CASE REPORT

The life-saving little tip: intraosseous gas

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SUMMARY

A case is presented of an-aerobic osteomyelitis with intraosseous gas resulting in the extension of gas in soft tissue structures in a patient with diabetes mellitus. The finding of intraosseous gas and its extension into the pubic joint and the left anterior abdominal wall is depicted. Intraosseous gas is a rare but worrying finding for osteomyelitis in the absence of a penetrative wound, recent surgery, biopsy or fracture.

BACKGROUND

Gas formation within joints and somatic soft tissues, diagnosed via radiological modalities is a well-known finding of degenerative diseases or infections. However, the presence of intraosseous gas, particularly in the extra-axial skeleton, is rare in the absence of a compound fracture or surgery.^{1–3} Intraosseous gas is a pathognomonic sign for emphysematous osteomyelitis.^{1–3} It is important to recognise this sign because rapid diagnosis and immediate aggressive treatment are necessary to prevent the fulminant course of the disease that can result in serious side effects or even death.³ Here, we present a case of emphysematous osteomyelitis of the pubic bone diagnosed with CT and MRI. Culture results of the diagnostic specimens obtained from CT-guided drainage and surgical debridement confirmed a monobacterial Gram-negative infection.

CASE PRESENTATION

A 55-year-old woman with diabetes mellitus and hypertension was admitted to the emergency department and presented with high fever (40°C), nausea and pelvic pain. She had no history of intravenous drug use, pelvic surgeries, malignancies or trauma. On admission, she was tachycardic and hypertensive. Physical examination revealed pelvic and pubic tenderness on deep palpation. Laboratory data included leukocytosis (12 390/mm³ with 85.5% neutrophils), high procalcitonin (33.8 ng/mL), C reactive protein (211 mg/dL) levels, a high sedimentation rate (80 mm/h), also elevated blood sugar (290 mg/dL) and elevated glycated haemoglobin level (13.4%). Blood cultures were obtained prior to the initiation of antimicrobial therapy. An echocardiogram was performed, which showed a normal sinus rhythm.

Abdominal ultrasonographic examination revealed cholelithiasis without gallbladder wall thickening and a small amount of isolated pelvic free fluid. A subsequent CT of her abdomen and pelvis showed multiple gas bubbles in the medullary cavity of the bilateral pubic bones, extending into the anterior acetabulum (figure 1). A moderate amount of gas was seen in the soft tissues

surrounding the pubis. Also, marked subcutaneous reticulation and low-attenuation areas of subcutaneous gas were detected in the right gluteal region.

MRI confirmed the CT scan findings and provided clearer images of the small abscess formations and the peripubic soft tissue component of the infection. Subcutaneous and deep oedema and fluid collections with ill-defined faint enhancing margins were detected in the right gluteal subcutaneous fat (figure 2). A CT-guided biopsy of prepubic soft tissue collection was performed (figure 3), and *Escherichia coli* was cultured from the diagnostic specimen.

TREATMENT

Intravenous imipenem cilastatin (4×500 mg) and vancomycin (2×1 g) was started as an empirical treatment. The patient underwent urgent surgical debridement of the soft tissue abscess. Infected pubic bones and peripubic soft tissues causing the abscess formations which were detected by CT and MRI were debrided by using the Pfannenstiel exposure. During the surgery, pubic bones were also explored and all infected and devitalised parts were excised with curettes and rongeurs as routinely conducted for osteomyelitis. The excised parts were used for pathological and microbiological investigations. After irrigation, a hemovac tube was placed into the wound bed for observing the postoperative drainage.

All samples (biopsy-surgical specimens and blood cultures) revealed a monomicrobial growth of *E. coli*. Intravenous ciprofloxacin (2×400 mg) was started based on the antibiogram results. The first 3 weeks of treatment was completed as intravenous therapy. The patient was discharged with

Figure 1 Axial CT image demonstrating intraosseous gas in symphysis pubis and bilateral superior pubic ramus, also inflammatory changes in tissues surrounding the pubic bones.

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Figure 2 Precontrast (A) and postcontrast (B) axial fat-suppressed T1-weighted images depicting small abscess formations (arrows) with marked peripheral enhancement, just posterior to the symphysis pubis. Apparent diffusion coefficient map (C) demonstrating hypointensity within the abscess (arrowhead). T2-weighted image with fat suppression (D). Note the increased signal in the subcutaneous tissues indicating inflammation on the right side and prepubic area.

oral antibiotic treatment (ciprofloxacin 2×750 mg). The patient's treatment was completed in 6 weeks. No complications were seen and she continues to be followed up.

DISCUSSION

In the presence of clinical and laboratory signs of infection, radiological examinations played a key role in determining the source of infection in our patient. Detection of the intraosseous gas on CT images resulted in a significant alteration of the patient's management. MRI results not only confirmed the CT scan findings, but also provided additional information about the extent of this inflammatory process and showed the small abscess formations more clearly. A CT-guided biopsy verified the diagnosis.

Figure 3 Axial CT image obtained during CT-guided biopsy with 18-gauge needle (short arrow). The needle is noted in the gas-containing abscess within the left anterior abdominal wall (long arrow).

Gas formation within the joint spaces and the extraosseous soft tissues as a sign of anaerobic infection is not uncommon. However, the presence of gas in the medullary cavity of the bone is rare and is pathognomonic for emphysematous osteomyelitis when encountered on cross-sectional imaging.^{1–3} It was first described as a sign of osteomyelitis by Ram *et al*¹. The most reported extra-axial sites are the pelvis, femur, tibia and fibula, but any bone can be affected.³ Bielecki *et al*⁴ reported a similar association of intraosseous and intradiscal gas with spinal infections. The other causes of intraosseous gas are lymphangiomatosis of bone, necrosis, neoplasm, biopsy, penetrating wounds and fractures.²

The underlying comorbidities were reported, with diabetes and malignancy being the most common.³ It is known that diabetic patients are more prone to infections and are generally associated with an increased risk of complications, due to the autonomic and sensory neuropathy, local and systemic immunological defects, macrovascular diseases and microvascular dysfunctions.⁵ The presence of high glucose levels in the tissue and impaired circulation favour the anaerobic metabolism or facultative anaerobic bacteria, resulting in gas production.⁶ Probably, underlying uncontrolled diabetes was the most important factor on the occurrence of infection in our patient.

Most cases in the literature include monomicrobial infections and causes similar to the reported monomicrobial causes of other gas-forming infections, which include *E coli*, *Klebsiella pneumoniae*, *Enterobacter aerogenes*, and *Clostridium* spp. The mechanism of infection was determined to be either a haematogenous spread or a contiguous spread from an intra-abdominal infection followed by local spread from skin or soft tissue sources.^{2–3} Both haematogenous and local spread would be the proposed mechanism in the present patient. Monomicrobial growth of *E coli* in the blood culture strongly

suggested haematogenous spread of infection (sepsis). Inflammation of the soft tissues in the right gluteal region, which is well outlined by MRI, also supports the theory of local spread.

Management of patients should be aggressive; surgical debridement is a cornerstone of therapy. Antibiotic treatment should be guided by the knowledge of possible etiological agents. No consensus yet exists regarding the duration of antibiotic treatment for chronic osteomyelitis. The general approach is to give broad spectrum antibiotics for 4–6 weeks (at least 2 weeks parenteral). Because revascularisation in the bone starts at the third to fourth week, treatment should be given parenterally at the beginning.^{7 8} High mortality rates (32%) have been reported 7–56 days following diagnosis.³

In conclusion, we want to emphasise two points. First, emphysematous osteomyelitis is a rare but fulminant disease. Therefore, radiologists should be aware of the implication of intraosseous gas signs for quick diagnosis. Second, infections in diabetic participants will be more serious than in non-diabetic patients. In the presence of clinical signs of infection, radiological examinations should be evaluated much more carefully for this patient group.

Learning points

- ▶ Intraosseous gas is a rare but worrying finding for osteomyelitis.
- ▶ Gas formation within the joint spaces and the extraosseous soft tissues as a sign of anaerobic infection is not uncommon.
- ▶ Emphysematous osteomyelitis is a rare but fulminant disease. Therefore, radiologists should be aware of the implication of intraosseous gas signs for quick diagnosis.

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REFERENCES

- 1 Ram PC, Martinez S, Korobkin M, *et al.* CT detection of intraosseous gas: a new sign of osteomyelitis. *Am J Roentgenol* 1981;137:721–3.
- 2 Potocki J, Kaushik S, Mira JL. Anaerobic osteomyelitis of femoral head with intraosseous, intra-articular, bursal and muscle pneumatosis. *Skeletal Radiol* 2003;32:46–8.
- 3 Luey C, Tooley D, Briggs S. Emphysematous osteomyelitis: a case report and review of the literature. *Int J Infect Dis* 2012;16:216–20.
- 4 Bielecki DK, Sartoris D, Resnick D, *et al.* Intraosseous and intradiscal gas in association with spinal infection: report of three cases. *Am J Roentgenol* 1986;147:83–6.
- 5 Hannan CM, Attinger CE. Special considerations in the management of osteomyelitis defects (diabetes, the ischemic or dysvascular bed, and irradiation). *Semin Plast Surg* 2009;23:132–40.
- 6 Bowler PG, Duerden BI, Armstrong DG. Wound microbiology and associated approaches to wound management. *Clin Microbiol Rev* 2001;14:244–69.
- 7 Lew DP, Waldvogel FA. Osteomyelitis. *Lancet* 2004;364:369–79.
- 8 Conterno LO, da Silva Filho CR. Antibiotics for treating chronic osteomyelitis in adults. *Cochrane Database Syst Rev* 2009;3:CD004439.

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