

Case Report

Emphysematous osteomyelitis of the calcaneus: a case report and review

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Abstract: Emphysematous osteomyelitis is a rare but potentially fatal condition, which classically features intraosseous air on imaging without a direct communication with the atmosphere. Prompt recognition and treatment of the disease cannot be overstated as there is a high mortality rate associated with this condition. Here we report a case of emphysematous osteomyelitis of the calcaneus in a sixty-one-year-old male with diabetes mellitus and end-stage renal disease. This case of osteomyelitis was associated with an overlying necrotizing soft tissue infection, mandating an urgent below-knee amputation for source control. This case report is the first of its kind in the literature involving the calcaneus as emphysematous osteomyelitis more commonly involves the vertebral column. The purpose of this case report is to discuss the presentation and treatment of emphysematous osteomyelitis involving the calcaneus as well as provide a review of the current literature on this diagnosis.

Keywords: Acute care surgery, emphysematous osteomyelitis, calcaneus, necrotizing fasciitis

Introduction

Emphysematous osteomyelitis is defined as intraosseous gas without a direct communication with the atmosphere, in the absence, that is, of recent surgery or an open fracture. It is a rare form of osteomyelitis which is complicated by infection with gas-forming organisms. Ram et al. were the first to describe emphysematous osteomyelitis on computed tomography (CT) in 1981 [1]. Patients who develop this disease often have multiple comorbidities leading to immunosuppression and, not surprisingly, have a high mortality rate. The most common causative organisms are members of the *Enterobacteriaceae* family; however, these infections are often polymicrobial. Here we report an older male with a history of end-stage renal disease and type 2 diabetes mellitus, who developed necrotizing soft-tissue infection of the left lower extremity and emphysematous osteomyelitis of the left calcaneus.

Case presentation

A sixty-one-year-old male was transferred to the United States Army Institute of Surgical

Research Burn Center from an outside hospital with concern for necrotizing fasciitis of the left lower extremity. He had a complex medical history of poorly controlled diabetes mellitus, end-stage renal disease on peritoneal dialysis, biventricular heart failure with reduced ejection fraction, and peripheral arterial disease. He complained of a left calcaneal ulcer that had progressively become more painful over the course of seven days prior to arrival. Physical examination was notable for crepitus of his left lower extremity with associated soft-tissue swelling, bullae, and pain with passive range of motion at the ankle joint. There was a large 4 x 5 cm necrotic ulcer overlying the calcaneus without purulence. He had faint distal signals in his dorsalis pedis and posterior tibial artery on Doppler exam. He was hemodynamically stable. Laboratory studies were notable for leukocytosis ($20.7 \times 10^9/L$), hyperglycemia (530 mg/dL), hyponatremia (131 mEq/L), and elevated creatinine (15.7 mg/dL). Blood cultures were drawn in the emergency department and broad-spectrum antibiotics were started.

Outside radiographs of the left foot and ankle were significant for extensive soft-tissue gas in

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Figure 1. Sagittal view of hind foot with intraosseous and soft tissue emphysema.

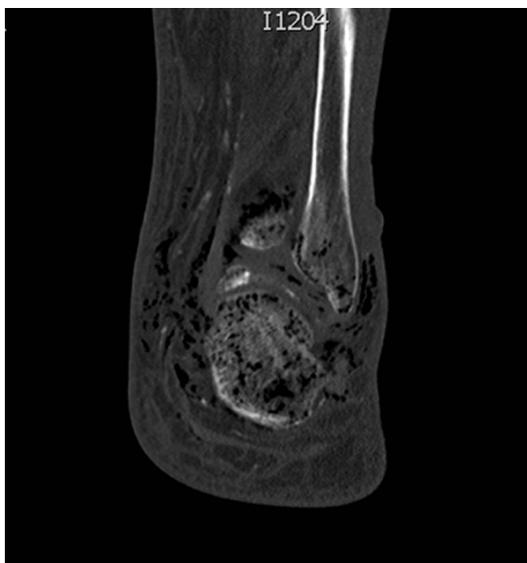


Figure 2. Coronal view with air present in the calcaneus and the lateral malleolus of the fibula with surrounding subcutaneous emphysema.

the dorsum and plantar surfaces extending to the lower leg, destruction of the left calcaneus, and significantly calcified arterial anatomy. A computed tomography scan of the left lower extremity revealed intraosseous air within the calcaneus as seen in **Figures 1, 2.**

The patient was taken urgently to the operating room for source control. Debridement of the calcaneal ulcer immediately produced purulent

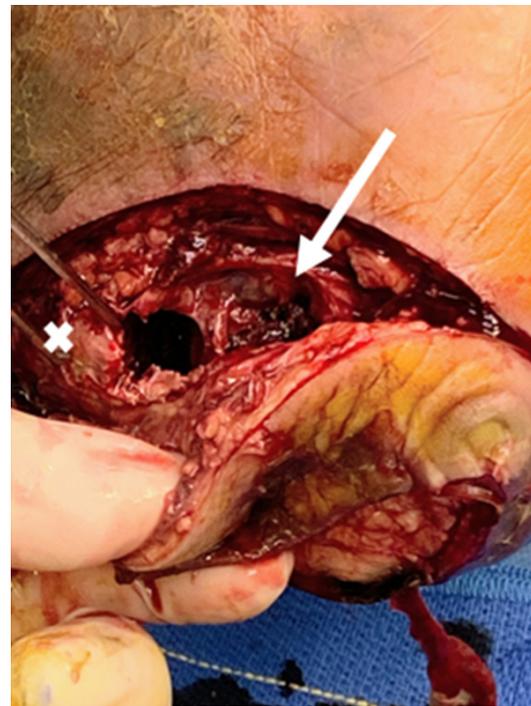


Figure 3. Intra-operative photo showing osteomyelitis (arrow) and destruction of the lateral malleolus of the fibula (asterisk).

drainage and revealed complete bony destruction of the left calcaneus with avulsion of the Achilles tendon, as seen in **Figure 3.** Since limb salvage in this setting was not felt to be feasible, we proceeded with a left below-knee guillotine amputation. Postoperatively the patient was transferred to the ICU and required vasopressor support and renal replacement therapy. The patient returned to the OR for several additional debridements and ultimately received a formal above-knee amputation. The patient otherwise recovered appropriately and was transferred to a rehabilitation facility upon discharge. Final wound cultures grew *Enterococcus faecalis*, *Enterobacter cloacae*, and *Klebsiella pneumoniae*. Consent to publish the case report was provided by the patient's brother as the patient passed from complications due to uremia several months after his initial presentation to our facility.

Discussion

To our knowledge, this is the first case report of emphysematous osteomyelitis of the calcaneus. There are several reports of mid-foot emphysematous osteomyelitis, all requiring

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operative treatment and intravenous antibiotics [2-4]. Emphysematous osteomyelitis is a rare finding with only 49 cases available upon review of the literature [5]. In terms of location, involvement of the foot has only been described in 8.2% of cases. The vast majority (57%) involve the vertebral column. Most patients with emphysematous osteomyelitis have pre-existing co-morbidities, specifically diabetes mellitus (45%). Members of the *Enterobacteriaceae* family were present on cultures in 61% of available cases [5]. The duration of antibiotic therapy has been recommended to be between 4-6 weeks, similar to that of osteomyelitis [6].

The mechanism of infection is thought to be through hematogenous spread, and there are reports of infection secondary to intra-abdominal sources, recent spinal surgery, and skin and soft-tissue conditions [7]. Our patient's most likely source was his chronic diabetic foot ulcer which rapidly progressed to necrotizing fasciitis and emphysematous osteomyelitis. Given the degree of osseous destruction, it is likely that the chronic calcaneal infection seeded his fascial planes leading to his massive soft-tissue infection at presentation. Early amputation and treatment with intravenous antibiotics proved to be successful in controlling the spread of disease in our patient and preventing further tissue loss. The findings of intraosseous air may prove to be a helpful radiological finding to use pre-operatively to counsel patients and families regarding limb salvage versus amputation for source control. There are no reports of successful limb salvage in the setting of emphysematous osteomyelitis. Future research regarding limb salvage techniques in the setting of emphysematous osteomyelitis would be beneficial.

Conclusion

The presence of intraosseous gas on imaging should raise concern for emphysematous osteomyelitis in the right clinical context. The finding may be useful both for pre-operative counseling and intra-operative decision making. Definitive source control (often requiring ampu-

tation) and intravenous antibiotics are crucial at preventing the rapid sequela of disseminated infection. As emphysematous osteomyelitis is a rare disease, further research is needed to better understand the nature of the disease and possible outcomes especially regarding possibility of limb salvage.

Disclosure of conflict of interest

None.

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