Open and Arthroscopic Anterior Shoulder Stabilization

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» Risk factors for recurrent shoulder instability (e.g., glenoid bone loss, high patient demand, younger patient age (i.e., thirty years or younger), more than three dislocations requiring reduction, and ligamentous laxity) should be carefully elucidated in order to guide treatment.

» Previous literature favors open surgery for those at greatest risk of redislocation; however, with newer arthroscopic techniques and instrumentation, the indications for open surgical treatment have narrowed.

» Arthroscopic stabilization is favored for primary surgical management in patients with capsulolabral avulsions.

» Arthroscopic management with use of double-row techniques is an option in young, high-demand athletes who do not have substantial bone loss, as this scenario allows for greater footprint restoration and improved fixation.

» Indications for open surgical management remain: revision surgery, poor tissue quality, substantial bone loss, and patients considered to be at especially high risk for redislocation.

The glenohumeral joint is the most common major joint to dislocate, at a rate of 23.1 per 100,000 people per year[1,2]. In high-school students, the rate is 0.63 per 10,000 athletic exposures[3]. Ninety percent of traumatic shoulder dislocations are anterior. Biomechanical and clinical studies have shown that traumatic dislocation or subluxation of the shoulder leads to anteroinferior capsulolabral detachment from the glenoid—the so-called Bankart lesion. It has also been shown that the glenohumeral ligaments fail in continuity (stretching and attenuation of the capsulolabral complex, whose osseous attachments remain intact) and fail from the bone-ligament interface[4,5].

The risk factors associated with treatment failure (recurrent instability or functional deficits) following arthroscopic operative repair include age, sex, presence of an osseous Bankart and/or a large Hill-Sachs (cortical depression in the posterolateral part of the humeral head)[6] lesion, participation in competitive collision sports or sports that entail forcible overhead shoulder activity, hypermobility, and number of (typically, more than three) instability episodes prior to operation[7-10]. As a result, there has been a recent shift toward open stabilization in high-risk patients

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without substantial bone loss due to historical data indicating improved outcomes after open stabilization when compared with arthroscopic stabilization[11]. While open stabilization continues to have a role in surgical management of glenohumeral instability (particularly in the presence of a large osseous lesion, poor quality tissue, hypermobility, or the revision setting), advanced arthroscopic techniques may allow for refinement of the indications for open versus arthroscopic stabilization.

This article will review: (1) the physical examination and radiographic findings, classification, and risk factors for recurrent anterior shoulder instability in patients with first-time and recurrent dislocations; (2) the nonoperative management of anterior shoulder instability; (3) the open surgical management of anterior shoulder instability; (4) the arthroscopic surgical management of anterior shoulder instability; and (5) an evidence-based treatment algorithm for first-time and recurrent anterior glenohumeral dislocations.

Risks for Recurrence and Assessment of Bone Loss

The risk factors for acute traumatic shoulder instability are well known[12,13]. Compared with noncontact sports, contact sports (e.g., football, wrestling, ice hockey), especially those that involve forcible overhead activity, put the athlete at greater risk of dislocation. Male athletes are at greater risk than female athletes, in part due to the higher rate of participation in contact sports. Ligamentous laxity confers a greater risk of dislocation and subluxation of the glenohumeral joint[8,9]. Finally, younger patients are at higher risk than those older than thirty years of age[9,14-20].

Risk factors for recurrent instability following stabilization are similar to the factors that put an individual at risk of having initial instability: age younger than thirty years, male sex, the presence of ligamentous laxity, and participation in contact sports. Furthermore, more than three preoperative dislocations requiring reduction, substantial glenoid bone loss (>25% of surface area), and an engaging Hill-Sachs lesion further predispose patients to recurrent instability[9,21-24].

In the event of traumatic anterior glenohumeral dislocation, glenoid bone loss must be assessed when deciding on a treatment strategy. Bone loss is best assessed radiographically with radiographs and computed tomography (CT) scans. Axillary-view radiographs may be used to assess glenoid bone loss, and anteroposterior radiographs made with the shoulder in internal and external rotation may be used to assess a Hill-Sachs lesion. Substantial glenoid bone loss (>25%) may allow even a small Hill-Sachs lesion to engage and become clinically important[25,26]. Further, Hill-Sachs lesions in the "glenoid track," or zone of the posterior aspect of the humeral head that contacts the glenoid at times of increased elevation of the arm[27,28], predispose patients to recurrence. Bone loss is best evaluated with use of CT scans, which should be ordered when radiographic findings are positive (e.g., when a Hill-Sachs lesion is identified on a Stryker notch view[29,30] or a glenoid defect is identified on an axillary view), elevated clinical suspicion, or midrange instability.

Although radiography can be used to assess for substantial amounts of bone loss on the glenoid and humerus, CT scans allow for more precise quantification of bone loss. The best CT scan views to evaluate the glenoid are sagittal cuts and three-dimensional reconstructed *en face* views of the glenoid with the humerus subtracted[31,32]. The inferior two-thirds of the glenoid forms a circle, and bone loss results in circumferential asymmetry. A 1.5-mm osseous lesion corresponds to a glenoid bone loss of 5%[33]. It is known that glenoid bone loss in the range of >18% to 25% of the glenoid surface area increases the risk of failure of nonoperative management and of operative management that does not address the bone loss[24,34,35].

History and Physical Examination

History and physical examination are crucial during the initial patient encounter. An understanding of the mechanism of injury, the need for manual reduction, and the history of prior dislocations or subluxations (including age at first occurrence) is paramount. The physician should note the time interval between instability events, the length of time that the shoulder was dislocated prior to reduction, any prior treatment (surgical and/or nonsurgical), activity level (contact versus noncontact versus nonathletic), and provocative activities (e.g., overhead activities, activities requiring external rotation, or position during sleep).

Physical examination should begin with an assessment of the range of motion of the cervical spine and an examination of the acromioclavicular and sternoclavicular joints, with a notation made of any pain or instability. Passive and active glenohumeral range of motion and strength should be assessed, and a neurovascular examination should be performed, as the risk of axillary nerve injury ranges from 5% to 35% after anterior shoulder dislocation[36,37]. The integrity of the rotator cuff should be assessed in patients who are older than forty years of age[38]. Any signs of ligamentous laxity with use of the criteria of Beighton and Horan should be noted, including passive dorsiflexion of the fifth metacarpophalangeal joint >90°, passive apposition of the thumb to the flexor surface of the forearm, hyperextension of the elbow or knee >10°, and the ability to touch the palms flat to the floor while keeping the knees either extended or hyperextended on forward bend[39].

Provocative examination maneuvers specific to shoulder instability should be performed. (Fig. 1). The anterior apprehension test[4] is performed by progressively externally rotating the patient's shoulder while holding the arm in 90° of abduction, and is best performed with the patient supine. A positive test is marked by a sense of apprehension, which can be manifested

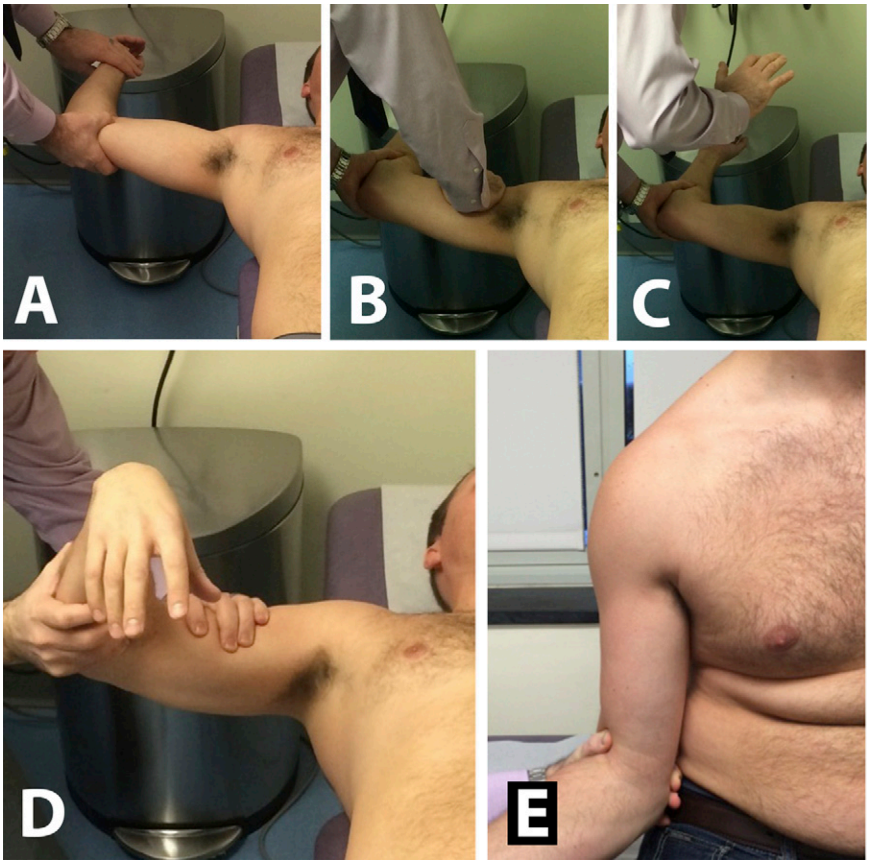

Fig. 1

Figs. 1A through 1E Photographs demonstrating provocative examination maneuvers specific to shoulder instability: anterior apprehension test (Fig. 1A), relocation test (Fig. 1B), anterior release test (Fig. 1C), load-and-shift test (Fig. 1D), and sulcus sign (Fig. 1E).

as fear of pain and instability. This test is completed with the relocation test, which evaluates for resolution of pain and apprehension when a posteriorly directed force is subsequently applied[40]. If releasing this posteriorly directed force produces a sense of pain, instability, or apprehension, the anterior release test is positive with a sensitivity of 64% and a specificity of 98% for anterior instability[41]. The load-and-shift test evaluates the degree of glenohumeral translation and is best performed both when the patient is awake and cooperative as well as when the patient is under anesthesia prior to any surgical intervention. With the patient supine (or positioned in the beach-chair or lateral decubitus position preoperatively), an axial load is applied to the humeral shaft to center the humeral head on the glenoid. An anteroinferior force is applied, and the test is graded on the basis of the amount of translation of the humeral head that occurs in relation to the glenoid rim: Grade 1 (to the glenoid rim), Grade 2 (over the glenoid rim but spontaneously reducible), and Grade 3 (over the glenoid rim and not spontaneously reducible). This test has poor sensitivity but has a 98% specificity in diagnosing glenohumeral instability[42]. Finally, the sulcus sign is used to assess inherent laxity and rotator interval competency. With the patient seated, inferior traction is applied to the arm, first with the arm in neutral position and then with the arm positioned in 30° of external rotation. Rotator interval incompetency is suspected if the sulcus persists when the arm is positioned in external rotation, and the incompetency is graded as 1+, 2+, or 3+, depending on the number of centimeters of displacement.

Imaging

Radiographs remain the standard initial imaging modality after glenohumeral dislocation and are an important tool in the evaluation of concentric reduction and in ruling out any concomitant osseous injury of the glenoid rim (Bankart lesion) or humeral head (Hill-Sachs lesion). Initial radiographs should include anteroposterior and supine axillary or West-Point (prone) axillary views[29]. Anteroposterior radiographs made with the shoulder in internal and external rotation are also useful in evaluating the humeral head for Hill-Sachs lesions. The internal rotation view is particularly important after an anterior glenohumeral instability event because it can be used to evaluate the contour of the posterior aspect of the humeral head. If the Hill-Sachs lesion is evident on the internal rotation view, the size of the defect is more substantial and the potential for an engaging lesion is more likely.

Magnetic resonance imaging (MRI) is further used to evaluate the soft-tissue envelope surrounding the glenohumeral joint and, given the high incidence of injury with glenohumeral dislocation, MRI evaluation of the rotator cuff is recommended in all patients who are older than forty years[43,44]. Furthermore, MRI is useful in confirming the presence of Bankart or so-called Perthes (injury of the anterior portion of the labrum with periosteal sleeve avulsion)[45] lesions, ruling out a HAGL (humeral avulsion of the inferior glenohumeral ligament)[46] lesion, and evaluating patterns of bone-marrow edema.

Although radiography can be used to assess for substantial amounts of bone loss on the glenoid and humerus, CT scans allow for more precise quantification of bone loss. CT scans are typically unnecessary for patients with a first-time dislocation, unless there is an elevated suspicion for glenoid bone loss (e.g., radiographic evidence or marked instability). CT is a useful assessment tool in patients who have sustained a second or third dislocation, for patients with a dislocation that occurred more than four to five hours prior to reduction, and for patients in whom primary stabilization has failed[47]. The ideal series for evaluation and quantification of bone loss are three-dimensional reconstructed *en face* glenoid views with the humerus subtracted[32].

Natural History of Primary Dislocation

Primary dislocation is typically treated nonoperatively, although there is a higher rate of recurrence in young patients. In a study of 324 patients[14], the redislocation rate in patients who were younger than twenty years of age was greater than 90%, while the redislocation rate in patients who were older than forty years of age was below 25%. This finding has been reproduced recently, in two large series. Kralinger et al.[16] noted that age between twenty-one and thirty years was a risk factor for recurrence in a retrospective series of 180 patients, and Hovelius et al.[18] confirmed these results in a prospective study of 255 patients (257 shoulders) with a twenty-five-year follow-up. In that study, 43% had no additional dislocations, 7% had one recurrence or subluxation, 27% had an operative procedure because of recurrent dislocation, and 22% had a recurrent dislocation or subluxation but no operative treatment. In patients who were twenty to twenty-five years old at the time of primary dislocation, 50% either never had a recurrence or stabilized over time without surgery. Adolescent athletes tend to have the greatest risk for recurrence, with redislocation rates of 70% to 80% for nonoperative treatment versus 13% to 14% for arthroscopic stabilization[17,19].

In addition to age at the time of first dislocation, there is a sex-specific difference in recurrence rate following nonoperative treatment, with male patients demonstrating a greater than 50% recurrence rate well into their middle to late twenties as compared with females, who reach a 50% recurrence rate in their late teens[15].

Nonoperative Management of Acute Shoulder Dislocations

Acute dislocations of the glenohumeral joint should be reduced as quickly as possible. A reduction should be attempted prior to obtaining radiographs if an athlete is evaluated on the field or sideline[48]. The axillary nerve should be evaluated prior to reduction. Following closed reduction, the patient is immobilized in a sling for one week, followed by range-of-motion exercises as tolerated. The patient is then transitioned to a strengthening program that focuses on scapular stabilization. Although the historical treatment for first-time glenohumeral dislocation has been immobilization, this has been debated in the literature in the past decade (i.e., 2004 to 2014). In a prospective series of 257 primary dislocations, no difference was found between groups randomized to immobilization or no immobilization[18].

The method of immobilization has been debated in the literature, as well. Because anterior glenohumeral dislocations classically create a Bankart lesion, or a detachment of the inferior glenohumeral ligament-labrum complex from the glenoid, bracing in external rotation has been advocated by some authors as a means of closed reduction of the fragment. Pennekamp et al.[49] used MRI to show that the Bankart lesion was reduced when the shoulder was positioned in external rotation and displaced when the shoulder was positioned in internal rotation. These results have not been clearly substantiated clinically. One randomized controlled trial of 198 patients found that the recurrence rate with immobilization in external rotation was 26% as compared with a rate of 42% in the group braced in internal rotation[50]. A subsequent randomized controlled trial found no difference in recurrence of instability in those braced in external rotation and those treated with a conventional sling in internal rotation[51], thus leaving position of immobilization a matter of debate.

Operative Management of Glenohumeral Instability

A recent review of eighteen studies (including four randomized controlled trials) found that arthroscopic stabilization was associated with a higher risk of recurrent instability (18% versus 8%) as well as reoperation (relative risk = 2.32)[52]. Furthermore, a recent randomized controlled trial comparing open and arthroscopic stabilization for recurrent traumatic anterior shoulder instability in 196 patients showed increased recurrence in those who underwent arthroscopic stabilization (23% versus 11%), despite no differences in patient-reported outcome scores after two years of follow-up[53]. Despite historical data indicating the superiority of primary open stabilization, that treatment method has fallen out of favor even in the treatment of young, active patients, as it is more invasive than arthroscopic stabilization, is associated with the risk of subscapularis insufficiency, and because recent data have shown equivalence or superiority of modern arthroscopic techniques[20,54-56].

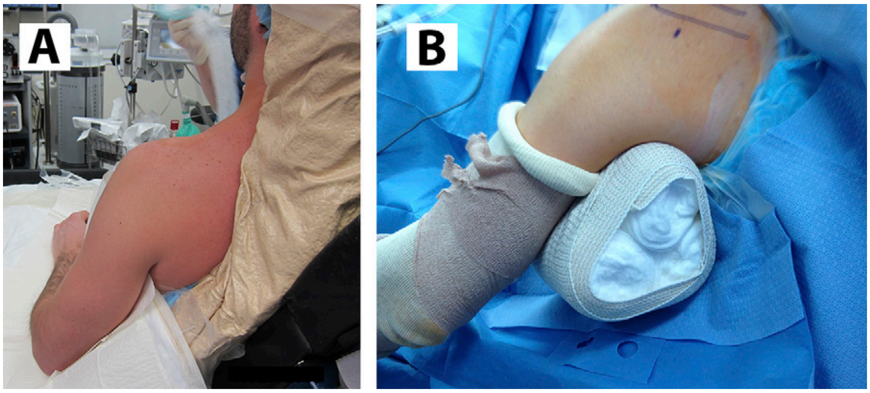

Fig. 2

Figs. 2A and 2B Patient positioning takes place in the beach-chair (modified Fowler) position, with use of a beanbag extending to the medial border of the scapula (Fig. 2A). A bump is constructed and placed in the axilla and provides distraction in conjunction with a pneumatic arm holder in order to enhance the arthroscopic working space (Fig. 2B). (Reprinted from Moran CJ, Fabricant PD, Kang R, Cordasco FA. Arthroscopic double-row anterior stabilization and Bankart repair for the "high-risk" athlete. Arthrosc Tech. 2014 Feb;3(1):e65-71, with permission of Elsevier and the Arthroscopy Association of North America.)

Risk factors for failure of operative stabilization include age younger than twenty years, involvement in competitive or contact athletic sports, shoulder hyperlaxity, a Hill-Sachs lesion present on the anteroposterior radiograph with the shoulder positioned in external rotation, and loss of the anteroinferior glenoid contour on the anteroposterior radiograph[7,8,10,20,23,53]. These factors have been used to develop the instability severity index score, which identifies patients who may be treated more effectively with open stabilization[23]. In addition, the number of formal reductions required following anterior dislocation has also been shown to be directly correlated with failure following arthroscopic anterior dislocation[9,21].

Indications

Currently, open stabilization tends to be utilized in patients who are at high risk of recurrence of dislocation. Open stabilization is of particular benefit in the treatment of patients who are considered to be at high risk of recurrence due to the following: participation in contact sports, age younger than twenty-five years (particularly when those patients are involved in at-risk sports or activities), the occurrence of more than three dislocations requiring formal reduction, a demonstrable glenoid or humeral head bone loss warranting bone augmentation or transfer (e.g., the Latarjet procedure[57], the Bristow procedure[58], or a free allograft or autograft procedure[59]), the presence of a HAGL lesion, the presence of hyperlaxity, or the need for a revision stabilization procedure[60,61].

Soft-Tissue Stabilization

Patients are typically positioned in the beach-chair position (modified Fowler position), and a deltopectoral approach is utilized. After a thorough diagnostic arthroscopy is performed, the anterior portal incision is extended inferiorly toward the anterior axillary skin crease[62]. The cephalic vein is identified and retracted laterally as the deltopectoral interval is developed. The subscapularis tendon is identified, and the bicipital groove is palpated. The tendon is incised 1 cm medial to the insertion site, and sutures are placed in the subscapularis tendon, which is sharply dissected off the capsule and retracted medially for later repair. Next, the surgeon identifies the Bankart lesion and performs a direct repair to bone using a simple or mattress suture technique via knotless or standard anchors (according to the surgeon's preference). An inferior-to-superior capsular shift is then performed with plication of redundant capsule before repairing the capsule to the humerus. In treating the occasional athlete who does not have a Bankart lesion and has capsular pathology only, the surgeon can split the interval between the middle and inferior glenohumeral ligaments and shift the inferior limb superiorly and the superior limb inferiorly using a standard capsular shift technique[63]. Finally, the surgeon repairs the previously divided subscapularis tendon.

Coracoid Transfer and Bone-Block Techniques

Bone-block supplementation techniques are indicated when there is glenoid bone loss with resorption. The Latarjet coracoid transfer procedure provides a triple blocking effect by increasing the anterior-to-posterior diameter of the inferior portion of the glenoid fossa, making it more difficult for the humeral head to subluxate or dislocate[64]. Also, the conjoined tendon acts as a sling, reinforcing the inferior capsular ligamentous complex and the inferior portion of the subscapularis. Finally, repair of the inferior capsular ligamentous complex to the stump of the coracoacromial ligament reconstructs the capsulolabral anatomy. Following the preparation of the coracoid bone block, the subscapularis muscle is divided in line with its fibers at the junction of the middle and inferior thirds of the muscle. The glenoid is exposed and the coracoid is positioned

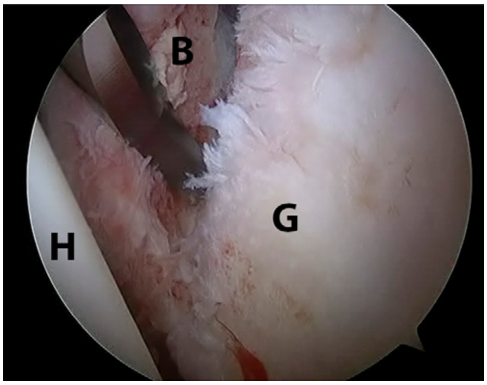

Fig. 3
A 70° arthroscopic lens enhances visualization around the glenoid during fragment mobilization. G = glenoid, H = humeral head, and B = Bankart lesion. (Reprinted from Moran CJ, Fabricant PD, Kang R, Cordasco FA. Arthroscopic double-row anterior stabilization and Bankart repair for the "high-risk" athlete. Arthrosc Tech. 2014 Feb;3(1):e65-71, with permission of Elsevier and the Arthroscopy Association of North America.)

flush with the articular surface of the glenoid, fixed in place with screw fixation to the scapula. Performance of the Latarjet procedure with use of a "classic" or "congruent arc" technique has been described[65]. Alternatives to the use of Latarjet coracoid transfer in the setting of revision would be the use of a free autograft (e.g., from the iliac crest) or an allograft from the distal tibial plafond; these two techniques provide mechanical blocks to dislocation but do not provide a sling effect[59].

Conversely, the Bristow coracoid transfer employs only the distal tip of the coracoid, providing a sling effect without an enhanced mechanical block to dislocation. Furthermore, the small fragment of bone may allow only one fixation point, leading to a high risk of nonunion and rotational instability[66].

Arthroscopic Anterior Shoulder Stabilization

While there is a clear role for open stabilization (e.g., for shoulders with a large osseous lesion, poor-quality tissue,

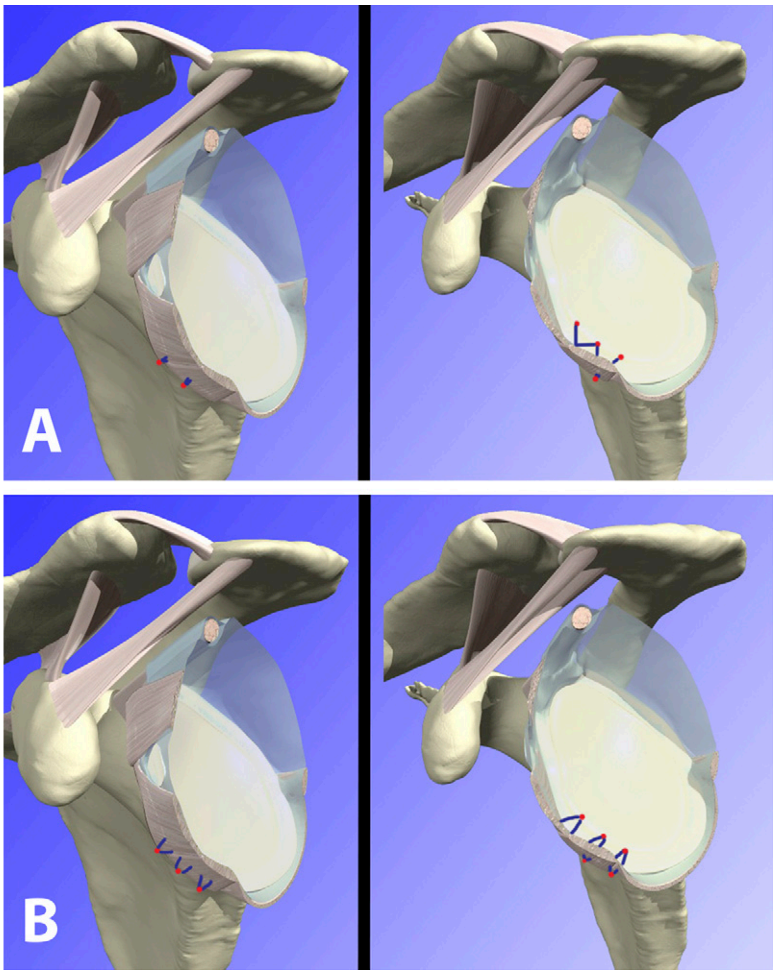

Fig. 4
Figs. 4A and 4B Two suture anchor configuration patterns for arthroscopic double-row Bankart repair are demonstrated: the Cassiopeia ("W") divergent technique (Fig. 4A) uses one more anchor laterally than medially, while the convergent ("M") technique (Fig. 4B) uses a symmetric number of anchors medially and laterally with the suture limbs converging to a single lateral row anchor. Suture management and tensioning are more predictable with use of the convergent technique because of the one-to-one anchor configuration. (Reprinted, with permission of Elsevier and the Arthroscopy Association of North America, from Moran CJ, Fabricant PD, Kang R, Cordasco FA. Arthroscopic double-row anterior stabilization and Bankart repair for the "high-risk" athlete. Arthrosc Tech. 2014 Feb;3(1):e65-71.)

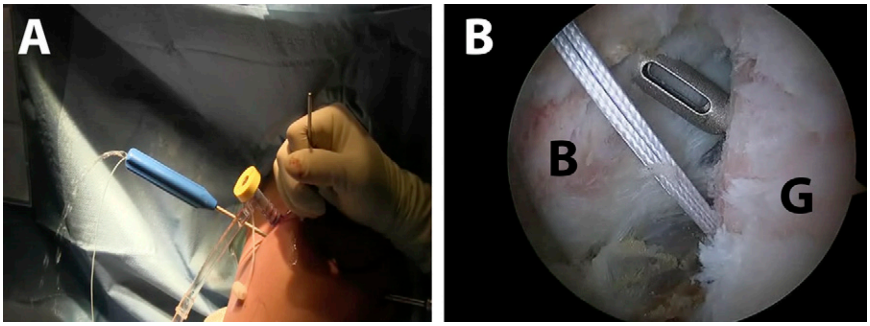

Fig. 5

Figs. 5A and 5B A percutaneous guide is passed lateral to the conjoined tendon (Fig. 5A) to establish the medial row of anchors 10 to 15 mm medial to the articular surface of the glenoid (Fig. 5B). G = glenoid, and B = Bankart lesion (both labeled in black lettering).

hypermobility, or a need for revision surgery), advanced arthroscopic fixation techniques may allow for refinement of the indications for open and arthroscopic stabilization. Objective data suggest that the outcomes of open and modern arthroscopic stabilization techniques for recurrent traumatic anterior shoulder instability are similar in the setting of minimal bone loss[54-56]. This information has resulted in a relative increase in the use of arthroscopic stabilization techniques and an overall decline in open stabilization techniques[67,68]. Furthermore, recent data from a study of 3854 active-duty military patients who underwent Bankart repair revealed a 4.5% rate of recurrence after arthroscopic stabilization and a 7.7% rate of recurrence after open stabilization[20].

While arthroscopic single-row techniques are commonly employed for primary surgical management in patients with capsulolabral avulsions, recent cadaveric studies have shown that double-row fixation may better restore normal anatomy[69-71]. This is true even in the setting of small (≤25% of the glenoid surface area) osseous Bankart lesions as well[72]. Arthroscopic approaches to shoulder stabilization may benefit from the application of these principles in the clinical setting[73]; however, this remains an area of future research interest as, to our knowledge, no comparative clinical studies have been performed to date to demonstrate the superiority of the double-row technique over traditional techniques. Herein we describe our technique for shoulder stabilization through double-row capsulolabral repair of a soft-tissue Bankart lesion in the high-risk patient or the patient with a small osseous Bankart lesion (Video 1).

We utilize double-row stabilization in patients with recurrent instability, for patients with first-time dislocation who are at a high risk of having a recurrence, in male patients who are younger than twenty-five years of age, in patients who participate in collision or overhead athletic sports, and/or in patients who have had more than three dislocations requiring a formal reduction. Contraindications include hyperlaxity due to a genetic collagen disorder, substantial bone loss greater than 20% to 25% of the glenoid width, a large or engaging Hill-Sachs lesion, revision surgery in athletes who participate in contact sports, and/or poor-quality capsulolabral tissue.

With the patient in the beach-chair position (Fig. 2), the procedure begins with an arthroscopic examination of the shoulder. A standard posterior portal is used as well as an anterior portal through the rotator interval[74]. Both the 30° and 70° lenses are utilized for arthroscopic inspection (Fig. 3). In particular, the anterior and posterior aspects of the labrum and the capsule should be examined in order to ensure that any lesions

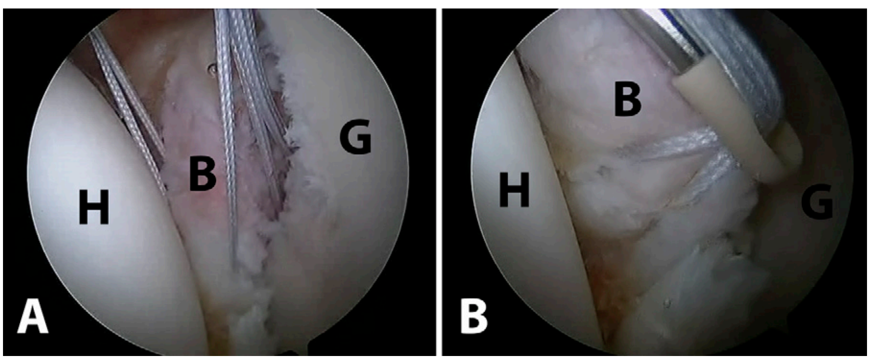

Fig. 6

Figs. 6A and 6B The anchor suture limbs are passed from the medial row (Fig. 6A) and are prepared on knotless anchors for lateral-row fixation (Fig. 6B). G = glenoid, H = humeral head, and B = Bankart lesion (all labeled in black lettering).

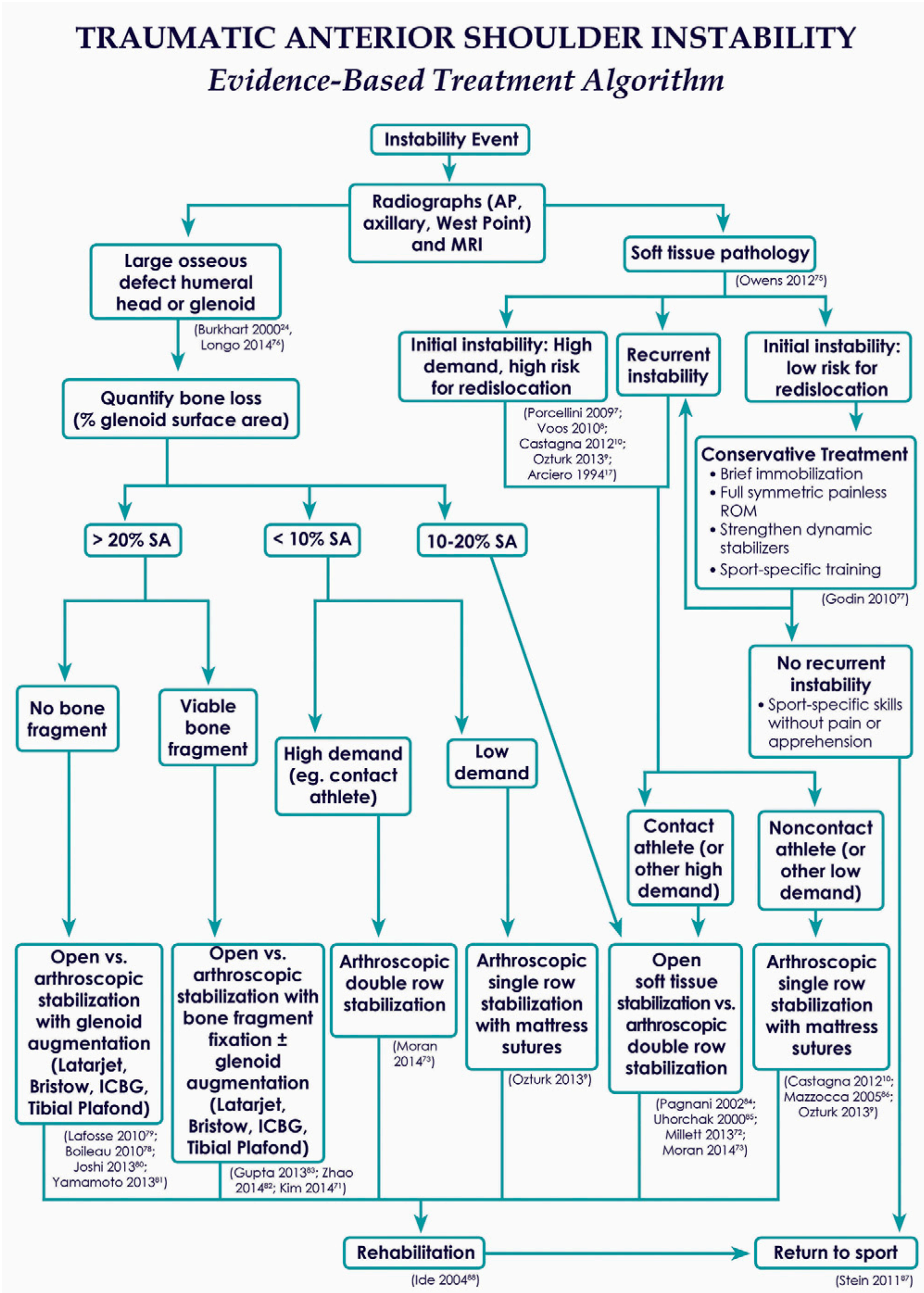

Fig. 7

An evidence-based treatment algorithm for traumatic anterior shoulder instability is shown, focusing on the treatment of capsulolabral and glenoid pathology. In any shoulder in which a humeral-head defect is present (i.e., a Hill-Sachs lesion), the surgeon may elect to perform an additional procedure such as remplissage or bone-grafting, depending on the size and location of the defect. AP = anteroposterior, MRI = magnetic resonance imaging, ROM = range of motion, SA = surface area, and ICBG = iliac crest bone graft.

that may be present in the posterior aspect of the shoulder are identified. Careful inspection for bone loss should be routinely performed for humeral-sided defects (Hill-Sachs lesions) and osseous Bankart lesions. In the event that the decision is made to convert to open surgery, the anterior portal incision can be extended inferiorly toward the anterior axillary skin crease[62].

To perform a double-row repair (Video 1, Fig. 4), the so-called footprint is prepared with a mechanical shaver. In the event of a chronic tear, the capsulolabral tissue is elevated sharply with an arthroscopic blade prior to footprint preparation. The surgeon places a percutaneous long needle while staying lateral to the conjoined tendon. A guidewire and cannulated drill are introduced. The surgeon then identifies the correct location for the medial row of anchors that will be placed 10 to 15 mm medial to the articular surface of the glenoid. Each of the two to four anchors (depending on the size of the lesion) is placed (progressing from inferior to superior) without removing the drill guide (Fig. 5). The anchor suture limbs are passed from the medial row with use of an outside-in or inside-out technique (Fig. 6). Sutures are prepared on knotless anchors for lateral-row fixation at the articular margin. A final inspection is performed through the anterosuperior and posterior portals with use of both 30° and 70° lenses, followed by an inspection of the subacromial space.

Postoperative Rehabilitation

Regardless of the operative technique used, postoperative rehabilitation is critical to successful surgical treatment. For the first three weeks, the patient is immobilized in a sling. Once healing begins, active-assisted range of motion to as much as 90° in the scapular plane and to as much as 25° in external rotation is allowed. By four to six weeks, the sling is discontinued and progressive range of motion is achieved. Gradual strengthening takes place during weeks six to twelve, followed by flexibility, strengthening, plyometric exercises, and closed-chain strengthening. Typically, patients may return to sports activities approximately six months postoperatively; however, this is dependent on progression through the previous stages of rehabilitation.

Authors' Preferred Treatment Algorithm

A graphical evidence-based treatment algorithm is outlined in Figure 7. When surgically treating glenohumeral instability, we prefer to use single-row arthroscopic repair for the management of noncontact athletes who are more than twenty-five years of age, double-row arthroscopic repair for the management of younger contact athletes who have recurrent dislocation and osseous or soft-tissue Bankart lesions, and open stabilization in the management of patients who have capsular laxity or who are undergoing revision surgery for the performance of a formal capsular shift. In the event of bone loss without a viable bone fragment, we prefer to perform an open Latarjet reconstruction with a "classic" technique.

Conclusion

Anterior glenohumeral joint dislocations are exceedingly common. Initial evaluation should include a careful documentation of the patient's medical history, a physical examination, and imaging consisting of radiographs (anteroposterior and axillary views). Subsequent advanced imaging may be obtained to evaluate the rotator cuff and soft-tissue envelope (with use of MRI) and/or osseous pathology (with use of CT scan) as appropriate. Risk factors for recurrent instability (e.g., glenoid bone loss, patient demand, patient age, number of dislocation events, and ligamentous laxity) should be carefully elucidated in order to guide treatment.

The natural history of primary dislocation is largely dependent on age, with younger patients at greater risk of recurrent instability. When nonoperative management is chosen, there are conflicting Level-I studies (prospective randomized controlled trials) advocating for postreduction immobilization of the shoulder in both internal rotation and external rotation. Neither method of immobilization is clearly superior.

Operative treatment may be performed via arthroscopic or open surgery. Previous literature favors open surgery; however, with newer arthroscopic techniques and instrumentation, primary arthroscopic stabilization is favored because it is less invasive, eliminates the risk of subscapularis insufficiency, and has been associated with postoperative outcomes similar to those obtained with open surgery. Indications for open surgical management are the following: revision surgery, poor tissue quality, substantial bone loss, and patients who are considered to be at an especially high risk for redislocation. Coracoid transfer and bone-block techniques are typically reserved for the revision setting, and most investigators favor an open approach. Arthroscopic management with use of double-row techniques is an option in the young high-demand athlete who is without appreciable bone loss, as double-row techniques allow for greater footprint restoration and improved fixation.

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