Arthroscopic Anterior Shoulder Stabilization With Incorporation of a Comminuted Bony Bankart Lesion

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Abstract: Bony Bankart lesions are a common finding in patients with anterior glenohumeral dislocation. Although there are no defined guidelines, small bony Bankart fractures are typically treated arthroscopically with suture anchors. The 2 main techniques used are double- and single-row suture anchor stabilization, with debate over superiority. Biomechanical studies have shown improved reduction and stabilization with the double-row over the single-row suture anchor technique; however, this has not been reported for small or comminuted bony fragments. Both techniques have shown promising preliminary clinical outcomes. In this Technical Note, we describe our preferred technique for arthroscopic instability repair using a single-row all-suture anchor method with the incorporation of a comminuted bony Bankart fragment in the lateral decubitus position.

Bony Bankart lesions have been associated with up to 30% of anterior dislocations[1] and consist of an avulsion fracture of the anterior glenoid rim.[2] Multiple techniques are available for the surgical treatment of a bony Bankart lesion, with some surgeons advocating open fixation whereas others prefer arthroscopic techniques. Although there are no strict management guidelines, it is suggested that acute bony Bankart lesions with a fragment size of less than 25% of the glenoid area can be fixed arthroscopically and that chronic lesions or lesions of greater than 25% should be treated with open techniques,[3] such as the Bristow-Latarjet stabilization procedure. Two main arthroscopic techniques for a small bony Bankart repair have been described in the literature: single-row suture anchor fixation versus double-row suture fixation.[1-3] Biomechanical studies have shown improved reduction and stabilization with the double-row over the single-row suture anchor technique; however, both techniques have shown promising preliminary clinical outcomes.[4] Comparison of long-term clinical functional outcomes between the 2 techniques is still needed.[4] Arthroscopic management of a comminuted bony Bankart lesion is less reported on in the literature, with no consensus as to the optimal surgical technique.

In this Technical Note, we describe our preferred technique for arthroscopic instability repair with the incorporation of a comminuted bony Bankart fragment in the lateral decubitus position. A summary of key steps is provided in Table 1, and a summary of the technique is provided in Video 1.

Surgical Technique

Preoperative Planning

For patients with clinical reports of instability, initial radiographs are obtained, including an axillary lateral view and a Stryker notch view to evaluate for a Hill-Sachs lesion. Magnetic resonance imaging is obtained to evaluate the soft-tissue injury and can also show bony injury to the glenoid (Fig 1A). Our preference for optimal evaluation of bony injury is to obtain a computed tomography scan with

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Table 1. Key Steps for Arthroscopic Stabilization With Incorporation of Comminuted Bony Bankart Lesion

Place an anterior portal immediately above the subscapularis tendon, and establish an anterosuperior viewing portal immediately inferior to the long head of the biceps tendon.
Using a Bankart elevator, elevate the bony Bankart fragment.
Debride the labrum and capsule.
Create a bleeding bed on the glenoid with a bone shaver to encourage healing.
Percutaneously place a double-loaded suture anchor at the posteroinferior position.
Pass sutures through the labrum, reapproximate the labral position, and tie these first 2 sutures immediately while holding the labrum and bony defect reduced with an arthroscopic grasper.
Establish double-loaded suture anchors at the 5:30 clock-face position—usually placed through a percutaneously established trans-subscapularis portal.
Pass sutures through the capsule and labrum.
Place double-loaded sutures within the bony defect. Pass the sutures around the bony fragment, incorporating the bony defect, labrum, and capsule.
Establish the final anchor at the 3-o'clock position with sutures passed through the capsule and labrum. Tie the sutures while the labrum is held reduced with an arthroscopic grasper.
Tie the remaining sutures from inferiorly to superiorly while still holding the injury in a reduced position.
After standard closure, immobilize the shoulder in an abduction sling for 6 wk.

3-dimensional reconstructions of the glenoid with subtraction of the humeral head (Fig 1B). These images can help in the decision-making process regarding attempted fixation of a bony fragment versus bony reconstruction with a coracoid transfer procedure.

Patient Positioning

An interscalene nerve block is administered preoperatively. After the induction of general anesthesia, a beanbag is used to keep the patient in the lateral decubitus position. Our preference is to perform instability procedures in the lateral position given the excellent visualization this provides circumferentially of the glenoid and the labrum. An axillary roll is placed, and the down leg is well padded to decrease the risk of neural injury. An examination under anesthesia is performed to evaluate anterior instability and check for posterior and inferior instability. The operative arm is suspended in a traction arm holder (Spider 2; Smith & Nephew, Andover, MA) with an arm positioner placed under the mid arm to provide further lateral distraction (Fig 2).

Initial Arthroscopic Approach and Preparation

A standard posterior portal is established, and a 30° arthroscope is inserted into the glenohumeral joint. A diagnostic arthroscopy is performed to thoroughly inspect the joint and evaluate the status of the labrum and bony injury to the glenoid and posterior humeral head. An anterior portal is established in the rotator interval under spinal needle localization immediately superior to the upper border of the subscapularis tendon, and an 8.25-mm cannula is inserted (Fig 3). The labrum and bony Bankart lesions are probed, and a bone-cutting shaver is used to debride the fracture bed. Then, an arthroscopic Bankart elevator is used to mobilize the fracture fragments. An anterosuperior portal is established immediately inferior to the biceps

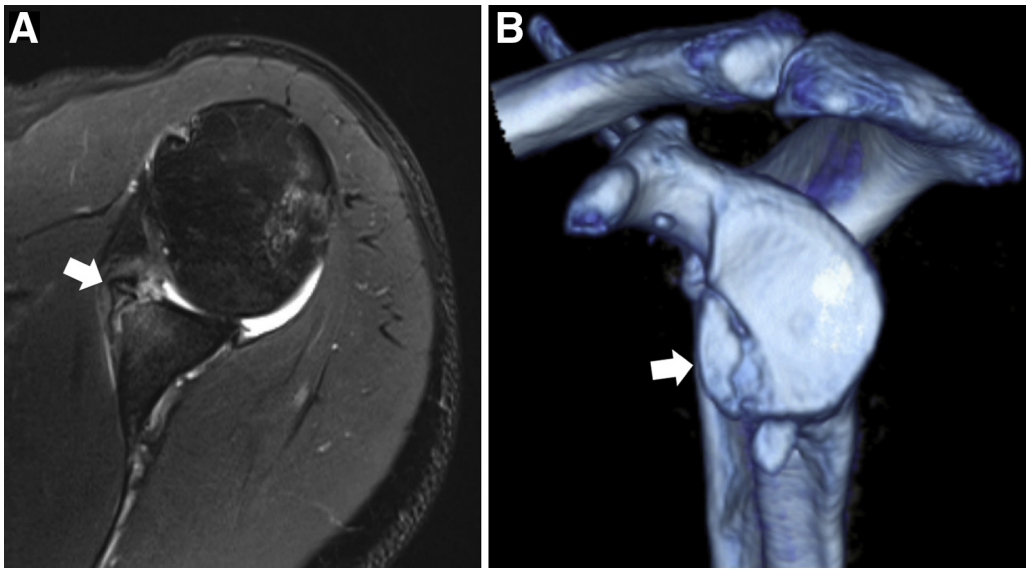

Fig 1. (A) Preoperative fat-suppressed, T2-weighted, axial magnetic resonance image of a left shoulder showing a minimally displaced anteroinferior glenoid fracture (arrow) with associated capsular injury in a 44-year-old male patient. (B) Preoperative 3-dimensional reconstruction of a computed tomography scan of the glenoid showing a minimally displaced glenoid fracture (arrow) consistent with a bony Bankart lesion.

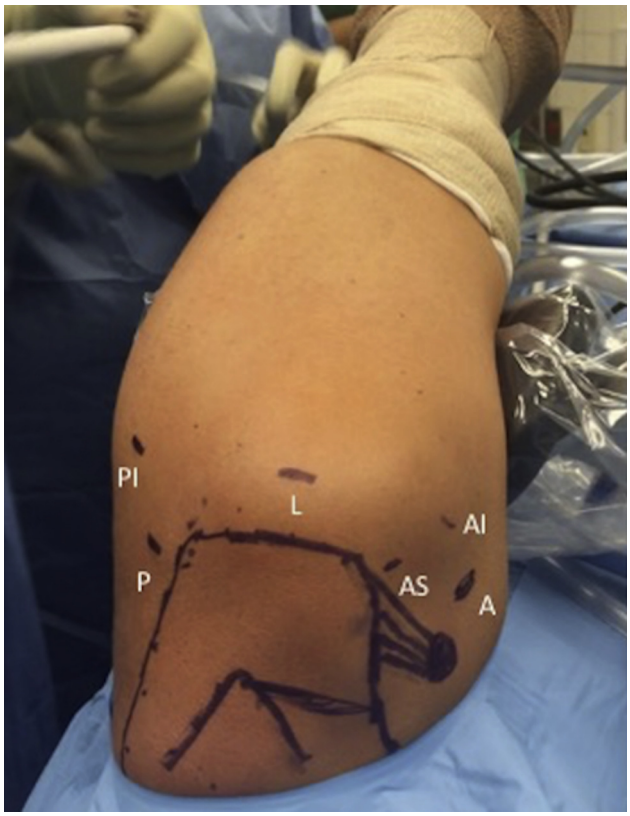

Fig 2. Preoperative photograph showing the patient in the lateral decubitus position with the left arm in traction using an axillary support. The acromion and clavicle are identified, and their locations are marked on the skin, as are the posterior (P), posteroinferior (PI), lateral (L), anterosuperior (AS), anterior (A), and anteroinferior (AI) (trans-subscapularis) portals.

tendon and more medial than the initial low anterior portal, and a 6-mm cannula is inserted. The arthroscope is switched to the anterosuperior portal to allow for a bird's-eye view of the labrum and bony defect, and the shaver and elevator are used to finalize preparation of the anterior glenoid (Fig 4A). It is imperative to ensure the capsulolabral complex and bony fragment are freely mobilized because they are often adhered more medially. In addition, if the bony fragment is smaller than anticipated or has resorbed, the surgical plan may need to be altered to a coracoid transfer or bony augmentation procedure if the patient has been appropriately counseled and provided consent for this option. Reduction of the fragments and soft tissue is checked provisionally by mobilizing them to their appropriate position with an arthroscopic grasper (Fig 4B). Finally, we often place drill holes on the bony surface to create a bleeding surface and optimize healing. In the presented case example, the bony injury extends from the 4- to 6-o'clock position with soft-tissue injury from the 6- to 7-o'clock position and 3- to 4-o'clock position (Fig 4B).

Reduction and Fixation of Bony and Soft-Tissue Injury

A posteroinferior portal is localized with a spinal needle. The trajectory is checked to allow for placement of a posteroinferior anchor (7- to 8-o'clock position in the left shoulder). The first anchor is inserted percutaneously and should be positioned at the far extent of the labral injury. A drill guide is passed down to the glenoid rim, a pilot hole is placed, and a double-loaded anchor (SutureFix Ultra; Smith & Nephew) is inserted (Fig 5A). A switching stick is inserted, followed by a soft-tissue dilator, and a threaded 8.25-mm cannula is inserted into the joint. Sutures are managed through the anterior portal. A suture-passing device (Spectrum II; ConMed Linvatec, Largo, FL) curved to the side opposite the involved shoulder (curved to the right for a left shoulder) is used to place a passing suture (No. 1 polydioxanone suture; Ethicon, Somerville, NJ) through the posteroinferior capsule and labrum. Sutures from the anchor are then shuttled through the capsule and labrum in a simple configuration. It is important to note that, while passing the suture-passing device, the labrum is held with an arthroscopic grasper in a reduced position against the glenoid rim. We prefer to tie these sutures immediately to achieve provisional reduction in a posteroinferior manner (Fig 5B). The labrum again is held in position with an arthroscopic grasper as the knots are tied to maintain an anatomic reduction. Arthroscopic knots are tied with the knots positioned on the capsulolabral side to push the tissue up to the glenoid face.

Next, an anchor is placed at the anteroinferior glenoid (5:30 clock-face position to 6-o'clock position in the left shoulder). Spinal needle localization is used to establish

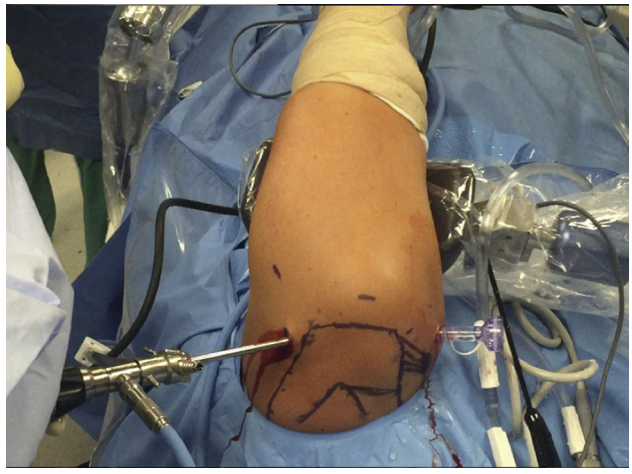

Fig 3. With the patient in the lateral decubitus position, a 30° arthroscope is placed in a standard posterior portal and an 8.25-mm cannula is inserted in an anterior portal established in the rotator interval after spinal needle localization to begin the diagnostic arthroscopy and mobilize the Bankart lesion.

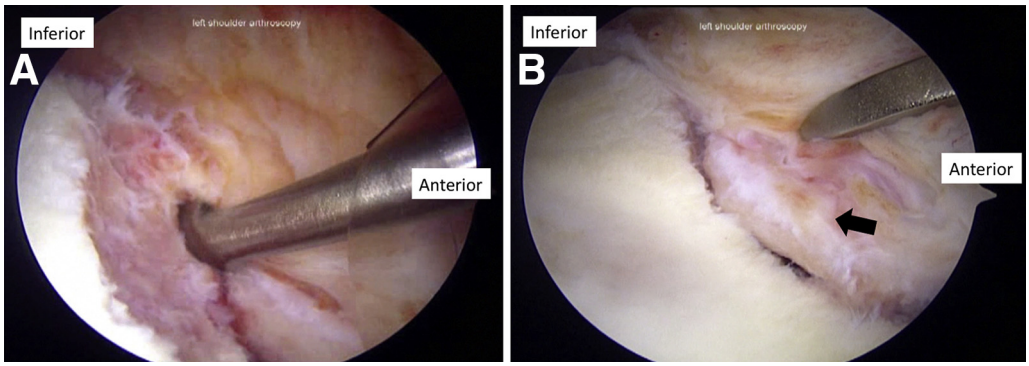

Fig 4. While viewing through the anterosuperior portal, a Bankart elevator is used through the anteroinferior portal to elevate the bony Bankart fragment from the anterior glenoid (A), and the bony fragment (arrow) is mobilized and then provisionally reduced with an arthroscopic grasper through the anteroinferior portal against the intact glenoid (B), confirming complete mobilization and the ability to achieve an anatomic reduction.

the trajectory through the subscapularis tendon. The same steps as described earlier are used to percutaneously place the double-loaded anchor, which is inserted through the upper border of the subscapularis tendon. The suture-passing device is used from the posteroinferior portal to place the passing suture around the inferior capsulolabral tissue, including the anterior band of the glenohumeral ligament. On the basis of the tear pattern, 1 of the 2 sutures from the anchor may be removed. These sutures are passed out of the posterior portal, managed outside of the cannula, and tied later in the procedure.

A third anchor is placed through the anterior portal and into the bony defect (Fig 6). The suture-passing device is used through the anterior portal to loop the passing suture around the capsulolabral tissue and bony defect. The second suture from this anchor is passed around the bony defect in a similar fashion. These sutures are then passed posteriorly, managed outside of the posteroinferior cannula, and tied later in the procedure. Additional anchors are placed into the bony defect approximately 1 cm apart until the superior end of the bony defect is reached.

Finally, the superior-most anchor is placed at the extent of the soft-tissue injury and in an area of normal glenoid bone. The anchor is inserted through the anterior portal, and the suture-passing device is used to place the passing suture through the capsulolabral tissue; the suture from the anchor is then shuttled through the tissue. When this suture is being placed, the injured tissue is held in an anatomic position with the arthroscopic grasper. After placement, this suture is tied immediately while the labrum is still being held in its reduced position (Fig 7A).

At this point, we have knots tied at the anterosuperior and posteroinferior extent of the injury and have restored the normal tension of the labrum at these points. The sutures around the bony defect are then tied sequentially, beginning inferiorly and working superiorly (Fig 7B). The grasper is used to hold the bony defect in place while the remaining sutures are tied. Excessive or inadequate tension on the knots can lead to an over- or under-reduction of the bony fragments or labrum, and holding the defect in position allows for better calibration of the tension on the knots. The final construct is inspected, the alignment of the bony defect

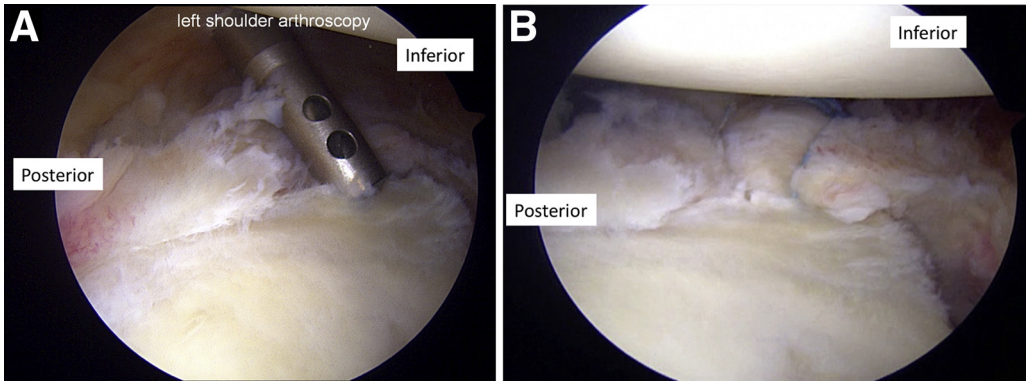

Fig 5. While viewing through the anterosuperior portal, a double-loaded all-suture anchor is placed in the posteroinferior position at the far extent of the labral injury (A); sutures are then passed through the labrum and subsequently tied immediately after placement (B), achieving provisional reduction and restoration of the labrum in a posteroinferior manner.

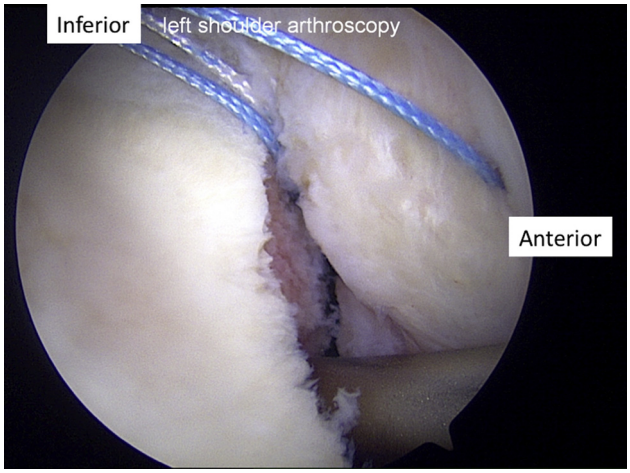

Fig 6. Viewing from the anterosuperior portal, a double-loaded all-suture anchor has been placed within the bony defect at its inferior aspect, with sutures passed around the bony fragment and the drill guide in place to insert a second anchor more superiorly within the bony defect.

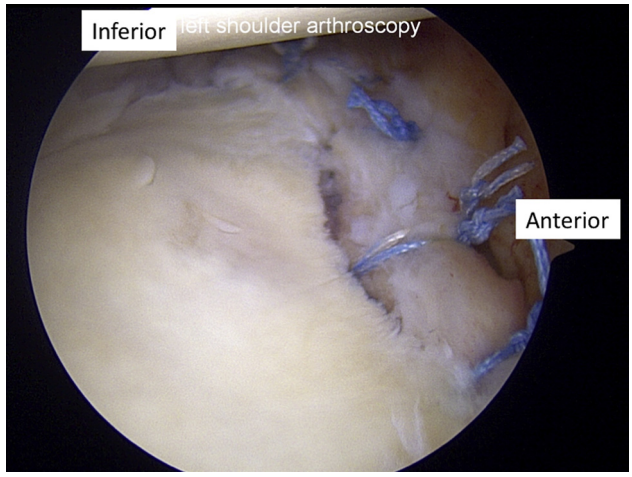

Fig 8. The final construct is inspected and probed to confirm reduction and stability of the bony fragments and restoration of the capsulolabral complex.

is checked, and the stability is confirmed by probing the defect (Fig 8).

Closure and Rehabilitation

All portals are closed with interrupted absorbable sutures, and the arm is placed in a shoulder abduction sling. Our preference is to begin passive range-of-motion exercises at 2 weeks after surgery and allow for forward flexion to 90° and external rotation to 30°. The sling is used for 6 weeks with progressive advancement of active and active-assisted range of motion with a goal of achieving full range of motion by 12 weeks. At this point, progressive strengthening exercises are started. Full return to activities is generally allowed by 6 months after surgery.

Potential Complications

The primary complication after arthroscopic surgery to treat shoulder instability is recurrent instability. In the setting of a chronic injury or resorbed bony fragments, the described technique may not be appropriate for shoulder stabilization. If an appropriate reduction is not obtained or there does not appear to be sufficient bony contact for healing, consideration should be made for a bony augmentation procedure instead. Pearls and pitfalls of this procedure are shown in Table 2, and indications and contraindications are listed in Table 3.

Discussion

In this Technical Note, we describe our preferred technique for arthroscopic stabilization with the incorporation of a comminuted bony Bankart lesion. Currently, single- and double-row suture anchor Bankart repairs remain the 2 main arthroscopic techniques used. Recent biomechanical data published by Millett and Braun[2] have shown superior stability and fracture reduction with the double−suture row technique compared with the single-row technique in a cadaveric model. This study simulated bony Bankart

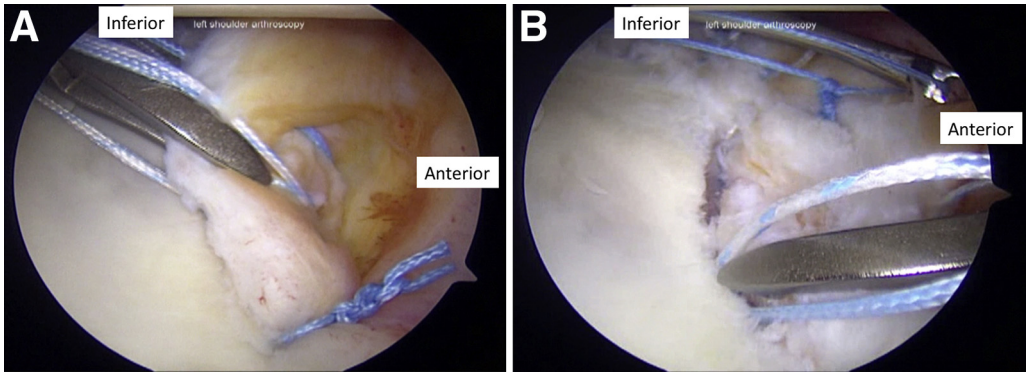

Fig 7. Viewing from the anterosuperior portal, the bone fragment is provisionally reduced to its anatomic position during the sequential tying of sutures. Sutures are tied starting at the superior anchor (A), followed by tying from inferiorly to superiorly around the bony Bankart lesion to securely fix the injury (B).

Table 2. Pearls and Pitfalls Associated With Arthroscopic Stabilization With Incorporation of Comminuted Bony Bankart Lesion

Pearls
The lateral position allows for excellent visualization and access to the entire glenoid.
Careful spinal needle localization of all portals enables precise positioning and facilitates the remainder of the procedure.
Full mobilization of the bony injury is needed before attempting fixation to allow for anatomic reduction of the bony injury, capsule, and labrum.
A posteroinferior anchor is key because this area of the labrum is often involved in the injury.
Using the arthroscopic grasper to position during suture passing and knot tying allows for proper tensioning in the setting of a comminuted fracture.
Tying the posterior knot first and superior-most knot second allows for reapproximation of the soft-tissue component of the labrum to further guide reduction of the bony portion of the injury.
Pitfalls
Failure to fully mobilize the fracture fragments will lead to an inability to reduce the labrum and capsule to their native positions.
Attempting to place the anteroinferior anchor through the low-anterior portal may lead to incomplete purchase of the anchor in the glenoid bone. This is addressed by using the percutaneous trans-subscapularis approach.
If the fragments are not held reduced while tying each suture, the injury will likely be over- or under-reduced, based on the tension applied to the knot.

lesions with a width of 25% of the glenoid and did not investigate smaller or comminuted fractures, such as observed in our clinical case. Although the double row may be able to obtain good purchase of the large bony fragment, allowing superior reduction of the fragment in the setting of a simple fracture pattern, there are no data that show this is true with small or comminuted fragments. A single row of anchors within the bony defect allows for simultaneous reconstruction of the capsulolabral structures.

Clinically, this technique has shown positive results. Porcellini et al.[3] conducted a case-series study on 25 athletic patients who underwent a single-row repair for acute bony Bankart lesions involving less than 25% of the glenoid. At 2 years' follow-up, they found no recurrences of instability and 92% of the patients returned to the same level of sport with restored function and stability. Therefore, for acute bony Bankart lesions involving less than 25% of the glenoid face, single-row suture anchor fixation has promising outcomes.

Table 3. Indications and Contraindications for Arthroscopic Stabilization With Incorporation of Comminuted Bony Bankart Lesion

Indications
Anterior shoulder instability with acute comminuted bony injury
No history of attempted stabilization surgery
Contraindications
Glenoid bone loss
Insufficient bony fragments
Inability to mobilize bony fragments back to anatomic position
Contact athletes

With certain bony defects or insufficient soft-tissue quality, some surgeons elect to fix bony Bankart lesions with a bone block procedure, most notably the Bristow and Latarjet procedures.[5] Although the injury pattern alone in our patient may lead some surgeons to consider a bony augmentation procedure, the functional demands and age of the patient, as well as the morbidity of each procedure, should be considered when making this decision. These bony procedures have been shown to provide good postoperative stability with increased complication and reoperation rates. Harris and colleagues[5] conducted a systematic review analyzing the complication and reoperation rates after Bristow-Latarjet procedures and found a complication rate of 30%, with a reoperation rate of 7%. In their study, most recurrent instability events were reported in the first year postoperatively.

With several soft-tissue surgical techniques for stabilization of small bony Bankart lesions and little evidence to suggest superiority, the surgeon's preference and training largely guide the technique used. Although both single-row suture anchor stabilization and double-row suture anchor stabilization remain the main techniques of choice, comparison of long-term clinical functional outcomes between the 2 techniques is still needed. Arthroscopic stabilization using single-row suture anchors remains our preferred technique for small and comminuted bony Bankart lesions over the Bristow-Latarjet bone block procedure because of the associated complication and reoperation rates.

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