Evaluating the Athlete with Instability from on the Field to in the Clinic

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KEYWORDS

• Shoulder instability • Dislocation • Athlete • Labrum

KEY POINTS

- Shoulder instability can present with a frank dislocation or a more subtle insidious inset of pain.
- Clinical suspicion, early evaluation, and communication with the athlete are key factors in treating instability appropriately.
- Serial examinations are often helpful for clarifying clinically difficult situations.

INTRODUCTION

Shoulder instability is a relatively common problem encountered in the young athletic population. Previous National Collegiate Athletic Association (NCAA) surveillance literature estimates isolated anterior shoulder instability has an incidence rate of roughly 31.3 injuries per 100,000 athlete exposures and a surgical intervention in 30% of these cases.[1] This leads to significant time missed from sport, performance challenges, augmented training, and can even affect the overall well-being of the athlete.[2,3] This characterization of the burden of shoulder instability in the athlete fails to capture the true burden of pathology as the majority of studies fail to capture multidirectional instability, posterior instability, or more subtle spectrums of instability such as pain with microtrauma and repetitive overuse injuries.[4,5] This suggests a significant burden on the high-level athlete concerning shoulder instability and necessitates physician awareness, attention, and expertise.

Biomechanically, the shoulder is designed with fairly minimal bony constraint that necessitates significant contribution from soft tissues as both dynamic and static stabilizers.[6–9] The high demands that overhead and contact athletes in particular place across this joint, combined with its minimal bony constraint, predispose this joint to instability injuries.[10] Understanding the unique challenges posed by shoulder

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instability in the athlete requires a thorough understanding of the underlying mechanism of injury and the functional anatomy of the patient.[11,12]

RECOGNIZING INSTABILITY

Shoulder instability is multifaceted and recognizing that an injury has occurred may be straightforward or may require a high level of index clinical suspicion. Understanding that multiple mechanisms may contribute to glenohumeral instability is key. Traumatic dislocations typically present with a fixed deformity in a position of relative risk. Primary traumatic anterior instability presents with the abducted and externally rotated position of risk, and typically, the athlete will have fixed external rotation of their injured extremity.[13] Traumatic posterior dislocation requires stress in an adducted and internally rotated position and will present with the opposite, the athlete holding their arm in an internally rotated position.[14]

Often the presentation can be more subtle with a subluxation event or spontaneous relocation event where the glenohumeral shifted out of position but relocated prior to initial evaluation. Athletes often describe a brief sensation of shoulder slipping or "popping" out of place.[15] Finally, repetitive overhead athletes may experience pain as the sole indicator of abnormal glenohumeral joint motion secondary to repetitive microtrauma and high demands leading to subtle subluxation during their sport-specific exercises.[7,16]

It is important to maintain a broad differential during initial examination including fracture, soft tissue other than labral injury, and evaluate for other life-threatening concomitant injuries. Removing the athlete from the field of play to a controlled location (sideline evaluation tent or medical area) is a crucial first step in managing initial shoulder instability evaluation.

ON FIELD EVALUATION AND INITIAL MANAGEMENT

The immediate sideline evaluation of an injured athlete aims to rule out critical medical emergencies and progresses to pain alleviation and further injury prevention. Practitioners should be quick to recognize visible deformity, pain/guarding, apprehension, and recurrent instability. In the setting of fixed deformity, a reduction maneuver should be attempted to relocate the joint and prevent ongoing cartilaginous injury and soft tissue trauma (**Fig. 1**).[17] This reduction should be done soon after the dislocation occurs. If it is during a game, taking the player to a more private area such as a sideline tent or to the locker room is preferred. If it is during the practice, then reducing it there on the playing surface is appropriate. This can be attempted by the health care professional in attendance (physician, physician assistant, athletic trainer, and so forth). Several reduction maneuvers exist, but the general principles require scapular stabilization, muscle relaxation through fatigue, and gentle traction, with subsequent atraumatic relocation of the deformity.[18] This is effective for both anterior and posterior dislocations. Irreducibility should prompt urgent imaging and repeated evaluation. It is also critically important to assess neurovascular integrity both before and after reduction with specific attention paid to axillary nerve function. The goal of reduction is to achieve a stable concentric reduction with full passive range of motion.

Athletes may also present with spontaneous relocation or a subluxation event. This typically manifests as significant pain and guarding. The inability to perform full range of motion with good strength should raise clinical suspicion and prompt further evaluation.[19] Additionally, the inability of an athlete to maintain strength throughout a functional range of motion should preclude return to sport from a sideline evaluation standpoint. Serial examinations may be necessary to help determine the degree of

Fig. 1. On field reduction maneuver in the supine athlete.

injury as well as assess for improvement and return to play.[20] In the setting of frank instability, the initial management after reduction should include immobilization and pain management.[20,21] Imaging such as radiographs are then obtained to assess the joint and rule out a fracture. Commonly, advanced imaging is done to assess more completely the extent of the injury to the labrum and cartilage as well as any associated injuries.

TRANSITIONING TO CLINICAL ASSESSMENT

Athletes may present to the clinic either in continuity from a sideline event or as a first time in office evaluation after unknown outside initial sideline management. In either scenario initial clinical office evaluation should begin with a thorough history.[22] It is important to understand the athlete's sport, their time in season, expected demands, prior history of injuries or instability, and expectations as a baseline for establishing a treatment. Special consideration should be paid to the number of subluxations or dislocations experienced by the patient as outcomes/recurrence/management is intimately associated with the number of dislocations an athlete has experienced.[23] It is also important to discuss the position and force placed upon the upper extremity when the injury occurred to aid in the understanding of directional instability. In the setting of chronic repetitive overhead athletes presenting only with pain, the specific portions of their sport that reproduce the discomfort should be discussed to help identify the source of the subtle instability.

After a thorough history, attention should be paid to physical examination. Range of motion both active and passive should be documented in a controlled manner to not provoke another dislocation. The contralateral upper extremity should be evaluated as well as the entire kinetic chain in athletes with repetitive overhead throwing injuries. Strength testing should be performed and palpation of the external surface anatomy is helpful to determine areas of potential bony injury. A Beighton's score to document ligamentous laxity should be obtained. Clinical history and a description of the injury

should help drive special testing. In the setting of suspected anterior instability, a load and shift test, apprehension, and relocation tests should be performed. In the setting of posterior instability, a jerk test, Kim's test, and a posterior load and shift or push–pull test should be performed.[24] Superior instability should be suspected with a positive O'Brien's and dynamic labral shear tests and a pure inferior instability is suggested by a positive Gagey test. Again, asking the athlete to demonstrate provocative positions of pain and subjective instability can be extremely helpful in the more subtle presentations.

In all cases, it is important to discuss concerns and expectations with the patient from the onset as athletes may perceive these injuries differently, and this can affect not only rehabilitation but also mental well-being without proper contextualization and open lines of communication between the physician and the athlete.[20]

IMAGING

After a thorough history and physical examination, imaging should be obtained. Standard radiographic assessment should be performed for all shoulder instability athletes.[25] This includes a glenohumeral anteroposterior view (Grashey) as well as a scapular Y view and an axillary lateral (**Fig. 2**). The glenohumeral joint should be critically assessed for concentric reduction on all views. Additionally, each view should be critically assessed for change in the humeral head contour suggesting prior impaction injury from dislocation (Hill Sachs) or loss of glenoid bone stock from either attritional changes or acute fracture (boney Bankart).[26]

Advanced imaging modalities are available and widely used in the setting of shoulder instability to both better elucidate the pathology and to help with dictating treatment. In the setting of radiographs demonstrating bone loss, a computed tomography (CT) scan is the next advanced imaging modality of choice. This allows for precise measurement of bone loss on both the humeral side and the glenoid

Fig. 2. Anteroposterior (AP) radiograph of a left shoulder demonstrating a "lightbulb" sign or internal rotation from a posterior dislocation.

side.[27] In addition to age, contact, and level of sport, bone loss has been shown to be an important factor in the natural history of traumatic glenohumeral dislocations as well as outcomes after operative intervention.[28,29] This makes accurate representation of bone stock crucial for counseling these athletes on their risk–benefit profiles with different treatment strategies.[30]

In addition to CT advanced imaging, MRI is a commonly utilized form of advanced imaging (**Fig. 3**). This allows for an accurate assessment of soft tissue injury. In the setting of minimal boneless or chronic microtrauma leading to suspected labral pathology, an MRI is an invaluable tool for assessing labral pathology, capsular abnormalities, and the surrounding musculature of the glenohumeral joint.[31] Some literature has advocated for the addition of intra-articular contrast medium when assessing for labral and partial thickness rotator cuff pathology, and prior studies have demonstrated a significant increase in MRI sensitivity with these injuries utilizing contrast when compared to isolated lower magnetic field MRIs.[32,33] However, with increasing magnetic field power, the use of contrast in routine shoulder MRIs for instability is debated. Ultrasonography has also been utilized as an adjunct imaging modality. While useful for visualizing the rotator cuff and dynamic evaluations, the surgical utility of ultrasound for the evaluation of labral pathology is still unclear.[34]

In conclusion, radiographs, CT, MRI, and ultrasound each offer unique advantages to the assessment of an athlete with shoulder instability. A comprehensive understanding of each modality is essential to determine which, if any, additional imaging is going to be beneficial from a diagnostic and prognostic standpoint.

BIOMECHANICAL CONSIDERATIONS

Often the mechanism, or traumatic event, sufficiently explains the source of instability experienced by an athlete. This is more common in contact or high-energy athletes who experience a traumatic dislocation requiring a reduction. However, as previously discussed, the diagnosis can be more difficult when microinstability in the repetitive overhead athlete is the source of the painful chief complaint.[16] The complex nature of the kinetic chain and the adaptive changes athletes undergo to throw overhead with velocity requires the additional consideration.[35,36] Consideration of compounding

Fig. 3. Axial T2 MRI slice of a left shoulder demonstrating an anterior bone/capsular disruption (*red arrow*) from anterior dislocation.

functional impairments throughout the kinetic chain and the role that fatigue plays in loss of dynamic stabilization are crucial in understanding the throwing shoulder's instability.[37] Treating physicians should be acutely aware of the role the rehabilitation plays in managing these patients as well as the limitations that surgical intervention has in return of these complex patients to play.[38,39]

DISCUSSION

While the treatment options vary for glenohumeral shoulder instability widely depending upon age, laxity, bone loss, chronicity, number of dislocations, sport, level of competition and other factors, the initial management of these patients should be systematic and methodical.[40,41] Prompt evaluation begins on the sideline with a high index of suspicion secondary to high incidence rates among young competitive athletes. Sideline assessment should focus on eliminating life-threatening or limb-threatening conditions from the differential and proceeding with prompt reduction of residual deformities. Careful monitoring and documentation of neurovascular status should be performed with any attempt at reduction and failure should prompt urgent imaging and elevation of level of care. After reduction treatment should focus on a brief period of immobilization for comfort and pain control followed by office evaluation with radiographs and advanced imaging as appropriate. In the setting of subluxation or questionable microinstability, sideline assessment should include a careful assessment of passive and active range of motion as well as strength. Deficits in either strength or motion indicate an inability to return safely and are an indication for further evaluation.

SUMMARY

Shoulder instability is a common upper extremity injury among young athletic populations. Prompt recognition and evaluation is crucial for triaging appropriate intervention and eventual return to sport. Clinicians should maintain a high level of suspicion, especially among young contact or overhead athletic populations.

CLINICS CARE POINTS

- Reduce residual deformities appropriately, monitor neurovascular status throughout.
- Maintain a high clinical suspicion for pain as leading complaint for subluxations or microinstability.
- Establish and maintain open communication with the athlete concerning diagnosis and management options for shared decision-making.

DISCLOSURE

The authors have nothing to disclose.

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