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Upper Extremity Injuries in Soccer

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Authors:
Niv Marom, MD Riley J. Williams III, MD
Author Affiliation | **Disclosures**

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Dr. Marom is a Clinical Fellow and Dr. Williams is Professor of Orthopedic Surgery, Sports Medicine & Shoulder Service, Hospital for Special Surgery, New York, New York.

Address correspondence to: Riley J. Williams III, MD, 535 East 70th Street, New York, NY 10021 (email, WilliamsR@hss.edu).

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Take-Home Points

- Upper extremity injuries in soccer are not common, however they can reach up to 18% of all injuries in professional goalkeepers.
- Common injury locations in the upper extremity in soccer are the shoulder/clavicle, hand/finger/thumb, the elbow, and the wrist and most of these injuries are traumatic injuries.
- Mechanism of injury, players' complaints and presentation, physical examination, and imaging features are all important for a proper evaluation and optimal management.
- Position of play is an important consideration in the management of upper extremity injuries in soccer. Outfield players may be able to return to play before a complete resolution of their injury, with protective accessories.
- Prompt and accurate diagnosis and appropriate management are essential for improved outcomes and timely return to play.

Upper limb injuries in association with soccer have been reported to represent only 3% of all time-loss injuries in professional soccer players[1]. However, they are considered an increasing problem in recent years[2-4] and have been reported in high proportions in children under the age of 15 years.[5] Some of the reasons for the increase in upper extremity injuries may be explained by modern soccer tactics that have been characterized by high speed, pressing, and marking.[2] Furthermore, upper extremity injuries may still be underestimated in soccer, mainly because outfield players are sometimes able to train and play even when they suffer from an upper extremity injury.

Unsurprisingly, upper extremity injuries are reported to be up to 5 times more common in goalkeepers than in outfield players,[1,2] reaching a high rate of up to 18% of all injuries among professional goalkeepers. The usage of upper extremities to stop the ball and repeated reaching to the ball and landing on the ground with changing

upper extremity positions are some of the contributors to the increased upper extremity injury risk in goalkeepers.

Following 57 male professional European soccer teams from 16 countries between the years 2001 and 2011, Ekstrand and colleagues[1] showed that 90% of upper extremity injuries are traumatic, and only 10% are related to overuse. They also reported that the most common upper extremity injury location is the shoulder/clavicle (56%), followed by the hand/finger/thumb (24%), elbow (10%), wrist (5%), forearm (4%), and upper arm (1%). Specifically, the 6 most common injuries are acromioclavicular joint (ACJ) sprain (13%), shoulder dislocation (12%), hand metacarpal fracture (8%), shoulder rotator cuff tendinopathy (6%), hand phalanx fracture (6%), and shoulder ACJ dislocation (5%).

This article will discuss common upper extremity injuries observed in soccer players, focusing on proper diagnosis and optimal management.

The Shoulder

The majority of upper extremity injuries in professional soccer players are shoulder injuries.[1,2,4] Almost a third of these injuries (28%) are considered severe, preventing participation in training and matches for 28 days or more.[6] Ekstrand and colleagues[1] reported that shoulder dislocation represents the most severe upper extremity injury with a mean of 41 days of absence from soccer. When considering the position of the player, they further demonstrated that absence from full training and matches is twice as long for goalkeepers as for outfield players, which reflects the importance of shoulder function for goalkeepers.

In terms of the mechanism of shoulder instability injuries in soccer players, more than half (56%) of these injuries occur with a high-energy mechanism in the recognized position of combined humeral abduction and external rotation against a force of external rotation and horizontal extension.[3] However, almost a quarter (24%) occur with a mechanism of varied upper extremity position and low-energy trauma, and 20% of injuries are either a low energy injury with little or no contact or gradual onset. These unique characteristics of shoulder instability injuries in soccer players should be accounted for during training and may imply that current training programs are suboptimal for the prevention of upper extremity injuries and shoulder injuries. Ejnisman and colleagues[2] reported on the development of a Fédération Internationale de Football Association (FIFA) 11+ shoulder injury prevention program for soccer goalkeepers as one of the ways to promote training programs that address the risk of shoulder injuries.

Reporting on the management of severe shoulder injuries requiring surgery in 25 professional soccer players in England, between 2007 and 2011, Hart and Funk[3] found that the majority of subjects (88%) reported a dislocation as a feature of their presentation. Twenty-one (84%) subjects were diagnosed with labral injuries, of which 7 had an associated Hill-Sachs lesion. Two (8%) subjects were diagnosed with rotator cuff tears requiring repair, and 2 (8%) subjects had a combination of rotator cuff and labral injury repair. All patients underwent arthroscopic repair, except for 5 who had a Latarjet coracoid transfer. Post-surgery, all players were able to return to unrestricted participation in soccer at a mean of 11.4 weeks, with no significant difference between goalkeepers and outfield players and no recurrences at a mean of 91 weeks' follow-up.

Up to one-third of shoulder instability injuries in soccer players are reported to be recurrences,[1,3] which emphasizes the need to carefully assess soccer players before clearing them to return to play. These data raise the controversy over the treatment of first time shoulder dislocators and may support early surgical intervention.[7-9] In terms of the preferred surgical intervention in these cases, Balg and Boileau[10] suggested a simple scoring system based on factors derived from a preoperative questionnaire, physical examination, and anteroposterior

radiographs to help distinguish between patients who will benefit from an arthroscopic anterior stabilization using suture anchors and those who will require a bony procedure (open or arthroscopic). Cerciello and colleagues[11] reported excellent results for bony stabilization (modified Latarjet) in a population of 26 soccer players (28 shoulders) affected by chronic anterior instability. Only 1 player did not return to soccer, and 18 players (20 shoulders, 71%) returned to the same level. One re-dislocation was noted in a goalkeeper 74 months after surgery.

An injury to the ACJ has been previously reported to be the most prevalent type of shoulder injury in contact sports.[12] In soccer, injury to the ACJ is responsible for 18% of upper extremity injuries, and the majority (72%) are sprains.[1] Interestingly, but unsurprisingly, implications of such an injury differ significantly between goalkeepers and outfield players with up to 3 times longer required absence periods for goalkeepers vs outfield players sustaining the same injury.

ACJ injury is commonly the result of a direct fall on the shoulder with the arm adducted or extended. Six grades of ACJ injuries have been described and distinguished by the injured anatomical structure (acromioclavicular ligaments and coracoclavicular ligaments) and the direction and magnitude of clavicular dislocation.[13,14] Presentation will usually include anterior shoulder pain, a noticeable swelling or change in morphology of the lateral end of the clavicle (mainly in dislocation types), and sharp pain provoked by palpation of the ACJ. Radiographic imaging will confirm the diagnosis and help with identifying the specific grade/type of injury.

Decision making and management of acute ACJ injury should be based on the type/grade of injury. Nonoperative treatment is recommended for types I and II, and most athletes have a successful outcome with a full return to play.[12] Types IV, V, and VI are treated early with operative intervention, mostly due to the morbidity associated with prolonged dislocation of the joint and subsequent soft tissue damage.[12] Treatment of type III injury remains controversial. Pereira-Graterol and colleagues[15] reported the effectiveness of clavicular hook plate (DePuy Synthes) in the surgical stabilization of grade III ACJ dislocation in 11 professional soccer players. At a mean follow-up of 4 years, they showed excellent functional results with full shoulder range of motion at 5 weeks and latest return to soccer at 6 months. The hook plate was removed after 16 weeks in 10 patients in whom no apparent complication was observed.

The Elbow

Ekstrand and colleagues[1] reported that 10% of all upper extremity injuries in professional soccer players are elbow injuries, of which only 19% are considered severe injuries that require more than 28 days of absence from playing soccer. The most common elbow injuries in their cohort were elbow medial collateral ligament (MCL) sprain and olecranon bursitis.

Elbow MCL is the primary constraint of the elbow joint to valgus stress, and MCL sprain occurs when the elbow is subjected to a valgus, or laterally directed force, which distracts the medial side of the elbow, exceeding the tensile properties of the MCL.[16] A thorough physical examination that includes valgus stress tests through the arc of elbow flexion and extension to elicit a possible subjective feeling of apprehension, instability, or localized pain is essential for optimal evaluation and treatment.[16,17] Imaging studies (X-ray and stress X-rays, dynamic ultrasound, computed tomography [CT], magnetic resonance imaging [MRI], and MR arthrography) have a role in further establishing the diagnosis and identifying possible additional associated injuries.[16] The treatment plan should be specifically tailored to the individual athlete, depending on his demands and the degree of MCL injury. In soccer, which is a non-throwing shoulder sport, nonoperative treatment should be the preferred initial treatment in most cases. Ekstrand and colleagues[1] showed that this injury requires a mean of 4 days of absence from soccer for outfield players and a mean of 21 days of absence from soccer for goalkeepers, thereby indicating more severe

sprains and cautious return to soccer in goalkeepers. Athletes who fail nonoperative treatment are candidates for MCL reconstruction.[16]

The olecranon bursa is a synovium-lined sac that facilitates gliding between the olecranon and overlying skin. Olecranon bursitis is characterized by accumulation of fluid in the bursa with or without inflammation. The fluid can be serous, sanguineous, or purulent depending on the etiology.[18] In soccer, traumatic etiology is common, but infection secondary to cuts or scratches of the skin around the elbow or previous therapeutic injections around the elbow should always be ruled out. Local pain, swelling, warmth, and redness are usually the presenting symptoms. Aseptic olecranon bursitis may be managed non-surgically with ''benign neglect'' and avoidance of pressure to the area, non-steroidal anti-inflammatory drugs, needle aspiration, corticosteroid injection, compression dressings, and/or padded splinting; whereas acute septic bursitis requires needle aspiration for diagnosis, appropriate oral or intravenous antibiotics directed toward the offending organism, and, when clinically indicated, surgical evacuation/excision of the bursa.[18] When treating this condition with cortisone injection, possible complications, such as skin atrophy, secondary infection, and chronic local pain, have been reported and should be considered.[19]

Severe elbow injuries in professional athletes in general,[20-22] and soccer players specifically, are elbow subluxations/dislocations and elbow fracture. The mechanism of injury is usually contact injury with an opponent player or a fall on the palm with the arm extended. Posterolateral is the most common type of elbow dislocation. Elbow dislocations are further classified into simple (no associated fractures) and complex (associated with fractures) categories.[22] Simple dislocations are usually treated with early mobilization after closed reduction; it is associated with a low risk for re-dislocation and with generally good results. The complex type of elbow fracture dislocation is more difficult to treat, has higher complication and re-dislocation rates, and requires operative treatment in most cases compared with simple dislocation.[22] The “terrible triad” of the elbow (posterior elbow dislocation, radial head fracture, and coronoid fracture) represents a specific complex elbow dislocation scenario that is difficult to manage because of conflicting aims of ensuring elbow stability while maintaining early range of motion.[22]

Isolated fracture around the elbow should be treated based on known principles of fracture management: mechanism of injury, fracture patterns, fracture displacement, intra-articular involvement, soft tissue condition, and associated injuries.

The Wrist

Ekstrand and colleagues[1] reported that 5% of all upper extremity injuries in their cohort of professional soccer players are wrist injuries, of which, only 2% are considered severe injuries that require >28 days of absence from playing soccer. The more common wrist injuries in soccer, which is considered a high-impact sport, are fractures (distal radius, scaphoid, capitate), and less reported injuries are dislocations (lunate, perilunate) and ligamentous injuries or tears (scapholunate ligament).[23]

Distal radius fractures in high-impact sports, like soccer, usually occur as a result of a fall on an out-stretched hand and will usually be more comminuted, displaced, and intra-articular compared with low-impact sports.[23] All these aforementioned characteristics usually indicate surgical management of open reduction and internal fixation, which will allow for rapid start of rehabilitation and return to play.

Scaphoid fracture is the most common carpal bone fracture and presents unique challenges in terms of diagnosis and optimal treatment[24] in professional athletes. A typical injury scenario would be a player falling on an outstretched hand and sustaining a scaphoid fracture during a match or training session. The player may

acknowledge some wrist pain but will often continue to play with minimal or no limitation. As wrist pain and swelling become more evident after the match/training session, the player will seek medical evaluation.[24] A complete wrist and upper extremity examination should be performed in addition to a specific assessment, which includes palpation of the distal scaphoid pole at the distal wrist flexion crease, palpation of the scaphoid waist through the wrist snuff box, and palpation dorsally just distal to the Lister tubercle at the scapholunate joint. Any wrist injury that results in decreased range of motion, snuff box swelling, and scaphoid tenderness should be further evaluated with imaging. Plain radiographs with special scaphoid views are the initial preferred imaging studies, but occult fracture will require an additional study such as a bone scan, CT, or MRI. Several studies have validated the benefit of MRI and the fact that it may outweigh the costs associated with lost productivity from unnecessary cast immobilization, especially in elite athletes.[23-25] Casting the patient with a nondisplaced scaphoid waist fracture has been the traditional treatment; however, stiffness, weakness, and deconditioning that can occur with long-term casting required for scaphoid fractures are significant impairments for the professional athlete and usually end the player's season. Surgical treatment, which was traditionally indicated for displaced or proximal pole fractures, is currently also considered for non-displaced scaphoid waist fractures in professional athletes. This treatment allows for a rapid return to the rehabilitation of the extremity and possible early return to professional sport. In view of the known complications (eg, malunion, nonunion, and avascular necrosis), return to soccer can be considered when imaging confirms advanced healing, which some consider as at least 50% of bone fracture bridging on CT scan, no pain, excellent motion, and at least 80% of normal grip strength.[24] Outfield players can return to play with a protective cast or brace until full healing is observed on imaging.

The Hand/Fingers/Thumb

Almost a quarter of upper extremity injuries in professional soccer players were reported to involve the hand, fingers, and thumb. A quarter of them were classified as severe injuries requiring >28 days of absence from playing soccer.[1] Specifically, hand metacarpal and phalanx fractures are the most common reported injuries in sports in general,[26] and in soccer,[1] and account for 14% of all upper extremity injuries[1] in professional soccer players. Goalkeepers require a functional hand to play, whereas an outfielder can play with protection on the injured area; thus, the period of absence from soccer in these injuries is significantly different between goalkeepers and outfielders with more than 4 times longer absence from soccer for a goalkeeper compared with an outfielder. The fifth ray has been shown to be the most frequently fractured ray in the hand in soccer with 51.7% of all hand fractures reported.[26] The common mechanism is a full hit on the hand, and a direct hit from the ball is another possible mechanism in goalkeepers.

In general, the diagnosis of hand injuries requires evaluation of the mechanism of injury and injury symptoms, proper and comprehensive physical examination of the whole extremity, and prompt imaging. In most cases, plain radiographs in several projections will suffice for the diagnosis of obvious fractures, but CT scan is an additional modality that allows for improved appreciation of occult or complex and comminuted fracture patterns. MRI or ultrasound can be used additionally whenever associated soft tissue injury is suspected. Optimal management of the hand is based on the specific characteristics of the fractures, which include location, direction of the fracture line, presence of comminution, displacement, articular involvement, and associated soft tissue injury. Nondisplaced extra-articular fractures often can be treated with buddy taping or splinting, whereas intra-articular fractures often require surgical treatment. Displaced fractures of the hand have a tendency to angulate volarly because of attachments of the interosseous muscles. Marginal fractures or avulsion fractures involving the metacarpals or phalanges can be sentinels of serious associated soft tissue injuries.[27]

Phalangeal fractures can potentially affect the function of the entire hand; therefore, no malrotation is acceptable for phalangeal fractures because they can lead to overlap and malalignment of the digit. Displaced or malrotated

fractures should be reduced either by closed or open techniques. Acceptable reduction is <6 mm of shortening, <15° of angulation, and no rotational deformity.[27,28] Nondisplaced phalangeal fractures can be treated nonoperatively with buddy taping and splinting with good results.[27] Interphalangeal (IP) dislocations can be reduced on the sidelines and then taped or splinted. Any injury with a force significant enough to cause joint dislocation indicates further evaluation for associated fractures and ligamentous injury or tear. The proximal interphalangeal (PIP) joint is the most common IP joint dislocation and is usually a dorsal dislocation. Reduction is often achieved by traction and flexion of the middle phalanx,[27] followed by splinting of the finger with the PIP in 30° of flexion or an extension block splint.[29] Successful reduction with no associated intra-articular fractures involving more than a third of the joint can be further managed nonoperatively with the splint, allowing 2 to 4 weeks for the volar plate, joint capsule, and collateral ligaments to heal. Additional 2 to 4 weeks of splinting with buddy taping to the adjacent finger is usually recommended.[29]

The "Mallet finger" injury can be observed in goalkeepers and is caused by a flexion force on the tip of the finger while the distal interphalangeal (DIP) joint is extended. This force results in tearing of the extensor tendon or an avulsion fracture at the tendinous attachment on the dorsal lip of the distal phalangeal base. The classic mechanism of injury is an extended finger struck on the tip by a ball. Physical examination will indicate loss of DIP joint active extension, and the joint rests in an abnormally flexed position. Treatment typically consists of splinting the DIP joint in extension for 6 to 8 weeks. Operative treatment is reserved for severe injuries or fractures involving greater than one-third of the articular surface of the DIP joint or with failed nonoperative treatment.[27]

Metacarpal fractures can be subdivided into distal, metacarpal neck, metacarpal shaft, and metacarpal base fractures. Metacarpal shaft fractures raise a specific concern regarding rotation, because even a small degree of rotation can create a substantial degree of deformity at the fingertip. This concern must be addressed during evaluation of the player. Fractures of the metacarpal base most commonly involve the fourth and fifth metacarpals and are often reduced easily but have a tendency to re-subluxate, which may indicate operative treatment. Most fractures of the metacarpals are low energy and result in simple fracture patterns that can be treated nonoperatively. Open reduction is reserved for high-energy trauma, fractures with excessive angulation, or multiple fractures.[27]

An important subgroup of metacarpal injuries involves the base of the thumb. These injuries result from an axial load applied to the thumb. The most common injury is the "Bennett fracture," which is an intra-articular fracture or dislocation involving the base of the first metacarpal. Bennett fractures are unstable fractures; unless properly recognized and treated, this intra-articular fracture subluxation may result in an unstable arthritic first carpometacarpal joint. These fractures are most commonly treated with closed or open reduction combined with internal fixation.[27] "Rolando fractures" are similar in location and etiology but are comminuted and usually require operative treatment.[27, 29]

Another common hand injury found in soccer goalkeepers and involving the base of the thumb is disruption of the ulnar collateral ligament (UCL) of the first metacarpophalangeal (MCP) joint as a result of an acute radial or valgus stress on the thumb. Known as "gamekeeper's thumb" or "skier's thumb," this injury can occur in the form of an avulsion fracture, an isolated ligament tear, or combined fracture and ligament rupture. On examination, swelling and tenderness over the thumb UCL are observed. A MCP joint stress test should be performed by gently applying a radially directed force to the thumb while stabilizing the metacarpal bone at both 0° and 30° at the MCP joint. Increased laxity, a soft or nonexistent end point, and gaping of the joint, as compared with the contralateral side, will indicate this injury.[29] Radiographs may show a small avulsion fracture fragment at the ulnar aspect of the base of the first metacarpal and at the attachment of the UCL. A Stener lesion is an abnormality that occurs when the thumb adductor muscle aponeurosis interposes between the 2 ends of the ruptured UCL, preventing UCL healing by immobilization alone. Ultrasound and MRI are additional imaging modalities that can

assist with the diagnosis of a Stener lesion. The presence of a Stener lesion is a prime indication for surgical intervention. A nondisplaced fracture or isolated ligament injury with no evidence of a Stener lesion can be treated nonoperatively with splinting of the thumb and may lead to healing and restoration of stability. However, in professional players, surgical repair is often times preferred.[27]

Conclusion

Upper extremity injuries are less common injuries among soccer players, but their prevalence is on the rise in recent years. Modern playing tactics and the increase in participation in soccer in younger age groups may be 2 contributing factors to this rise. Given the characteristics of their unique playing role and specific demands, the risk for upper extremity injuries among goalkeepers is significantly higher than that in outfielders and will usually result in a long absence period from soccer before they return to play. A thorough understanding of the mechanism of injury, players' complaints and presentation, osseous and soft tissue involvement based on a systematic physical examination, imaging features, and treatment options is important for the optimal care of the players. Prompt and accurate diagnosis and appropriate management are essential for improved outcomes and timely return to play.

Key Info

Figures/Tables

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Multimedia

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