Review Article

Diagnosis and Management of Traumatic Anterior Shoulder Instability

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ABSTRACT

Anterior shoulder instability is the most common form of shoulder instability and is usually because of a traumatic injury. Careful patient selection is key to a favorable outcome. Primary shoulder stabilization should be considered for patients with high risk of recurrence or for elite athletes. Soft-tissue injury to the labrum, capsule, glenohumeral ligament, and rotator cuff influence the outcome. Glenoid bone loss (GBL) and type of bone loss (on-track/off-track) are important factors when recommending treatment strategy. Identification and management of concomitant injuries are paramount. The physician should consider three-dimensional CT reconstructions and magnetic resonance arthrography when concomitant injury is suspected. Good results can be expected after Bankart repair in on-track Hill-Sachs lesions (HSLs) with GBL $< 13.5\%$. Bankart repair without adjunct procedures is not recommended in off-track HSLs, regardless of the size of GBL. If GBL is 13.5% to 25% but on-track, adjunct procedures to Bankart repair should be considered (remplissage and inferior capsular shift). Bone block transfer is recommended when GBL $>$ 20% to 25% or when the HSL is off-track. Fresh tibia allograft or lilac crest autograft are good treatment options after failed bone block procedure.

Anterior shoulder instability is the most common form of shoulder instability and is usually because of a traumatic injury such as a collision or fall on an outstretched arm with the shoulder abducted and externally rotated.[1,2] Atraumatic instability can develop in patients with preexisting generalized ligamentous laxity or after repetitive microtrauma (eg, overhead shoulder athletes and overhead laborers). Minimal bony restriction of the glenohumeral joint gives the shoulder maximum mobility, but stability relies on the complex interplay between bony and soft-tissue stabilizers. Anterior shoulder instability severity can be variable, ranging from complete dislocation of the glenohumeral joint to more subtle instability, which nevertheless can cause debilitating symptoms. Therefore, a detailed patient history together with a thorough examination must be considered along with the findings of advanced imaging modalities.

Surgical treatment has evolved from open techniques to advanced minimally invasive procedures, and the evolution of sophisticated imaging modalities has made it possible to identify important pathology and to obtain a successful outcome. Today, the orthopaedic surgeon must master a wide range of techniques to treat anterior shoulder instability. Risk factors associated with recurrent instability have been identified, and this knowledge has improved the guidelines for treatment. However, high rates of recurrent instability still pose a challenge, especially in young, active patients. This review will focus on risk factors, imaging workup, and detail modern techniques for the optimal treatment of recurrent anterior instability.

Epidemiology

The incidence of anterior shoulder dislocation requiring closed reduction is approximately 23 of 100,000 person-years.[3] It is almost three times more frequent in men, and when subcategorized for age <20 years, the incidence is 98 of 100,000 person-years.[3,4] The rate of recurrent instability after nonsurgical treatment has been reported to be as high as 75%,[4] and 19% require repeated closed reduction.[3]

Shoulder dislocations are associated with sport and recreational activities,[5] and athletes involved in contact sports have over a 50% risk of recurrence after a Bankart repair.[6]

Anatomy and Pathophysiology

The humeral head is large compared with the shallow glenoid fossa, and the inherent stability of the glenohumeral joint relies heavily on glenoid version and soft-tissue stabilizers. The native glenoid has an average retroversion of 1° ± 3°,[7] and the risk of anterior instability increases with greater anteversion.[8] The soft-tissue stabilizers of the glenohumeral joint can be divided into static and dynamic stabilizers (Figure 1). The static stabilizers have the greatest contribution to shoulder stability at the end range of motion (ROM). The principal dynamic stabilizers are the muscles of the rotator cuff.

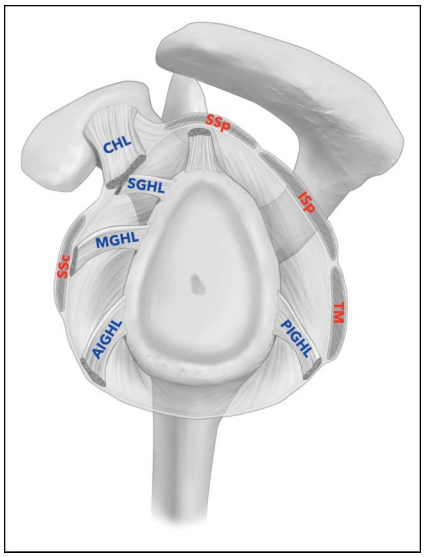
The position of the arm in which an anterior shoulder dislocation occurs is debated.[9] Anterior shoulder dislocation is thought to occur with the arm at 90° of abduction, horizontal extension, and maximum external rotation. In this position, the anteroinferior capsule and anterior band of the inferior glenohumeral ligament (IGHL) prevent glenohumeral dislocation. If a force greater than the resistant force of the IGHL is applied, an anterior glenohumeral dislocation occurs. As the shoulder dislocates, the restraining soft tissues and bony stabilizers are disrupted. The risk of residual instability after closed reduction is dependent on several factors, including the magnitude of force, mechanism of the initial trauma (collision/noncollision), bony and soft-tissue injury, and patient-specific factors (ie, age, gender, occupation, and activity level).

Anterior shoulder instability can also present without dislocation of the glenohumeral joint. Repetitive microtrauma (overhead athletes) can cause glenohumeral subluxation beyond the physiologic limits but with remaining glenohumeral contact. These patients will present with anterior shoulder pain and sensation of transient instability combined with pertinent clinical exam findings consistent with instability.[10]

Patient History and Clinical Examination

Patients with anterior shoulder instability typically presents with a report of joint instability and activity-related pain.[11] A detailed patient history should include generalized ligamentous laxity, previous instability

Figure 1



The dynamic stabilizers (red) of the glenohumeral joint are the rotator cuff muscles (SSc = subscapularis, SSp = supraspinatus, ISp = infraspinatus, TM = teres minor), and the static stabilizers (blue) are the capsule, labrum, and the glenohumeral ligaments (AIGHL = anterior band of the inferior glenohumeral ligament, CHL = coracohumeral ligament, MGHL = middle glenohumeral ligament, PIGHL = posterior band of the inferior glenohumeral ligament, SGHL = superior glenohumeral ligament).

Table 1. Specific Test for Anterior Shoulder Instability

Sulcus sign	A test for shoulder laxity. The patient is in a relaxed standing position with their arms at their side. A force is applied to the affected arm. If a sulcus appears at the superior aspect of the humeral head, then the arm is put into external rotation. The test is then repeated, and the test is positive if the sign persists.
Apprehension test	The patient is positioned supine. The shoulder is abducted 90° and externally rotated fully. Pain indicates a positive test.
Relocation test	If a posterior directed force is applied at the anterior margin of the glenoid reduces the pain in the apprehension test, the relocation test is considered positive.
Surprise test	The patient is seated with the arm in forward flexion at the shoulder to 90° and internally rotated to 90°. An axial load is quickly applied without warning to the humerus, pushing posteriorly. The test is possible if there is a "clunk" or pain.
Load-and-shift test	The patient is positioned supine with the shoulder at 40°-60° of abduction and 90 degrees of forward flexion. An axial load is applied to the humerus while anterior and posterior translational forces are applied.
Anterior drawer test	The scapula is stabilized with one of the examiner's hands and a force is applied anteriorly at the humeral head with the other hand of the examiner. The test is positive if the patient feels a sense of instability when compared with the contralateral side.
Posterior drawer test	The same method is used as in the anterior drawer test, but the force is applied posteriorly at the humeral head

events, mechanism of injury, previous treatment, activity level, and expectations for the treatment.

Both shoulders should be assessed including symmetry/asymmetry, palpation, ROM, neurovascular examination, and specific tests for anterior shoulder instability (Table 1). Joint hypermobility can be assessed using the Beighton score.[12] Care should be taken to differentiate between unidirectional and multidirectional instability because the latter entails a different treatment algorithm and surgical approach. The presence of a symptomatic sulcus sign is characteristic of multidirectional instability, and a posterior jerk test or push-pull test can be indicative of posterior or combined instability. If the patient is taken into surgery, the findings of the physical examination should be repeated and compared with the uninjured contralateral side.

Of note, an anterior shoulder dislocation puts the brachial plexus and notably the axillary nerve at risk (Figure 2).[13] Older individuals with higher risk of arteriosclerosis are at greater risk, and a thorough neurovascular examination is warranted after anterior shoulder dislocation and reduction. A motor examination of the axillary nerve can be challenging because of pain and limited ROM in the dislocated shoulder. The sensory function of the axillary nerve can be evaluated over the deltoid tuberosity. All patients should be checked for hard signs of vascular injury, including expanding or pulsatile hematoma, signs of distal ischemia, or absent pulses in the brachial, ulnar, and radial artery.

Imaging

It is important to consider the findings of a detailed patient history and careful examination together with the findings on radiographs, CT, and MRI as indicated.

Radiographs

Anteroposterior (AP) shoulder radiographs with the shoulder in external rotation and a true AP radiograph (Grashey view) is recommended. A true AP radiograph helps to detect loss of contour or irregularities of the sclerotic line on the anteroinferior glenoid, which should raise suspicion of glenoid rim deficiency. The lateral Y-view projection will detect translation in the sagittal plane and helps to confirm if the dislocation is anterior or posterior. The West Point axillary view is a tangential view of the anteroinferior rim of the glenoid, and a glenoid rim fracture or attritional bone loss can be diagnosed from this view. In a dislocation, some form of axillary lateral view needs to be performed to confirm the presence and direction of dislocation and subsequent confirmation of reduction.

Figure 2

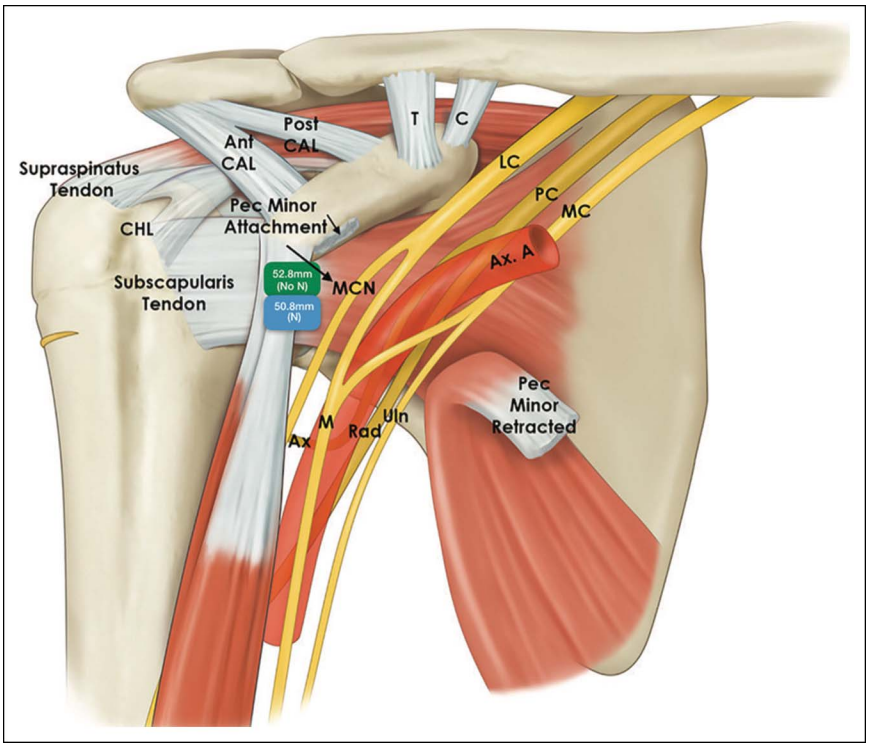


Illustration of the pertinent neurovascular structures at risk in traumatic anterior shoulder instability and during coracoid bone block transfer. The medial (MC), lateral (LC), and posterior (PC) cords along with the musculocutaneous nerve (MCN), the axillary nerve (Ax), and axillary artery (Ax. A) and median (Med), radial (Rad), and ulnar (Uln) nerves are shown. *LaPrade CM et al, Am J Sports Med. 2018;46:2185-2191.*

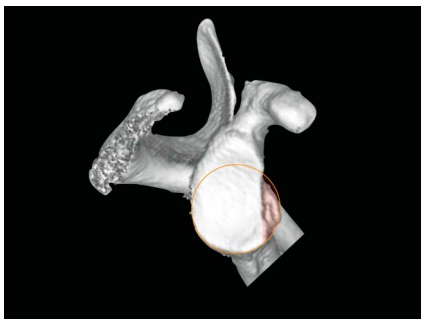
CT

A shoulder CT scan with three-dimensional (3D) reconstruction is very useful to analyze the influence of bone loss on anterior instability. CT is the method of choice to evaluate bone loss and is pivotal in decision-making and preoperative planning. CT is useful to identify small bony lesions in the acute phase, attritional bone loss, and size and orientation of humeral head bone lesions and glenoid bone loss (GBL).

A fracture of anterior glenoid rim (Bankart fracture) is observed in one-third of first-time anterior shoulder dislocations.[14] A glenoid rim fracture can easily be overlooked on radiographs; thus, a CT scan is recommended whenever a glenoid rim fracture is suspected. Failure to recognize and correctly address a glenoid rim fracture results in attrition of the fragment (Figure 3) and increased instability recurrence rate, and the size of the glenoid defect increases with repeated instability events.[14]

The Hill-Sachs lesion (HSL) is a compression fracture on the posterolateral humeral head and can be observed in up to 90% of patients after their first anterior shoulder dislocation.[14] The lesion is created from the impact of the humeral head on the glenoid rim. The lesions can be chondral or osteochondral and are commonly of limited size without notable effect on stability after first-time traumatic anterior shoulder dislocation.[15] However, in patients presenting with recurrent dislocation, the prevalence and size of the HSL is greater.

Figure 3



A three-dimensional CT scan of the glenoid; the humeral head digitally subtracted demonstrates a patient with multiple recurrences, and there is attritional bone loss of the fragment and approximately 20% of glenoid bone loss. Attritional bone loss develops rapidly if the Bankart fragment is not addressed early.

Figure 4

Posterior view of three-dimensional (3D) reconstruction of the humeral head (**A**) and en face view of a 3D reconstruction of the glenoid. To evaluate if a Hill-Sachs lesion (HSL) is on or off track, both glenoids are compared preoperatively in en face view on the 3D reconstructions. The glenoid track is 83% of the uninjured glenoid's width. The glenoid defect (**D**) is subtracted from the uninjured glenoid, and the calculated width of the glenoid track is applied to the posterior 3D view of the humerus (**B**). The medial margin of the rotator cuff insertion on the greater tuberosity (R) to G1 is the width of the normal glenoid track. However, the presence of a glenoid defect reduces the width of the glenoid track (G2). If the HSL (gray area) extends medially to the glenoid track, the HSL is considered off-track. In the illustration, the HSL would be on track if not for the glenoid bone loss, thus making the HSL off track.

A bipolar lesion is the presence of an HSL and glenoid bone defect occurring together. The glenoid track is the contact area between the humeral head and glenoid.[16] The HSL is considered to be off-track when the HSL engages the anterior glenoid rim, otherwise it is considered on-track. Whether the HSL is on-track or off-track can be determined in the operating room, but only after Bankart repair. This method has the risk of redislocation and damage to the repair. Therefore, the method described by Yamamoto et al[16] is a superior alternative (Figure 4), and the on-track/off-track concept has been validated in several studies.[17,18]

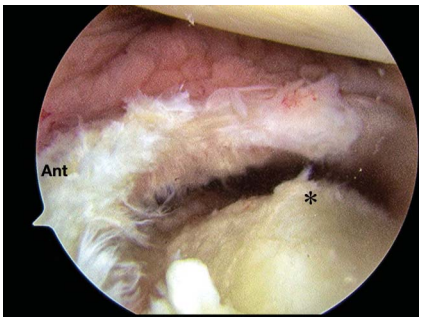
In the setting of recurrent shoulder instability, the significance of GBL and HSL can become considerable, and stabilization surgery should be considered after the first recurrence event in high risk patients.[14] Critical GBL has been debated and remains controversial. Bony glenoid reconstruction is considered when GBL is 20% to 25%; however, inferior clinical results have been demonstrated with GBL as low as 13.5% in young and active individuals.[19] In addition, the location of the HSL seems to influence clinical outcomes with the inferior results reported in HSLs located medially on the humeral head (peripheral-track lesion).[20]

MRI

MRI is a valuable tool for evaluating the labrum, capsule, glenohumeral ligament, cartilage, and the rotator cuff. Subtle intra-articular changes can be visualized on MRI with administration of intra-articular or intravenous agents.

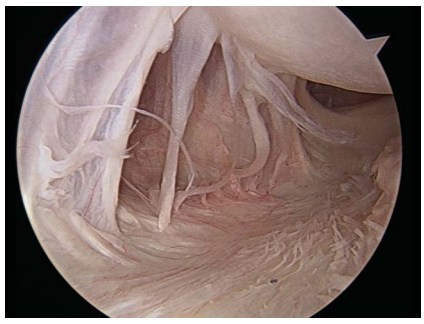
During an anterior shoulder dislocation, the anteroinferior capsule and labrum is torn off from the anterior margin of the glenoid. The injury is known as a Bankart lesion (Figure 5) and is the most commonly observed

Figure 5



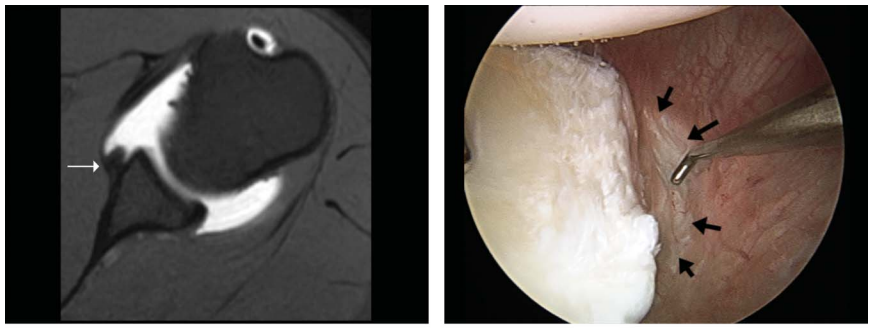
Arthroscopic view of an anterior capsulolabral (Bankart) lesion with the arthroscope in the anterosuperior portal. The asterix (*) marks the 6-o'clock position, and Ant is the anterior direction.

Figure 6



The arthroscopic view of a humeral avulsion of the glenohumeral ligamentshow multiple areas of tear of the anteroinferior capsule off the humerus.

Figure 7



A B

Anterior labroligamentous periosteal sleeve avulsion lesion visualized on MRI (**A**) and intraoperatively (**B**).

injury after an anterior shoulder dislocation or subluxation.[10] The labrum contributes markedly to glenohumeral stability and functions as a bumper. In addition, the labrum seals the interface between the glenoid and humeral head, thus creating a negative intra-articular pressure (suction effect).[21] A Bankart lesion causes a notable decrease in labral height and results in a pronounced reduction of glenohumeral stability.

Humeral avulsion of the glenohumeral ligament (HAGL) typically occur after hyperabduction and external rotation of the arm, resulting in incompetence of the IGHL. HAGL lesion has been observed in up to 9% of traumatic anterior shoulder dislocations (Figure 6),[22] is more prevalent in young, female athletes, and seems to be associated with traction rather than collision.[10,23] Patients with shoulder dysfunction and HAGL lesion often describe pain as the primary issue and not recurrence of instability events.[24]

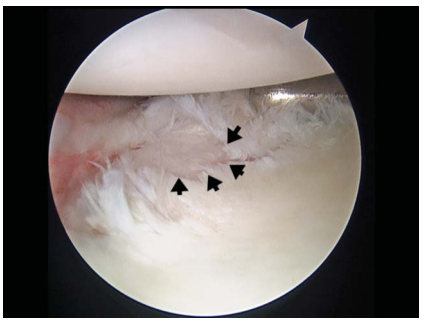
The long head of the biceps tendon attaches at the superior aspect of the labrum. Superior labrum anterior to posterior lesions, with or without detachment of the biceps tendon, can be observed after traumatic shoulder dislocations in 22% of patients.[15] Combined surgical repair of superior labrum anterior to posterior lesions in the setting of Bankart lesions demonstrate a low recurrence rate, favorable functional scores, and no notable restriction on ROM, all of which were not markedly worse than outcomes of isolated Bankart repair.[25]

The anterior labroligamentous periosteal sleeve avulsion (ALPSA) lesion differs from the Bankart lesion in that the scapular periosteum is not ruptured but peeled off. The labrum, anterior IGHL, and periosteum are displaced medially in a sleeve-like fashion on the anterior glenoid neck.[26] In chronic cases, the ALPSA lesion can heal to the medially on the glenoid neck, and it is imperative that the capsulolabral complex is mobilized so that it can be fixed anatomically on the anterior glenoid rim (Figure 7).

A glenoid labral articular disruption (GLAD) (Figure 8) lesion is a tear of the anterior inferior labrum with associated injury of the adjacent glenoid cartilage. It may be associated with persistent pain and early degenerative changes. It has been shown that the presence of a GLAD lesion is a harbinger for bone loss and residual instability.[27]

Rotator cuff injury is associated with anterior shoulder dislocation in overhead athletes and patients older than 40 years. Persistent pain and dysfunction after an instability event should raise the suspicion of rotator cuff tear. Patients who have a traumatic dislocation older than 40 years should have the rotator cuff evaluated carefully on clinical examination and advanced imaging performed with a low threshold to ensure that the rotator cuff is not traumatically torn.

Figure 8



Arthroscopic view of a glenoid labral articular disruption (GLAD) lesion showing the cartilage focally sheared off the anterior glenoid because of instability event(s).

Management

Choice of treatment is based on a detailed patient history, clinical examination, and the results from imaging

modalities. The patient's age, gender, expectations, and requirements must also be considered. Young age (<20 years) at first instability event has been shown to be a strong prognostic factor for recurrent instability events.[6]

The First-Time Dislocator

There is controversy about the treatment of the first-time dislocator. In a recent survey of the Neer Circle of the American Shoulder and Elbow Surgeons, consensus was reached for a surgical recommendation for athletes aged 14 to 30 at the end of their competitive season with apprehension and bone loss. Nonsurgical management results in higher recurrence rates than surgical treatment, and a recent study has demonstrated that recurrence results in notable increases in bone loss.[28] Furthermore, in collegiate athletes, surgical intervention resulted in higher return to sport in a subsequent season compared with nonsurgical management.[29] In high school aged athletes, however, nonsurgical management has resulted in a high rate of return to sport in the subsequent season.[30]

Nonsurgical Management

Nonsurgical management after an anterior shoulder dislocation consists of immobilization for 3 to 10 days and early rehabilitation to achieve full pain-free motion, with return to sport within 7 to 21 days. After a period of immobilization, most patients are referred to physical therapy with focus on restoring strength of the dynamic glenohumeral stabilizers.

Bankart Repair

The Bankart repair is the most common surgical procedure to treat traumatic anterior shoulder instability. When comparing open and arthroscopic Bankart repair, the clinical outcomes and recurrence rates seem to be comparable.[31,32] The most important risk factors for recurrence after arthroscopic Bankart repair are the number of previous dislocations, the total duration of instability, GBL, and the presence of an off-track HSL.[17] Stability of the labral repair increases with the number of anchors; however, young, active, male patients are at risk of fracture through the anchor holes used for fixation of the labrum (postage stamp fracture).[33]

An open Bankart procedure can also be considered after failure of arthroscopic Bankart and has been shown to be successful in patients with moderate (13.5% to 20%) GBL and in the contact athlete population.[19,34]

The advantages with arthroscopic Bankart repair are reduced surgical time, faster recovery, better identification of intra-articular pathology, and improved cosmetic result. Open Bankart operation can be considered when there is a concomitant acute glenoid fracture or if the patient is hyperlax and a capsular shift is considered during the same procedure.

Acute Management of Concomitant Glenoid Rim Fractures

Early, appropriate treatment of bony Bankart lesions is recommended to prevent GBL because of fragment resorption, and incorporating the fragment into the capsulolabral repair results in excellent outcomes compared with arthroscopic Bankart repairs in the setting of attritional bone loss.[35]

A bony Bankart fragment can be fixed with screws or arthroscopic suture in a linear or bridge technique with good results.[35] Failure to address the bony Bankart lesion appropriately can lead to GBL, and it has been shown that a glenoid defect of 13.5% in an active cohort increases recurrence rate.[36]

Bankart Repair (with Adjuncts) or Latarjet?

The instability severity index score (ISIS) considers preoperative risk factors and has been shown to be a reliable

Table 2. Summary of Treatment Options Based on Glenoid Bone Loss (GBL) Size and Whether the Hill-Sachs Lesion (HSL) is On-track or Off-track

GBL (%)	On-track HSL	Off-track HSL
0%-13.5%	Arthroscopic Bankart repair	Arthroscopic Bankart repair + remplissage
		Open inferior capsular shift
		Latarjet procedure
13.5%-25%	Arthroscopic Bankart repair + remplissage	Arthroscopic Bankart repair + remplissage
	Open inferior capsular shift	Open inferior capsular shift
	Latarjet procedure	Latarjet procedure
>25%	Latarjet procedure	Latarjet procedure

GBL = glenoid bone loss

tool.[37] However, the validity of the score has been questioned.[38] Recently, Di Giacomo et al[39] published a comparison of ISIS with the Glenoid Track Instability Management Score (GTIMS) (Table 2). The GTIMS is similar to ISIS, but it replaced radiographs with 3D CT and classified the bone loss as on-track or off-track. The authors demonstrated that GTIMS more accurately predicts failure after arthroscopic Bankart repair. Specifically, use of the GTIMS instead if ISIS reduced the number of Latarjet procedures without notable differences in outcomes.[39]

Adjunct to Bankart Repair 1: Capsular Shift

Capsular imbrication can be considered to reduce excessive capsular volume and in high-performance athletes undergoing Bankart repair, and the procedure can be done open or arthroscopically. Pagnani[34] demonstrated good outcomes after open Bankart repair with capsular shift; however, there are concerns that loss of external rotation may be problematic and should be used with caution in overhead athletes.

Adjunct to Bankart Repair 2: Remplissage ("to Fill in" in French)

The infraspinatus tendon and underlying capsule is transferred into the defect, thereby converting the defect to an extra-articular defect. Remplissage has been performed in patients with moderate to large Hill-Sachs defects associated with glenoid defects of <25% with good results.[9] A disadvantage associated with remplissage is reduced ROM, especially external rotation.

Adjunct to Bankart Repair 3: Rotator Interval Closure

Closure of the rotator interval can reduce anterior translation in abduction and external rotation, but reduced external rotation and abduction can be expected and should be considered with care in overhead throwing athletes.[40]

Coracoid Bone Block Transfer (Latarjet Procedure)

The Latarjet procedure is the most commonly used bone-block procedure and offers several stabilizing properties. First, the bone block restores the surface of an attritional glenoid. Second, the repair of the anterior capsule to the stump of the coracoacromial ligament create a bumper. Third, the conjoint tendon functions as a sling resisting anteroinferior translation of the humeral head.[41] The Latarjet procedure is a challenging procedure, and the management of several key steps is paramount to a successful outcome:

The available graft size is 23 to 26 mm in men and 20 to 23 mm in women.[42] The medial structures at risk when harvesting the coracoid bone block are the axillary and musculocutaneous nerves. Subscapularis management is key to good outcome, and a tenotomy of the subscapularis is not recommended because it reduces muscle strength and reduces overall outcomes. Two techniques for graft placement on the anterior glenoid surface exist. In the traditional method, the lateral side of the graft is used to replace bone loss; alternatively, the inferior surface can be used in the congruent arc fashion. The latter offers the advantage of more anatomic fit and can replace a greater surface, but a higher risk of graft fragmentation during fixation exists. The graft is fixed with two screws at least 1 cm apart to avoid graft fracture. Capsular closure should be done with the arm in external rotation and tied into 1 cm of the coracoacromial ligament stump.

Primary Bankart Repair or Latarjet?

Primary arthroscopic Bankart repair is an excellent first option in the surgical treatment of anterior shoulder instability, although some surgeons prefer Latarjet as the initial treatment, even in patients without notable bone loss.[43] Patients with higher risk of instability or recurrence (ie, young and active individuals and overhead and contact athletes) can be considered for primary Latarjet procedure; however, the reported complication and revision surgery rate may be up to 30% and 7%, respectively.[44]

The chance of returning to preinjury level depends on the type of activity (collision/noncollision/overhead athlete) and number of instability events before surgery. A recent study demonstrated that the number of dislocations before Latarjet procedure did not affect clinical outcomes, recurrence, or instability rates.[45] Given this, an arthroscopic Bankart repair offers a minimal invasive procedure while still having a secondary option of the Latarjet. However, humeral and glenoid bone lesions, including on-track/off-tracking, must be considered when selecting treatment strategy. A number of studies have shown that Latarjet has lower recurrence rates than an isolated Bankart repair. Newer adjuncts, such as remplissage, however, have shown equivalent results to Latarjet, with lower complication rates.[46] However, the latter study excluded large bone defects (>30%), and Latarjet remains the treatment of choice for large bone defects.

Salvage of Failed Latarjet

The recurrence rate after a Latarjet procedure has been reported to be as high as 12% and is commonly the result

of graft resorption, malunion, and hardware complications.[47] Graft resorption can cause recurrent dislocation, subluxation, pain, and reduced ROM. In a systematic review of complications and reoperations after Latarjet procedure, Griesser et al[44] reported a nonunion or fibrous union rate of 9.4%.

Several graft options are available in the treatment of failed bone block procedures, including various autologous iliac crest configurations (Eden-Hybinette, J-graft).[48] The advantage of the J-graft is that no fixation usually is required as the graft is press-fitted into the anterior glenoid. The functional outcomes and recurrence rates have been reported to be comparable; however, relatively high donor site morbidity can be expected.[49] A distal clavicle autograft offers a larger restoration of glenoid diameter compared with a traditional coracoid bone block and a cartilage-covered surface facing the humeral head.[50] Alternatively, allografts avoid risk of graft site complications, and using fresh distal tibia allograft (Figure 9) has been shown to restore the native curvature of the glenoid with high rates of bony union, minimal risk of recurrence, and excellent clinical results.[51]

Both fresh distal tibial allograft and the J-graft have demonstrated equivalent outcomes to the Latarjet and calls into question the importance of the so-called "sling effect" if bone loss is addressed.[49,52]

Surgical treatment of humeral head bone loss is usually reserved when there is concomitant damage to the humerus with a notable injury to the arc and surface. Multiple options to treat a notable HSL have been described, including remplissage, bone grafting, and percutaneous tamping.

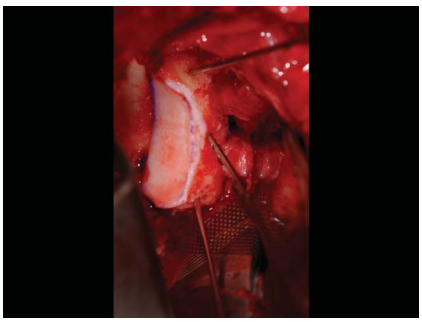
Postoperative Rehabilitation

After open or arthroscopic labral repair, the rehabilitation should allow healing of the capsulolabral structures the first 3 to 6 weeks. However, in a randomized controlled study, Kim et al[53] found no difference in dislocation rates or functional scores after immediate mobilization and 3 weeks of immobilization.

The healing time of the subscapularis must be taken into consideration when deciding the immobilization time after bone-block transfer. Depending on handling of the subscapularis muscle (split or peel-off), approximately 5 to 6 weeks of immobilization in a sling is recommended.

The rehabilitation usually starts with passive and active-assisted ROM exercise programs, and after 4 to 6 weeks, most patients can initiate strengthening exercise programs that focus on the rotator cuff and scapula stabilizers. Dependent on the patient's occupation and activity level, return to work or sport can be expected within 4 to 6 months.

Figure 9



A distal tibia allograft is a viable option when glenoid bone loss is >20% to 25% and recreates the architecture of the glenoid with the benefit of a cartilage covered graft surface.

Summary

Careful patient selection is key to a favorable outcome for traumatic anterior shoulder instability. After a first-time anterior shoulder dislocation, nonsurgical treatment with a short period of immobilization in external rotation is recommended. Primary shoulder stabilization should be considered for patients with high risk of recurrence or for elite athletes. The amount of GBL and type of bone loss (on-track/off-track) are important factors when recommending treatment strategy. Identification and management of concomitant injuries (GLAD, ALPSA, HAGL, rotator cuff, and bony Bankart lesions) are paramount. The physician should consider 3D CT reconstructions and magnetic resonance arthrography when concomitant injury is suspected.

Good results can be expected after arthroscopic Bankart repair in on-track HSLs with GBL < 13.5%. Bankart repair without adjunct procedures is not recommended in off-track HSLs, regardless of the size of GBL. If the GBL is 13.5% to 25% but on-track, adjunct procedures to Bankart repair should be considered (remplissage and inferior capsular shift). Bone block transfer is recommended when GBL > 20% to 25% or when the HSL is off-track.

Fresh tibia allograft or lilac crest autograft are good treatment options after failed bone block procedure.

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