

Emphysematous Osteomyelitis of the Distal Phalanx of the Third Toe: A Radiologic Case Report

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Abstract

Case Report

Emphysematous osteomyelitis is a rare and aggressive form of bone infection in which gas-forming organisms produce air locules within the osseous structures. We report the case of a 66-year-old man with a history of diabetes and long-term smoking who presented with painful ulceration of the left foot and cutaneous tissue loss over several proximal phalanges. Imaging revealed intramedullary gas within the distal phalanx of the third toe, consistent with emphysematous osteomyelitis. Surgical exploration confirmed the presence of necrotic bone, and cultures grew *Escherichia coli*. This case highlights the importance of early recognition of gas within bone as an imaging hallmark of severe infection, particularly in high-risk patients.

Keywords: Emphysematous osteomyelitis, intraosseous gas, distal phalanx, diabetic foot.

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INTRODUCTION

Emphysematous osteomyelitis is a rare and severe form of musculoskeletal infection, distinguished by the presence of gas within bone as a result of anaerobic or facultative bacterial growth [1]. It is most commonly reported in large skeletal structures such as the spine, pelvis, and long bones, making its occurrence in the small bones of the foot particularly unusual [2]. This condition typically arises in individuals with significant metabolic or vascular impairment, including long-standing diabetes or chronic smoking, in whom early symptoms may remain subtle or easily overlooked [3]. Local factors such as soft-tissue ulceration, peripheral ischemia, and neuropathy can further delay recognition of the underlying bone involvement.

In the present case, a 66-year-old diabetic and heavy smoker presented with skin loss over several proximal phalanges of the left foot, accompanied by emphysematous bullae and focal pain in the third toe. Imaging revealed distinct intramedullary gas within the distal phalanx, consistent with emphysematous osteomyelitis. Given the potential for rapid progression and extensive tissue destruction, prompt imaging assessment and targeted intervention were essential to preserve limb viability and limit further complications.

CASE PRESENTATION

A 66-year-old man with a long history of cigarette smoking and poorly controlled type 2 diabetes presented with increasing pain, swelling, and foul-smelling discharge from the left foot. He reported progressive skin breakdown over several weeks, with difficulty bearing weight and marked tenderness at the level of the toes.

Clinical examination of the left foot revealed skin loss over the dorsal aspect of the second, third, and fourth proximal phalanges, with exposed subcutaneous tissue and surrounding erythema. Several emphysematous bullae were visible adjacent to the areas of ulceration. The third toe was visibly swollen, warm, and sensitive to palpation. Peripheral pulses were diminished but present, and capillary refill was delayed.

A non-contrast CT scan of the foot demonstrated multiple foci of intramedullary gas within the distal phalanx of the third toe, with attenuation values compatible with air. Small collections of gas extended toward the adjacent soft tissues, correlating with the observed bullae (Figure 1). No foreign body or traumatic source was identified.

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Laboratory tests showed elevated inflammatory markers, with a neutrophil-predominant leukocytosis. Surgical debridement of the necrotic soft tissues and distal phalanx was performed. Tissue culture grew *Escherichia coli*, sensitive to multiple intravenous antibiotics.

The patient initially responded favorably to broad-spectrum antimicrobial therapy, followed by targeted treatment based on sensitivity results. Postoperative evolution was satisfactory, with progressive granulation tissue formation at the debridement site. The patient was counseled on smoking cessation and glycemic control to prevent recurrence.

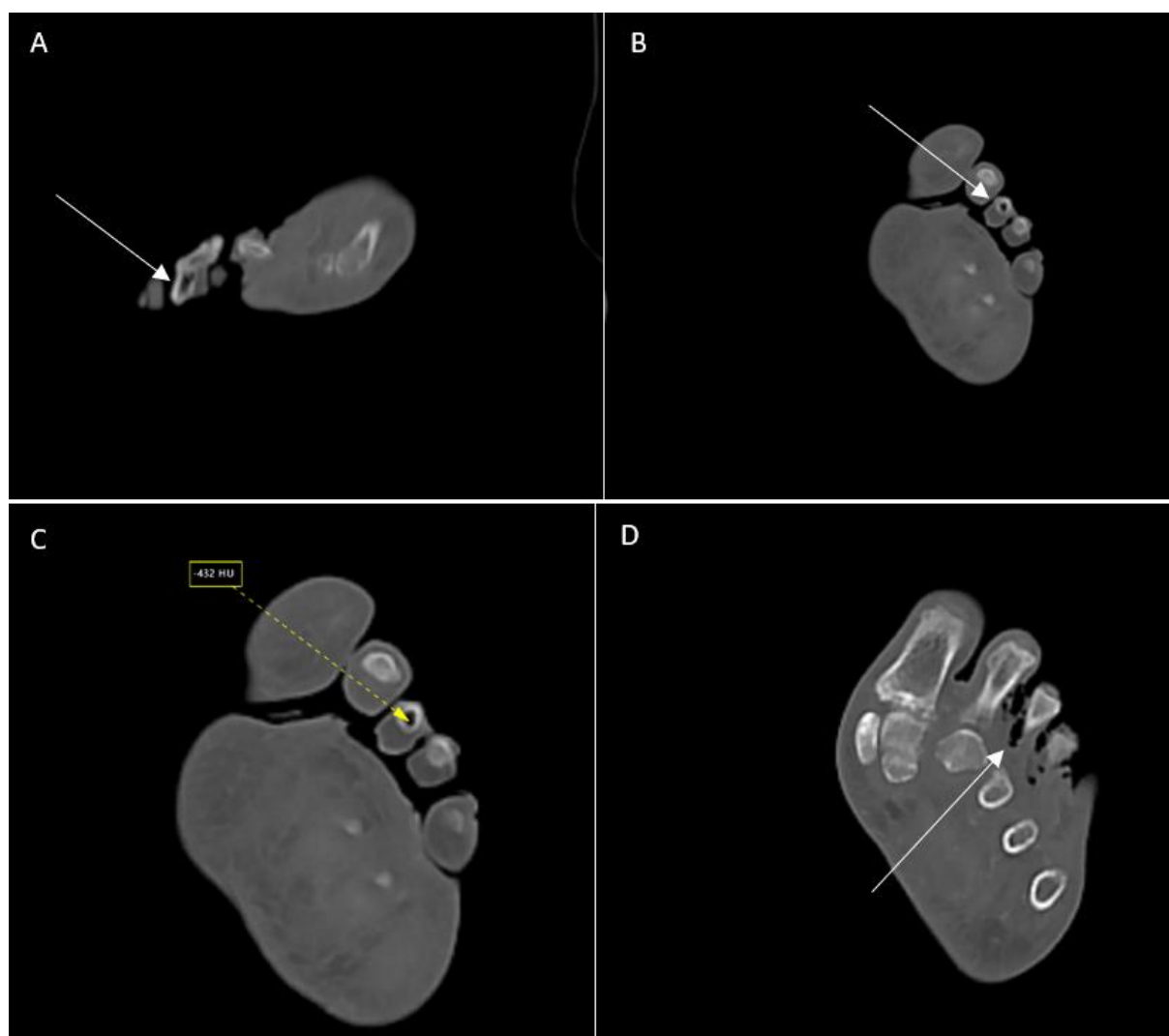


Figure 1 (A) Sagittal reconstruction in bone window during the arterial phase showing multiple intramedullary gas locules within the distal phalanx of the third toe. (B) Axial bone-window image in the arterial phase demonstrating the same intraosseous gas foci within the third toe. (C) Axial arterial-phase CT confirming that the attenuation of these locules is consistent with gas density. (D) Axial bone-window image revealing gas bubbles within the surrounding soft tissues, associated with overlying skin loss.

DISCUSSION

Emphysematous osteomyelitis is an exceptionally rare and potentially life-threatening form of bone infection, distinguished by the presence of gas within the osseous structures [1]. Most of the cases described to date involve large axial or appendicular bones such as the pelvis, femur, tibia, fibula, or spine, whereas the foot represents an unusual and far less frequently documented location [2]. The condition tends to arise in patients whose underlying health status compromises normal immune defenses, particularly

those with uncontrolled diabetes, malignancy, or chronic exposure to immunosuppressive therapies [3].

The infection is typically caused by anaerobic organisms or by members of the Enterobacteriaceae family, either in a mono-microbial or polymicrobial pattern [1, 3]. Once established, the disease may develop through hematogenous seeding, which is considered the most common route of spread [4, 5], although other pathways have occasionally been implicated, including direct extension from intra-abdominal infections, postoperative contamination following abdominal or

spinal surgery, and invasion from adjacent skin or soft-tissue infections [6].

Radiologically, the identification of intraosseous gas is central to the diagnosis [7], although several differential diagnoses must first be excluded. Penetrating injuries, open fractures, recent bone biopsies, osteonecrosis, and osseous lymphangiomatosis may also produce gas-like collections and therefore require careful clinical and imaging correlation [8]. Although the earliest imaging descriptions emphasized the value of CT in detecting intraosseous gas [9], plain radiographs can already reveal subtle air pockets within the bone and surrounding soft tissues. Nonetheless, CT remains the modality of choice for confirmation, offering excellent sensitivity for characterizing even minute gas locules [2, 7, 10], which, in the appropriate context, are considered virtually pathognomonic for emphysematous osteomyelitis [7]. Ultrasonography plays only a minimal role in this setting, as identifying gas within soft tissues by this method is particularly challenging. Magnetic resonance imaging is capable of detecting gas as well, yet the literature remains scarce regarding its accuracy and correlation with CT for the identification of intraosseous air [2].

Management of this infection demands urgent and aggressive intervention. Surgical debridement is the fundamental component of treatment, allowing removal of necrotic and infected tissue, while intravenous antibiotics help contain the spread of infection and support systemic control [7]. The recommended duration of antimicrobial therapy generally mirrors that used for other forms of osteomyelitis, extending over a period of four to six weeks to ensure adequate bacterial eradication and prevent recurrence [11].

CONCLUSION

Emphysematous osteomyelitis of the distal phalanx is an uncommon yet severe infection that requires immediate recognition and intervention. In diabetic and smoking patients, even minor cutaneous lesions can evolve into deep infections with gas-producing organisms such as *E. coli*. CT imaging plays a central role in identifying gas within bone, allowing timely surgical and medical treatment that can preserve limb function and prevent major complications.

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