-gram negative rods including *Pseudomonas aeruginosa*, can be isolated. Severe ischemic or gangrenous infections may contain obligate anaerobic bacteria. Furthermore, patients recently treated with antibiotics are more likely to be colonized with antibiotic resistant organisms. For mild or moderate infections, outpatient therapy is often appropriate. Reassessment of soft tissue infections for the outpatient should occur every two to five days to ensure adequate response to therapy.

For severe life or limb-threatening infections, hospitalization and treatment with parental antimicrobials is advised. Careful attention to optimizing fluid status and blood glucose is recommended. For severe infections, especially those in need of debridement or amputation, prompt surgical evaluation is imperative. Antibiotic selection should be broad in spectrum covering a variety of possible pathogens with careful consideration for patients who have been previously treated with antibiotics, as they may be infected with drug resistant organisms. Antibiotic regimens include piperacillin/tazobactam, imipenem-cilastin, ceftazadime, or a fluoroquinolone like ciprofloxacin with clindamycin.<sup>2</sup> Vancomycin should be added for coverage of methicillin resistant *Staphylococcus aureus*. When culture results are available, the antibiotic therapy may be appropriately narrowed.<sup>2</sup> Antibiotic regimens should always be analyzed and adjusted based on each patient's clinical status and the available microbiological data. If an open wound is present, antibiotics should be administered until the wound appears clinically uninfected.<sup>2</sup>

Many adjunctive wound care treatments have been proposed including wound vacuum-drainage systems, recombinant growth factors, granulocyte colony-stimulating factor, sterile maggot larvae, skin substitutes, antibiotic dressings, and others.<sup>2</sup> Insufficient evidence prohibits the standardized recommendation of these adjunctive treatments, though they may be indicated on a case by case basis.<sup>2</sup> Hyperbaric oxygen therapy has shown promising results in several recent clinical studies including one review in which hyperbaric oxygen therapy was shown to reduce the risk of amputation.<sup>2,10</sup>

## SUMMARY

Foot infections are common complications in the diabetic population resulting in significant associated morbidity. Several risk factors predispose these individuals to foot infections including, but not limited to, sensory neuropathy, autonomic neuropathy, motor neuropathy, atherosclerotic disease, hyperglycemia, and immune dysfunction.<sup>5</sup> Medical work-up and treatment of diabetic foot infections depends on the extent and severity of the infection. An organized and practical approach based on an understanding of the pathophysiology and microbiology is helpful in the evaluation and treatment of these infections.<sup>2</sup>

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