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The role of ultrasound in the diagnosis of acute osteomyelitis. The role of ultrasound in the diagnosis of acute osteomyelitis.

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SUMMARY
Osteomyelitis is an inflammation of the bone marrow, secondary to infection, most commonly caused by bacteria. It has a bimodal presentation and may be limited to one part of the bone or involve multiple regions. The different imaging methods are of great importance for diagnostic complementation in the different phases of the disease and imaging findings vary according to the clinical presentation and age of the patient. The importance of ultrasound for the early diagnosis of osteomyelitis is highlighted.
Key words: Osteomyelitis. Radiology. Ultrasound.

ABSTRACT
Osteomyelitis is an inflammation of the bone marrow, secondary to infection, most commonly caused by bacteria. It has a bimodal presentation and may be limited to one part of the bone or involves multiple regions. The different imaging methods are of great importance in the diagnosis in the different phases of the disease and imaging findings vary according to the clinical presentation and age of the patient. We highlight the importance of ultrasound for the early diagnosis of osteomyelitis.
Keywords:*Osteomyelitis. Radiology. Ultrasound.*

1. INTRODUCTION

Osteomyelitis is an inflammation of the bone marrow, secondary to infection, most commonly caused by bacteria. It can also occur due to other, more uncommon etiologies, such as fungal (*Candida spp., Candida albicans, Aspergillus spp.*.), especially in immunocompromised patients. It may be limited to one part of the bone or involve multiple regions, such as the marrow, cortex, periosteum and adjacent soft tissues. The clinical picture varies according to the age group. Children can presentlocal edema, pain, reduction or refusal of movement of the affected limb, while in adults the condition is generally insidious.

2. MATERIAL AND METHOD

To prepare this work, a bibliographic survey was carried out based on the analysis of articles and literature related to the subject. The scientific material addressing the different aspects of osteomyelitis was researched in databases such as*NIH (National Library of Medicine)*, UpToDate and SciELO. The chosen keywords and their corresponding words in English were: osteomyelitis, radiology and ultrasonography.

3. RESULTS

3.1 PATHOGENESIS

O*Staphylococcus aureus*is the most prevalent etiological agent, being responsible for up to 95% of cases, but agents such as*Staphylococcus epidermitis*and species of*Enterobacter*. Other microorganisms are more common in specific groups, such as*Solomonella,*in patients with sickle cell anemia, and*Pseudomonas*It is*Klebisiella,*in intravenous drug users.

3.2. FORMS OF INFECTION

Three main ways osteomyelitis spreads are described:
Local infection due to contiguity: caused by infection of adjacent soft tissues, due to trauma, orthopedic surgery, especially when related to prostheses. Secondary to vascular insufficiency, especially in diabetic patients, which in most cases is related to infection of the soft tissues of the lower limb that spreads to the bone.
Direct inoculation:spread from open fractures, animal bites or direct puncture wounds. **Hematogenous spread**: more common in children, predominantly affecting the long bones and, in the elderly, particularly affecting the vertebral bodies. The main site that predisposes infection is the bone metaphysis, as it has a slower local blood supply, which creates an ideal environment for bacterial proliferation.

3.3. ACUTE OSTEOMYELITIS

In acute osteomyelitis, the inflammatory response takes days or weeks. Bacterial proliferation generates a suppurative inflammatory response, leading to the accumulation of pus inside
of the medullary cavity, which increases local pressure and consequently vascular congestion, generating a reduction in local blood flow. The persistence of the infectious process without treatment leads toformation of a granulation tissue around the pus located in the bone marrow, forming a well-defined intraosseous abscess, called an abscess of*Brodie*.
In turn, with the formation of the abscess of*Brody,*The lack of early diagnosis and therapy can lead to the disease progressing to chronicity.

4. IMAGING METHOD

4.1 ULTRASOUND

Ultrasonography is a widely available method in medical centers and focuses its importance on initial diagnosis.in osteomyelitis, exclusion of findings related to septic arthritis and deep vein thrombosis, which may be associated with the disease.
Deep soft tissue edema is considered the earliest sign, present in the first three days after the onset of symptoms, as well as the presence of a collection around the bone surface. Increased blood flow within or around the periosteum can be demonstrated with a Power Doppler or Color Doppler study. It is also possible to observe the thickening and elevation of the periosteum with a subperiosteal liquid layer.

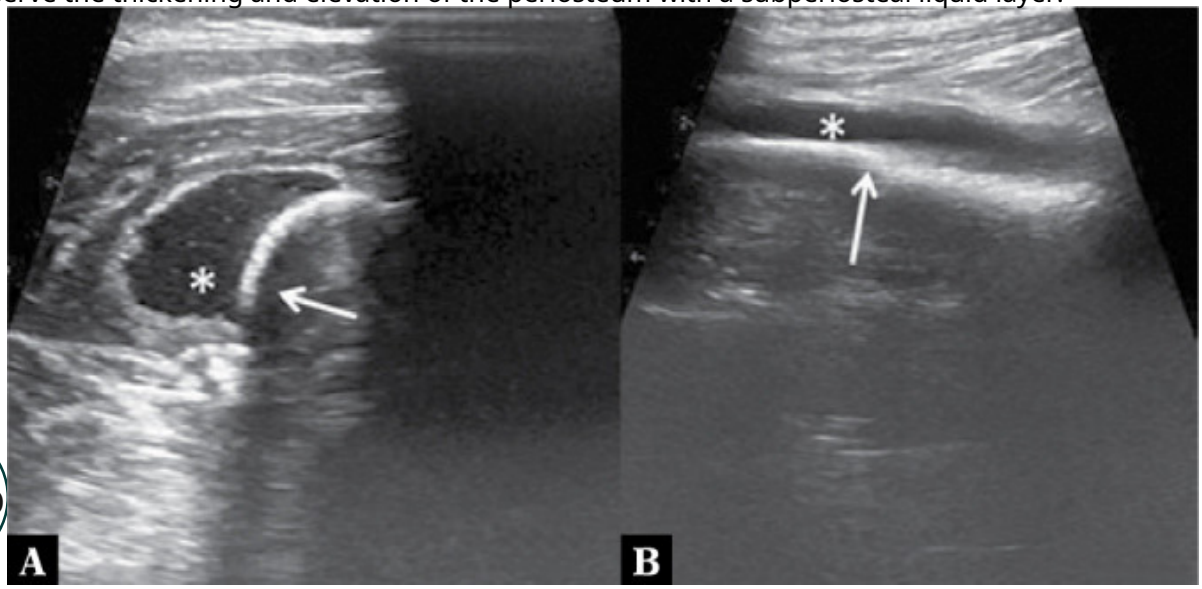

Figure 1 – Collection located in the deep subcutaneous tissue, in contact with the bone surface. Axial (A) and sagittal (B) showing deep collection (asterisk), located in the distal metaphyseal third of the femur (white arrow).
Source:Paliwal AK, Sahdev R, Deshwal A, Ram B. Role of ultrasound in the diagnosis of pediatric acute osteomyelitis. J Ultrason. 2021;21(84):34-40. doi: 10.15557/JoU.2021.0005. Epub 2021 Mar 8. PMID: 33791114; PMCID: PMC8008204.

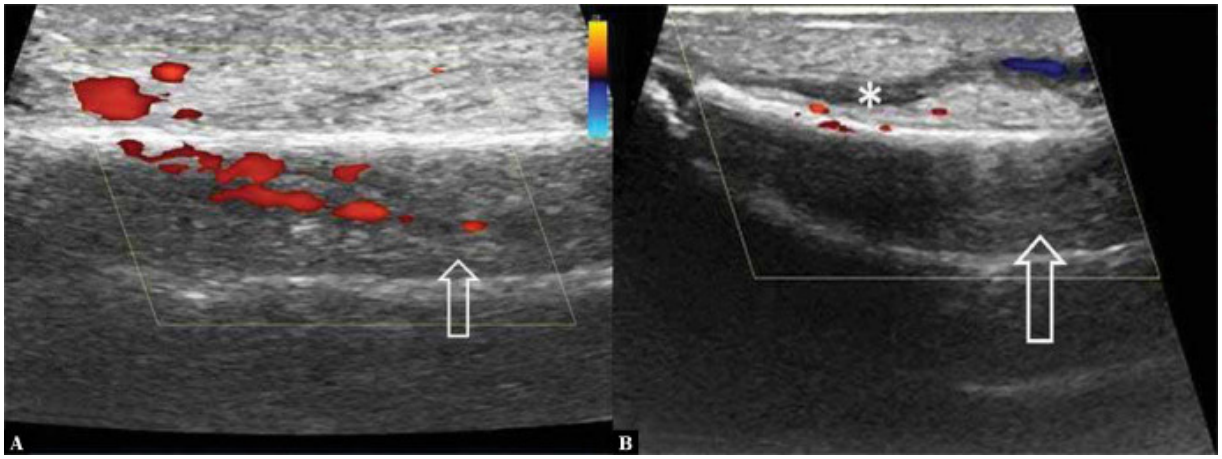

Figure 2 – Color Doppler. A. Increased vascularization around the bone and subperiosteal collection (white arrow). B. Increased vascularity around the bone surface and deep subcutaneous tissue, and subperiosteal collection (asterisk).
Source:Paliwal AK, Sahdev R, Deshwal A, Ram B. Role of ultrasound in the diagnosis of pediatric acute osteomyelitis. J Ultrason. 2021;21(84):34-40. doi: 10.15557/JoU.2021.0005. Epub 2021 Mar 8. PMID: 33791114; PMCID: PMC8008204.

5. FINAL CONSIDERATIONS

The variable radiological aspects of osteomyelitis can be explained by the different pathogenic mechanisms involved in the spread of the disease. Ultrasound is a modality that enables early diagnosis in cases of suspected acute osteomyelitis, especially in children, in addition to enabling assessment of possible joint involvement and thus promoting the shortest possible therapeutic management.

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