

Limping Child

Molly Wolf, M.D.^a, Joseph Makris, M.D.^b

^a University of Massachusetts Medical School, Worcester, MA

^b Department of Radiology, UMass Memorial Children's Medical Center, Worcester, MA

Case Presentation

A previously healthy 27-month-old boy presented with a 3-day history of worsening right hip pain, fever of 103.1°F, decreased oral intake, and irritability. The patient recently recovered from an upper respiratory tract infection, but otherwise had no significant past medical history. On physical exam, the patient was unable to bear weight on the right leg and had decreased range of motion due to pain. Ultrasound detected a right hip joint effusion (**Fig. 1A**). The patient subsequently underwent aspiration and drainage of the right hip joint. Synovial fluid had an elevated white blood cell (WBC) count of 176,500/ mm³. Further analysis of the patient's blood revealed an elevated WBC count, C reactive protein (CRP), and erythrocyte sedimentation rate (ESR). Culture from the synovial fluid subsequently grew *Streptococcus Pneumoniae*. MRI performed after the joint aspiration was significant for a small amount of residual joint fluid and normal bone marrow signal (**Fig. 1B**).

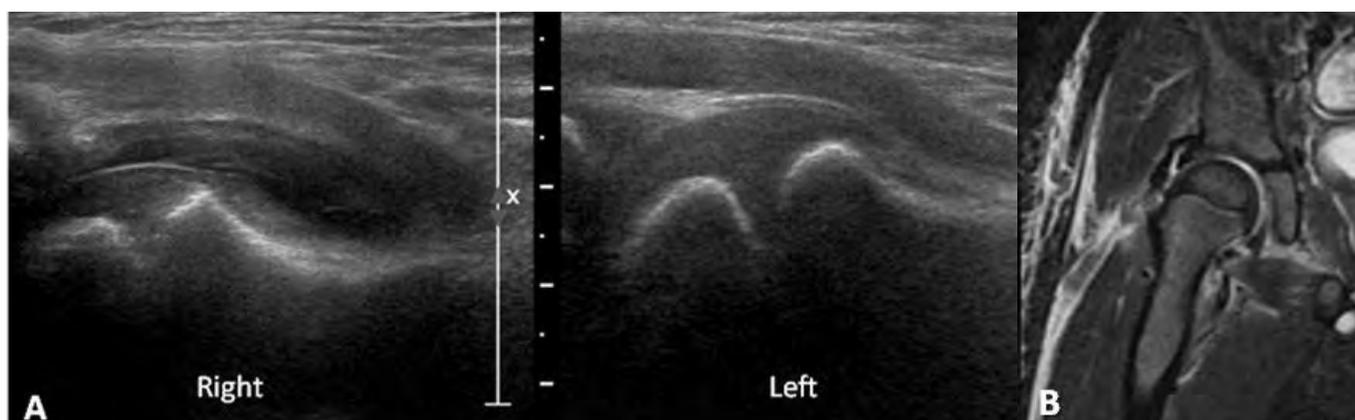


Figure 1. (Above): **(A)** Sagittal ultrasound images of the right and left hips demonstrate a right hip joint effusion; the left side is normal. There is some debris within the right hip joint fluid; although not diagnostic, this raises the suspicion for septic arthritis. **(B)** FS T2 weighted image from an MRI of the right hip obtained after incision and drainage is significant for small residual right hip joint effusion, normal bone marrow signal, and no abscess.



Figure 2. (Left): Ultrasound of a different patient with hip pain shows a small anechoic joint effusion for comparison.

Key Image Finding(s)

Hip joint effusion

Differential diagnoses

Septic Arthritis

Transient Synovitis

Osteomyelitis

Discussion

The differential diagnosis for a limping toddler is broad and includes trauma (e.g. toddler's fracture), infection (e.g. osteomyelitis, septic arthritis), inflammatory disorders (e.g. inflammatory arthritis, toxic synovitis), and neoplastic conditions. A careful history and physical examination can sometimes localize the source of pain to a specific area, but imaging is often crucial to establish the site of the disease and narrow the differential diagnosis. When a hip joint effusion is detected on ultrasound, the differential diagnosis includes transient (toxic) synovitis, septic arthritis, and osteomyelitis with secondary joint effusion. Juvenile Inflammatory Arthritis (JIA) is very unlikely to present as a monoarticular arthritis involving the hip. Septic arthritis and transient synovitis may appear similar on imaging. Thus, the Kocher criteria are used to help determine the likelihood of septic arthritis versus transient synovitis. In a child with a hip joint effusion, the presence of each of the following clinical parameters increases the likelihood of septic arthritis: 1) fever, 2) non-weight bearing, 3) elevated ESR, and 4) high serum WBC.¹ According to Kocher et al, the likelihood of septic arthritis is as follows:

4/4 criteria met -- 99% chance of septic arthritis
 3/4 criteria met -- 93% chance of septic arthritis
 2/4 criteria met -- 40% chance of septic arthritis
 1/4 criteria met -- 3% chance of septic arthritis

The child presented in this case had a 93 % likelihood of septic arthritis, meeting 3 of the 4 Kocher criteria, and underwent emergent incision and drainage and subsequent intravenous antibiotic therapy.

Septic Arthritis.

Defined as infection of the joint, septic arthritis results from bacteria entering the synovial space. In children, bacteria are most commonly spread hematogenously, but may also spread from adjacent osteomyelitis, soft tissue infection, or direct inoculation.² The synovium is easily colonized due to its adequate vascular supply and lack of a limiting basement membrane.² Bacterial colonization generates an acute inflammatory response with cytokines and activation of complement factors,² resulting in a joint effusion. The effusion increases intra-articular pressure which may disrupt the vascular supply. Additionally, lytic enzymes in the fluid can destroy the articular and epiphyseal cartilage, as well as the synovium. Thus, prompt recognition and treatment is crucial to prevent long-term complications. On presentation, children with septic arthritis are typically febrile and ill-appearing with a single warm and tender joint. They may report a 1-2 week history of progressive swelling, pain, and decreased range of motion in the affected joint.³

Plain radiography is the first line imaging choice, which often appears normal, but may demonstrate widening of the affected joint space. Both ultrasound and MRI can detect a joint effusion; however ultrasound is preferred for its accessibility and patient acceptance. MRI has the additional utility of being able to assess osseous and soft tissue involvement more completely. The absence of a joint effusion essentially excludes septic arthritis.⁴ When a joint effusion is found, imaging alone cannot distinguish septic arthritis from transient synovitis or other causes of joint effusion. Clinical suspicion for septic arthritis should be evaluated using the Kocher criteria.¹ Definitive diagnostic confirmation is only met with arthrocentesis and subsequent culture analysis. Drainage is helpful for joint decompression to avoid avascular necrosis.³ Treatment most often also relies on antibiotic therapy.³

Transient Synovitis.

Thought to be one of the most common causes of hip pain in children, transient synovitis is characterized by benign and self-limiting inflammation of the joint synovium.⁵ The etiology is unknown, however, the inflammation has been attributed to viral, traumatic and/or allergic conditions.⁵ The reactive inflammation

causes pain, which limits the range of motion of the joint. Children classically present with a limp and acute unilateral hip pain,⁵ but are not toxic appearing. They commonly hold the affected hip externally rotated and in a flexed position to open the joint and relieve pressure.⁵ In the setting of normal temperature, WBC, and ESR (thus scoring low using the Kocher criteria), many physicians are comfortable with a presumptive diagnosis of transient synovitis, treatment with non-steroidal anti-inflammatory drugs (NSAIDs) and rest, and close clinical follow-up.⁵ The imaging modality of choice is ultrasound of the affected hip; ultrasound typically shows an anechoic joint effusion, the most common finding in transient synovitis (Fig. 2). However, as mentioned above, this finding is non-specific, and a definitive diagnosis would require joint space aspiration to rule out infection. Treatment is supportive, and the condition is classically self limiting.⁵

Osteomyelitis.

While strictly defined as inflammation of the bone, osteomyelitis is most always the result of bacterial infection.⁶ In children, the bacteria, most commonly *Staphylococcus aureus*, spread hematogenously and deposit in the bony metaphysis.⁷ Clinical presentation is often non-specific with mild symptoms, consisting of malaise and low grade fever during the bacteremic phase; subsequently, there is redness, warmth, pain, and decreased range of motion when bacteria seed the bone.⁷ Symptoms present for more than 10 days may correlate with bony destruction.⁷ Laboratory testing is characteristic with elevated ESR, CRP, and WBC; however, the diagnosis is greatly aided by imaging.

Initial imaging for suspected osteomyelitis includes plain radiographs which may be normal in the early stages of the disease. Osteolytic lesions may be radiographically apparent after approximately 2-3 weeks from symptom onset. MRI is the imaging modality of choice to diagnose and/or confirm the location of osteomyelitis, since it offers the earliest and best demonstration of bone marrow and soft tissue pathology. Given the high negative predictive value of MRI for acute osteomyelitis, the lack of bone marrow edema essentially eliminates this diagnosis. Marrow edema can, however, be difficult to assess in young children due to the appearance of normal

hematopoietic marrow. The presence of marrow edema is not pathognomonic of osteomyelitis; therefore, definitive diagnosis requires culture of the offending organism. Management generally consists of intravenous antibiotic therapy, drainage of any abscesses, and close clinical follow-up.⁶

Diagnosis

Septic Arthritis

Summary

Presentation of a limping child due to hip pain is a common complaint in primary care. Although the causes can be quite varied, a complete history, physical exam, and strategic imaging are important to localize the process to a specific anatomic area and appropriately narrow the differential diagnosis. When pain is localized to a joint, imaging is critical to identify the presence of joint fluid and any secondary complications. In this child with a hip joint effusion, inability to bear weight, fever, and elevated ESR, the probability of septic arthritis was very high and emergent aspiration was indicated.

References

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