

Emphysematous osteomyelitis of the foot: A case report

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Emphysematous osteomyelitis is a rare life-threatening infection requiring early recognition and immediate surgical intervention. The condition is usually caused by anaerobes, gram negative rods, or is polymicrobial. It presents in immunocompromised hosts with comorbidities such as diabetes mellitus, thalassemia major, sickle cell disease, alcohol abuse, and exogenous immunosuppression. This infection can be either of contiguous or hematogenous spread, and has been previously reported in both the axial and the appendicular skeleton. Intraosseous gas is frequently overlooked on plain radiographs but is easily diagnosed by CT scan. We describe a case of direct extension emphysematous osteomyelitis involving the foot of a 52-year-old male with poorly controlled diabetes mellitus type 2. We emphasize the need for a high index of suspicion, early diagnosis via CT scan, and immediate surgical intervention. We also underscore the utility of the Symes amputation, used in our case as an alternative to transtibial amputation for diabetic limb salvage.

Keywords: emphysematous, foot, gas, intraosseous, osteomyelitis

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Emphysematous osteomyelitis is a rarely-reported condition, previously not described in the podiatric literature. It was first noted by Ram PC, et al., in 1981, when a CT scan demonstrated gas within the medullary cavity of the involved bone [1]. In their case series, all plain radiographs were negative and there was no clinical suspicion of the severity of the infection until a CT scan was obtained. The CT scan findings significantly changed the management of the patients.

Since the initial report, the majority of the cases described have been limited to the axial skeleton with suspected hematogenous spread [2]. A hand-full of cases have been described in the appendicular skeleton, both of contiguous and hematogenous extension, with emphysematous osteomyelitis presenting in the femur, the tibia, and the foot. In the majority of the reported cases, the patients have multiple comorbidities including diabetes mellitus, use of immunosuppressive medication, malignancy,

alcohol abuse, thalassemia major, or sickle cell disease [2-4]. In many cases, the X-rays were negative for soft tissue gas and the diagnosis was made only with prompt CT imaging [1]. We report a case of contiguous spread emphysematous osteomyelitis in the foot, emphasizing the need for a high-index of suspicion, prompt advanced imaging, and aggressive treatment for this rare but life-threatening condition.

Case Report

A 52-year-old African American male, with a past medical history of polysubstance abuse, poorly controlled diabetes mellitus type 2, iron deficient anemia, seizure disorder, peripheral neuropathy, history of chronic ulcerations, had underwent treatment in our facility from 12/2018 through 01/2019 for emphysematous osteomyelitis of the right foot. The patient presented to the emergency department on December 6, 2018 with a chief complaint of right foot pain and swelling.

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Figure 1 Clinical appearance.

He previously underwent a partial right first ray amputation at a different hospital in 08/2018, with delayed healing of the surgical wound. The patient was unable to provide a detailed history of his condition at the time of the admission. The patient had no known drug allergies. Family history was non-contributory. Review of systems was unremarkable, with exception of the chief complaint.

On examination, the patient was noted to be a well-nourished, well-developed male in no apparent distress. The vital signs were stable, with the exception of a low-grade fever at 99.4 degrees Fahrenheit and a pulse of 126 bpm. Significant findings on the physical exam included moderate edema and erythema to the right foot. A partially healed amputation site of the first ray of the right foot was appreciated with a necrotic ulceration on the dorsum of the foot probing directly to bone and tendinous structures. Mild serous drainage was noted from the wound, but no obvious fluctuance, purulence, or soft tissue crepitus was appreciated (Figure 1). Pedal pulses were faintly palpable bilaterally with capillary refill times less than four seconds to the remaining digits of the right foot. Neurologically, light touch and sharp/dull sensation was diminished distal to the mid-leg level of bilateral lower extremities.

Radiographs of the right foot were obtained and were suggestive of osteomyelitis of the second metatarsal base, however no evidence of significant osseous destruction or soft tissue gas was noted. Vascular calcifications were appreciated. (Figure 2). Significant neutrophilic leukocytosis was noted with WBC at 14.4. Blood cultures were positive for *Strep. Pyogenes*. Lactic acid was 2.1.

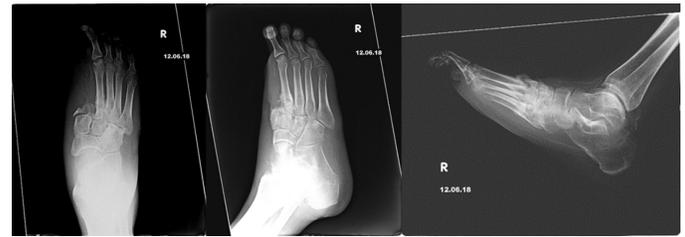


Figure 2 Radiographs of the right foot, suggestive of osteomyelitis of the second metatarsal base.

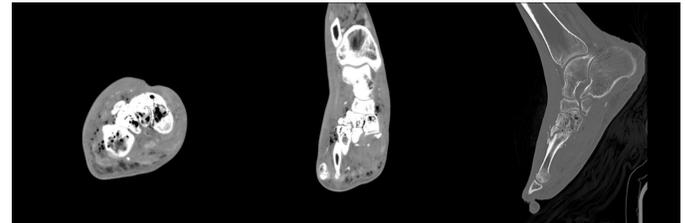


Figure 3 CT of foot, showing small foci of subcutaneous gas were also noted in the tissues.

The last HbA1C was 13.7%. Albumin was 1.4. Deep wound cultures were obtained at the time of admission. The patient was started on IV fluids and Vancomycin and transferred to the hospital floor for further evaluation and management. Infectious disease and a podiatry consult was requested.

Infectious disease and podiatry recommended the addition of piperacillin/tazobactam and metronidazole to broaden the antibiotic coverage. A CT scan of the right foot was obtained. The CT scan demonstrated multiple foci of intraosseous gas in the midfoot including navicular, cuboid and cuneiform bones, as well as the bases of second, third, fourth, fifth metatarsals. Small foci of subcutaneous gas were also noted in the tissues (Figure 3). The findings were consistent with the “pumice stone” pattern previously reported by Small JE, et al., and diagnostic for emphysematous osteomyelitis.

Given the findings, an emergent incision and drainage of the right foot with a guillotine amputation at the Chopart level was performed. Clearance fragments were obtained from the distal talus and the calcaneus. Following surgical intervention, the patient continued to improve with resolution of leukocytosis and fever. Blood cultures were negative. Wound culture results revealed growth of *Staphylococcus Aureus*, *Klebsiella*, *Enterobacter Aerogenes*, and *Streptococcus Pyogenes* Group A. Empiric antibiotic therapy was narrowed to clindamycin and penicillin, per sensitivity report and infectious disease recommendations.



Figure 4 Radiographs after Chopart level amputation.

Arterial doppler studies of the lower extremities confirmed no significant peripheral arterial disease of the right lower extremity with biphasic waveforms throughout. Follow-up radiographs and CT scan demonstrated no proximal spread of emphysematous osteomyelitis (Figure 4). Pathology analysis of the resected foot displayed skin and subcutaneous tissue showing necrosis and gangrene; bone with underlying acute and chronic osteomyelitis. Clearance fragments from the distal talus and calcaneus were negative for osteomyelitis.

In the subsequent days revision of the amputation and delayed primary closure was performed. Due to fair right lower extremity arterial perfusion, a decision was made to attempt distal limb salvage with a Syme's amputation, as opposed to a below-the-knee amputation. A Syme's amputation was performed per standard technique and the patient tolerated the procedure well (Figure 5). The remaining hospitalization course was uneventful and the amputation flap was healing well. The patient was discharged to an extended care facility. The patient missed his first two postoperative appointments and was seen in the outpatient clinic for follow-up about one month after the surgery. The patient was noted to have partial dehiscence and necrosis of the lateral one-third of the incision with the remainder of the incision healing well. The patient was readmitted for IV antibiotic therapy, vascular evaluation, and debridement. An angiogram of the right lower extremity confirmed no significant disease in the bilateral common internal and external iliac arteries and there was noted to be a two-vessel runoff to the foot without any significant disease. The patient underwent further debridement and wound care. The patient had successful healing of the Syme's amputation stump via secondary intention without further setbacks.



Figure 5 Radiographs after Syme's level amputation.

Discussion

Emphysematous osteomyelitis is a rare but potentially life-threatening condition [1-5]. About thirty cases have been described thus far in literature; the majority presenting with predominantly hematogenous spread in the spine, pelvis, and hip [1-5]. Only three cases have been previously described affecting the foot [2-4].

Our case of emphysematous osteomyelitis in the foot was similar in presentation to those previously reported by Mautone et al and Abdelbaki et al [3-4]. The spread of the infection was contiguous from a chronic ulceration persisting from delayed healing of a partial foot amputation. Khanduri et al reported the only case of hematogenous spread to the foot, with the source likely being a urinary tract infection [2].

As in the previously reported cases of emphysematous osteomyelitis of the foot, our patient was immunocompromised with multiple comorbidities. Clinical findings and X-rays were fairly benign and underestimated the extent of the infection. A prompt CT scan allowed for accurate diagnosis and appropriate emergent treatment. The finding of intraosseous "pumice stone" pattern of gas formation on CT scan was diagnostic for emphysematous osteomyelitis [5]. The CT scan allowed for clear visualization of the extent of the infection and helped to guide the level of the amputation.

As in other reported cases of emphysematous osteomyelitis, the infection in our case was polymicrobial. As such, empiric antibiotic therapy should be broad-spectrum and should include anaerobic coverage, with later narrowing based on culture and sensitivity results. As with gas gangrene of the soft tissues, the primary treatment for emphysematous osteomyelitis is emergent surgical debridement with amputation of all infected structures. Input and intervention from internal medicine, interventional cardiology, and infectious disease specialists is also critical in the successful management.

As with other diabetic foot infections, the long-term treatment goal should be distal limb salvage with rapid return to functional activity [7]. Previous studies have demonstrated the utility of the Syme's amputation, with advantage of a more natural gait resulting in decreased metabolic expenditure and cardiac stress [6-7]. The literature also suggests lower morbidity and mortality rates after a Syme's amputation in comparison to transtibial amputations [6-7]. We believe that it remains a viable alternative for limb salvage.

We describe a case of emphysematous osteomyelitis, previously not reported in the podiatric literature, managed with a Syme's amputation. We emphasize the need for a high-index of suspicion in immunocompromised patients with long-standing post-surgical ulcerations, as well as early use of advanced imaging. The use of a CT scan helps to

determine the extent of infection and the level of amputation. We also note that the Syme's amputation remains an alternative to transtibial amputations for distal limb preservation. Severe diabetic foot infections such as emphysematous osteomyelitis, are a challenging entity, requiring prompt intervention by a multidisciplinary team to achieve a successful outcome.

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