

Arthroscopic Bony Bankart Repair Using a Double-Row Double-Pulley Technique



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Abstract: We propose an arthroscopic technique called “double-row double-pulley” to restore a bony Bankart lesion. This technique is a 2-point fixation construct using the sutures from a medial row anchor at the glenoid neck to wrap around the bony Bankart fragment and tie to the sutures from a lateral row anchor at the glenoid rim with the double-pulley method. This technique may present some difficulty with suture management, but there are several advantages. First, due to the 2-point fixation, the risk of a bone piece fracture from direct penetration is minimized. Moreover, the fragment can be reduced directly due to the multiple knots that are tied sequentially over the bony fragment.

A bony Bankart lesion is common in patients who have sustained a shoulder dislocation as a result of a high-energy trauma.¹ Failure to detect and fix the bony fragment may lead to a recurrent dislocation. Several techniques for bony Bankart repair, using either open or arthroscopic means with good midterm clinical outcomes, have been reported.² To restore the bony Bankart fragment, we propose an arthroscopic technique called double-row double-pulley.

Surgical Technique

Patient Positioning and Portal Placement

Preoperatively, plain radiographs (anteroposterior, Velpeau view) and surface reconstruction computed tomography imaging of the affected shoulder are requested to evaluate the extent of the bony Bankart lesion (Fig 1 A, B). After examination under anesthesia is done, the patient is positioned in the modified semilateral decubitus³ (Fig 2A). The posterior portal is

created at the posterior edge of the acromion, and the routine arthroscopic examination steps are performed: (1) glenoid surface, (2) biceps anchor, (3) biceps sling, (4) supraspinatus tendon, (5) infraspinatus tendon, (6) teres minor tendon, (7) axillary pouch, (8) inferior labrum, (9) posterior labrum, (10) subscapularis tendon, (11) middle glenohumeral ligament, and (12) anteroinferior glenohumeral ligament. The anterior portal, midway between the anterior acromial edge and the coracoid process, is then created using the outside-in technique. Intra-articularly, the anterior portal should be positioned just above the subscapularis tendon; it should be at an angle to the glenoid surface and able to reach the inferior glenoid rim. An 8 mm cannula is inserted as the main working portal. Next, a modified transcuff portal is made at about 1 cm posterior to the anterolateral corner of the acromion. The portal enters the joint space just posterior to the long head of the biceps tendon. We switch the scope to this portal and use it as the main viewing portal throughout the rest of the procedure. Lastly, a 5 o'clock portal is made using an outside-in technique. This portal is used to insert the medial row suture anchor at the glenoid neck. All portals are illustrated in Figure 2B.

Prepare the Bony Fragment

The bony Bankart fragment is evaluated using a probe to determine its size and the extent of the lesion. The malunited fragment is released using a small osteotome or Bankart knife. The adhesion around the fragment is also released using a Bankart knife or a radiofrequency wand (Super Turbovac Coblation Wand, ArthroCare, Austin, TX). Once the fragment and labrum are freed, the glenoid rim is prepared using a motorized shaver and a bone rasp.

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Fig 1. Preoperative anteroposterior radiographic view of the right shoulder (A) and 3-dimensional computed tomography scan (3D CT scan), on the oblique sagittal plane (en face view) with humeral subtraction showed a large bony Bankart lesion of the anteroinferior glenoid rim (B). The 3D CT scan of the right shoulder at 6 months postoperatively showed the union bony Bankart fragment (C).

Bony Bankart Repair

Starting from the posteroinferior aspect of the glenoid rim, the first anchor (2.6 mm double-loaded Genesys PressFT, ConMed, Utica, NY) is placed at the roughened glenoid rim through the posterior portal (Fig 3A). A 45° left curved suture passer (Spectrum, ConMed Linvatec, Largo, FL), loaded with a no. 1 polydioxanone suture (Ethicon, Somerville, NJ), is used to pierce the capsulolabral tissue and shuttle 1 suture limb from the anchor while the other 3 suture limbs are left free; then, all 4 suture limbs are retrieved through the posterior portal (Fig 3 B, C). The second suture anchor (2.6 mm double-loaded Genesys PressFT) is placed at the glenoid neck just medial to the center of the bony Bankart defect through the 5 o'clock portal (Fig 4A). The 45° left curved suture passer is used to shuttle all 4 suture limbs from the second anchor around the bony Bankart fragment (Fig 4 B, C, Video 1).

The third suture anchor (1.9 mm Suturefix Ultra, Smith & Nephew, Andover, MA) is placed at the glenoid rim just above the superior margin of the bony defect (Fig 5A). One suture limb of this anchor is shuttled around the labrum adjacent to the superior

aspect of the bony fragment, while the other 3 suture limbs are left free (Fig 5B). Next, a pair of free suture limbs from the first anchor and a pair of suture limbs from the second anchor are tied together using a non-sliding arthroscopic knot (stacked half hitches) as a double-pulley technique (Fig 6A). All the knots from each pair of suture limbs should be placed at the periphery (medial to the bony Bankart fragment) to prevent irritation of the knot at the humeral head. The same technique is applied to another pair of suture limbs from the second to the third anchor to create the double-row bony Bankart repair technique (Fig 6B, Video 1).

Then the rest of the suture limbs are tied to secure the capsulolabral complex. We add one more suture anchor superior to the third anchor to gain a more secure fixation to the labrum (Fig 7A, Video 1). The final appearance after knot tying to reduce and fix by the double-pulley suture technique is shown in Figure 7 B, C. Postoperatively, the shoulder is placed in an abduction sling for 6 weeks. Surface reconstruction computed tomography imaging of the affected shoulder is obtained 6 months postoperatively (Fig 1C).

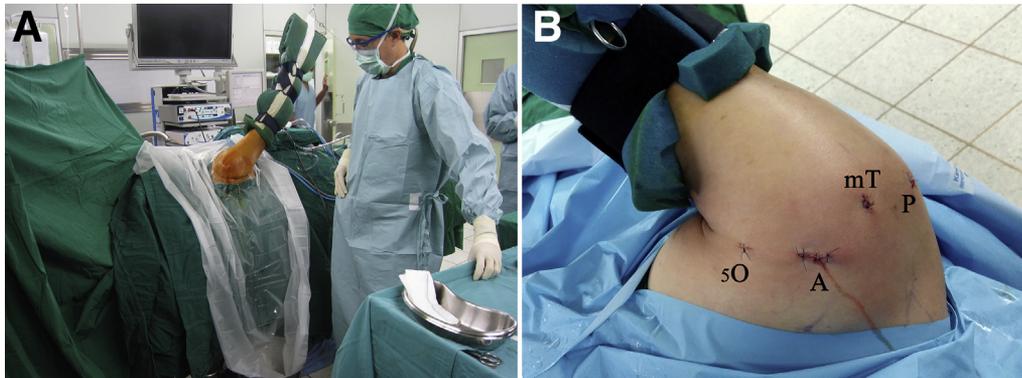


Fig 2. (A) A modified semilateral decubitus position of the right shoulder. (B) Surgical portals for surgery. Posterior portal (P), a modified transcuff portal (mT) at 2 cm posterior and lateral to the anterolateral border of the acromion, anterior portal (A), and the 5 o'clock portal (5O).

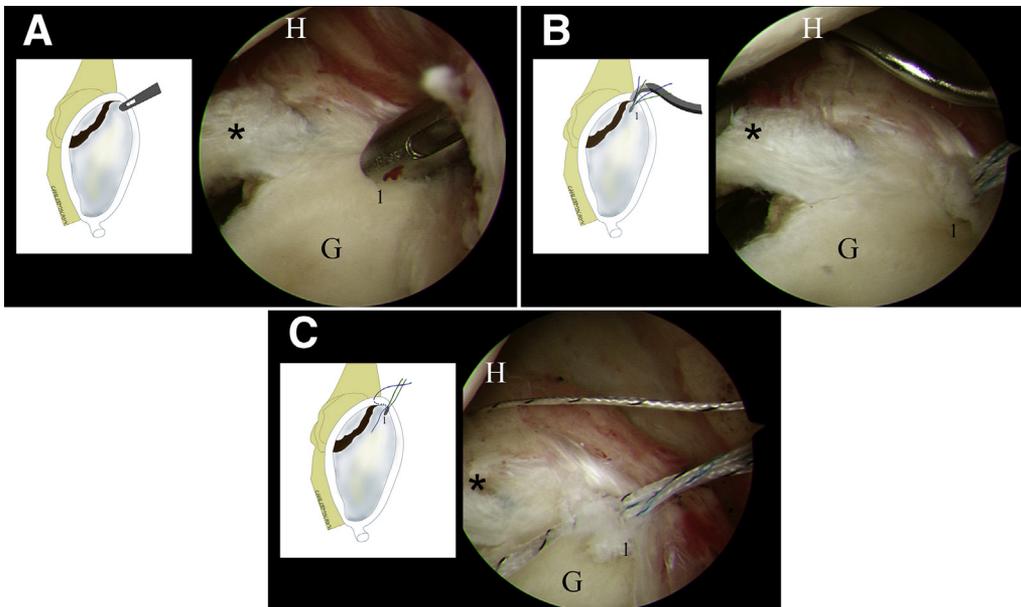


Fig 3. Arthroscopic photographs and 3-dimensional drawings demonstrate en face view of the glenoid showing bony Bankart repair in a right shoulder (a modified semilateral decubitus position, viewed from a modified transscuff portal). (A) The first anchor was placed at the posteroinferior glenoid rim through the posterior portal. (B) A no. 1 polydioxanone suture is passed to the capsulolabral tissue at the posterior-most point of the bony fragment via posterior portal. (C) One suture limb (black tiger) is then shuttled around the labrum and retrieved from the posterior portal while the other 3 suture limbs are left free. Asterisks indicate the osseous fragment. (1, first anchor; G, glenoid; H, humeral head.)

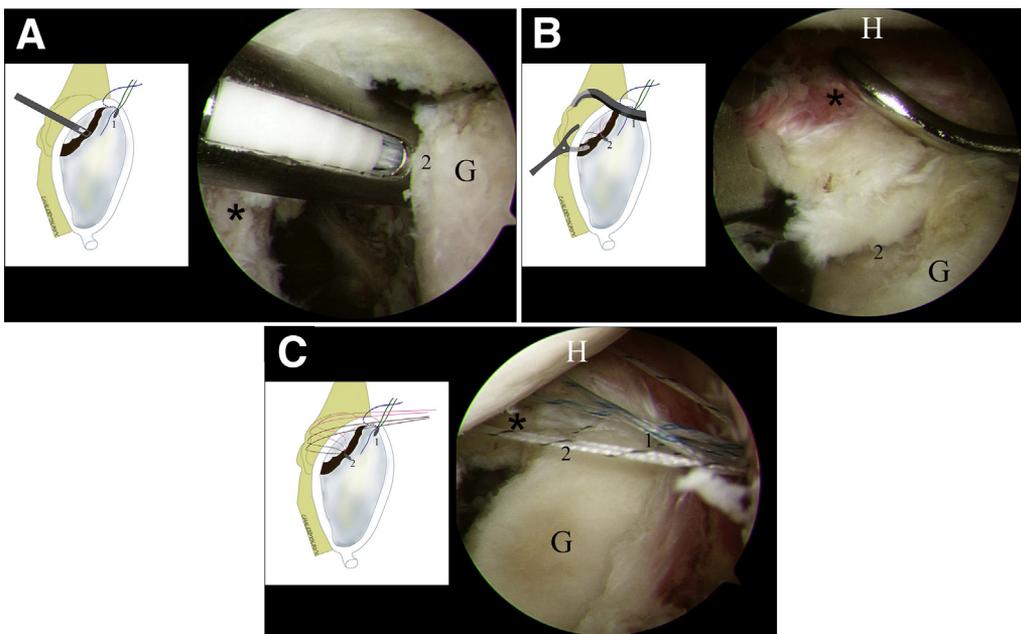


Fig 4. Arthroscopic photographs and drawing of the right shoulder (a modified semilateral decubitus position) viewed from a modified transscuff portal. (A) The second anchor is placed at the glenoid neck around the midportion of the bony Bankart fragment (asterisks) through the 5 o'clock portal. (B) The 45° left curved suture passer is used to shuttle suture limb around the bony Bankart fragment. (C) All 4 suture limbs are shuttled around the bony Bankart fragment. Asterisks indicate the osseous fragment. (1, first anchor; 2, second anchor; G, glenoid; H, humeral head.)

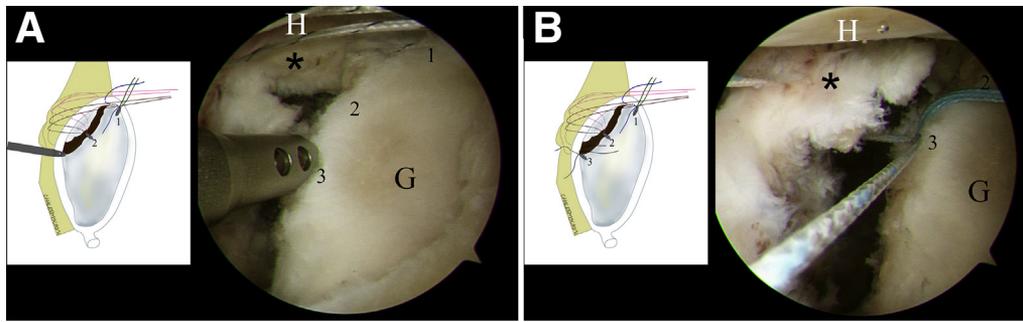


Fig 5. Arthroscopic photographs and drawing of the right shoulder (a modified semilateral decubitus position) viewed from a modified transscuff portal. (A) The third anchor is placed at the glenoid rim just above superior margin of the bony defect. (B) One suture limb (blue) of this anchor is shuttled around the labrum adjacent to the superior aspect of the bony fragment using the same technique. Asterisks indicate the osseous fragment. (1, first anchor; 2, second anchor; 3, third anchor; G, glenoid; H, humeral head.)

Discussion

An arthroscopic suture anchor fixation of bony Bankart lesions provides successful midterm outcomes and has a low recurrence rate.² Variations of the bony Bankart fixation technique have been reported; for instance, sutures being passed around or through the osseous fragment,^{4,5} using sutures of the adjacent anchor as a suture bridge,⁶ a pulled suture,⁷ transglenoid fixation,⁸ indirect reduction by labral repair, and internal fixation with a screw.⁹ Previously reported techniques have yielded good results; however, fixation through the bony fragment might result in the fragment fracturing, making the surgery more complicated. Regarding the strengths of 1-point versus 2-point fixations, Giles et al.¹⁰ performed a biomechanics study and found equivalent failure strengths and load transfers for the 2 groups. The suture bridge technique may provide greater initial fracture stability.

The proposed technique is a 2-point bony Bankart fixation that passes the sutures from the medial row

anchor around the bony fragment and ties them to another 2 anchors (superior and inferior to the bony fragment); thus, piercing through the bony fragment is not necessary (Fig 6 A, B). As for the double-pulley fixation, each pair of suture limbs is tied sequentially so that the postlimb and the knot are located at the periphery of the bony Bankart capsulolabral tissue. The advantage of this knot-tying technique is that the position of the knot pusher, which pushes the fragment from the periphery, may assist with the anatomic reduction of the fragment to the glenoid. Moreover, the tension of the suture during the fragment reduction can be adjusted before completing the double-pulley construct.

The downside of this technique is its suture management. Because at least 3 double-loaded suture anchors are used for the bony Bankart fixation, 12 suture limbs are encountered at a time (Fig 5B). The advantages and disadvantages of this technique are listed in Table 1. To simplify the suture management, a

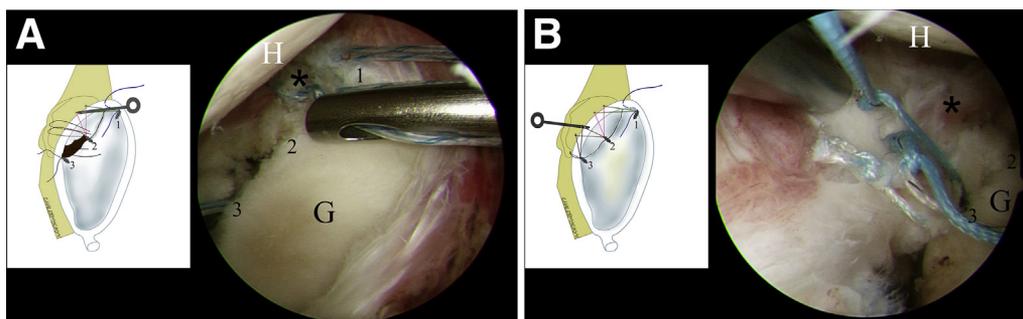


Fig 6. Arthroscopic photographs and drawing of the right shoulder (a modified semilateral decubitus position) viewed from a modified transscuff portal. (A) A pair of free suture limbs from the first anchor and a pair of suture limbs from the second anchor are tied together as a double pulley. (B) The same technique is applied to a pair of suture limbs from second and third anchors to create the double-row bony Bankart repair using the double-pulley suture technique. Asterisks indicate the osseous fragment. (1, first anchor; 2, second anchor; 3, third anchor; G, glenoid; H, humeral head.)

Fig 7. Arthroscopic photographs and drawing of the right shoulder (a modified semilateral decubitus position) viewed from a modified transcuff portal. (A) If needed, a fourth anchor is added to repair the remaining capsule labrum. (B) The displaced osseous fragment is reduced and fixed by the double-pulley suture technique. (C) Line drawing showing the final appearances on the axial image after knot tying. Asterisks indicate the osseous fragment. (1, first anchor; 2, second anchor; 3, third anchor; 4, fourth anchor; G, glenoid; H, humeral head.)

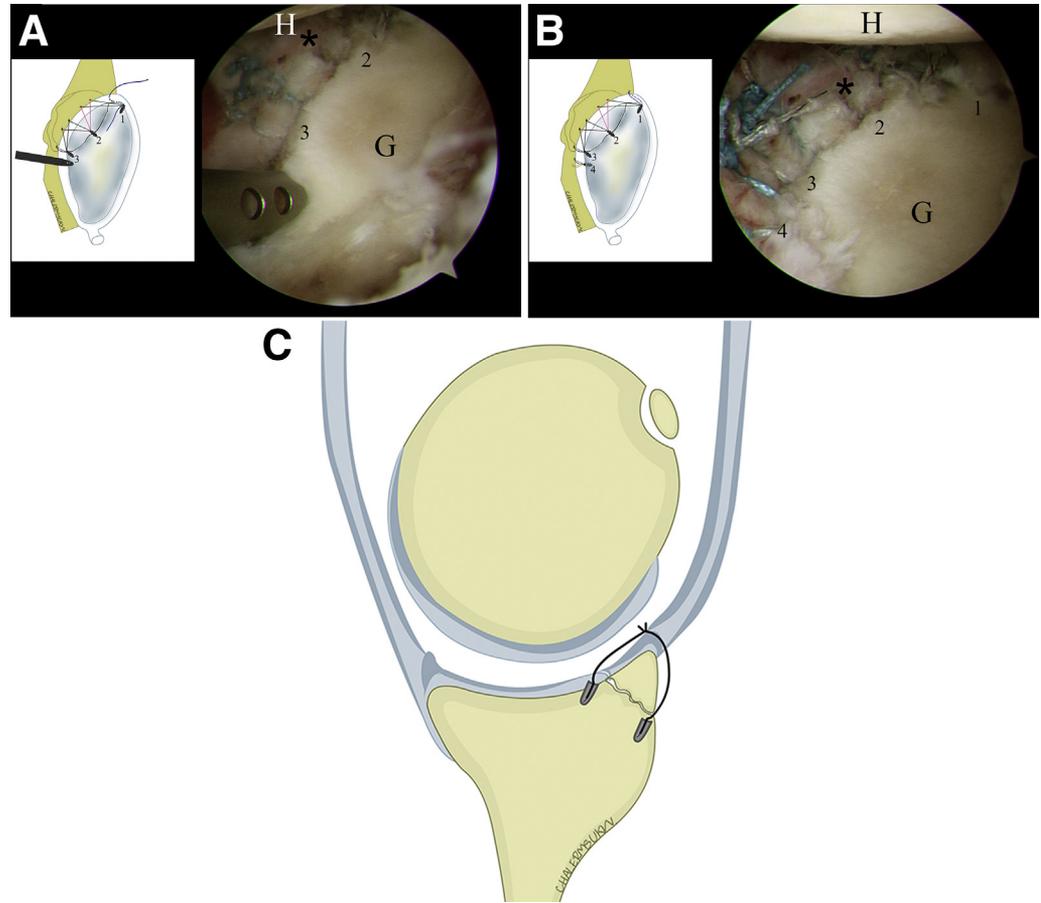


Table 1. Technique Advantages and Disadvantages

Advantages	Disadvantages
Two-point fixation with suture from medial row passed around the bony fragment.	No clinical outcome studies currently available for this technique.
May reduce risk of iatrogenic fracture from fixation through the fragment.	Three or more double-loaded suture anchors are required for bony Bankart fixation.
For double-pulley fixation, the periphery position of the knot pusher may assist in the anatomic reduction of the fragment.	Difficulty with suture management.
Adjustable tension during fragment reduction before completion of the double-pulley construct.	Learning curve.

pair of suture limbs from anchors no. 1 and no. 3 (which are used to secure the labrum) are passed through the labrum and left to one side. Then 8 suture limbs from anchors no. 1, no. 2 (4 limbs), and no. 3 are used to fix the bony Bankart fragment as previously described. The knot-tying technique is also a crucial step. If the first knot for the double pulley is not tied securely, tension during the tying of the second knot might result in the loosening of the first knot before the construct is completed.

This proposed technique is a safe method and an alternative surgical technique to restore a bony Bankart fragment.

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