Pediatric musculoskeletal trauma and infections are a major cause of morbidity, including growth arrest, limb deformity, chronic pain, and arthritis. Investigation of pediatric orthopedic injuries and conditions requires knowledge and understanding of the unique childhood bony anatomy. To maximize normal growth and development, the emergency physician should be mindful of physeal injuries, bone-remodeling potential, and unique pediatric orthopedic conditions.

**KEY POINTS**

- Ligaments are stronger than bones in young children.
- The history should be consistent with the injury and the developmental stage of the child.
- Children are poor at localizing pain and often refer symptoms to neighboring joints. The pathologic site in knee pain may be the hip.
- Growth plate injuries are subtle but have the potential to lead to growth arrest.
- Radiographs of the contralateral side are useful as comparison views for the investigation of subtle fractures.

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**RADIAL HEAD SUBLUXATION**

Radial head subluxation, or nursemaid’s elbow, is a common injury that affects children between the ages of 6 months and 5 years. It results from hyperextension with subluxation of the radial head and acute interposition of the annular ligament into the radiocapitellar joint. A history of longitudinal traction may not be obtained because the caretaker may not be aware of a particular event or may feel guilty about causing the child’s injury. A concern about wrist or shoulder injury may be reported because inadvertent manipulation of the injured elbow caused pain.

**PRESENTING SIGNS AND SYMPTOMS**

Children refuse to use the affected arm and hold it close to the body and in slight flexion. They do not appear to be in particular distress but may be fearful that examination will elicit pain. There is no tenderness with palpation or bony or soft tissue abnormality. Radiographs are unnecessary unless another particular injury is suspected. Edema and tenderness are present with supracondylar fractures.

A number of reduction techniques are used, including the hyperpronation method and the supination-flexion method. The hyperpronation method has proved more effective and appears to be less traumatic. With the arm held in extension, the wrist is hyperpronated and a click is sometimes heard. In the supination-flexion approach the examiner places the thumb of one hand over the radial head and provides countertraction. Next, while holding the wrist, the elbow is pulled into extension. The final phase is supination and flexion at the elbow. Most children return to full functioning within 15 minutes, and the child should be observed until full range of motion is regained.

When multiple reductions fail, radiography should be considered. In a child with failed reduction and negative radiographic findings, a sling or posterior splint is necessary with close orthopedic follow-up.

**FRACTURES**

Trauma to immature and incompletely ossified bones results in unique pediatric orthopedic injuries, including torus, greenstick, bowing, and physeal fractures. These patterns do not occur in dense adult bone. Because the radiographic findings of some of these abnormalities are incredibly subtle, comparison views are particularly helpful. Trauma that would result in sprains and strains in structurally mature individuals causes the thick periosteum to be torn from the bony cortex and resultant avulsion fractures. Ligamentous tears are uncommon in children because their ligaments are stronger than the neighboring bones.

Children’s bones are apt to bend with a fracture on only one side of the periosteum. Callus formation and remodeling are extensive in pediatric injuries and contribute to the faster healing found in children. The goal of reduction should always be nearly perfect alignment, and growing bones have a dramatic potential for spontaneous correction.

Pediatric bones are less dense and therefore more prone to compression or bending when an axial load is applied. Falls onto an outstretched arm may result in torus or buckle fractures (Fig. 25.1). Greenstick fractures are incomplete, with the cortex remaining intact on one surface. To obtain complete
CHAPTER 25  PEDIATRIC ORTHOPEDIC EMERGENCIES

Pediatric Orthopedic Emergencies

Types I and II are transverse fractures that do not involve the growth plate. They require splinting and generally carry a good prognosis. Types III and IV are intraarticular fractures that also involve the growth plate. In a type III injury, the fracture line extends through the epiphysis into the physis. In type IV, the fracture passes through the epiphysis, physis, and metaphysis. Types III and IV carry a risk for growth retardation, altered joint mechanics, and functional impairment and thus require urgent orthopedic evaluation. Type V fractures are compression injuries and are difficult to visualize on radiographs. The diagnosis is often made retrospectively following a case of growth arrest.

TODDLER’S FRACTURES

Toddler’s fractures are nondisplaced oblique or spiral fractures through the distal end of the tibia. Questioning may not reveal any significant injury, just that the child might refuse to bear weight after a day playing at the park. Findings on physical examination can range from entirely benign to diffuse tenderness along the tibial shaft. The absence of edema and ecchymosis is commonplace and not surprising. Gentle twisting of the lower part of the leg may elicit pain as the fracture plane is opened. Radiographic findings are subtle, and multiple views, including anteroposterior (AP), lateral, and oblique images, may be necessary. In the event of negative findings, a bone scan may be considered.

If the symptoms persist, one may choose to repeat the films in 7 to 10 days to look for new subperiosteal bone formation. Immobilization is sufficient to promote healing. When the child limps and radiographic findings are negative, a fracture or injury in another location should be considered. Varied pathology, including appendicitis, toxic synovitis, septic arthritis, foot and ankle fractures, soft tissue injuries, and abuse (Box 25.1), may all be manifested as a limp in a toddler.

SUPRACONDYLAR FRACTURES

Supracondylar fractures are the most frequent elbow fractures in children and often occur in children 3 to 10 years of age. The most common mechanism is a fall onto an outstretched hand with the elbow hyperextended. Classification of the types of supracondylar fractures is based on the extent of the injury: type I is nondisplaced (Fig. 25.4), type II is displaced posteriorly with an intact cortex.
**BOX 25.1 Fractures Suggesting Abuse**

Multiple fractures, especially in various stages of healing  
Fracture patterns inconsistent with the history  
Fractures coexistent with soft tissue injuries consistent with abuse  
Metaphyseal chip fractures  
Lower-extremity fractures in nonambulatory children  
Spiral fractures of the humerus  
Multiple depressed skull fractures  
Rib fractures, especially multiple posterior fractures

*A skeletal survey should be done in all cases of suspected abuse.

(Fig. 25.4), and type III is completely displaced with no cortical contact (Fig. 25.6). Type I injuries are managed by immobilization for 4 to 6 weeks. Treatment of type II injuries is based on the extent of the damage, and an orthopedist should be consulted. More severe cases require admission, reduction, and internal fixation, but milder cases may be treated as type I injuries. All type III fractures require closed reduction with pinning in the operating room.

Radiographic findings may be subtle, particularly in type I injuries (Box 25.2). When a fracture line cannot be visualized easily, other findings may assist in making the diagnosis. A posterior fat pad or joint effusion located dorsal to the distal end of the humerus at the level of the olecranon fossa is always pathologic and evidence of a fracture. An anterior fat pad is normal unless it is lifted up and squared off inferiorly into a “sail sign.” A line drawn along the anterior surface of the humerus should intersect the capitellum in its middle third. Posterior displacement of the distal end of the humerus will cause the line to fall further anteriorly or miss the capitellum entirely.
LEGG-CALVÉ-PERTHES DISEASE

Legg-Calvé-Perthes disease is characterized by avascular necrosis and resorption of the femoral head. Its onset occurs in children between 4 and 9 years of age, and it is more common in overweight boys. Although the definitive etiology is unknown, research has focused on clotting abnormalities and increased blood viscosity.

PRESENTING SIGNS AND SYMPTOMS
The disease is initially clinically silent and may come to medical attention incidentally as a result of trauma. The onset of symptoms is usually insidious. Pain may be present in the hip or be referred to the hip, knee, anterior aspect of the thigh, or groin. Tenderness is rarely present, and symptoms include an antalgic gait with decreased hip abduction and medial rotation.

DIAGNOSTIC TESTING
AP and frog-leg views of the pelvis allow optimal visualization of the femoral head. Disease findings include widening of the articular cartilage, subchondral fractures, irregularity, and flattening of the epiphysis.

TREATMENT AND DISPOSITION
Treatment includes pain management with nonsteroidal anti-inflammatory drugs (NSAIDs) and referral to a pediatric orthopedic surgeon. The majority of children with this disease do well with observation and nonsurgical intervention.

SEPTIC ARTHRITIS

Septic arthritis is a true medical emergency that requires early intervention to prevent permanent joint destruction. The joint space is invaded by microbes as a result of hematogenous seeding, local spread from neighboring infection, or direct inoculation from trauma or surgical infection. Bacterial enzymes cause direct tissue destruction. Synovial edema, increased synovial fluid production, and pus increase intraarticular pressure, which causes damage to vessels and articular cartilage. Commonly involved organisms are *Staphylococcus aureus* and assorted *Streptococcus* species. Group B streptococci and *Escherichia coli* are important causes in neonates, and gonococcal arthritis should be a serious consideration in sexually active adolescents.

PRESENTING SIGNS AND SYMPTOMS
Children suffering from septic arthritis are frequently ill appearing with a fever of 104° F (40° C) or higher, limited range of motion in the affected joint, and pain and swelling. The pain is constant and increases with movement. In the case of septic arthritis of the hip, the child lies in a position of comfort with the hip slightly flexed, abducted, and externally rotated. An infected knee will be erythematous, edematous, warm, and tender to palpation.

DIAGNOSTIC TESTING
Plain radiographs, a complete blood count, erythrocyte sedimentation rate, C-reactive protein, and blood culture are necessary in the evaluation of children with suspected septic...
arthritis. Radiologic findings include joint space widening, soft tissue swelling, and displacement of adjacent fat pads. Comparison views may be helpful in determining the presence of effusion, as only a few millimeters from the teardrop of the acetabulum to the medial metaphysis of the femoral neck may be significant. In young children, lack of ossification limits the usefulness of radiographs, and ultrasonography provides more detail.

A convincing clinical or laboratory picture justifies joint aspiration for fluid analysis, including protein, glucose, Gram stain, and culture. Joint fluid yields a positive culture in approximately 50% to 75% of cases. Blood culture is much less effective and is positive in approximately one third of cases.

**TREATMENT**

Definitive therapy is intravenous administration of antibiotics and surgical drainage of purulent material from the joint. Because the potential for joint destruction is great and the yield of Gram stain is low, empiric antibiotic therapy in the emergency department is indicated. Coverage should include an antistaphylococcal agent, either a β-lactamase–resistant penicillin, clindamycin, or a first-generation cephalosporin. Gram-negative coverage should also be considered for neonates.

**TOXIC SYNOVITIS**

Toxic, or transient, synovitis is a benign, self-limited inflammatory condition. A postinfectious inflammatory response has been suggested as the possible cause, but no definitive etiology has been determined. It affects children 3 to 10 years of age, and its findings mimic those of septic arthritis. The joints most often involved include the hip and knee. Fever is rarely present, but when it occurs, it is usually low grade.

**PRESENTING SIGNS AND SYMPTOMS**

Although patients will sit in a position of comfort and complain with movement of the limb, the affected joint has full range of motion. This is in stark contrast to septic arthritis, in which the child appears systemically ill, is in significant pain, and cannot move the affected joint through full range of motion.

**DIAGNOSTIC TESTING**

The white blood cell count, erythrocyte sedimentation rate, and C-reactive protein findings are usually normal or slightly elevated, consistent with an inflammatory process. Radiographs are often normal or may reveal a mild effusion with joint space widening. Because sufficient overlap exists in some manifestations of septic joint and toxic synovitis, synovial fluid is necessary to make the diagnosis (Table 25.1). When obtained, synovial fluid is sterile.

**TREATMENT**

Treatment is directed at relief of symptoms with NSAIDs on an outpatient basis. Pain usually lasts 3 to 4 days but may persist for a few weeks. Children return to full activity with no associated morbidity.

**REFERENCES**

References can be found on Expert Consult @ www.expertconsult.com.
REFERENCES