Pediatric Septic Arthritis

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KEYWORDS

• Septic arthritis • Pyogenic arthritis • Osteoarticular infection • Acute inflammation

KEY POINTS

- Septic arthritis requires urgent recognition and treatment to avoid joint destruction.
- The most common pathogen responsible for septic arthritis in children remains *Staphylococcus aureus*.
- Our understanding of pathogens continues to evolve as detection methods, such as targeted real-time polymerase chain reaction, continue to improve. MRI has improved our ability to detect concurrent infections and is a useful clinical tool where readily available.
- The treatment course involves intravenous antibiotics followed by transition to oral antibiotics when clinically appropriate.
- The recommended surgical treatment of septic arthritis is open arthrotomy with decompression of the joint, irrigation, and debridement as well as treatment of any concurrent infections.

INTRODUCTION

Septic arthritis is a bacterial joint infection that can result in significant acute and chronic disability. This condition requires urgent identification and treatment. In many cases acute bacterial arthritis may be associated with infection at other sites and in other tissue types.[1] The overall incidence of acute septic arthritis is estimated to be 4 to 10 per 100,000 children in well-resourced countries.[2] The most commonly affected joints are in the lower extremities: knees, hips, and ankles account for up to 80% of the cases.[3]

Pathophysiology

The joint can become infected via hematogenous inoculation through the transphyseal vessels, spread of infection of the adjacent metaphysis, or direct inoculation from trauma or surgery.[4,5] The inflammatory response to septic arthritis leads to high local cytokine concentrations, which increase the release of host matrix metalloproteinases and other collagen-degrading enzymes. Direct release of bacterial toxins and lysosomal enzymes further damages the articular surfaces.[6] Joint destruction may start as soon as 8 hours following inoculation.[7] In addition, increased intracapsular pressure in the hip joint may lead to compressive ischemia and avascular necrosis of the femoral head if not promptly addressed.

Bacteriology

The organisms most likely to cause bacteremia in a child are the organisms most likely responsible for acute bacterial arthritis. *Staphylococcus aureus*, both methicillin sensitive and methicillin resistant, is the most commonly cultured organism.[8] In the past 10 years studies have identified an increasing prevalence of community-associated methicillin-resistant *S aureus* (CA-MRSA) as an isolate in 26% to 63% of cases of septic arthritis.[9] Some strains of CA-MRSA contain a gene encoding for the cytotoxin Panton-Valentine leukocidin (PVL).[10] PVL-positive CA-MRSA strains are associated with complex infections with higher rates of septic shock, longer hospital stays, greater

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number of surgical interventions, and prolonged antibiotic therapy.

One organism that has increasing prevalence in the population less than 4 years of age is *Kingella kingae*. *K kingae* is a fastidious oral gram-negative bacterium. With *K kingae* septic arthritis there may be a history of a preceding upper respiratory tract infection.[11] Overall, these patients have a different presentation than the typical *S aureus* septic arthritis. Patients with *K kingae* septic arthritis tend to present with a milder clinical picture. Most patients do still present with an elevated erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) but less likely to be febrile and have normal white blood cell (WBC) counts.[12–14]

Other frequently isolated species include group A beta-hemolytic *Streptococcus* as well as *Streptococcus pneumoniae*. In neonates, *S aureus* remains a common organism but group B *Streptococcus* is also isolated. Neonates are also at risk for infection with gram-negative enteric organisms.[15] Because of widespread vaccination against *Haemophilus influenza* type B, the organism is now an unusual cause of septic arthritis. It should remain on the differential for septic arthritis in a child with unknown or unvaccinated status.[16] Neonates and sexually active adolescents are at risk for infection by *Neisseria gonorrhoeae*.[17] Patients with sickle cell disease are at risk for septic arthritis caused by *Salmonella* species in addition to the more common organisms. *Neisseria meningitides* may either cause a septic or reactive arthritis.

DIAGNOSIS

Acute septic arthritis carries the potential for joint destruction, avascular necrosis, bacteremia, and sepsis. Because acute bacterial septic arthritis is a surgical emergency, expedient and accurate diagnosis is of the utmost importance. Diagnosis is made by history and physical examination coupled with laboratory studies, imaging studies, and arthrocentesis. There are a few conditions to be aware of that may mimic the clinical presentation of acute bacterial septic arthritis. Diagnoses that may be confused with septic arthritis include trauma, hemarthrosis, reactive effusion, juvenile rheumatoid arthritis, arthritis of acute rheumatic fever, osteomyelitis, pyomyositis, septic bursitis, tumor, leukemia, slipped capital femoral epiphysis, Legg-Calvé-Perthes disease, Lyme arthritis, Henoch-Schönlein purpura, sickle cell anemia, and transient or toxic synovitis.

History and Physical

Children typically present with a combination of immobility and dysfunction of the involved joint, fever, malaise, and pain. The child may have a history of antecedent mild trauma, concurrent infection, or illness. Around 20% of children have a history of injury to the affected extremity or a nonspecific fall before presentation.[18] Supporting history is important in raising suspicion for more rare infections. Travel history, sick contacts, immunization status, recent illnesses, animal exposures, exposure to unpasteurized dairy products, and family history should be ascertained. Clinical findings may include swelling, erythema, tenderness to palpation, limited joint range of motion, and gait disturbance. Patients may or may not appear acutely ill or toxic. Some infections are life threatening and associated with deep vein thrombosis, septic emboli, and a diathesis of septic shock and multisystem organ failure.[19]

Laboratory Studies

Initial studies for a child with septic arthritis should include a complete blood count with differential, CRP, ESR, and blood cultures. Although these studies are helpful in the workup, they alone cannot make a definitive diagnosis. Some children will have minimally elevated or even normal laboratory values in septic arthritis. Meanwhile some patients with other diagnoses, like toxic synovitis, may have moderately elevated laboratory values.[20] In comparison with ESR, CRP has been shown to be a better independent predictor of infection. In addition, CRP is a better negative predictor than a positive predictor of disease. If the CRP is less than 1.0 mg/dL, the probability that patients do not have septic arthritis is 87%.[21] Some children who are ultimately found to have deep musculoskeletal infections may present with laboratory indices that are within the spectrum of normal; some children who do not have an infection, such as those with transient synovitis or reactive arthritis, may have moderately elevated laboratory indices.[22] A child with superficial infection, such as cellulitis, may have markedly elevated laboratory indices that suggest an underlying deep infection, which may ultimately be excluded after further imaging with MRI. It is important to consider each case as being unique and to seek to establish an early, accurate diagnosis with all of the available information.

Imaging

Imaging of the affected joint should start with plain radiographs. In the setting of isolated