Abstract:
Acute upper extremity injuries are common in child and adolescent athletes as a result of sports participation, particularly collision and contact sports. In addition, skeletally immature athletes can sustain unique injuries that must be differentiated from those sustained by skeletally mature athletes. Emergency care providers must be aware of these acute injuries to properly evaluate and manage them. This review describes current strategies for the evaluation and treatment of acute common sports injuries in addition to less common but more problematic sports injuries to the upper extremity of youth athletes. Common injury mechanisms, pertinent history and physical examination, radiographic findings, initial treatment, need for subspecialty referral, and return-to-play guidelines are discussed.

Keywords:
sports; injury; pediatric; shoulder; elbow; wrist; hand; Salter-Harris; fracture; dislocation; sprain

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Acute Upper Extremity Injuries in Young Athletes

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Sports are a major cause of injury to the upper extremity in children and adolescents. Acute sport-related injuries to the shoulder, elbow, wrist, hand, and fingers that need immediate evaluation and management in the emergency department (ED) setting are common. The following sections will describe acute sport-related injuries to the pediatric upper extremity with focus on injuries likely to be seen by pediatric emergency care providers.

EVALUATION

A comprehensive injury history should include details of the injury mechanism, specifically, type of impact and position of the limb at the time of injury as well as history of previous injury to the upper extremities. In addition, the athlete should be asked to identify the location of their pain and activities or motions that are painful. A good understanding of the relevant anatomy of the injured body part is essential to accurate diagnosis.

Physical examination of the entire limb should begin with inspection for deformity, asymmetry, swelling, ecchymosis, or injury to the skin, such as abrasions. Palpation to identify the point of maximal tenderness (PMT) can aid in diagnosis. Range of motion (ROM) should be assessed for the injured extremity including joints above and below the site of injury and then compared with the unaffected side. It is imperative to rule out a neurovascular injury with a thorough evaluation of motor and sensory function of the injured limb.

Plain radiographs are the most appropriate initial imaging study in the acute setting. All injuries should be assessed with 2 to 3 views

of the injured body part (anteroposterior [AP] or posteroanterior, lateral, and oblique views) in addition to radiographs of the joint above and/or below and, when clinically indicated, the contralateral/uninjured extremity (eg, swelling, limited ROM, tender to palpation, high likelihood of associated injury). Some injuries may require specific views. Advanced imaging such as computed tomography or magnetic resonance imaging is generally not indicated in the ED. For many injuries, initial diagnosis and treatment can be provided in the ED, with clear instructions on when to follow-up and with whom, to ensure proper injury management, healing, and safe return to play. For some injuries, subspecialty consultation is indicated in the ED for more definitive management and to prevent adverse outcomes.

GROWTH PLATE INJURIES

In the skeletally immature child with open physes, an injury or fracture through the physis is more common than other injuries, such as ligamentous sprain or joint dislocation. Until the cartilage of the physis has been completely replaced by bone in the skeletally mature adolescent, the physis remains the "weakest link" prone to injury. Because skeletal development occurs later in boys, the risk of physeal fracture peaks at age 12 to 14 years for boys compared with age 11 years for girls.[1] The Salter-Harris classification is used to describe and categorize growth plate injuries (Figure 1). Type I injuries involve only widening of the physis, whereas type II fractures extend across the physis then into the metaphysis. Type III and IV fractures are intra-articular, involving the epiphysis or the epiphysis and metaphysis, respectively. Type V injuries are compression injuries to the physis, which are rare but are associated with the highest risk of growth arrest. In general, nondisplaced physeal fractures can be splinted in the ED, with orthopedic or sports medicine follow-up in approximately 1 week. Displaced fractures or type III or IV fractures require immediate orthopedic consultation for closed or open reduction because anatomic reduction of the fracture is essential for an optimal outcome. All physeal injuries should be monitored for 1 to 2 years for possible growth arrest and secondary complications.[1]

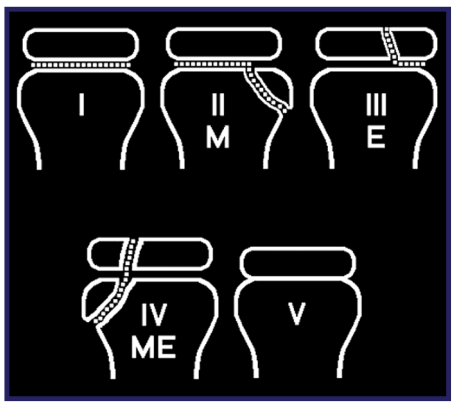

Figure 1. Salter-Harris classification system for epiphyseal fractures. With permission from Metzl JD, Sports Medicine in the Pediatric Office. Elk Grove Village, IL: American Academy of Pediatrics; 2008.

SHOULDER INJURIES

Clavicle Fractures

The clavicle is an S-shaped strut bone that is the only bony connection between the axial skeleton and upper extremity. Seventy-six percent of clavicle fractures occur in the midshaft.[2-4] The medial clavicular physis is one of the last to fuse and can remain open until 23 to 25 years of age.[2,3,5] Thus, pediatric patients are also at risk for Salter-Harris type I and II fractures of the medial clavicle. The distal and proximal thirds are less likely to fracture because muscles and ligamentous attachments stabilize each end of the clavicle. The mechanism of injury for fractures is typically a fall onto an adducted shoulder with force applied to the acromion. Football players, wrestlers, and cyclists often sustain this injury. Athletes present with localized tenderness and swelling over the fracture, often accompanied by ecchymosis and deformity. Thorough neurovascular testing distal to the injury is imperative given the proximity of the clavicle to the brachial plexus and subclavian veins. The examiner should evaluate the skin for tenting to identify areas at risk for displaced bone to erode through the skin and create an open fracture. If suspicion is high for a fracture but none is seen on the standard clavicle views, a Zanca view, which is an AP view angled 20° cephalad, should be performed.[2,6] Nonoperative management is preferred in the pediatric population for midshaft clavicle fractures with up to 2 cm of displacement or shortening. Athletes should be advised to wear a sling for 24 to 48 hours and thereafter only for comfort, as early mobilization of the upper extremity is important to preserve function.[2] Clavicle fractures treated nonoperatively usually heal within 3 to 6 weeks in children but take longer in skeletally mature adolescents. Serial radiographs are seldom indicated as long as the patient demonstrates clinical improvement when