Variety of Pediatric Musculoskeletal Infections Stresses Need for Accurate Diagnosis

Written by Mary Beth Nierengarten

The wide variability in which patients present with musculoskeletal infections requires physicians to recognize and understand patterns of infection presentation for accurate diagnosis and treatment. Included among the different diagnoses are isolated osteomyelitis (OM), septic arthritis, pericapsular pyomyositis, and complication from the infections, such as deep vein thrombosis and pulmonary embolism. Often, however, recognizing patterns of infection can be very difficult. For most physicians on the front lines, as in emergency rooms, who are faced with a patient presenting with symptoms suggesting infection surrounding, for example, the hip, the most common default diagnosis is septic arthritis unless proven otherwise, according to Jonathan G. Schoenecker, MD, Vanderbilt University, Nashville, Tennessee, USA. However, he said, this diagnosis is often either not correct or incomplete, and what he and his colleagues are seeing in their clinic is that the majority of these patients have either pericapsular pyomyositis or a combination of bone, muscle, and joint infections.

Dr Schoenecker and colleagues undertook a 2-year prospective study to test the hypothesis that current diagnostic criteria are not sufficient to distinguish an infection of bone or soft tissue surrounding the hip from septic hip arthritis. In their study, they included the addition of a rapid-sequence magnetic resonance imaging (MRI) in children presenting with acutely irritable hip. The study found that about one-third of the children had pericapsular pyomyositis, and only 15% had septic hip arthritis [Mignemi ME et al. *J Pediatr Orthop.* 2014].

Based on these findings, he emphasized that pericapsular pyomyositis and septic arthritis are indistinguishable without MRI. Accurate diagnosis is critical, he said, as treatment of the 2 can be very different. For patients without abscess pericapsular pyomyositis, the infection can improve with antibiotics. He also said that serial monitoring of physical examination and C-reactive protein (CRP), along with repeat MRI, are helpful in following patients with pericapsular pyomyositis.

He also emphasized the need to consider musculoskeletal infections overall as a spectrum of disease, beginning with injury and moving on to abscess and, finally, dissemination of disease. To avoid an infection reaching the dissemination phase, he encouraged physicians to monitor the acute-phase response and to use imaging to determine the location of the infection.

To illustrate the variability in which children present with musculoskeletal infections, Scott Rosenfeld, MD, Texas Children's Hospital, Baylor College of Medicine, Houston, Texas, USA, walked participants through several case studies of variable presentations of OM. Highlighted in these case studies were the varying degrees of illness in which children present with OM and the appropriate treatments based on the degree of illness, ranging from antibiotics to surgery to intensive care.

For example, one case study highlighted the need for further workup of a child with suspected septic arthritis to confirm the diagnosis and determine whether the child also may have adjacent or concomitant infections, such as OM (Table 1). Dr Rosenfeld cited data showing that children with suspected septic arthritis often can have concomitant or adjacent infections, with one study showing 59% of children having adjacent infections and another study showing 21.5% of children with probable septic arthritis having a concomitant infection [Rosenfeld S et al. *J Pediatr Orthop*. 2015; Montgomery CO et al. *J Pediatr Orthop*. 2013].

Although, historically, the treatment of isolated infection of the bone was straightforward, Dr Rosenfeld said that infection has evolved into an often multisystem disease with the emergence and greater prevalence of more virulent organisms, such as methicillin-resistant

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Table 1. Case Study

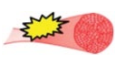
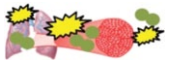
Presentation	7-y-old child with leg pain, inability to walk, and irritable hip Temperature, 102°F Stable blood pressure and heart rate CRP, 15; ESR, 90; WBC, 12.6 Normal x-ray and ultrasound
Workup	Need to aspirate hip joint to confirm SA. Early aspiration is beneficial to decompress the joint and obtain cultures. MRI will show adjacent infections, including OM or pyomyositis
Treatment	If hip joint aspiration is positive, irrigation and debridement of SA If MRI shows OM and hip joint aspiration is negative, antibiotics for OM

CRP, C-reactive protein; ESR, erythrocyte sedimentation rate; MRI, magnetic resonance imaging; OM, osteomyelitis; SA, septic arthritis; WBC, white blood count.

Staphylococcus aureus (MRSA) or methicillin-sensitive *S aureus*. Over the past decade, he said, evidence has shown an increase in the incidence and severity of OM. Data from one study showed less isolated OM and more OM associated with abscess and septic arthritis in 2009 compared with 2002 to 2004 [Copley LA et al. *J Bone Joint Surg Am.* 2013], and another study found a clear increase in the incidence and severity of acute hematogenous OM [Arnold SR et al. *J Pediatr Orthop.* 2006]. As such, he emphasized that treatment for severe disease requires a multidisciplinary approach that often includes critical care, hematology, cardiothoracic surgery, infectious disease, interventional radiology, and orthopedic surgery.

With the increased severity of the disease, several groups are now working on ways to predict disease severity, including a proposed scoring system developed by Copley et al [*Pediatr Infect Dis J.* 2014] that looks at admission respiratory rate, CRP (initial measure and at 48 and 96 hours), febrile days on antibiotics, evidence of disseminated disease, and need for intensive care unit admission. Using this scoring system, they found higher disease severity scores in patients with MRSA, those requiring intensive care, those who had ≥2 surgeries, those with longer hospital stays, and those with ≥2 complications.

Table 2. Scoring System to Identify Disease Severity

	Categories		
	Aseptic (n = 49)	**Local Infection (n = 42)**	**Disseminated Infection (n = 109)**
Tissue injury	 Mild tissue injury	 Mild persistent tissue injury	 Major persistent tissue injury
Operational definition	Negative local and/or blood culture	1 compartment; ≤1 positive blood culture	Multifocal disease; thromboembolic disease; ≥2 positive blood cultures
Inpatient hospital outcomes			
ICU, d	0	0.2	1.1
LOS, d	1	3.4	8.9
Antibiotics duration, d	0	19	44
Surgeries, no.	0.04	0.5	1.5
ED snapshot			
CRP, mg/L	< 20	20 < CRP < 90	> 90
D-dimer		< 1.2	> 1.2

CRP, C-reactive protein; ED, emergency department; ICU, intensive care unit; LOS, length of stay.

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Table 2 shows another scoring system to identify disease severity using CRP levels as an indicator of tissue injury [Mignemi M et al. AAOS 2015 (paper 325)].

In addition to identifying patients most likely to have disease severity and get sick, Dr Rosenfeld highlighted that OM is no longer just about the bone; it is also about multiple organ systems that requires a multidisciplinary team to manage.