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INJURIES IN OVERHEAD ATHLETES (J DINES AND C CAMP, SECTION EDITORS)

On-field Management of Shoulder and Elbow Injuries in Baseball Athletes

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Abstract

Purpose of Review The goal of this review article is to help medical personnel of all levels and backgrounds identify and appropriately manage on-field acute shoulder and elbow injuries in the baseball athlete. This article discusses the most common acute shoulder and elbow injuries in baseball players along with recommendations for appropriate on-field management.

Recent Findings Shoulder and elbow injuries are very common in baseball players and can be problematic because of the unique demands placed on the shoulder and elbow during the throwing and swinging motions. While many shoulder and elbow injuries in baseball players are chronic, some acute injuries, including dislocations and fractures, require urgent on-field management. Evaluation should begin with a broad assessment to rule out life-threatening emergencies prior to performing a neurovascular evaluation of the affected extremity. Red-flag signs during examination, such as difficulty breathing, asymmetric pulses, weakness, and limb discoloration, require emergent treatment. In the absence of an emergency, the evaluating medical team should complete a basic neurovascular exam before performing any further on-field care.

Summary Contusions, dislocations, and fractures are the most commonly seen acute shoulder and elbow injuries in baseball athletes. Athletic trainers and physicians caring for these athletes should be familiar with these injuries and their appropriate on-field management.

Keywords Shoulder dislocation · Elbow dislocation · AC sprain · Baseball

Introduction

Shoulder and elbow injuries are extremely common in baseball players, accounting for the most time missed from competition [1–3, 4••] and the most likely injuries to end a player's season [4••]. Baseball players are overhead athletes who place unique forces across the shoulder and elbow joints due to the complex motions required to throw a baseball and swing a bat. Medical professionals who care for baseball players must be familiar with the variety of upper extremity injuries that commonly occur in these athletes.

The most common shoulder and elbow injuries experienced by baseball players are chronic injuries that result from repetitive high velocity throwing [1, 3, 4••, 5–8, 9•, 10]. Commonly seen pathology, including rotator cuff tendinitis, internal shoulder impingement, superior labrum anterior to posterior (SLAP) tears, valgus-extension overload, and ulnar collateral ligament sprain or tear commonly present with chronic symptoms. Therefore, these injuries are usually managed away from the competition field. While chronic shoulder and elbow injuries are more common, baseball players do experience acute shoulder and elbow injuries that require on-field management, including anterior shoulder dislocation, posterior shoulder instability, acromioclavicular (AC) joint sprain/dislocation, clavicle fracture, elbow dislocation, and elbow fractures (Table 1). The epidemiology and on-field management of these acute injuries in baseball players will be the focus of this article.

While not a true collision sport, baseball does provide opportunities for various forms of projectile-related injuries and player collisions during competition. Most acute injuries are related to these events, including sliding into a base, diving for a ball, colliding with another player, or being hit by a pitch or

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Table 1 Commonly diagnosed chronic versus acute shoulder and elbow injuries in baseball players

Chronic shoulder injuries	Chronic elbow injuries
• Superior labrum anterior to posterior (SLAP) tear	• Ulnar collateral ligament (UCL) sprain/tear
• Biceps tendinitis	• Flexor/pronator tendinitis/tendon tear
• Rotator cuff tendinitis/tear	• Ulnar neuritis (cubital tunnel syndrome)
• Distal clavicle osteolysis	• Olecranon stress fracture
• Internal shoulder impingement	• Sublime tubercle stress fracture
• Scapular dyskinesis	• Valgus extension overload
• Anterior capsular laxity/attritional tear	• Medial epicondyle apophysitis (open physes)
	• Medial epicondyle fracture (open physes)
Acute shoulder injuries	Acute elbow injuries
• Anterior shoulder dislocation	• Elbow dislocation
• Posterior shoulder dislocation	• Elbow fracture
• Acromioclavicular joint sprain/dislocation	
• Clavicle fracture	

batted ball. Acute shoulder and elbow injuries can also occur from over-exertion while swinging a bat or making a pitch. Offensive sliding injuries are particularly problematic, creating over 4000 days missed in professional baseball each season with upper extremity injuries occurring more frequently than lower extremity injuries [11••]. Head-first sliding can be especially dangerous, resulting in an injury nearly twice as frequently as feet-first sliding [11••]. Being hit a by a pitch is much less common in higher levels of baseball, yet it can generate high velocity injuries that may lead to contusions or fractures of the upper extremity [12•].

Principles of On-field Evaluation

When a player sustains an acute injury that requires on-field management, the medical staff must follow a predetermined algorithm for complete evaluation of the injured player. This minimizes the possibility of missing a more severe, potentially life-threatening injury to the head or sternum. Therefore, obvious extremity injuries should not be the initial focus of the evaluating staff. Instead, an initial evaluation consistent with the tenets of basic life support (BLS), namely assessment of the player's airway, breathing, and circulation (ABCs), should occur before any further examination takes place. If the player has an abnormality with any of the ABCs, the emergency medical response team should be activated immediately.

Once all life-threatening emergencies have been ruled out, a more detailed neurovascular examination of the affected extremity is appropriate. The evaluator should be attentive to any red flag signs or symptoms, including obvious deformity, diminished pulses, decreased sensation, or discoloration of the extremity. Any of these signs should alert the evaluating medical team that the player may require more urgent or even emergent intervention. In the absence of any red flag symptoms during the neurovascular exam, the patient's range of motion and protective strength throughout range of motion should be evaluated. Following these steps will allow the medical staff to make a preliminary diagnosis and treat the patient accordingly. Of note, unstable fractures should be provisionally stabilized before removing the player from the field of play, and dislocations may undergo a reduction attempt depending on the type of dislocation and experience level of the evaluating medical team.

After initial diagnosis, the medical team must decide whether the player can safely remain in the game. The decision of whether to remove a player from competition is made on a variety of factors, including the player's level of pain, initial diagnosis, and ability to safely perform all required activities. Specific considerations for return to play after each injury are discussed in their respective sections. In general, if a player is removed from competition, he should undergo a more thorough examination of the injured extremity in a controlled environment away from the field of play. A training room is an ideal location, or a dugout can suffice if a training room is not available. Decisions to obtain appropriate imaging and further orthopedic care can then be made and executed either in the training room or in the emergency room depending on the severity of the injury and the resources of the on-site medical staff. Above all else, protecting the injured player's safety is always the most important consideration.

Shoulder Injuries

Shoulder injuries are very common in baseball players and account for the most time missed from competition [1, 3, 10]. While chronic shoulder injuries occur more frequently, traumatic shoulder injuries can be very problematic in the overhead athlete. A baseball player's shoulder requires a fine balance between flexibility and strength, and any injury that alters this balance can alter throwing mechanics and negatively affect performance. The most common injuries that require on-field management are anterior

shoulder dislocation, posterior shoulder instability, AC joint sprains and clavicle fractures.

Anterior Shoulder Dislocation

The shoulder is the most commonly dislocated joint with an average incidence of 1.7% in the general population [13]. It is also the most commonly dislocated joint during sports competition and often occurs from a collision with another player or the playing surface [13, 14]. In baseball, it most frequently occurs from sliding head first into a base or diving head first while playing defense. The underlying mechanism usually involves forward elevation, abduction, and external rotation of the shoulder.

Traumatic anterior shoulder dislocation is much less common in baseball players compared to contact athletes [14], yet this injury is extremely serious and potentially career-threatening in the overhead athlete. Return-to-play rates are largely dependent on the player's position and laterality of dislocation. Dislocations of the dominant shoulder lead to a worse return-to-play rate in baseball players, especially in pitchers [15••].

Diagnosis can often be made by deformity and pain of the shoulder along with inability of the player to move the shoulder joint. When a player is diagnosed with a shoulder dislocation, the treating staff must decide if an on-field reduction attempt is appropriate. In the absence of any red-flag symptoms and in the presence of an appropriately qualified staff, we recommend one reduction attempt on the field whenever possible. An on-field reduction attempt often allows the distinct advantage of an easier reduction before the onset of muscle spasm and patient apprehension. The reduction should always be performed in a controlled manner without undue force. Various reduction techniques have been described, and we recommend that the treating staff use the maneuvers that work best in their hands.

After a successful reduction attempt, we recommend removing the player from competition as it is unsafe to compete in an overhead sport immediately following a shoulder dislocation. The affected extremity should be placed in a sling, and radiographic imaging should be obtained to confirm adequate reduction and to further evaluate for any concomitant fractures. If the player's shoulder cannot be successfully reduced with one on-field attempt, then we recommend removing the player from the field and assessing him further in the training room or dugout. It is reasonable to attempt another reduction in this setting. However, if a subsequent reduction attempt is still unsuccessful, then the player should be sent to the emergency department for radiographic imaging and reduction with sedation. Of note, the player should be promptly sent to the emergency department if there is no one qualified to perform a reduction.

Posterior Shoulder Instability

Posterior shoulder instability, also known as "batter's shoulder," is less common than anterior shoulder instability. As its nickname suggests, posterior shoulder instability often occurs during a batter's swing; although it can also result from landing on a flexed, adducted, and internally rotated shoulder while diving to make a catch. The lead shoulder of a batter's swing is most commonly affected, and the most common mechanism is reaching for an outside pitch with or without contact [16, 17]. The act of swinging a bat results in high rotational velocity and large forces across the shoulder. Swinging at an outside pitch increases the abduction angle of the shoulder, which increases the shear force across the shoulder during the swing. Swinging and missing exacerbates the forces seen by the posterior shoulder since there is no counter-force from contact. This can result in posterior subluxation or even dislocation of the shoulder. A complete posterior dislocation is rare but can also result from a posterior directed force while the player's shoulder is in a flexed, adducted and internally rotated position [13, 17, 18]. While initially disabling, a high return-to-play rate after surgical management has been reported [17].

The evaluating staff can usually make the diagnosis based on the mechanism and the location of pain in the posterior shoulder. A dislocation must be ruled out, and if present, an on-field reduction attempt should be attempted if possible. We recommend placing gentle traction on the arm while bringing it into flexion and adduction with an anteriorly directed force on the shoulder.

We recommend removing the player from competition after a posterior instability event due to the high likelihood of recurrent subluxation episodes while swinging. The patient should receive initial radiographs and may be placed in a sling only if there was a dislocation. Return to play is variable based on whether the player can be treated conservatively with physical therapy or requires surgical intervention. Regardless, we do not recommend allowing an athlete to play through multiple subluxation episodes as this is deleterious to the health and safety of the shoulder.

AC Joint Sprains/Dislocations and Clavicle Fractures

AC joint sprains are most commonly caused by a direct fall onto the acromion with the arm adducted by the side of the body. A clavicle fracture can also be caused by this mechanism in addition to a collision, a forceful dive onto an outstretched arm or direct contact from a baseball. The diagnosis can be made based on pain localized to the AC joint or the clavicle, respectively. In the setting of an AC joint dislocation, the examiner can also appreciate the prominent distal clavicle at the location of the AC joint. Reduction of the AC joint is generally unsuccessful and unnecessary except in the

exceedingly rare instance of an open fracture dislocation or impending open dislocation. Tenderness to palpation and crepitus along the clavicle will obviate the diagnosis of a clavicle fracture. Players should be removed from competition and placed in a sling for support. Orthogonal radiographs should be obtained to better assess the injury pattern and help guide treatment options. Same day return to play is contraindicated, and treatment decisions between conservative or surgical options can be quite controversial with these injuries [19].

Elbow Injuries

Much like their shoulder counterparts, elbow injuries are extremely common in baseball players and account for a large amount of time missed from competition [3, 10, 20, 21]. Common elbow injuries include ulnar collateral ligament sprain or tear, ulnar nerve entrapment, stress fractures, valgus extension overload, and flexor-pronator tendon injuries. These common injuries are chronic, and therefore do not require on-field management. Furthermore, the most common acute injuries, like elbow contusions from being hit by a pitch or acute rupture of the ulnar collateral ligament, usually do not require specialized on-field treatment. While generally rare, elbow dislocations and various elbow fracture patterns can occur in baseball players, and these injuries do merit further description of their on-field management.

Elbow Dislocations

The elbow is the second most commonly dislocated joint in the adult athlete behind only shoulder dislocations [13, 22]. Of note, elbow dislocations have an increased prevalence in the pediatric population [22]. These injuries usually occur due to a fall onto an outstretched arm with concomitant elbow supination and valgus. Players present with notable deformity of the elbow, which is usually a posterolateral deformity. Nerve injury is commonly seen with an elbow dislocation with the ulnar nerve most frequently involved [22]. Therefore, special attention should be paid to the neurological status of the extremity prior to any reduction attempt to ensure that a nerve injury is not the result of a reduction maneuver. Worsening neurologic function after reducing the elbow may signify nerve entrapment, and this scenario merits emergent evaluation and treatment.

Unlike a shoulder dislocation, an elbow dislocation often requires conscious sedation to achieve reduction. Therefore, we generally recommend against an on-field reduction attempt of an elbow dislocation. The player should be removed from competition, and the decision to attempt a reduction in the training room should be made on a case by case basis. In general, it is safest to transport the patient to the emergency room where appropriate sedation can be administered to facilitate successful reduction. The reduction maneuver can vary based on the direction of the dislocation but most commonly requires hyper-supination, valgus and direct force on the olecranon as the elbow is brought into flexion. The patient should then be placed into a long arm splint, and radiographs should confirm concentric reduction. Concurrent fractures should be identified as radial head fractures and coronoid fractures are commonly seen in adult patients with an elbow dislocation. Return to play varies based on the presence or absence of associated fractures and whether the patient requires surgical intervention.

Elbow Fractures

Elbow fractures include any fracture to the proximal ulna or radius or to the distal humerus. In baseball, they are often the result of direct trauma, being hit by a pitch or fall onto an outstretched arm. An ulna fracture is the most common elbow fracture from a hit-by-pitch [12•]. Additionally, fractures can occur with an elbow dislocation or as an isolated injury. Pediatric and adolescent patients deserve special consideration because they are prone to physeal fractures due to the presence of open growth plates [23].

The evaluating medical staff can make the diagnosis based on location of pain over a bony prominence of the elbow. Crepitus may also be felt depending on the location of the fracture. Range of motion of the elbow can be preserved or reduced, but it will invariably be painful. Establishing a baseline neurological exam is important, and then the player should be removed from competition for radiographic assessment. The player should also be placed in a sling until radiographs can be obtained, at which time the patient can be placed in a splint if needed based on the imaging results. Return to play varies based on the location of the fracture, severity of the fracture and whether the patient requires surgery.

Conclusions

Shoulder and elbow injuries are very common in baseball athletes and sometimes require on-field management. Simple injuries, like contusions and minor sprains, can often be managed expectantly with or without removal from competition. However, more serious injuries, such as dislocations and fractures, require special consideration, prompt medical evaluation and removal from competition. Evaluation should always begin with ruling out life and limb threatening emergencies before managing obvious extremity injuries. A timely neurovascular exam and early, accurate diagnosis is paramount. If the diagnosis is ever in question, then the player should be removed from competition for further evaluation. Prompt and appropriate management is important to help reduce adverse outcomes and morbidity to the patient.

Compliance with Ethical Standards

Conflict of Interest James B. Carr II, Brian Chicklo, and David W. Altchek each declare no potential conflicts of interest.

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