CASE REPORT

Early Diagnosis of Paediatric Osteomyelitis by Ultrasound After a Negative X-Ray: A Case Report

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Abstract

Acute osteomyelitis is a potentially severe bone infection that commonly affects children, and early diagnosis is essential to prevent complications. However, plain radiographs are often normal in the early stages, which can delay treatment. We report the case of a 9-year-old female who presented with acute pain, swelling, and tenderness over the distal right tibia. Initial plain radiographs showed no bony abnormalities, while ultrasound revealed a hypoechoic subperiosteal fluid collection with surrounding soft tissue oedema and increased vascularity on colour Doppler, consistent with early osteomyelitis. The patient was treated with antibiotics, and a follow-up radiograph obtained six weeks later demonstrated cortical destruction, periosteal elevation, and patchy osteolytic changes, confirming the diagnosis. This case report highlights the value of ultrasound as a sensitive, accessible, and radiation-free tool for the early detection of acute osteomyelitis in children, especially in resource-limited settings where advanced imaging may not be readily available.

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Introduction

Acute osteomyelitis is a new-onset disease with gradual inflammatory destruction of bone tissues.[1] Incidence of osteomyelitis in the North American continent is estimated to be around 50,000 (reported) cases yearly.[1] Early diagnosis, management and treatment is essential in reducing adverse outcomes such as permanent bone damage and hypo-kinetic functions of the extremities.[2,3] Medical imaging plays an integral role in establishing the diagnosis of acute osteomyelitis and characterizing the extent of disease spread.[4] In low resource settings, plain radiography and sonography are the most available imaging modalities.[5] We herein report the case of a 9-year-old female who presented with acute osteomyelitis which was missed on initial plain radiographs. Point-of-care ultrasonography (POCUS) subsequently, identified subperiosteal fluid collection and soft tissue hyperemia, confirming early osteomyelitis. This case highlights the value of ultrasound as a sensitive, accessible, and radiation-free tool for the early detection of acute osteomyelitis in children, especially in resource-limited settings where

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advanced imaging may not be readily available.

Case Report:

A 9-year-old female presented with a five-day history of right ankle pain and swelling, associated with fever and limping. She denied recent trauma, although the outpatient referral note suggested a possible sprain. On admission, she was febrile (38.5 °C), alert, and systemically stable. Examination revealed localised swelling, warmth, and tenderness over the distal third of the right tibia with limited ankle movement. The overlying skin was intact, with no erythema or draining sinuses. Further physical examination showed no swollen lymph nodes, skin rash, or signs of inflammation in other joints. The rest of the physical and systemic examination was normal. The patient's past medical history was unremarkable. She had no previous hospital stays, chronic illnesses, or similar episodes of bone or joint pain that were reported. Her family history did not include musculoskeletal disorders, autoimmune conditions, or recurrent infections. Psychosocially, she lived with her parents and attended school regularly, with no major social stressors reported. Her vaccinations were up-to-date.

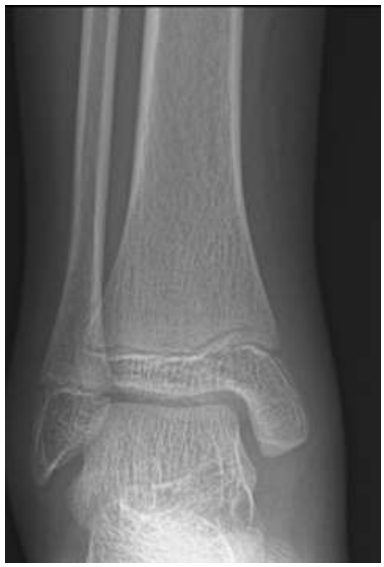

Figure 1: *Right distal Tibia initial AP X-ray revealing no bone pathology*

Differential diagnoses considered included right ankle sprain, fracture, septic arthritis, trauma-related injury, pyomyositis, deep vein thrombophlebitis, and acute osteomyelitis.

Ultrasound of the distal tibia/ankle revealed a hypoechoic subperiosteal fluid collection with periosteal elevation and increased peri-cortical vascularity on Doppler, consistent with acute osteomyelitis

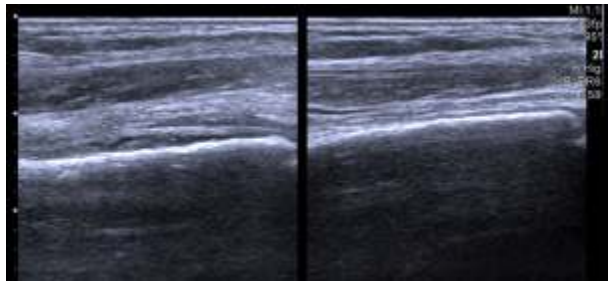

Figure 2*: Initial ultrasound images obtained five days after onset showing periosteal reaction on the right distal tibia and a comparative image of the left tibia showing smooth bone.*

sonographer under the direct supervision of a consultant radiologist experienced in paediatric musculoskeletal imaging. Both grayscale and color Doppler assessments were performed to evaluate periosteal reaction, soft-tissue changes, and local hyperemia. Varying multidirectional flow was recorded with color Doppler and pulsed-wave analysis, showing increased vascularisation in the subperiosteal region. Given that this is a single case, no formal inter-observer validation was conducted.

Empiric antibiotic therapy consisted of intravenous ceftriaxone (75 mg/kg/day) and cloxacillin (50 mg/kg every 6 hours) administered via peripheral IV line for six weeks. This combination was selected to provide broad coverage for *Staphylococcus aureus*, the most frequent cause of paediatric osteomyelitis[11,12,13], and possible Gram-negative organisms, consistent with local antimicrobial stewardship guidelines where culture confirmation may be unavailable. Blood cultures were negative; therefore, the oral step-down therapy (cloxacillin)

was guided by clinical response and normalisation of inflammatory marker. Orthopaedic review supported medical management.

Serial inflammatory markers showed progressive normalisation during admission and follow-up . CRP fell from 224 mg/L at peak to 0.8 mg/L at 8 weeks, ESR declined from 95 mm/hr to 11 mm/hr, and WBC normalised from 12.7 × 10?/L to 5.3 × 10?/L. These trends correlated with clinical improvement, including resolution of fever, decreased swelling, and restoration of mobility.

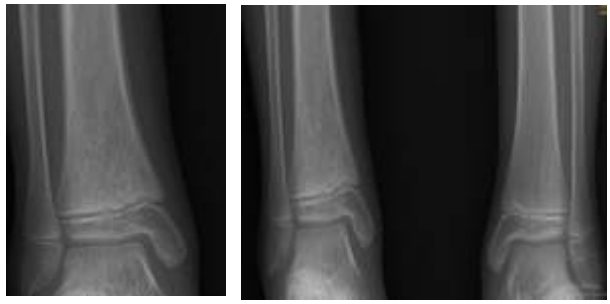

Figure 4: *Six weeks later, follow-up x-ray (AP views) of both right and left digital tibia shows new bone formation and trabecular alteration on the right side, consistent with acute osteomyelitis, and normal bone on the left side.*

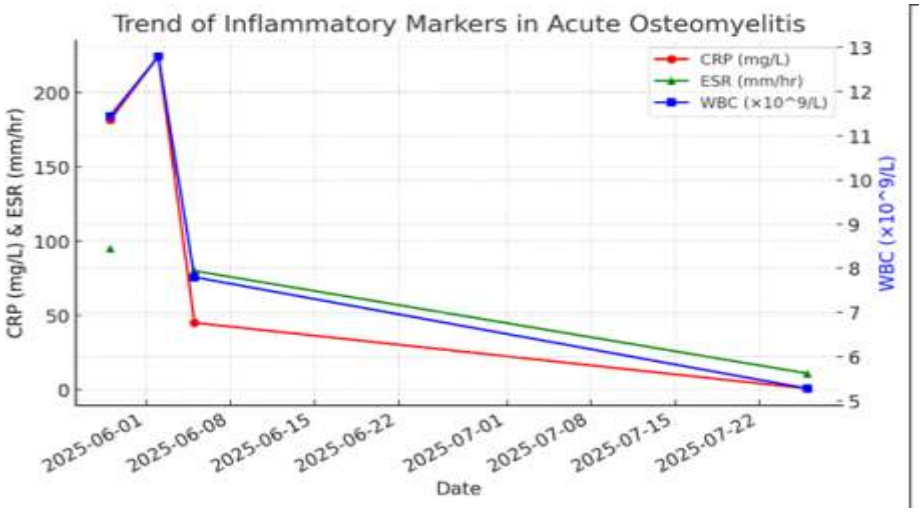

Figure 3*: Serial inflammatory markers normalisation in six weeks since treatment since treatment initiation*

The patient was discharged after seven days on oral cefixime and cloxacillin to complete a six-week course. At follow-up, she was asymptomatic. No adverse effects were reported during or after antibiotic therapy. High C-Reactive Protein (hCRP) and white blood cell count were within normal limits. Full range of flexion and flexion motion was seen in the ankle joint. A follow up radiograph demonstrated periosteal new bone formation, confirming healing osteomyelitis. The patient's guardian expressed relief at the rapid diagnosis and recovery without surgery.

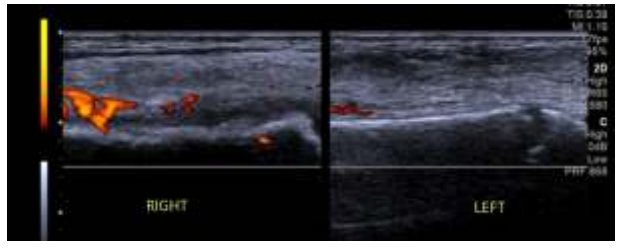

Figure 6: Six weeks later, follow-up ultrasound images of both right and left distal tibia showed irregular bone margins on the affected side(right) and smooth bone on the left distal tibia, which is normal.

Table 1 gives a summary of the timeline of clinical events.

Table 1: Timeline of Clinical Events

Date/ Day	Event	Key Findings & Actions
Day 1	Symptom Onset	Right ankle pain and swelling, fever, and limping begin.
Day 5	Hospital Admission	Presented to hospital. Febrile (38.5°C). Examination: swelling, warmth, tenderness over distal tibia. Lab: Elevated CRP (181.6 mg/L), ESR (95 mm/hr), WBC (11.4 × 10? /L).
Day 5	Initial Investigations	Plain radiograph: Unremarkable. Ultrasound: Subperiosteal fluid collection, consistent with acute osteomyelitis.
Day 5	Treatment Initiated	IV Ceftriaxone and Cloxacillin started. Admitted under pediatric department.
Day 12	Hospital Discharge	Clinical improvement. Switched to oral antibiotics (Cefixime and Cloxacillin).
Week 8	Follow-up	Asymptomatic. Inflammatory markers normalized (CRP 0.8 mg/L, ESR 11 mm/hr). Repeat radiograph confirmed periosteal new bone formation and healing.

DISCUSSION

This case illustrates a diagnostic challenge in pediatric emergency medicine: the child with high clinical suspicion for acute osteomyelitis but an initially normal radiograph. As established in the literature, plain radiographs are insensitive in the early stages of the disease, often requiring 10 to 14 days to demonstrate bony changes such as periosteal reaction or osteolytic destruction.[1,5] This inherent limitation, evident in this case whose initial films were unremarkable, creates a window for diagnostic delay. Such a delay can increase the risk of devastating complications, including permanent bone damage, pathological fracture, and chronic infection.[3,6] In this context, the case underscores the critical role of POCUS as a pivotal next-step imaging modality to bridge this diagnostic gap especially in resource-limited settings.

The diagnosis of osteomyelitis was supported by the exclusion of other key differentials. Septic arthritis was ruled out due to the focal tenderness over the tibial metaphysis rather than the joint line itself, and the preservation of some ankle movement, which is typically globally and severely restricted in a septic joint.[1] A significant traumatic event was also confidently excluded based on the patient's history and the presence of systemic signs, including high-grade fever and profoundly elevated inflammatory markers, which pointed strongly toward an infectious etiology.[3]

The sonographic findings in our patient, a hypoechoic subperiosteal fluid collection with periosteal elevation and hyperemia on Color Doppler, are the hallmark signs of early osteomyelitis and were instrumental in guiding timely management. This aligns with existing evidence that ultrasound excels at detecting these soft tissue and periosteal abnormalities long before they are visible on a radiograph .[4] As demonstrated in other case reports, ultrasound can reveal subperiosteal abscesses and cortical irregularities, effectively confirming the diagnosis when clinical and laboratory suspicion is high.[7,8] While magnetic resonance imaging (MRI) remains the gold standard for characterizing the full extent of osseous involvement due to its superior sensitivity and specificity,[9,10] it is often less accessible, especially in resource-limited settings.

Therefore, the principal significance of this case is its reinforcement of ultrasound as a highly sensitive, rapid, and radiation-free tool for the early detection of acute osteomyelitis. This is particularly vital in low-resource environments, where, as noted by DeStigter,[5] ultrasound and radiography are the most available modalities. By enabling a prompt diagnosis, ultrasound facilitates the immediate initiation of targeted antibiotic therapy and prevents the progression of disease. We advocate for the

increased integration of POCUS into the initial diagnostic pathway for suspected pediatric osteomyelitis. This is not to replace MRI when it is indicated and available, but to serve as an indispensable triage tool that ensures no child suffers a delay in treatment due to the limitations of conventional radiography.

This case report has several limitations. First, it focuses on the experience of one patient, so our findings may not apply to all groups. Second, although the diagnosis is highly suggestive, it was not confirmed with an MRI, which is the best method to define the full extent of bone involvement. Finally, the follow-up period showed clinical and biochemical cure, but it was relatively short for evaluating potential long-term issues like growth plate disturbance or avascular necrosis. Despite these limitations, this case shows how ultrasound can be used effectively as a triage tool in a resource-limited clinical setting. The objective and ongoing documentation of the patient's progress, along with the normalization of inflammatory markers and clinical signs, offers a strong basis for evaluating the successful outcome.

CONCLUSION

This case report underscores a critical diagnostic paradigm in the evaluation of pediatric acute osteomyelitis. It confirms that a normal initial radiograph, as demonstrated in this 9-year-old female, cannot rule out early bone infection due to the modality's well-documented lack of sensitivity in the first stages of the disease. The subsequent and timely use of POCUS was definitive, identifying pathognomonic subperiosteal and soft tissue changes that enabled immediate therapeutic intervention and prevented potential long-term sequelae. Consequently, this case strongly advocates for the integration of ultrasound as a first-line adjuvant imaging tool in the diagnostic pathway for suspected osteomyelitis, particularly in settings with limited access to advanced imaging. Its accessibility, lack of ionizing radiation, and high sensitivity for early soft tissue and periosteal abnormalities make it an indispensable asset for improving patient outcomes by bridging the dangerous diagnostic gap left by conventional radiography.

Declarations

Funding: None.

Conflicts of Interest

The authors declare no conflicts of interest.

Informed Consent Statement

Written informed consent was obtained from the patient's legal guardian for publication of this case report and any accompanying images. However, for confidentiality, the names and any identifying information of the patient was removed.

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