



Open Bankart Repair: A Reproducible Technique

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Shoulder instability is one of the most common complaints seen by orthopaedic surgeons taking care of an athletic patient mix. The management of shoulder instability has varied over the years and significant controversy and debate surrounds the proper management of this pathology. Traditionally, open Bankart surgical repair was the gold standard of care; however, over the past 20 years with the advancement of arthroscopic surgery, arthroscopic shoulder stabilization has become more popular. Furthermore, a soft-tissue stabilization procedure versus a bony procedure is another consideration that the treating orthopaedic surgeon must consider when taking care of this pathology. Patient selection, risk factors, and pathology are crucial in making the correct treatment decision. Short- and long-term data regarding open Bankart repair including the indications of open Bankart repair will be discussed. Additionally, a reliable surgical technique for open Bankart repair will be presented.

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Introduction

Shoulder instability surgery is one of the most common orthopaedic surgical procedures performed in athletic populations. Furthermore, instability events and chronic instability can lead to pain, dysfunction, and decreased participation in work or sport. A recent epidemiologic study found that the incidence of shoulder stabilization surgery increased approximately 18% from 1994 (5.84 per 100,000 person-years) to 2006 (6.80 per 100,000 person-years).¹ While much of shoulder instability surgery has shifted toward arthroscopic repair and stabilization of a Bankart lesion or bone transfer procedure, the open Bankart repair should remain in the shoulder surgeon's armamentarium for patients with shoulder instability. Prior to the advance of arthroscopic techniques and implants, the open Bankart repair was the gold standard for this pathology.²⁻⁴

There have been a multitude of studies comparing both arthroscopic and open stabilization procedures in an effort to establish clinical equivalence between arthroscopic and open procedures. There are several high quality and recent short-

term studies comparing arthroscopic and open procedures. The issue of arthroscopic vs open soft tissue repair remains controversial.

A recent randomized controlled trial involving 19 military cadets with minimum 2-year follow-up demonstrated no significant difference in the Western Ontario Shoulder Instability (WOSI) Index scores or subluxation events between arthroscopic and open stabilization.⁵ Other level I studies by Jørgensen et al⁶ and Fabbriani et al⁷ also demonstrated no significant difference in instability events or outcome scores in patients with shorter follow-up, 36 month follow-up and 2-year follow-up, respectively. Another prospective randomized study with 64 active military personnel and a mean of 32 months follow-up found similar outcome metrics including the Simple Assessment Numerical Evaluation (SANE) score, Western Ontario Shoulder Instability Index (WOSI) score, Rowe, Simple Shoulder Test (SST), and University of California, Los Angeles Shoulder Rating Scale between both arthroscopic and open procedures. They did report 2 failures with open stabilization group and 1 patient in the arthroscopic stabilization group.⁸ Mohtadi et al,⁹ with a prospective randomized study consisting of 79 open Bankart repair patients and 83 arthroscopic repair patients with minimum 2-year follow-up demonstrated no difference in mean WOSI score, American Shoulder and Elbow Surgeons (ASES) score

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or shoulder range of motion; however, recurrent instability was found to be significant with 11% recurrence in the open group compared to 23% in the arthroscopic group.

More long-term case series and follow-up demonstrate higher recurrent shoulder instability rates with arthroscopic procedures. Aboalota et al,¹⁰ with a mean of 13-year follow-up data found an overall redislocation rate of 18.18% in 143 shoulders. This series found that younger age of first dislocation and less rehabilitation duration was correlated with redislocation. Other more long-term case series have demonstrated recurrent instability in 35% in 8-10 years¹¹ and 21% in 10 years.¹² When looking at overhead and collision type athletes Castagna et al¹³ found 21% recurrence at 5 years. Moroder et al¹⁴ with 20-year follow-up on 47 patients having undergone an open Bankart procedure had recurrent instability in 17.5% of patients, with 6 out of 7 of those patients having the instability event after more than 8 years without symptoms. Other long-term open Bankart repair studies with 20-year follow-up data have demonstrated similar recurrence rates.¹⁵⁻¹⁷

Young patients, particularly those who are involved in overhead activities or collision sports are more likely to have a subsequent instability event after arthroscopic stabilization. A recent study from Nakagawa et al¹⁸ followed 115 athletes after arthroscopic Bankart repair for a minimum of 2 years finding an overall postoperative recurrence of instability of 20.4%. When these data were examined considering sport specific analysis a recurrence rate of 33.3% in rugby, 17.2% in American football, other collision sports 11.1%, contact sports 14.3%, and overhead sports 12.5% was observed. A multivariate analysis found the most significant factor being younger age at operation and preoperative glenoid defect with small or no bone fragment. Cho et al¹⁹ found looking specifically at collision athletes versus noncollision athletes undergoing arthroscopic repair, that collision athletes were noted to recurrent instability 2.5 times higher in collision athletes (17.2%) than that of noncollision athletes (6.7%). Despite these reported high recurrence rates, another recent level IV study reviewing over 90 patients found their overall recurrence rates in an athletic population to be 6.4% with a mean 5-year follow-up. Additionally, they found no difference between contact and limited-contact athletes.²⁰ Open repair for athletes has shown lower recurrence rate. Pagnani's series of 119 patients treated with open Bankart repair followed for a minimum of 2 years with 83 of those patients being contact athlete found an overall recurrence rate of 2%.²¹ Similar to the Castagna et al¹³ study which had 21% recurrence in teenage athletes, Hatch and Hennrikus²² performed open Bankart repair in a similar teenage athletic population finding no recurrences of instability in their series over a 2-year period. Comparative studies between arthroscopic and open procedures have demonstrated some benefit for an open procedure. Studies by Shymon et al²³ and Rhee et al²⁴ support an open Bankart repair, decreasing the rate of recurrence by 40% and finding the recurrence rate 2-times higher for athletes who underwent an arthroscopic repair, respectively.

Similar to many procedures, revision surgery for failed primary stabilization does not have the same outcomes as a primary surgery; however, they can be effective. While this is a

smaller subset of patients and thus studies, the data highlights the importance of choosing the appropriate first line of care. Neviasser et al²⁵ with 10-year follow-up on patients undergoing open Bankart repair for revision failed arthroscopic stabilization found that there were 0 recurrences and all patients were satisfied with the surgery and would undergo it again. A study by Cho et al,²⁶ following 25 patients who underwent revision open Bankart repair for a failed arthroscopic repair reported failure at 11.5% and a mean Rowe score of 81 during a 4-year follow-up period. In the review paper by Mauro et al²⁷ focusing on failed anterior shoulder stabilization surgery they found the failure rate of revision surgery to range from 0% to 22% of open revision surgery and 0%-20% for arthroscopic revision.

An attempt to synthesize the information from the studies mentioned above demonstrates that critical patient selection is vital to successful outcomes. When counseling a patient with shoulder instability certain factors should be considered and influence the decision between arthroscopic and open procedures. Young males engaged in collision or contact sports are particularly at risk for recurrence after arthroscopic stabilization. In contrast, overhead athletes where motion is critical may be particularly suited for arthroscopic repair. Furthermore, the status of the athletic season should be considered since recovery from an open procedure will be longer. The number of dislocations and instability events should always be obtained from the patient since multiple dislocations could lead to failure of an arthroscopic procedure or lead to a diagnosis of multidirectional instability based on history. Additionally, the type and number of prior procedures in addition obtaining any prior operative notes should be obtained. Prior studies and advanced imaging should be reviewed for any additional pathology and quantifying the amount and location of bone loss.²⁸ The Instability Severity Index Score (ISIS) similarly can be a predictive tool taking into account type and level of sport, laxity, and bony lesion creating a 10-point scale, which can aid in treatment choice. The study by Balg and Boileau²⁹ found that patients with an ISIS score >6 had a 70% risk for instability recurrence with an arthroscopic procedure. Bone loss must be considered in every case and in particular, the revision setting.

The author's indications for open Bankart repair include collision male athletes less than 20 years old, 10%-20% of glenoid bone loss, so called "intermediate bone loss," multiple dislocations (>5), poor capsulolabral tissue, revision of well-done arthroscopic procedure with minor bone loss, instability events during activities of daily living or sleep.

Operative Technique

Patient Positioning and Setup

The patient is placed in a beach-chair position and given general anesthesia. It is important to slightly rotate the head away from the surgical arm to allow for improved operative field exposure. An exam under anesthesia is then performed on both extremities to examine for the affected and normal

shoulder for hyperlaxity. The patient is then positioned by flexing up the hips and padding all bony prominences in addition to placing sequential compression devices on the lower extremities. The surgical field is then prepped which includes the entire upper extremity and extending medially to the sternoclavicular joint. It is the author's preference to use a Tri-mano limb holder to aid in arm positioning during surgery.

Diagnostic Arthroscopy

A diagnostic arthroscopy is then performed utilizing a posterolateral portal. This is helpful in identifying the bony Bankart lesion, Hill-Sachs lesion, and also allows for an intra-articular view of the exam under anesthesia.

Approach

The preferred incision of the author is an anterior axillary incision from the coracoid to the axilla following Langer's lines. It is helpful to adduct the arm and then mark from axilla proximally to the coracoid for the planned incision (Fig. 1, A). A scalpel is then used for incision of the skin, followed by needle-tip electrocautery through the subcutaneous tissue to the deltopectoral fascia.

The landmark for the deltopectoral interval is the cephalic vein, which often has a small amount of fat around it separating the two muscle planes (Fig. 1, B). Electrocautery can also be used to stimulate the 2 muscles to differentiate them.

Once the interval is identified, the cephalic vein is mobilized laterally, which is the author's preferred technique, as it does not sever any of the feeder vessels from the deltoid helping improve hemostasis and visualization. It is also helpful to extend the dissection to fully utilize the incision and slightly undermine beyond actual incision to aid in visualization as the surgery progresses deeper into the wound.

A self-retaining or link retractor is placed between the deltoid laterally and the pectoralis major muscle medially. This allows for visualization of the clavipectoral fascia and the conjoint tendon (Fig. 1, C). This fascia is then opened just lateral to the coracobrachialis and then extended superiorly to the coracoacromial ligament and inferiorly to the falciform ligament (Fig. 1, D). It is helpful to incise the inferior half the coracoacromial ligament to allow for better retraction of the conjoint tendon, additionally incising the superior aspect of the falciform ligament to the level of the pectoralis major tendon enhances exposure. The link retractor is then removed and inserted deeper between the deltoid and the conjoint tendon.

Subscapularis Takedown

The superior and inferior boundaries of the subscapularis tendon are identified. Additionally, the bicipital groove, lesser tuberosity, and anterior humeral circumflex vessels that reside at the inferior border of the subscapularis tendon should be identified.

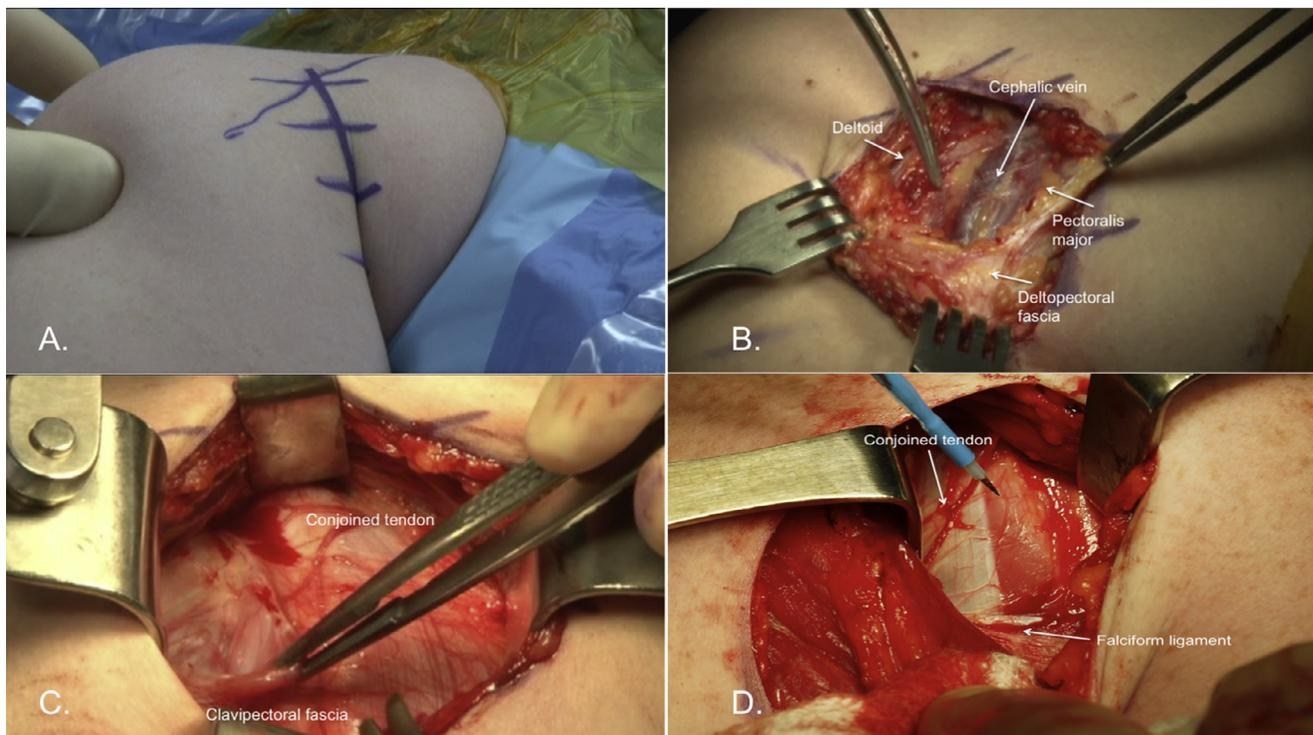


Figure 1 Intraoperative photographs demonstrating the approach for open shoulder stabilization. Images A-C are a right shoulder, image D is a left shoulder. (A) The planned anterior axillary incision from the coracoid down toward the natural axillary fold. (B) The deltopectoral approach is utilized for the approach; the cephalic vein is identified and mobilized laterally. (C) The clavipectoral fascia and conjoint tendon are exposed. (D) The clavipectoral fascia is then incised just lateral to the conjoint tendon and carried down releasing the falciform ligament.

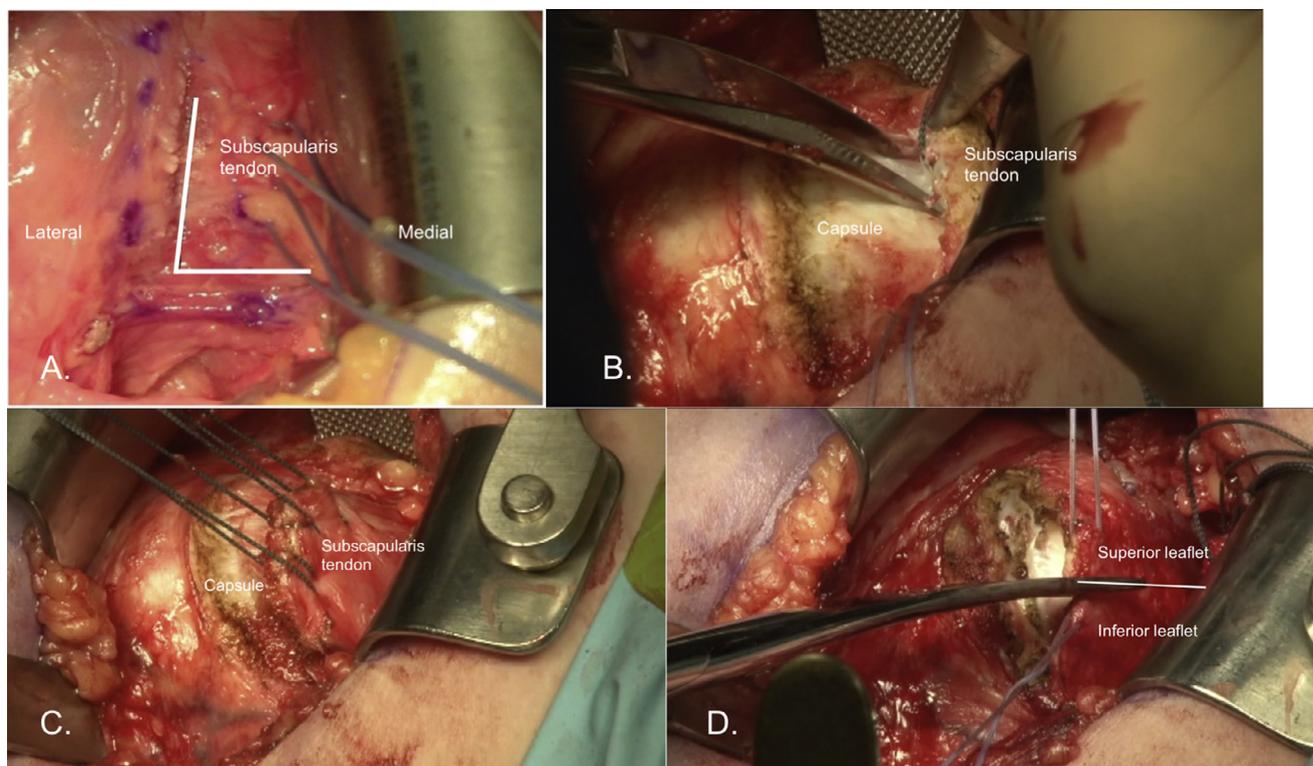


Figure 2 Intraoperative photographs demonstrating the subscapularis tenotomy, dissection, and T-shaped capsulotomy for open shoulder stabilization of a right shoulder. (A) The planned L-shaped tenotomy of the subscapularis tendon with tagging sutures placed medially. (B) Dissection of the subscapularis tendon medially off of the underlying capsule. (C) The subscapularis tendon fully mobilized. (D) The T-shaped capsulotomy is made with the horizontal limb at the midlevel of the glenoid after tagging sutures in superior and inferior limbs are placed.

Tagging stitches are then placed 1.5-2.0 cm medial to the lesser tuberosity. Typically, 3-4 heavy, nonabsorbable sutures are used. A L-shaped incision is utilized for the subscapularis takedown. The vertical limb of the incision is made just lateral to the tagging sutures (~1.5 cm medial to the lesser tuberosity) from the rotator interval to a level just above the anterior humeral circumflex vessels at the inferior border of the subscapularis tendon (Fig. 2, A). It is helpful to start this tenotomy inferiorly, above the circumflex vessels and carry the incision superiorly to the rotator interval with electrocautery. The horizontal limb is then carried medially via sharp dissection as to protect the axillary nerve from electrocautery. It is important to leave a tuft of subscapularis tendon on either side of the takedown for repair. The axillary nerve can then be palpated for identification in the medial aspect of the wound on the inferomedial border of the subscapularis tendon. The subscapularis is then dissected off of the underlying capsule, creating a distinct interval between the 2 for the capsular shift and subscapularis tendon repair (Fig. 2, B). It is often easier to find the interval between the capsule and subscapularis in the inferomedial corner (Fig. 2, C).

After dissection of this interval, a suture is placed laterally in the rotator interval to aid in stability, especially in patients with inferior laxity. The arm is externally rotated to 45° and a nonabsorbable suture is placed to close the lateral 1.0-

1.5 cm of the interval. Performing the closure of the interval medial to the coracoid can severely restrict external rotation when the arm is in an adducted position. Care is also taken to not capture the biceps tendon while placing the stitch.

Capsulotomy

A T-capsulotomy is utilized for intraarticular visualization in addition to allowing a capsular shift with closure. The patient's arm is placed in 30° of external rotation for the incision. The vertical incision is made laterally at the level of the humeral neck. Two nonabsorbable tagging sutures are then placed in the superior and inferior borders. The horizontal limb is then made at the midglenoid level and carried medially between the 2 tagging sutures. Tension is applied to the 2 tagging sutures to aid in creating this horizontal limb and the superior and inferior leaflets (Fig. 2, D).

The anterior capsulolabral tissue and anterior glenoid should then be exposed at this time. Retractors are then placed for visualization of the glenoid and Bankart lesion. A capsular or Batman retractor is placed around the glenoid neck medially, a Fakuda retractor is placed to retract the humeral head, and spiked Hohmann retractor can be placed deep to the Bankart lesion to better expose the glenoid. It is important to be able to fully visualize the anterior and inferior aspect of the glenoid for suture anchor placement.

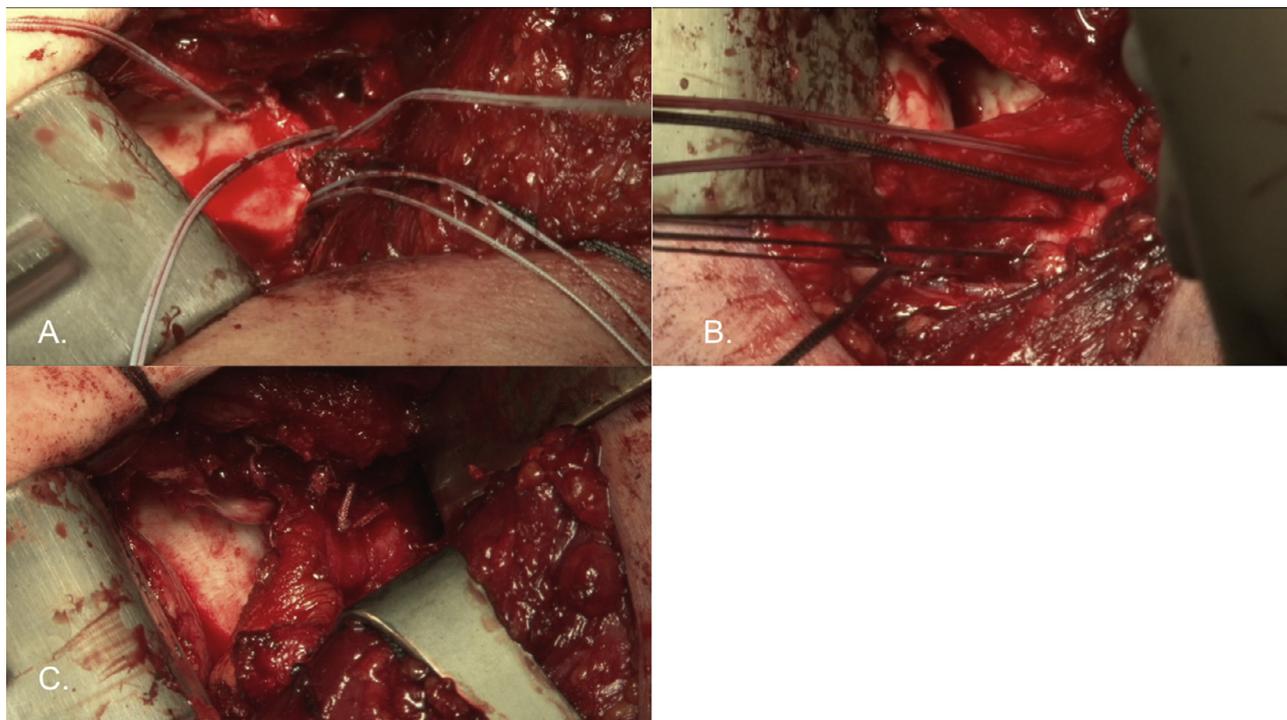


Figure 3 Intraoperative photographs demonstrating the Bankart repair for open shoulder stabilization of a right shoulder. (A) Anchors are placed in the anterior and anteroinferior edge of the glenoid articular surface. (B) Sutures are passed through the Bankart lesion in a horizontal mattress fashion. (C) Completed Bankart repair.

Bankart Repair

The anterior glenoid should be fully exposed and a bony bed is prepared for suture anchor placement. Any fibrous tissue should be removed via a rongeur and a burr can be used to create a bleeding bed in the glenoid for suture anchor placement.

Anchors should be placed at the articular surface of the glenoid. Placement of the anchors should be placed in at least the 5 o'clock position in right shoulders and the 7 o'clock position in left shoulders. The author preference is to typically place 3-4 double loaded suture anchors spaced approximately 5 mm apart to avoid any fixation failure. Anchors can also be placed medially on the glenoid neck in patients with larger Bankart lesions to create a double-row construct (Fig. 3, A).

Once the anchors are placed, sutures can be placed through the Bankart lesion. The spiked Hohmann that was placed deep to the Bankart lesion is then moved superficial to the capsulolabral tissue to allow for direct visualization while passing sutures. The sutures are passed in a horizontal mattress fashion moving from inferior to superior, taking care to protect the axillary nerve (Fig. 3, B). Once all sutures are passed they are then tied from an inferior to superior fashion (Fig. 3, C). The shoulder can then be taken through range of motion testing for instability.

Capsular Shift and Repair

It is the preferred technique of the author to perform a capsular shift in combination with the Bankart repair. The

horizontal limb of the capsulotomy is closed via a reefing stitch with a high-strength, nonabsorbable suture. Another high-strength, nonabsorbable suture is placed in the inferior leaflet using an outside-in, outside-in technique as a tensioning stitch. Similarly, another suture is placed in the superior leaflet using an inside-out, inside-out technique. Once these stitches are placed, 2 double-loaded anchors are placed into the superolateral and inferolateral aspect of the lesser tuberosity, just medial to the subscapularis insertion site (Fig. 4, A). The inferior leaflet is then tensioned towards the superolateral anchor while horizontal mattress sutures are placed from the anchor and are then tied (Fig. 4, B). The superior leaflet is then tensioned toward the inferolateral anchor and secured via the same technique, over the top of the inferior leaflet completing the capsular shift (Fig. 4, C).

Subscapularis Repair and Closure

The subscapularis tendon is then repaired in an anatomic fashion. The prior 3-4 placed sutures in the subscapularis tendon are passed into the remaining tendon stump on the lesser tuberosity in a horizontal mattress fashion. These are then tied from superior to inferior. The repair is then oversewn with a running number one vicryl suture from superior to inferior (Fig. 4, D). The arm is then taken through another range of motion test and stability testing. The wound is then irrigated. Closure can be based on surgeon preference.

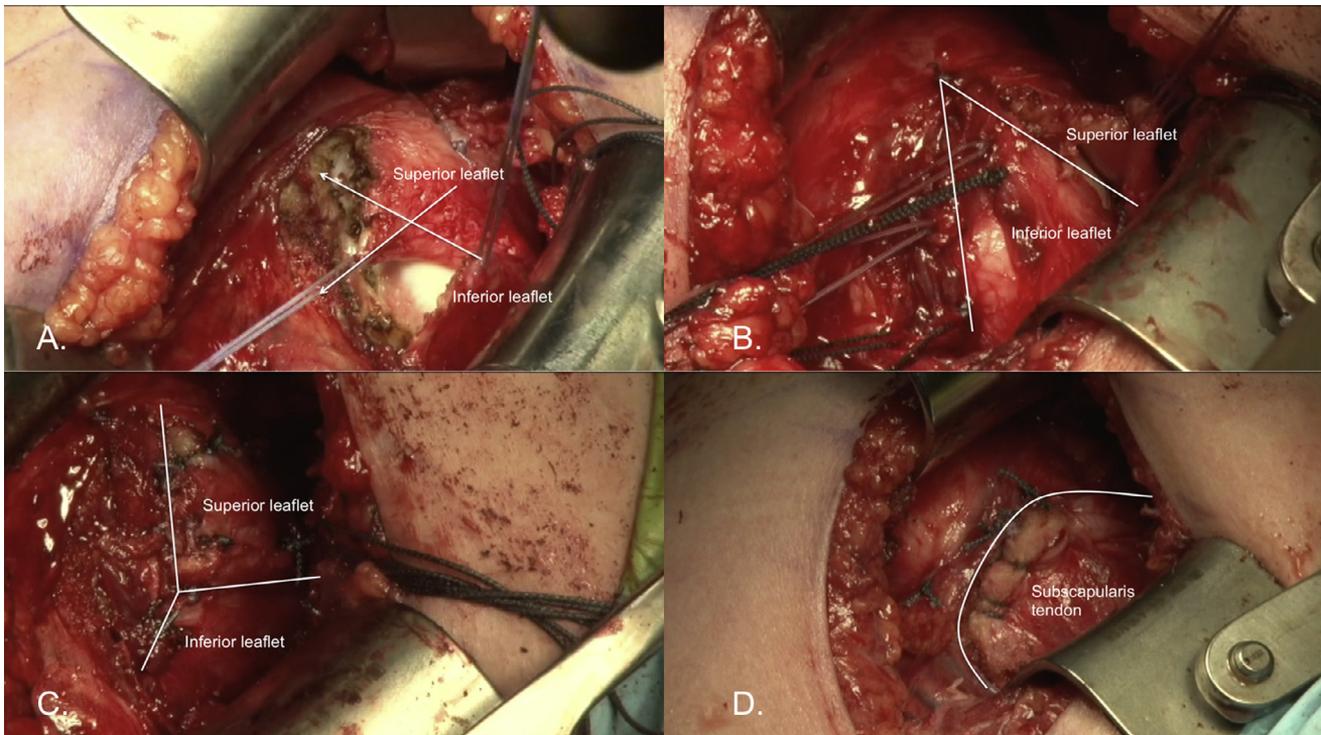


Figure 4 Intraoperative photographs demonstrating the capsular shift and subscapularis repair for open shoulder stabilization of a right shoulder. (A) The capsular shift brings the inferior leaflet superiorly and the superior leaflet inferiorly. (B) The inferior leaflet is repaired first, superiorly with suture anchors placed medial to the subscapularis tendon insertion. (C) The superior leaflet is then brought over the inferior leaflet and repaired to the inferior aspect of the capsulotomy. (D) Subscapularis tendon is repaired anatomically.

Postoperative Plan

Typically, the patient is immobilized but allowed protected motion. The subscapularis repair is protected with immobilization for 4 weeks and from external rotation or any strengthening for 6 weeks. During this time, passive external rotation to 30° and supine forward elevation to 90° is allowed under direct supervision of a physical therapist.

Pendulum exercises are also performed during this time. After 4 weeks, active range of motion can begin and strengthening can begin at 6 weeks postoperatively. Typically, return to play is at 6 months. The patient is usually seen in 1 week to check the surgical wound and is placed on Aspirin 81 mg daily for anticoagulation.

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