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Case Report

Staphylococcus aureus costal osteomyelitis with complicated by pleural effusion in a 7-month-old infant: A misleading clinical presentation ☆

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ABSTRACT

Osteomyelitis is a rare infectious disease in children, predominantly affecting long bones; however, its clinical presentation can be ambiguous if the location is atypical. Costal osteomyelitis is very rare in children and can mimic other pathologies. We present a case of a seven-month-old infant diagnosed with costal osteomyelitis complicated by rupture of a subperiosteal abscess into the pleura. His clinical condition improved with conservative treatment, which included chest drain insertion and intravenous antibiotic therapy without the need for surgical debridement. Rib osteomyelitis represents a potentially severe condition. Early detection is imperative to prevent the necessity for invasive therapies and mitigate long-term complications.

Introduction

Osteomyelitis is an invasive bacterial infection that usually affects the long bones metaphysis. Its incidence in children is approximately 8 cases per 100,000 annually with a notable peak during puberty [1]. However, rib osteomyelitis represents an exceptionally rare occurrence, constituting only 1% of all cases of acute pediatric osteomyelitis. Literature on this condition predominantly consists of case reports and small series [2].

Delayed recognition is common due to its indolent presentation and low suspicion, often necessitating invasive diagnostic modalities as nonspecific laboratory and radiological

Abbreviation: MSSA, Methecillin-sensitive *Staphylococcus aureus*.

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I assure that the manuscript is original; no part of it has been published before, nor is any part of it under consideration for publication at another journal. As corresponding author, I confirm that there is no conflict of interest.

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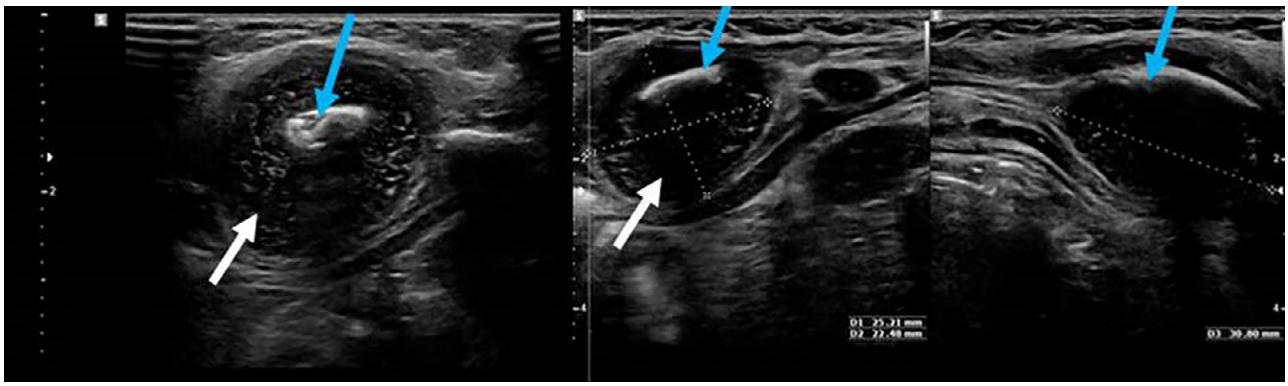

Fig. 1 – US images showing an intraosseous fluid collection (white arrow) around the rib which is presenting cortical irregularities (blue arrow).

findings are typical. Due to its infrequency, guidelines regarding diagnosis, treatment and surgical intervention are lacking. *Staphylococcus aureus*, particularly methicillin-sensitive *S aureus* (MSSA), is the primary pathogenic agent, although incidence rates may vary [3]. Here, we present a case of costal osteomyelitis in a 7-month-old infant to underscore the diagnostic challenges associated with this rare condition.

Case presentation

The 7-month-old male infant, previously healthy and fully vaccinated, was referred to our surgical department due to a 2-week history of intermittent fever reaching 39°C. The infant had a recent episode of acute otitis media, treated with oral cefotaxime-clavulanic acid for the past 2 weeks. However, 3 days before presentation, he developed continuous irritability, agitation, and persistent crying.

Upon examination, the infant exhibited normal respiratory and saturation rates. However, a tender, mildly erythematous swelling measuring 4 × 3 centimeters was noted on the left anterior chest wall, with no apparent history of trauma. Differential diagnoses of costal osteochondritis or superinfected costal hematoma were considered. An ultrasound of the mass (Fig. 1) revealed a heterogeneous fluid collection measuring 3 cm surrounding the middle arch of the left seventh rib, with an irregular lytic cortex of 3 cm. Laboratory investigations demonstrated a significant inflammatory response, with hyperleukocytosis (white blood cell count = 22,000/mm^3), neutrophil count at 15,000/mm^3, and an elevated C-reactive protein level of 240 mg/L. Chest X-ray revealed soft tissue thickening of the lower left chest wall.

The patient was initiated on treatment with amoxicillin-clavulanic acid. However, as the fever persisted, a needle aspiration was performed, yielding 3 mL of pus, prompting a modification in the intravenous antibiotic regimen.

Seventy-two hours later, the child developed fever (39°C), tachypnea (70 breaths/minute), and decreased left respiratory sounds. Inflammatory markers showed an elevated C-reactive protein level of 337 mg/L and neutropenia with a count of 5000/mL.

A second chest X-ray raised suspicion of left pleural effusion, which was confirmed by chest ultrasound (Figs. 2 and 3). Pleural tapping yielded 100 mL of purulent fluid, with a direct examination revealing 4000 white cells per mm^3 and 1000 red cells per mm^3, predominantly neutrophils (60%), along with evidence of gram-positive cocci. Treatment consisted of intravenous antibiotic therapy with amoxicillin/clavulanic acid at a dose of 150 mg/kg/day combined with gentamicin. A thoracic CT scan with iodinated contrast injection (Fig. 4) was performed and demonstrated osteolysis of the middle arch of the left seventh rib, with surrounding collection and infiltration of soft tissues, along with moderate septate left pleural effusion.

The diagnosis of left costal osteomyelitis complicated by pleural effusion was confirmed. Pleural fluid culture revealed methicillin-susceptible *S aureus*, while blood cultures were negative.

By the third day, complete drainage of the effusion was achieved, and the chest tube was removed. The child's recovery was uneventful, with resolution of fever and normalization of laboratory tests.

During hospitalization, immune function and hemoglobin electrophoresis were assessed, revealing no abnormalities. Additionally, medical interviews indicated no history of infection susceptibility among family members or relatives.

The child was discharged on oral cefotaxime-clavulanic acid for a duration of 21 days. At 7 months of follow-up, the child remained asymptomatic with no recurrent symptoms.

Discussion

Rib osteomyelitis is uncommon in children and typically manifests during infancy [2]. However, there have been rare reports of rib involvement in older children [4], as evidenced by the case we present of an infant with rib osteomyelitis.

Methicillin-sensitive *S aureus* (MSSA) remains the predominant pathogen, responsible for over 50% of cases due to its numerous intra- and extracellular virulence factors [3]. The emergence of methicillin-resistant *S aureus* (MRSA) in recent years is attributed to extensive antibiotic use. Other bacterial

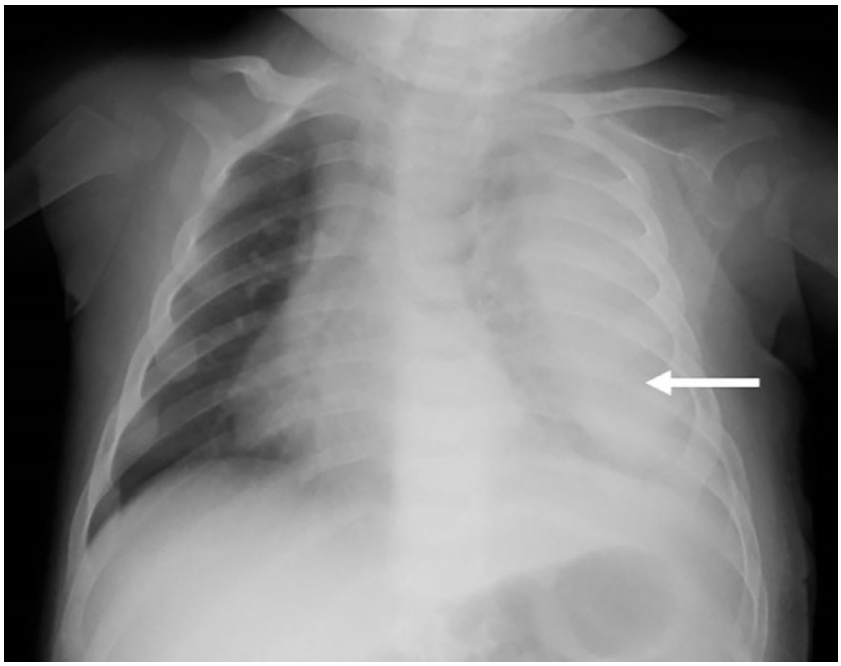

Fig. 2 – Chest X ray showing a radio-opacity in the left zone forming an obtuse angle with the chest wall secondary to a thoracic empyema (white arrow).

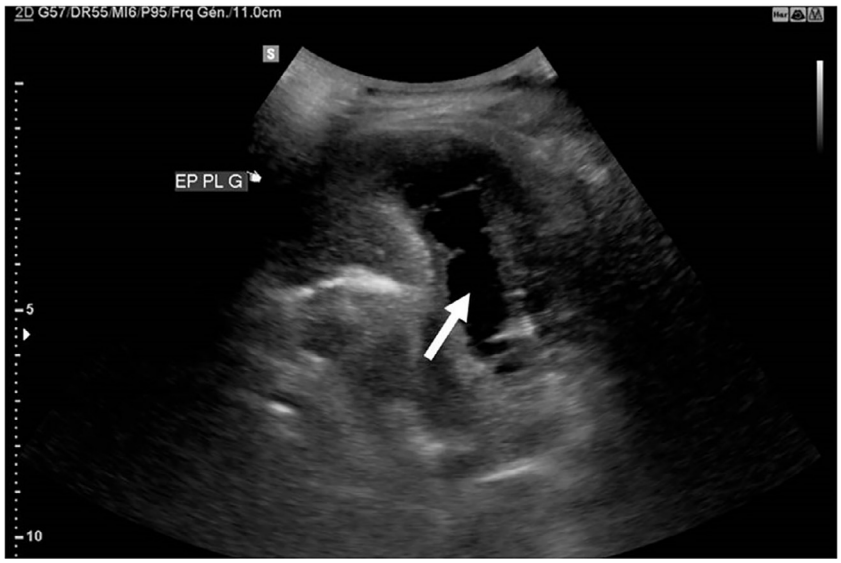

Fig. 3 – US images showing loculated left pleural effusion (white arrow).

agents include Streptococcus B and Escherichia coli in infants under 3 months of age, as well as Streptococcus A and pneumococcus. Additionally, atypical pathogens such as mycobacterial and fungal species have been reported [4].

Dissemination of osteomyelitis may occur via 3 mechanisms: local spread from adjacent sites, inoculation secondary to trauma, surgery, vascular insufficiency, or hematogenous dissemination, which is most common in children [3]. Despite the absence of trauma or surgical history in our patient, the presence of pleural effusion following prior middle ear otitis media suggested hematogenous spread, even in the absence of positive blood cultures. Notably, blood cultures are positive in only 40% of cases of hematogenous osteomyelitis, underscoring the limitation of relying solely on blood culture results for diagnosis [3]. In developing countries, the incidence rate of pediatric hematogenous osteomyelitis ranges from 1 in 500 to 2300, compared to 1 in 5000 to 7700 in developed countries [5]. To date, only 63 cases of pediatric costal osteomyelitis have been documented in the literature over the last century [1,6].

In ribs, similar to long bones, hematogenous disease tends to occur in areas with the highest blood supply, notably an-

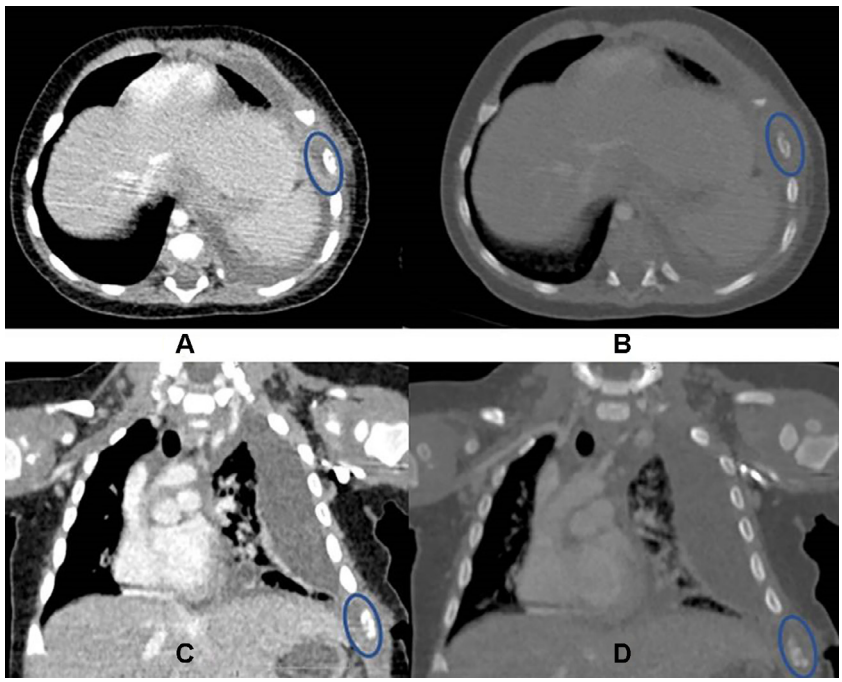

Fig. 4 – CT images: (A) axial Mediastinal window shows an abscess englobing the middle arch of the 7th left rib and in (B) axial Bone window image showing cortical erosions of the same left rib (circle). CT frontal view (C and D) showing a left pleural loculated effusion.

teriorly near the costochondral junction and posteriorly near the costovertebral angle [6]. Additionally, rib fractures create an environment conducive to bacterial implantation and subsequent osteomyelitis [7,8].

Diagnosis of rib osteomyelitis is often delayed, particularly in infants, as initial symptoms are nonspecific and may present indolently [9]. Furthermore, rib osteomyelitis predominantly affects the lower ribs, potentially referring pain to the abdomen, further complicating diagnosis [2]. Thorough examination for subtle swellings is imperative for early detection [10].

While elevated inflammatory markers are common, abnormalities in immunocompetent children without sickle cell disease are nonspecific [5,11]. In the absence of predisposing factors, a high index of suspicion is necessary for early diagnosis.

Plain radiography has traditionally been used for diagnosis, but it exhibits low sensitivity and specificity rates, with acute osteomyelitis changes becoming visible around the 10th to 14th day [12]. In our case, the initial X-ray revealed discrete soft tissue thickening of the lower left chest wall.

Ultrasound examination has been shown to detect changes several days earlier, with sensitivity ranging from 55% to 90% [13]. Some authors recommend treating all pericostal edemas in children as osteomyelitis until proven otherwise. Given the challenges of MRI accessibility and the need for sedation in children, CT scan is considered the preferred alternative [14], offering excellent anatomical detail and high sensitivity for detecting early infection and underlying lung involvement.

Indeterminate presentations should prompt consideration of surgical biopsy to rule out other possibilities and confirm the diagnosis of osteomyelitis and its causative pathogen [4]. However, in most cases, appropriate blood cultures and abscess aspirations suffice.

Empirical antibiotic therapy should include coverage for MSSA, the predominant pathogen. Although there are no established guidelines for duration, a standard regimen of 4-6 weeks or longer is widely accepted [5]. In our case, the patient received 3 weeks of intravenous therapy followed by 3 weeks of oral therapy for a total of 6 weeks.

Antibiotic therapy may achieve resolution without surgical debridement. While no clear data exist regarding the preferred approach, invasive surgery should be considered in cases of poor response to antimicrobial therapy or recurrence. For contiguous infection or chronic osteomyelitis, direct inoculation may be the preferred source control [15]. Due to early diagnosis, our patient responded well to medical therapy, obviating the need for invasive treatment. However, surgical drainage was required for the abscess and pleural effusion.

Guidelines regarding surgical treatment of rib osteomyelitis in children are lacking, necessitating a case-by-case approach.

In conclusion, pediatricians and pediatric surgeons should maintain a high index of suspicion for this uncommon presentation of osteomyelitis. Our case underscores the diagnostic challenges associated with rib osteomyelitis. Early diagnosis is paramount for appropriate management and to minimize the need for invasive interventions.

Patient consent

Thank you for your inquiry. We want to assure you that we have obtained the necessary consent from the parents of the patient for the publication of this case report and accompanying images. We understand the importance of adhering to ethical standards in medical publishing and ensuring patient confidentiality.

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