SURGICAL TECHNIQUES

ARTHROSCOPIC OSSEOUS BANKART REPAIR IN
THE TREATMENT OF RECURRENT ANTERIOR
GLENOHUMERAL INSTABILITY

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Introduction

Anterior glenohumeral instability associated with an anterior-inferior fracture of the glenoid (osseous Bankart lesion) can be treated successfully with arthroscopic, rather than open, surgical repair, or fixation of the osseous fragment. Arthroscopic repair can achieve osseous union and normalization of glenoid anatomy with a low prevalence of recurrent instability¹ even in shoulders with a chronic, large glenoid defect as long as the shoulder retains an osseous fragment²⁻⁴. We attribute these favorable outcomes to excellent fragment reduction and retensioning of the entire inferior glenohumeral ligament (IGHL) enabled by an extensive labral release during the procedure^{1,5-7}.

Indications & Contraindications

Indications

- Recurrent glenohumeral instability associated with a small-to-large osseous Bankart fragment (Fig. 1).
- Recurrent glenohumeral instability associated with a very small osseous Bankart fragment in non-athletic patients.

Contraindications

- Recurrent glenohumeral instability associated with a very small osseous Bankart fragment but a severely attritional glenoid in active athletic patients.

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Step 1: Patient Positioning

Place the patient in the beach-chair position and examine both shoulders for laxity after induction of general anesthesia with an interscalene block.

- After induction of general anesthesia, with an interscalene block for postoperative pain control, place the patient in the beach-chair position.
- Place the upper extremity in a positioning device (e.g., the SPIDER arm holder; Smith & Nephew) to maintain the shoulder in slight flexion and neutral rotation. The arm holder is also helpful when an assistant tries to open the joint by distracting the arm.

Step 2: Portal Placement

Create a standard posterior viewing portal and anterior and anterosuperior working portals.

- Create a standard posterior portal as an entry portal at the soft spot of the posterior aspect of the shoulder. The soft spot is 2 to 3 cm below the posterior border and 1 cm medial to the lateral border of the acromion in men of average size. Carry out routine diagnostic arthroscopy through this portal (Fig. 1-A, Video 1), which is used as the main viewing portal throughout the procedure.
- Next establish an anterior portal just superior to the subscapularis and lateral to the conjoint tendon using an outside-in technique to facilitate instrument insertion without cannulas⁸. Make a skin incision at least 4 to 5 cm anterior to the anterior margin of the acromion in order to provide enough space between the anterior portal and the anterosuperior portal, which will be created later. The Bankart lesion and the osseous fragment are palpated by a device introduced from the anterior portal. Then, the arthroscope is introduced from the anterior portal and the osseous Bankart lesion and glenoid morphology are assessed (Fig. 1-B, Video 1). The anterior portal is used for the main working portal.
- An additional working (anterosuperior) portal at the anterosuperior margin of the rotator interval is established after release of the labroligamentous complex. Since 2 working portals are established at the rotator interval, the anterosuperior portal is created 3 to 4 cm superior to the anterior portal, which is very close to the anterior aspect of the acromion.

Fig. 1-A

Fig. 1-B

Fig. 1-C

Fig. 1-D

Figs. 1-A through 1-D Since the osseous fragment of a Bankart lesion is normally covered by surrounding soft tissue, the fragment cannot be visualized through the arthroscope. Therefore, preoperative 3D reconstructed CT images are necessary. H = humeral head and G = glenoid. **Fig. 1-A** Arthroscopic view from the posterior portal in a left shoulder. **Fig. 1-B** Arthroscopic view from the anterior portal in the same shoulder. The asterisks indicate the osseous fragment seated inside the soft tissue.

En face (**Fig. 1-C**) and oblique (**Fig. 1-D**) 3D reconstructed CT images of the same shoulder shown in Figs. 1-A and 1-B.

Video 1 Diagnostic arthroscopy. The bone fragment is embedded in the surrounding soft tissue.

Step 3: Mobilization

Separate the displaced osseous fragment associated with the labroligamentous complex from the glenoid neck and mobilize the labroligamentous complex together with the fragment up to the 7 o'clock or 7:30 position (in a right shoulder).

- Separate the displaced osseous fragment associated with the labroligamentous complex from the glenoid neck. To do this, insert the tip of a rasp into the space between the native glenoid and the labrum under which the fragment lies, tap the rasp with a hammer, and pry the complex apart from the glenoid neck with the rasp until the labroligamentous complex together with the bone fragment is completely freed from the glenoid neck.
- Even if the inferior part of the labrum looks intact, release it with arthroscopic scissors along with the border between the inferior parts of the glenoid and labrum. Then, introduce a curved rasp and release the inferior part of the labrum from the glenoid starting from the 2 to 3 o'clock position and continuing up to the 7 o'clock or 7:30 position (in a right shoulder). This enables complete and extensive mobilization of the labroligamentous complex together with the fragment, which is very important for both excellent fragment reduction and eventual osseous remodeling of the glenoid.
- After extensive labral release, remove a small amount of articular cartilage at the inferior portion of the glenoid face, from 3 to 7 o'clock (in a right shoulder), to promote tissue-healing after repair (Fig. 2, Video 2).

Fig. 2

Fig. 2 Mobilization of the fragment and labroligamentous complex. Extensive labral release and cartilage removal at the inferior part of the glenoid face are critical to achieve proper tensioning of the entire IGHL complex and excellent fragment reduction. The asterisks indicate the inferior glenoid surface where cartilage has been removed. G = glenoid.

Video 2 Mobilization and preparation, which includes extensive labral release and cartilage removal.

Step 4: Inferior Labrum Repair

Perform an inferior labrum repair by inserting 2 suture anchors at the anteroinferior part of the glenoid face.

- Insert the first anchor, loaded with a number-2 high-strength suture, at the inferior part of the glenoid face (6 o'clock position) using a drill guide introduced from the anterior portal and pushing down on the humeral head to obtain an optimal angle with the glenoid (Fig. 3, Video 3). Then, establish the anterosuperior portal at the anterosuperior margin of the rotator interval. Place 1 limb of the suture from the first anchor through the inferior part of the labrum at the 6:30 position using a 7-mm Caspari punch (ConMed Linvatec) loaded with a looped monofilament suture.
- Insert the second suture anchor at the anteroinferior part of the glenoid face (4:40 position in a right shoulder) and place 1 limb of the suture through the anteroinferior part of the labrum adjacent to the inferior side of the osseous fragment using the Caspari punch.
- Tie the suture of the superior anchor (at the 4:40 position in a right shoulder) into a knot using a cannula introduced from the anterior portal while reducing the labrum and fragment by pulling a grasper introduced from the anterosuperior portal with the arthroscope remaining in the posterior portal. After tying this suture, remove the grasper and tie the suture of the inferior anchor.
- When the osseous fragment is large, suture placement through the fragment can sometimes cause loosening of the inferior knots. Therefore, we recommend inserting a third anchor in such cases and placing the first fragment suture before knotting the inferior labral sutures (Video 4).
- Repairing the inferior aspect of the labrum reduces the displaced osseous fragment to a lateral and superior position. This facilitates management of the osseous fragment in the next step, which is the most difficult portion of the entire procedure.

Fig. 3

Fig. 3 Anchor insertion into the inferior aspect of the glenoid face (6 o'clock). A drill guide is introduced from the cannula-free anterior portal, and the guide is pressed down on the humeral head to obtain as perpendicular an angle to the glenoid as possible. C = released complex and G = glenoid.

Video 3 The first anchor insertion. The drill guide is pressed down on the humeral head to obtain a more vertical angle with the glenoid face.

Video 4 Bone fragment management using a Bone Stitcher.

Step 5: Osseous Fragment Fixation

Fix the osseous fragment by passing the sutures either through or around the fragment with use of a bone penetrator, or Bone Stitcher, while stabilizing the labrum and fragment with a large grasper.

- Insert the third suture anchor into the anterior part of the glenoid face, at the 3:20 position. Then retrieve sutures from the anterosuperior portal. Stabilize the labrum together with the osseous fragment with a large grasper. Introduce the grasper from the anterosuperior portal in order to facilitate the fragment management by the bone penetrator, which is introduced from the anterior portal, thereby leaving the arthroscope in the posterior portal.
- Pass the suture through or around the bone fragment using a bone penetrator, or Bone Stitcher (Smith & Nephew). After securing the fragment by the tip of the Bone Stitcher, push the tip with the fragment to the glenoid neck; then the fragment can be penetrated. If it is too difficult to penetrate the fragment, rotate the Stitcher while pushing the tip and the fragment to the glenoid neck.
- Insert another suture anchor into the anterior edge of the glenoid (the 2 o'clock position). If the fragment is large, it is preferable to use a suture anchor loaded with 2 number-2 high-strength sutures. Penetrate the osseous fragment with 1 limb of the sutures in the same manner as described above and place the remaining suture through the labrum superior to the fragment (Figs. 4-A and 4-B).
- Finally, perform knot-tying, starting with 1 suture from the anchor placed last, followed by the other suture of that anchor, and then by the suture from the previous anchor. This sequence can be altered according to surgeons' preference (Video 5).
- The fragment is usually reattached to a higher-than-anatomical position as a result of retensioning of the entire IGHL.
- After completing the repair, assess the range of motion of the arm to ensure that there is no restriction of normal external rotation. If it is restricted, with the arm hanging at the side, this is usually due to a thick bite by the most superior suture. If this is the case, release the lateral side of the capsule next to the suture with a radiofrequency device and then confirm that external rotation has been restored to normal (Figs. 5-A and 5-B).

Fig. 4-A

Fig. 4-B

Fig. 5-A

Fig. 5-B

Figs. 4-A and 4-B Arthroscopic appearance from the posterior (**Fig. 4-A**) and anterior (**Fig. 4-B**) portals after completion of the osseous Bankart repair. The asterisks indicate the osseous fragment seated inside the soft tissue. H = humeral head and G = glenoid.

Video 5 Bone fragment management and the final arthroscopic view.

Figs. 5-A and 5-B Anterosuperior capsular release in a patient with loss of external rotation after completion of the arthroscopic osseous Bankart repair. H = humeral head. **Fig. 5-A** The taut anterosuperior aspect of the capsule (asterisks) limits external rotation with the arm at the side. **Fig. 5-B** Full external rotation was confirmed after release of the taut anterosuperior portion of the capsule. The asterisk indicates the subscapularis muscle.

Step 6: Augmentation Procedures

Rotator interval closure, done with the arm in $>60^\circ$ of external rotation, is the most frequently performed augmentation procedure.

- An augmentation procedure such as rotator interval closure or Hill-Sachs remplissage is often recommended to avoid early postoperative failure before osseous union has been obtained, especially in potentially noncompliant patients and athletes participating in collision/contact sports.
- Prior to performing rotator interval closure, confirm that external rotation is not limited after the arthroscopic osseous Bankart repair.
- Introduce a 16-G epidural needle loaded with a looped number-2-0 nylon suture from the anterior portal. Pierce the lateral side of the subscapularis tendon with the needle and place the looped nylon suture through the tendon with the arm in neutral rotation.
- With the shoulder externally rotated, preferably by $>60^\circ$, introduce an Ideal Suture Grasper (DePuy Synthes) from the anterior portal to the subacromial bursa blindly to pierce the tissue behind the biceps tendon, which includes part of the coracohumeral ligament, and retrieve the nylon suture. Then, replace the nylon suture with a number-2 high-strength suture.
- Place a nylon suture into the medial side of the subscapularis tendon in the same manner as described above. Then introduce the Ideal Suture Grasper to penetrate the tissue at the superomedial corner of the rotator interval with the arm in $>60^\circ$ of external rotation. Replace the retrieved nylon suture with another number-2 high-strength suture.
- Perform knot tying of each suture with the shoulder in $>60^\circ$ of external rotation.

Results

A consecutive series of 46 patients with an osseous Bankart lesion who demonstrated $>15\%$ glenoid bone loss underwent osseous Bankart repair, which was performed regardless of the fragment size, between January 2005 and December 2006¹. Thirty-eight patients (83%), including 34 males and 4 females with an average age of 23.4 years (range, 15 to 36 years) at the time of surgery, were available for final follow-up at an average of 6.2 years (range, 5.0 to 8.1 years) after surgery. One patient sustained a redislocation during a traffic accident 5 months after the surgery, which was deemed an early failure before osseous union was obtained. The rest of the patients demonstrated significant improvement of both the Rowe score⁹ and the Western Ontario Shoulder Instability Index (WOSI)¹⁰ postoperatively. In addition, they had substantial improvement in terms of glenoid bone loss (calculated as a percentage loss of the diameter of the assumed circle on the inferior aspect of the glenoid, not including the bone fragment, on a three-dimensional computed tomography [3D CT] image) to -1.1% , from 20.4% preoperatively, with the fragment size only 4.7% on average¹. We believe that this substantial improvement of glenoid morphology was due to excellent fragment reduction and retensioning of the entire IGHL provided by the extensive labral release described above.

Pitfalls & Challenges

- Extensive labral release is the most important part, and also a challenge, of the procedure. Although the inferior aspect of the labrum usually appears intact, the surgeon must release it to provide mobility to achieve proper retensioning of the entire IGHL and excellent fragment reduction.
- It is very important to assess the size and shape of the fragment on preoperative 3D reconstructed CT images since the fragment size and shape vary by individual. On the basis of these images, surgeons need to decide preoperatively whether to penetrate or pass around the bone fragment.

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References

1. Kitayama S, Sugaya H, Takahashi N, Matsuki K, Kawai N, Tokai M, Ohnishi K, Ueda Y, Hoshika S, Kitamura N, Yasuda K, Moriishi J. Clinical outcome and glenoid morphology after arthroscopic repair of chronic osseous Bankart lesions: a five to eight-year follow-up study. *J Bone Joint Surg Am.* 2015 Nov 18;97(22):1833-43.
2. Sugaya H, Moriishi J, Dohi M, Kon Y, Tsuchiya A. Glenoid rim morphology in recurrent anterior glenohumeral instability. *J Bone Joint Surg Am.* 2003 May;85(5):878-84.
3. Sugaya H, Moriishi J, Kanisawa I, Tsuchiya A. Arthroscopic osseous Bankart repair for chronic recurrent traumatic anterior glenohumeral instability. *J Bone Joint Surg Am.* 2005 Aug;87(8):1752-60.
4. Sugaya H, Moriishi J, Kanisawa I, Tsuchiya A. Arthroscopic osseous Bankart repair for chronic recurrent traumatic anterior glenohumeral instability. Surgical technique. *J Bone Joint Surg Am.* 2006 Sep;88(Suppl 1 Pt 2):159-69.
5. Frank RM, Mall NA, Gupta D, Shewman E, Wang VM, Romeo AA, Cole BJ, Bach BR Jr, Provencher MT, Verma NN. Inferior suture anchor placement during arthroscopic Bankart repair: influence of portal placement and curved drill guide. *Am J Sports Med.* 2014 May;42(5):1182-9. Epub 2014 Feb 27.
6. Seroyer ST, Nho SJ, Provencher MT, Romeo AA. Four-quadrant approach to capsulolabral repair: an arthroscopic road map to the glenoid. *Arthroscopy.* 2010 Apr;26(4):555-62.
7. Cvetanovich GL, McCormick F, Erickson BJ, Gupta AK, Abrams GD, Harris JD, Romeo AA, Bach BR, Provencher MT. The posterolateral portal: optimizing anchor placement and labral repair at the inferior glenoid. *Arthrosc Tech.* 2013;2(3):e201-4. Epub 2013 May 31.
8. Sugaya H, Kon Y, Tsuchiya A. Arthroscopic Bankart repair in the beachchair position: a cannulaless method using an intra-articular suture relay technique. *Arthroscopy.* 2004 Jul;20(Suppl 2):116-20.
9. Rowe CR, Patel D, Southmayd WW. The Bankart procedure: a long-term end-result study. *J Bone Joint Surg Am.* 1978 Jan;60(1):1-16.
10. Kirkley A, Griffin S, McLintock H, Ng L. The development and evaluation of a disease-specific quality of life measurement tool for shoulder instability. The Western Ontario Shoulder Instability Index (WOSI). *Am J Sports Med.* 1998 Nov-Dec;26(6):764-72.