On-Field Management of the Acute Anterior Glenohumeral Dislocation

DOI: 10.3810/psm.2011.09.1931

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Abstract

Background: Glenohumeral dislocations are prevalent injuries in an athletic population, and proper, acute on-field management remains a topic of debate among health care professionals. **Objective:** Firstly, to provide a systematic approach to the on-field management of acute anterior glenohumeral dislocations for on-field health care professionals. Secondly, to present current methods of reduction, including a description of the safest and most efficacious methods. **Methods:** Based on the current literature, an overview of the relevant anatomy, mechanisms of injury, and associated injuries is provided. In addition, systematic guidelines for on-field management of acute glenohumeral dislocations are provided. **Results:** The glenohumeral joint remains the most commonly dislocated joint in the body. Anterior dislocations comprise 90% to 98% of all glenohumeral dislocations. Despite a variety of described methods of reduction, there remains a lack of high-level evidence reporting the efficacy of each. To date, there is no position statement or consensus regarding the acute management of glenohumeral dislocations, creating discontinuity among health care professionals. **Conclusion:** A systematic approach in management of the acute anterior glenohumeral dislocation is paramount. Method of reduction and position of immobilization should be dependent on physician and patient comfort, respectively. Reduction is safest in patients aged < 40 years with no neurovascular compromise, and when minimal attempts are performed.

Keywords: glenohumeral dislocation; glenohumeral joint instability; treatment; acute management

Introduction

Glenohumeral dislocations account for nearly 50% of all joint dislocations,[1] and have been reported to be more common than any other diarthrodial joint injury.[2] In 2010, the incidence of glenohumeral dislocations presenting to emergency departments in the United States was estimated at 23.9 per 100 000 person-years.[3] Younger male patients appeared to have a higher risk of sustaining a dislocation, with a significant portion occurring during sport or recreation.[3]

Surveys among the high school and college athletic populations have shown that certain sports carry a higher risk of glenohumeral dislocations and shoulder injuries in general.[4,5] These sports include basketball, soccer, wrestling, and football. Among high school athletes, glenohumeral dislocations and shoulder separations combined accounted for approximately 24% of all shoulder injuries, corresponding with $> 55\,000$ glenohumeral dislocations per year nationwide.[4] The majority of dislocations are anterior, accounting for 90% to 98% of all occurences.[6]

During an athletic event, it is paramount that the responding medical personnel be familiar with the potential complexity of the injury in order to act in a systematic

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manner and optimize patient care. Time, prolonged pain, potential for increased injury, and fear are commonly associated with delayed treatment and emergency department visits, and add to the importance of having trained medical personnel available on-site for early intervention.

The original descriptions of the glenohumeral dislocation and reduction techniques can be dated back 2000 years.[7] However, there remains discontinuity within the literature regarding appropriate management of these injuries. The athletic trainer is commonly the first medical professional to examine the patient following an injury.[4] Currently, there is no consensus or National Athletic Trainers' Association (NATA) position statement outlining the standard for on-field care of glenohumeral dislocations, leaving a gap within formal athletic training education curricula. Furthermore, a joined consensus statement in 2008 by the American Academy of Orthopaedic Surgeons (AAOS) and American Orthopaedic Society for Sports Medicine (AOSSM),[8] among others, lacked thorough guidelines for the approach and treatment of glenohumeral dislocations.

To date, no authors have outlined a systematic approach in managing the on-field acute anterior glenohumeral dislocation. The aims of this article are 1) to provide a systematic approach for health care professionals, outlining what should be included in the on-field management of these injuries, and 2) to present current methods of reduction, describing the safest and most efficacious methods.

Glenohumeral Joint Stability: Anatomy

One of the most prevailing sequelae of anterior glenohumeral dislocations is joint instability.[9] To gain perspective on possible subsequent instability, it is important to understand and recognize factors that contribute to glenohumeral stability. These factors can be divided functionally into static and dynamic restraints. Together, these restraints contribute to the concept of the anterior mechanism, as described by Townley[10] and Moseley and Overgaard,[11] and act as an effective barrier against anterior projection of the humeral head in external rotation. The ability to identify these restraints will greatly assist the physician in providing appropriate injury and post-injury management.

Static Restraints

Static restraints of the glenohumeral joint include a negative intra-articular pressure,[12] the bony geometry of the glenoid surface and humeral head,[13] the glenoid labrum,[14] and the joint capsule, including incorporated glenohumeral ligaments.[15,16]

The natural negative pressure of the glenohumeral joint contributes to stability in the inferior, posterior, and (up to 50%) in the anterior direction.[12] The labrum is a fibrous rim acting as a "chock block," or circumferential restraint, to humeral head translation, which contributes to the overall stability by adding up to 50% of total depth to the glenoid and surface area of the joint.[17] Additionally, the labrum serves as an attachment point for the glenohumeral ligaments and the long head of the biceps tendon.[18] Although the shallow glenoid has been reported as merely one-fourth[19] to one-third[14] the size of the humeral articular surface, it contributes significantly to the concavity-compression mechanism due to the thicker cartilage layer peripherally, which matches the contour of the humeral head.[20] As dynamic stabilizers are activated, the humeral head is compressed into the glenoid surface, creating stability within the joint.[14,19]

The glenohumeral ligaments that contribute to joint stability have been historically defined as static restraints. However, more recent studies have demonstrated the functional capacity of these structures, which can serve as checkreins while creating a countervailing force.[13,16,18] The superior glenohumeral ligament (SGHL) originates on the glenoid just below the biceps tendon and inserts on the lesser tuberosity just above the subscapularis tendon.[21] The SGHL primarily acts to restrain inferior translation in the adducted shoulder, as it provides little resistance against anterior translation.[21–23] The coracohumeral ligament assists in preventing inferior translations, and with the SGHL, subscapularis muscle and anterior capsule comprise the rotator cuff interval.[21–24] A positive sulcus sign on physical examination may be indicative of damage to the SGHL or coracohumeral ligament.[22]

The middle glenohumeral ligament (MGHL) shows great anatomic variability, being absent in up to 27% of the population.[15] It originates on the labrum just inferior to the SGHL and inserts just medial to the lesser tuberosity, deep to the subscapularis muscle.[23] The MGHL limits inferior translation of the adducted and externally rotated shoulder. It is also a secondary limitation to anterior translation in 45° of abduction if the anterior band of the inferior glenohumeral ligament becomes injured.[16]

The inferior glenohumeral ligament complex (IGHLC) is the most important stabilizing structure to anterior and posterior translation of the humerus, and therefore also the most commonly injured capsuloligamentous structure during an anterior glenohumeral dislocation.[13,15,22] The IGHLC is classically described as a "hammock-like" complex, consisting of an anterior band and posterior band with

a diffuse thickening between bands, termed the axillary pouch.[15] The anterior and posterior bands originate at the 2- to 4-o'clock and 7- to 9-o'clock positions of the labrum, respectively, and have either a collar-like or V-shaped insertion just lateral to the inferior articular surface near the axillary pouch.[15,23] The anterior band has been demonstrated as the primary restraint to anterior translation with the shoulder 90° abducted and externally rotated.[13,15] In contrast, the posterior band fans out, limiting posterior translation during internal rotation.[15] These bands maintain a cruciate orientation from 0° to 90° of abduction, creating a reciprocal tensioning relationship, or checkrein effect.[21]

Dynamic Restraints

The primary dynamic restraints in glenohumeral stability are the rotator cuff muscles, which contribute to the concavity-compression mechanism.[25,26] The subscapularis, infraspinatus, and teres minor muscles have each been described as restraints to anterior humeral translation, although the extent of each is debatable.[23] Due to the orientation of the infraspinatus and teres minor muscles, each have been reported to play an important role in anterior stabilization, with the teres minor muscle assuming more of a synergistic role.[23]

In addition to the rotator cuff musculature, stability is reinforced through the actions of the pectoralis major, latissimus dorsi, and the deltoid and periscapular musculature.[2] These structures act in synergy to contribute to both glenohumeral and scapulohumeral stability. In contrast with static restraints, these muscles provide stability during midrange, rather than end ranges of motion.[2] The long head of the biceps tendon was long thought to contribute to joint stability as well, although recent biomechanical evidence questions this.[27]

Mechanism of Injury

In addition to understanding the role of involved anatomical structures, full comprehension of the mechanism of injury is key for successful reduction. The classic mechanism described for an anterior glenohumeral dislocation is an indirect force to the abducted and externally rotated arm.[2] The force may be directed posterior on the distal segment of the humerus or anterior on the proximal humerus. As previously described, the IGHLC must essentially pick up the slack for the SGHL and MGHL in this position, thus allowing a sufficient force to cause dislocation.[16,21]

Anterior dislocations may be further subdivided into subcoracoid, subclavicular, subglenoid, and intrathoracic.[7] Although a variety of associated injuries may occur, depending on the type of dislocation, the focus of this article is on subcoracoid anterior dislocations and possible concomitant pathology, as they are most prevalent.[7]

Associated Injuries: Contraindications for On-Field Reduction

When sustaining an anterior dislocation, a variety of structures are inevitably damaged. Some of these associated injuries will have an impact on clinical decision making in the acute setting, forming so-called "red flags" or contraindications for rapid on-field reduction. Though rare in occurrence, potential complications of anterior dislocations include neurovascular injury, humeral head and neck fractures, clavicle fractures, and/or cervical spine injury.[9,28,29] It is important to identify these injuries and, if present, refer the patient to a hospital's emergency department as soon as possible.

Bony Pathology

Concomitant fractures to the humerus are not uncommon during shoulder dislocations; greater tuberosity and humeral neck fractures have been reported in 16% and 8% of dislocations, respectively, and Hill-Sachs lesions may even occur in up to 90% of patients.[9,29,30] The bony Bankart lesion, or anteroinferior glenoid rim fracture, may also be found in first-time dislocators, with a reported incidence range of 12% to 24%.[31,32] Age is found to be the most common predisposing factor to concomitant bony pathology; the incidence rate of humeral fractures is significantly higher in patients aged $>$ 40 years.[29,33] Additional predictors include high-impact mechanisms of injury and the presence of ecchymosis in the anterolateral region of the affected limb.[29,33,34]

Most of the fractures that can occur with anterior shoulder dislocation, such as the Hill-Sachs or bony Bankart lesions, will not affect the ability of a physician to reduce the shoulder. Fractures that influence acute clinical decision making are usually the result of high-energy trauma[29] and are rarely seen within an athletic population.[33] Red-flag situations, in which on-field reduction should not be attempted, include the presence of any crepitus or ecchymosis over the humeral head, which can be the result of a fragmented humeral head or neck fracture. In addition, an engaging Hill-Sachs lesion[35] should be suspected if reduction is not achieved.

Concomitant clavicle fractures, complicated shoulder dislocations, and suspected cervical spine injury require immediate emergency department referral for radiographic analysis. Clavicle fractures are likely to present with a palpable or visual deformity and/or painful crepitus. Posterior glenohumeral dislocations typically present with the arm in adduction and internal rotation, and may have a noticeable

defect of the anterior shoulder. An inferior dislocation, or luxatio erecta, which only accounts for 0.5% of shoulder dislocations, will typically present with the arm in abduction.[36]

Cervical spine injuries may be ruled out if the physician witnessed the mechanism of injury. If a cervical spine injury is suspected, a full neurologic evaluation must be performed. Shoulder reduction must be avoided in the presence of paralysis, cervical pain, crepitus, and/or palpable cervical defects. In the event of a suspected spine injury, standard precautions, including in-line immobilization and assessment of vital signs, should be performed, followed by immediate transportation.

There is debate in emergency departments with regard to the clinical necessity of radiographs prior to reduction. A thorough physical examination with special emphasis on the mechanism of injury, history of dislocations, and joint position is reportedly highly accurate, up to 98%, in assessing and diagnosing a glenohumeral dislocation.[37,38] Age, primary occurrence and mechanism of dislocation, and the presence of ecchymosis have been identified as predictors for concomitant fractures.[33,34] In addition, even if fractures of the shoulder girdle are present, the majority of dislocations can be successfully reduced in a closed fashion.[29] We therefore believe that most on-field glenohumeral dislocations can be safely reduced without prior radiographic analysis, and we stress that pre-reduction radiographs not be utilized as a defensive medicinal tool. However, this does not rule out post-reduction radiographs in case of suspected associated fractures of the shoulder girdle. Furthermore, clinical experience will play an inherent role in the on-field decision-making process.

Capsuloligamentous and Muscular Pathology

The anterior joint capsule is inherently stretched, or worse, following dislocation.[23] One of the most common associated findings is the Bankart lesion, which has been described as an "essential" lesion,[34] occurring in 87% to 100% of anterior dislocations.[29,34] A Bankart lesion is caused by detachment of the anterior labrum or fracture of the anterior glenoid (bony Bankart lesion) with subsequent detachment of the IGHL from the glenoid.[23] The anterior labral periosteal sleeve avulsion (ALPSA) lesion is caused by "sleeve-like" stripping of the anterior IGHL, labrum, and anterior scapular periosteum from the glenoid.[39] The prevalence of this type of lesion is high in young patients with first-time dislocations; however, immediate reduction is recommended.[39] Similar to the Bankart lesion, the humeral avulsion of the glenohumeral ligament lesion can occur when any of the glenohumeral ligaments avulse from the humeral head, although this is a rare pathologic finding in first-time dislocators.[30]

Muscular injury following anterior dislocation may involve isolated or concomitant tears of the subscapularis, supraspinatus, or infraspinatus muscles.[23] Especially in patients aged $>$ 50 years, anterior dislocations are often associated with rotator cuff tears, and one should address the possible presence of this pathology on examination. Although subscapularis tears have been associated with an increase in anterior laxity, the incidence is low, occurring again more frequently in older patients.[23,40]

Neurovascular Pathology

Nerve lesions that may occur following dislocation include injury to the axillary, suprascapular, or musculocutaneous nerves.[23,41,42] The axillary nerve is the most commonly injured nerve associated with shoulder dislocations due to its anatomical position.[43] As the humeral head luxates anterior, inferior, and medial, the axillary nerve is at risk for impingement or traction injury. Axillary nerve damage typically presents as a sensory deficit in the lateral deltoid region.[41,43,44] Temporary axillary nerve neurapraxia is not uncommon, and is reported in 19% to 55% of patients sustaining a first-time anterior dislocation; permanent damage, however, is rare.[29,42,45] Neurapraxia of the suprascapular and musculocutaneous nerve has been reported in 14% and 12% of first-time dislocators, respectively.[42] In 85% to 100% of cases, patients experience full recovery between 6 to 12 months after injury.[41] Patient age, time from injury to reduction, and associated trauma have been reported as key prognostic factors of this injury.[1,45–47]

Vascular damage is less common following anterior shoulder dislocation, with a prevalence of 0% to 2%.[29,48] In the event of severe neurovascular damage noted by pulselessness in the distal limb, inability to activate muscle fibers, and complete loss of sensation in the limb, immediate transportation to an emergency facility is recommended. Age is a determining factor in predicting damage to the neuromuscular system because as people age, soft tissue structures become less elastic, and older people are therefore more prone to injury during high-impact injuries.[41]

Acute On-Field Management

Recognition

Although each situation may present differently, there are several characteristic features of a true anterior subcoracoid dislocation. The athlete will initially present with pain and discomfort with the arm held in an externally rotated

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and abducted position. A brief but thorough examination is a vital component to determine whether to reduce a dislocation acutely.[49] A history of previous dislocations and reduction methods can be very helpful if applicable. This should be followed by a visual inspection and palpation. On visual examination, there may be a noticeable asymmetry of the deltoid contour with a seemingly more prominent acromion process. The coracoid process may appear full in nature as the humeral head abuts it. It is important to take these findings into consideration before continuing the physical examination.[1,7,49]

Physical Examination

Once identified as a subcoracoid dislocation, a neurovascular screening is mandatory. This should include sensory and motor assessment of nerve roots C4 to T1, as well as distal pulses. It should be noted that the physician is simply looking for motor-firing patterns rather than full range of motion of the involved limb. A brief motor assessment may be completed via finger extension (radial nerve), spreading the fingers (ulnar nerve), and thumb opposition (median nerve). Shoulder abduction, external rotation, and scapular protraction should be attempted as well to assess the axillary, suprascapular, and long thoracic[45] nerves, respectively. Although damage to the axillary nerve is most common,[41] it should be noted that axillary nerve injury may exist with or without sensory deficit in a dermatomal pattern.[44] The superficial lie of the radial artery makes it easily accessible for assessment of vascular integrity. If any neurovascular injury is present, 1 reduction attempt can be made; afterwards, however, the patient should be referred to the emergency department immediately.

Rationale Behind Rapid Reduction

After ruling out clinically important concomitant injuries, it is important that the physician reduces the shoulder in a timely manner. Advantages to a rapid reduction include reduction of injury progression via minimizing stress on neurovascular structures, decreasing muscle spasm, and minimizing humeral head defects in locked dislocations.[7,35,49]

Early reduction may also benefit the patient from a psychological and monetary perspective, as costs can range from $1000 to $8000 for reduction in the emergency department.[50] Associated costs of emergency department visits may include conscious sedation or use of a local anesthetic, performed reduction, and hospital admittance. Therefore, in the case of an anterior glenohumeral dislocation, the presence of trained health care personnel on site may not only reduce the progression of injury, but would intuitively improve patient-oriented outcomes with the possibility of reducing initial pain, fear of the injury, and subsequent emergency department time and costs.

Methods of Reduction

It is important to determine who is capable of attempting joint reduction maneuvers. The sports medicine–trained physician or orthopedist will have the highest degree of training and expertise in attempting reduction; however, there may not always be a physician present on field. As allied health care professionals with a particular expertise in orthopedics, athletic trainers are a qualified option to attempt reduction, provided that standing orders to allow such maneuvers have been established with his or her affiliated team physician prior. Instructions should be given on what is acceptable and what is not. It is the current recommendation that athletic trainers obtain standing orders prior to commencement of the athletic season and work in conjunction with the team orthopedist in attempted reduction. It should also be noted that the specific techniques used will likely vary based on physician experience, allowing for more active techniques, such as the external rotation and Milch techniques, as described below, to likely be performed by the physician or seasoned clinician. Less active maneuvers, such as the Stimson or scapular manipulation techniques, which tend to be more gentle and less invasive, are more likely to be suitable for performance by athletic trainers.

Many methods of reduction have been described in the literature.[36,51–64] Personnel, equipment, work setting, clinical experience, and level of comfort will each play a role in determining the favored method of reduction. To date, no studies have documented on-field reductions in the acute setting, and the majority of articles touching on this topic are conducted in hospital emergency departments. Several popular and reportedly safe methods of reduction are detailed below.

External Rotation

External rotation was first described by Leidelmeyer[65] in 1977 and was slightly modified by Eachempati et al[53] by adding passive forward flexion. They described a method that places the patient in a supine position, with the elbow of the affected limb at 90° of flexion and the humerus adducted to the side of the chest. Standing on the affected side, the physician then passively moves the shoulder into approximately 20° of forward flexion. While grasping the wrist on the affected side with 1 hand and stabilizing the elbow with the other, the physician gently externally rotates the shoulder

(Figure 1A, B). The authors reported a 90% success rate with this technique, and most reductions did not require the use of local anaesthetics.[53] Similar results have been reported by Marinelli and de Palma,[58] with an 89% success rate of reduction on the first attempt and without complications; however, they applied inferior traction to the humerus prior to forward flexion. It should be noted that this technique is not as successful in patients with an associated fracture of the greater tuberosity.[53] In addition, although high success rates have been reported, this technique is considered more active (especially when inferior traction is applied to the humerus) and thus more advanced, which inherently poses a risk for associated injury. However, in a time-sensitive situation, utilizing such a technique may be the preferred choice.

Spaso Technique

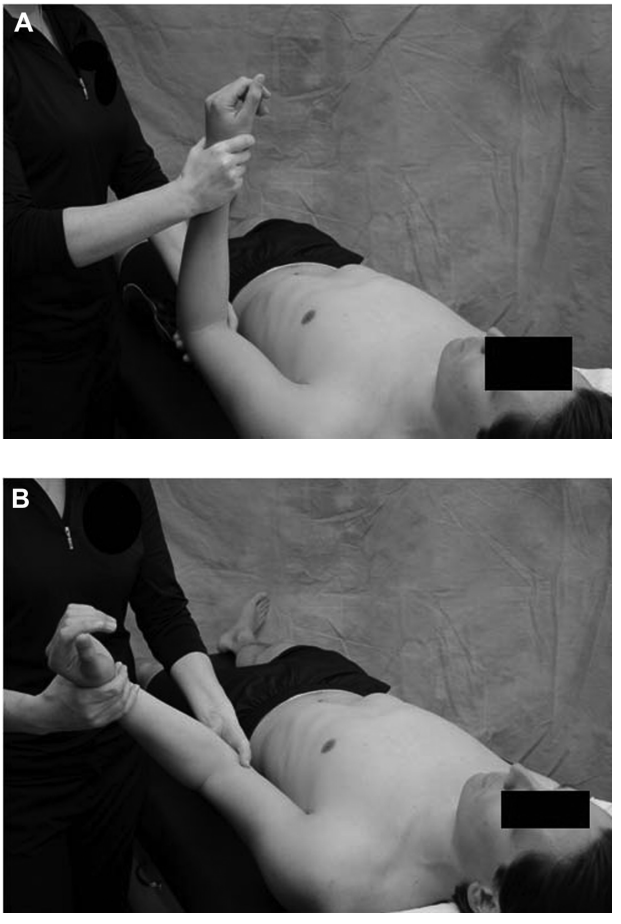
The Spaso technique requires the patient to lie supine with the affected arm placed at his or her side. The physician then holds the patient's wrist and forearm, lifts the arm vertically, and applies gentle vertical traction with external rotation while maintaining traction (Figure 2).[54] This technique may be performed more easily if a second physician is present to hold the patient in place and stabilize the scapula.

Initially, Yuen et al[64] reported an 87% success rate following 16 patients admitted to the emergency department with anterior glenohumeral dislocations who were treated by junior orthopedic residents in Hong Kong. However, more recent, larger studies reported lower success rates of 68%[54] and 75%.[62] Although no complications were reported, discomfort to the back of the treating physician was noted in some cases.[54] As this technique only requires 1 physician, it should be considered a viable technique for acute reduction.

Traction-Countertraction Technique

The traction-countertraction technique requires 2 physicians. With the patient in supine position and a sheet slung around the torso, 1 physician holds the ends of the sheet on the unaffected side and the other physician holds the wrist and elbow of the injured limb, placing the arm in 90° of abduction and

Figure 1A, B. External rotation reduction technique.



The elbow is placed at 90° of flexion while in neutral position in the coronal plane. The physician then passively moves the shoulder into approximately 20° of forward flexion. While grasping the wrist on the affected side with 1 hand and stabilizing the elbow with the other hand, the physician gently externally rotates the shoulder.

Figure 2. Spaso reduction technique.

The physician takes the patient's wrist and forward flexes the shoulder while applying vertical traction. The shoulder is then externally rotated while maintaining traction.

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external rotation (Figure 3). Countertraction is then applied with each physician pulling away from the midline of the body. The injured arm is then gently oscillated in a small arc of internal and external rotation.[18,66] This technique may be made easier if the physician in contact with the patient is able to place a hand into the axilla and essentially lift the humerus back into place. In a modified technique, the physician in contact with the patient would have a sheet around his or her body and the affected forearm just distal to the antecubital fossa. The physician would use the additional sheet for distraction, which may be appropriate should the patient be larger.

Few reports on this technique have been published, though anecdotal evidence makes this technique popular and relatively easy. In addition, no inferior traction to the glenohumeral joint is applied, eliminating possible injury to the axillary nerve. Although a popular technique, this maneuver may only be attempted with the appropriate personnel and equipment.

Milch Technique

First described in 1938,[67] the patient is placed in a supine position and the back elevated to 30°. The patient's affected arm is then slowly raised until fully abducted and externally rotated, either actively or passively, to the overhead position. The physician then places 1 hand on the elbow and 1 hand on the humeral head, guiding it over the glenoid rim with small pushing maneuvers (Figure 4).[7,59,67]

Success rates of joint reductions have been reported to be between 72% and 100%, depending on the amount of time the shoulder has been in a dislocated position.[7,59,67] Dudkiewicz et al[51] described a modified Milch technique in which patients self-reduced the dislocation by applying a downward force on the humeral head with their contralateral hand. This study reported on 32 of 33 patients with successfully self-reduced shoulders in a mean time of 10 minutes. In general, this technique is considered a gentle reduction technique that uses the shoulder's anatomy to more easily reduce the humeral head, as less force is necessary to overcome the musculature with the shoulder in an abducted position. However, it too is considered a primarily active technique, presenting the inherent risk, although low, of additional injury.

Figure 3. Traction-countertraction reduction technique.

This method requires 2 physicians; as 1 holds the ends of the sheet on the unaffected side, the other holds the wrist and elbow of the injured extremity. The arm is then placed in 90° of abduction and external rotation. Countertraction is then applied with each physician pulling away from the midline of the body. The injured arm is then gently oscillated in a small arc of internal and external rotation.

Figure 4. Milch reduction technique.

While supine, the hand of the affected limb is placed (actively or passively) behind the head. The physician then places a hand on the head of the humerus and applies a downward force.

Stimson Technique

The Stimson or "hanging-arm" technique, first described in 1900, also requires the patient to be in a prone position with the injured arm hanging over the table, but in a slightly abducted position (Figure 5).[61] Either gentle traction or a weight is applied to the arm for several minutes. Other variations include flexing of the elbow to deactivate the biceps muscle or adding gentle external rotation.[68–70] According to the original description, the shoulder may reduce spontaneously within 6 minutes due to relaxation of the surrounding musculature; however, some reports have indicated that this technique may take up to 20 minutes.[61,66] As this technique may not account for the time-sensitive situation, it would be recommended for off-field reduction. Very few numbers reporting the results of the Stimson technique exist in the literature. Kothari and Dronen[57] reported a 96% success rate when combining this with scapular manipulation.

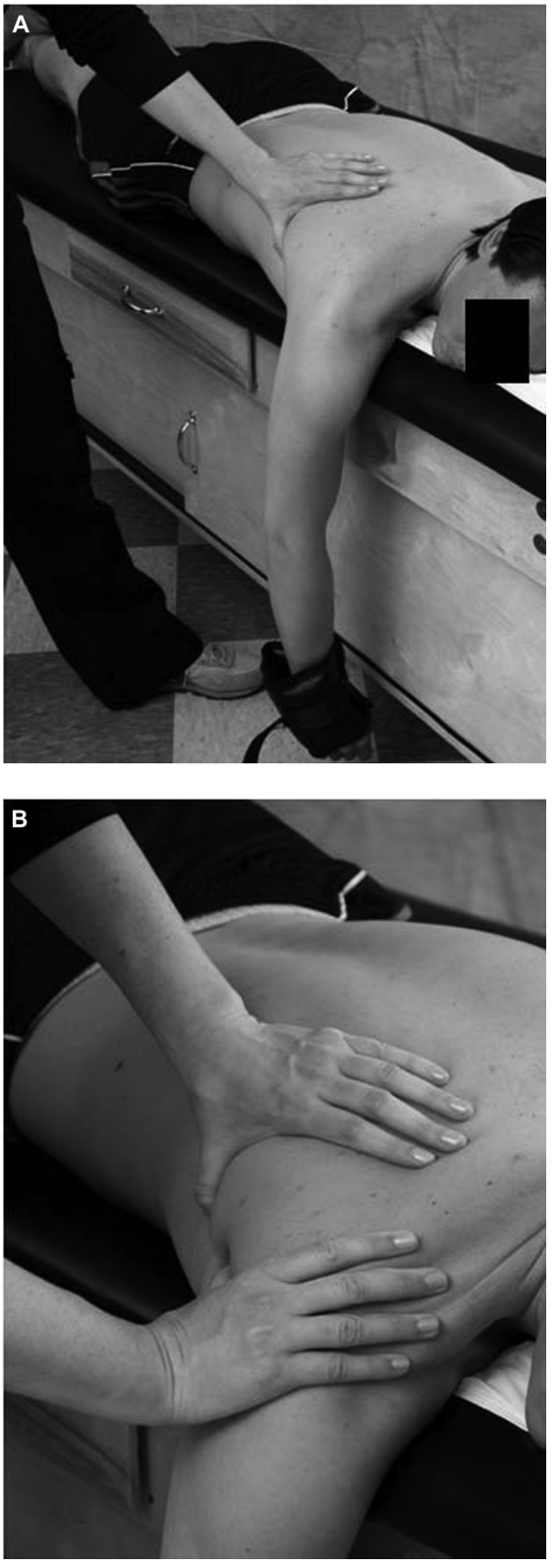
Figure 5. Stimson reduction technique.

While prone, the affected abducted arm is hung over a table. The physician can leave the patient in a prone position with something weighted around the effected wrist to help gravity do the job or add gentle traction at the wrist while applying external rotation.

Scapular Manipulation

The technique of scapular manipulation, which uses both anatomy and gravity to aid in reduction, was first reported on in 1979 by Bosley and Miles.[71] Although modified over time, in all versions described, the patient lies in a prone position with the affected limb hanging from the side of the table in slight forward flexion. A folded sheet can be placed between the table and the injured shoulder to minimize discomfort. Traction can be applied in the direction of the hanging arm, either by a physician or by applying a weight to the arm. After a short period of time, usually a few minutes, the physician places 1 hand on the inferior tip of the scapula pushing it medially, while the other hand fixates the superior spine of the scapula (Figure 6A, B).[72–74] Scapular manipulation has been reported to reduce dislocated shoulders on first attempt in 90% to 97% of cases, and is most commonly used in conjunction with the Stimson technique.[72–74] As possibly the least invasive of the techniques detailed, scapular manipulation should be highly

Figure 6A, B. Scapular manipulation reduction technique.



While prone, the affected extremity hangs from the side of the table. The physician can leave the patient in this position, or place a weight around the effected wrist to provide a distracting force. Having the physician place his or her hands on both sides of the inferior angle of the scapula and move it into internal rotation may add scapular manipulation.

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considered by the less-experienced physician, should the appropriate equipment be available.

Post-Reduction/Post-Injury Management

Similar to the initial on-field management following the injury, a thorough evaluation must be completed. The emphasis of the evaluation must again be placed on neurovascular integrity of the affected limb, noting any deficits in distal pulses or sensorimotor function. The presence of neurovascular injury would necessitate immediate emergency department referral. If neurovascular injury is absent, primary reduced anterior dislocations of the shoulder are traditionally treated by a period of immobilization.[75]

Immobilization

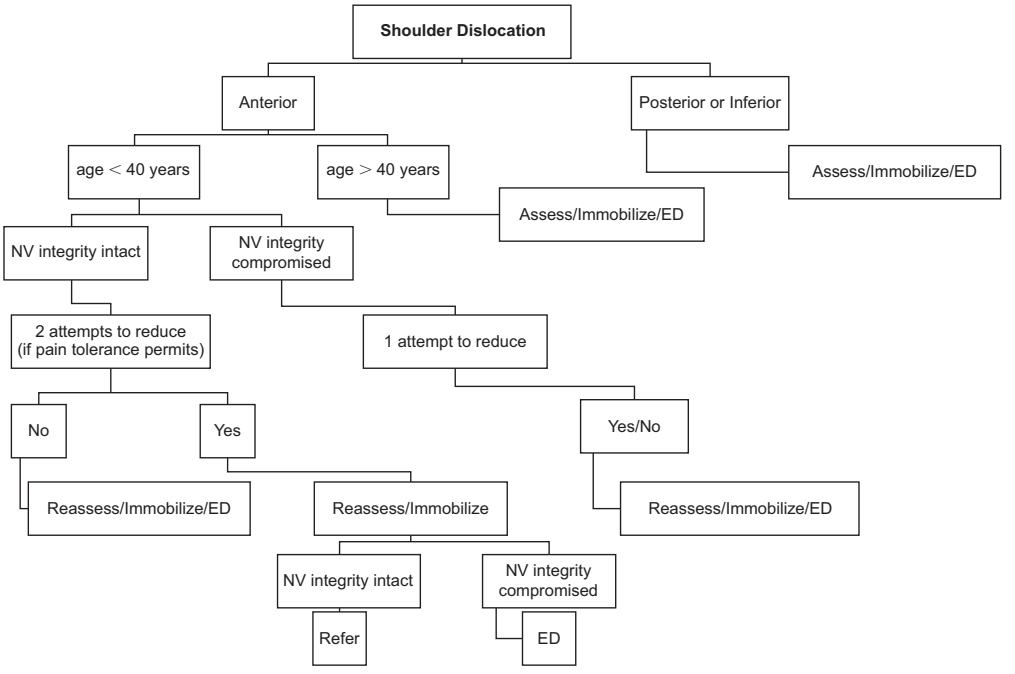
Optimum duration and arm position during immobilization have been topics of debate over the past decade. A recent systematic review assessing the duration of immobilization found no significant difference in recurrent instability in patients who were immobilized for 1 to 4 weeks.[75] In addition, although patients aged < 30 years showed a significantly higher rate of re-injury compared with older patients, the length of immobilization did not play a significant role in reducing recurrent dislocations in this population.

In 2003, Itoi et al[76] studied the effects of immobilization with the arm in external rotation, theorizing that Bankart lesions are better approximated and thus more likely to heal in this position. They found a recurrence rate of 30% in patients who were immobilized with the arm in internal rotation compared with 0% in patients who were immobilized in external rotation following primary anterior glenohumeral dislocations.[76] However, in a recent systematic review, Paterson et al[75] addressed position and duration of immobilization following primary anterior dislocation and found no significant data to clearly support this theory.[75] It should be noted, however, that immobilization with the arm in external rotation is highly uncomfortable and impractical. The greatest and most uniform predictor of recurrence that was found was the age of the patient; the younger the patient, the higher the risk of recurrence.

Clinical Recommendations

It remains difficult to mandate a specific approach regarding the management of anterior glenohumeral dislocations based on the current literature. We base our recommendations on the safest approach possible to avoid further damage to the affected joint and have summarized this in a treatment algorithm (Figure 7). We recommend that the injured patient be promptly removed from the playing field and brought to the nearest athletic training facility prior to reduction. It is

Figure 7. This treatment algorithm presents a safe approach to on-field management of an acute anterior glenohumeral dislocation based on the current literature. Please note the different approaches used for patients aged < 40 years and patients aged > 40 years. Should the neurovascular integrity be compromised, only 1 attempt to reduce should be made. This algorithm is a recommendation only.



Abbreviations: ED, emergency department; NV, neurovascular.

our preference that the Stimson technique be used initially in conjunction with scapular manipulation, followed by a second attempt, if necessary, as this technique is well tolerated and has high success rates. Should there be no athletic training facility available, on-field reduction using a more active maneuver, such as the Milch or external rotation technique, would be preferred. The use of a more active technique may likely result in faster reduction and less distraction from other athletes. However, it is recommended that these active techniques of reduction only be performed by experienced medical personnel. Regardless, if the second attempt is unsuccessful, immobilization and transportation to the nearest emergency department is recommended. With regard to postinjury immobilization and the current controversy in terms of arm position and duration, we recommend that the patient's arm be placed in a position of comfort until seen by the treating orthopedist within 1 week after injury. Most athletic training rooms are equipped with standard internal rotation slings or swaths, which would be adequate until the patient follows-up with his or her physician.

Each athletic trainer and overseeing team physician should have a conversation regarding standing orders. It is highly recommended that written guidelines are established with which all parties are comfortable. It is also important to be informed of the appropriate state regulatory acts that will dictate the guidelines by which athletic trainers, team physicians, and other allied health care professionals may practice.

Conclusion

Anterior glenohumeral dislocations are a common injury in the athletic population. It is in the patient's best interest to be treated immediately by a health care professional. Reducing a glenohumeral dislocation in a timely fashion can result in reduced pain and muscle spasm, decreased chance of prolonged neurovascular injury, and reduced financial cost to the patient. It is important that on-site health care professionals understand the etiology and physiology of glenohumeral dislocations, and become confident in discerning which injuries can be treated acutely and which to refer to the emergency department. Furthermore, a systematic approach in management of these injuries is paramount in establishing a standard of care. Uncomplicated anterior subcoracoid glenohumeral dislocations should be reduced, immobilized, and referred to a physician specializing in orthopedics. Continued efforts should focus on defining a position statement as to enhance the continuity in acute care of anterior glenohumeral dislocations.

Conflict of Interest Statement

This work was not supported directly by an outside funding or grant. However, Peter J. Millett, MD, MSc, has received from a commercial entity something of value (exceeding the equivalent of US $500) not related to this manuscript or research from Arthrex. Dr. Millett is a consultant and receives payments from Arthrex and has stock options in Game Ready. Olivier A. J. van der Meijden's research position is supported by Arthrex. This research was supported by The Steadman Philippon Research Institute, which is a 501(c)3 nonprofit institution supported financially by private donations and corporate support from the following entities: Arthrex, ConMed Linvatec OrthoRehab, Ossur Americas Smith and Nephew Endoscopy, and Siemens. Angela West, ATC, Grant E. Norte, ATC, and Michael Gnacinski, ATC disclose no conflicts of interest.

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