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The Diagnostic Value of MRI in Children with Acute Hematogenous Osteomyelitis

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ABSTRACT

Musculoskeletal infections are a significant cause of morbidity and mortality in children worldwide. This disease category includes osteomyelitis and septic arthritis, although this review will focus on the specific case of osteomyelitis. Osteomyelitis is a bone infection that occurs more often in the long bones and can develop in children of any age. Radiological signs obtained by magnetic resonance imaging such as bone marrow edema, intraosseous microabscesses, subperiosteal collection (subperiosteal abscess), sharp infiltration of soft tissues, interfascial fluid effusion, periosteum disintegration, inhomogeneity of the femur and deformed contours were the signs, based on which acute hematogenous osteomyelitis was diagnosed. Magnetic Resonance Imaging (MRI) can detect radiological signs of a similar type in the early stages of acute hematogenous osteomyelitis, which is essential role in the timely detection of the disease and the development of a treatment plan. It should be noted that ionizing radiation is not used during MRI, and the patient's body is unaffected by radiation.

INTRODUCTION

Osteomyelitis can be classified as hematogenous and non-hematogenous osteomyelitis. In hematogenous osteomyelitis, mainly in children, the causative agent resides in different body parts and enters the long bones through the blood.[1]

Non-hematogenous osteomyelitis occurs more often in older patients and develops due to direct exposure of the causative agent to the bone - due to penetrating trauma, open fractures, etc.[1]

Staphylococcus aureus is the most common cause of osteomyelitis. Other causative pathogens include Streptococcus pneumoniae, Streptococcus pyogenes, Pseudomonas aeruginosa, and Bartonella henselae.[1]

Osteomyelitis caused by Salmonella is common in patients with sickle cell disease. Gram-negative bacteria and group B streptococci often cause the disease, mostly in newborns.[1]

Recently, osteomyelitis caused by Kingella kingae has been common in developed countries, mainly in children under two years old. Kingella kingae is a relatively new strain, gram-negative and amenable to treatment with 3rd generation cephalosporins, diagnosed (in developing countries) only by PCR testing, which is not yet available in many other countries.[1]

CASE

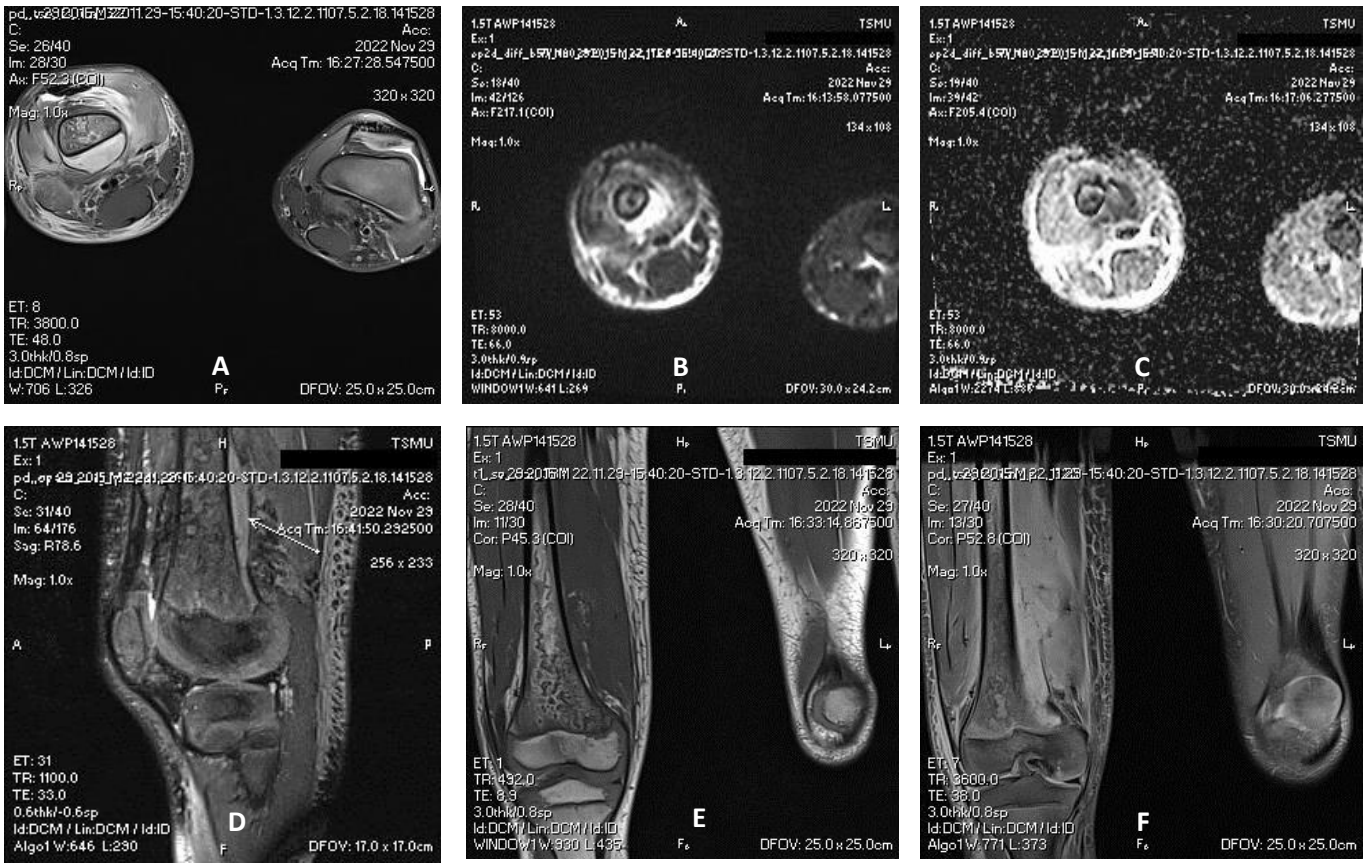
The 7-year-old child was hospitalized with fever, pain in the right knee joint, swelling in the joint area, and limitation of movement; the condition was assessed as moderate. The patient's mother claims the illness started with a high-grade fever (40^0C) resistant to antipyretic medications. After 2-3 days, swelling, pain, and limitation of movement in the right knee joint were detected.

After a normal bone X-ray, a pediatrician decided to continue antipyretics. However, after a few days, the patient was admitted to Zvania Academic Clinics of Pediatrics with persistent high-grade fever, swelling, and pain in the right knee joint.

Elevated C-reactive protein (360 mg/L) and white blood cells (13.18 x 109/L) with left shift were revealed by laboratory workouts. Ultrasonography of the knee revealed swelling of the joint capsule walls and the presence of a non-homogeneous fluid in the right knee joint space that extended down the front-outer surface of the knee to the articular fissure.

For an in-depth assessment of the severity of the disease and the spread of the pathological process in the bone, magnetic resonance imaging was performed using axial, sagittal, and coronary slices, T1, T2 TSE, and PD DWI modes.2 The amount of fluid in the articular fissure of the labrum was increased on the obtained tomograms, and the labrum's structure was homogeneous; however, there was fluid effusion along the dorsal edge of the quadriceps tendon, and Hoffa's fat pad and subcutaneous fat tissue were infiltrated (Fig. 1)

FIGURE 1. MRI image of knees



Explanations: **A**. Axial slices. PD (proton density)-weighted exposure. There is swelling of soft tissues near the knee joint; a subperiosteal abscess is shown on the dorsal surface of the femur; **B.** Axial slices. DWI, diffusion-weighted imaging; **C.** Axial slices. ADC (Apparent diffusion coefficient) imaging shows diffusion restriction zones; **D.** Sagittal cut at the level of the distal part of the femur, the periosteum is disturbed, showing a subperiosteal abscess. The maximum thickness of the liquid is 1.5 cm. Height 6 cm; **E.** Coronal incision. T1-weighted; **F.** Corona incision. PD (proton density)-weighted image of the right femur, at the middle and distal third level, is inhomogeneous; areas of bone marrow swelling and microabscesses are revealed. The soft tissues at the level of the upper and middle third of the thigh are swollen; the process is more pronounced at the level of the middle third in the space surrounding the femur.

DISCUSSION

Patients with limb pain due to osteomyelitis frequently visit family doctors or orthopedic surgeons, who primarily do an X-ray examination of the extremity.[3] However, traditional X-ray modality is less informative in the early and sometimes even late stages of the disease.[3] The wrong Diagnosis leads to the choice of inappropriate therapy strategies and the progression of the disease. Even if the typical radiographic indications of acute hematogenic osteomyelitis are absent during the first two to three weeks, it is still beneficial to do the abovementioned investigation to rule out traumatic injury.

Unlike radiography, MRI can detect early-stage osteomyelitis radiological signs and changes, which is crucial for an instant diagnosis and effective surgery or non-surgical treatment administration. If not, chronic osteomyelitis may develop, forcing further surgical interventions.[2,3]

The sensitivity of conventional radiography varies from 43-75%, and the specificity is 75-83% for diagnosing acute hematogenous osteomyelitis in children, according to research and statistical data compiled by various authors. The specificity of magnetic resonance imaging is between 75 and 96%, while the sensitivity is between 82 and 100%.[3]

CONCLUSIONS

Given the aforementioned clinical findings, it is suggested that patients suspected of having acute hematogenic osteomyelitis undergo an MRI examination as soon as possible. The patient will avoid unnecessary diagnostic procedures, therapeutic interventions, and future complications.

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