

# Arthroscopic Bony Bankart Fixation Using a Modified Sugaya Technique

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**Abstract:** Arthroscopic fixation of bony Bankart lesions in the setting of anterior shoulder instability has had successful long-term results. Key factors such as patient positioning, portal placement, visualization, mobilization of bony/soft tissues, and anatomic reduction and fixation are crucial to yield such results. We present a modified Sugaya technique that is reproducible and based on such key principles. This technique facilitates ease of anchor and suture placement to allow for anatomic reduction and fixation.

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**A**n anterior-inferior labroligamentous tear, or Bankart lesion, is considered the *sine que non* anatomic injury for an anterior-inferior shoulder dislocation. However, up to 30% of dislocations may incur an anterior-inferior glenoid fracture, or a bony Bankart lesion. This can occur in isolation or in addition to a soft-tissue Bankart lesion. Such bony injuries may often go unrecognized because of the low sensitivity of plain radiographs. Early recognition of this pathology with subsequent fixation has shown excellent outcomes with a minimal failure rate.<sup>1,6</sup>

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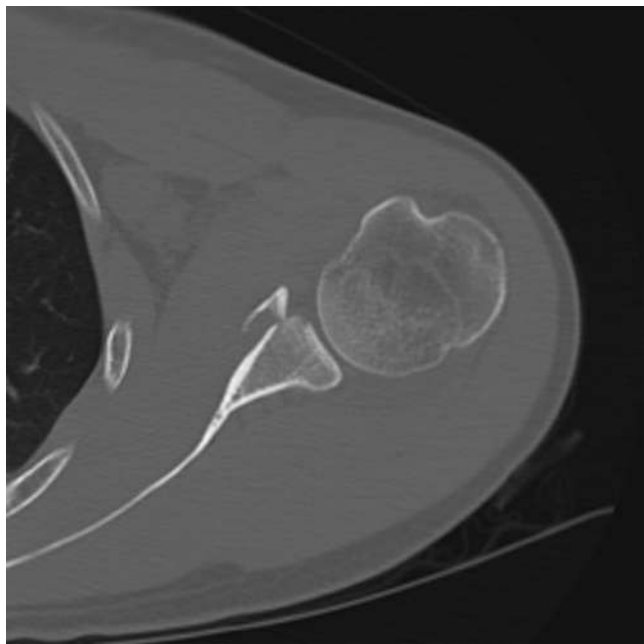
Our preferred surgical technique, a modification of the method of Sugaya et al.,<sup>1</sup> encompasses a few key reproducible steps that facilitate anatomic restoration of soft-tissue tension, as well as ease of reduction and fixation, and maximizes bony healing. This technical note and accompanying video show the key steps that are necessary to yield a successful result.

## Case Example

A 23-year-old male overhead athlete fell from a ladder and suffered a primary anterior-inferior shoulder dislocation of his dominant arm. Closed reduction was performed in the emergency department, where post-reduction radiographs showed a bony Bankart lesion with associated Hill-Sachs deformity of the humeral head. Computed tomography better showed the size of the fragment amount of glenoid articular surface involvement (Fig 1). The patient was active with recreational overhead sports and worked in construction. Because of his age, the size of the fragment, and the risk of recurrent instability, it was recommended that he undergo arthroscopic fixation of the bony and/or soft-tissue Bankart lesions (Table 1).

## Surgical Technique

The patient is placed in the lateral decubitus position by use of a beanbag. An axillary roll is placed, and careful attention is paid to pad all bony prominences, including the peroneal nerve at the knee. We prefer general anesthesia. An examination under anesthesia is performed to assess passive range of motion including forward elevation, external rotation at 0° of abduction, and external/internal rotation at 90° of abduction.



**Fig 1.** Preoperative computed tomography axial cut shows a bony Bankart anterior-inferior glenoid fracture.

Anterior and posterior translation testing is performed with the arm positioned at 40° of abduction in the scapular plane. Anterior-inferior translation and inferior translation are assessed separately. This information is critical when determining the amount of anterior and inferior soft-tissue tensioning that needs to be performed to ensure postoperative stability.

After the arm is prepared and draped, it is suspended in a balanced traction buoy (Arthrex, Naples, FL). Ten pounds total of longitudinal and lateral distraction is all that is required to provide adequate visualization of the glenoid and labroligamentous complex. Diagnostic arthroscopy is commenced. A posterior portal is created 2 cm distal to the posterolateral corner of the acromion. An anterior rotator interval portal is created under needle localization just superior to the upper rolled border of the subscapularis, 1 cm medial to its insertion on the humerus (Figs 2 and 3). Glenohumeral articular surfaces are evaluated for chondral injury and bone loss. The amount of bone loss is quantified with a graduated probe before mobilization of the fragment. The labroligamentous complex is evaluated along with the fracture

**Table 1.** Relative Indications and Contraindications for Arthroscopic Fixation of Bony Bankart Lesions

Relative Indications	Relative Contraindications
Recurrent instability	Fragment comminution
Contact and/or throwing athlete	Associated HAGL lesion
Single fragment	Comminution with >25% glenoid bone loss
No prior surgeries	Prior open shoulder surgery

HAGL, humeral avulsion of glenohumeral ligament.



**Fig 2.** In the left shoulder of a patient positioned in the lateral decubitus position, standard posterior (P) and posterolateral (PL) portals are marked on the skin with respect to the posterolateral corner of the acromion.

fragment. In the acute setting, the amount of glenoid articular bone loss typically correlates with fragment size. It is not uncommon to see both a fracture and concomitant labroligamentous tissue injury. The avulsed tissue often encapsulates the fragment. The axillary pouch is examined to evaluate for a humeral avulsion of the inferior glenohumeral ligament complex. Neglecting this injury can lead to failed anterior stabilization due to residual anterior-inferior instability. In the event that there is an associated humeral avulsion of the glenohumeral ligament lesion, the surgery is converted to an open procedure so as to address both pathologies. The rotator cuff is evaluated for a possible tear. This is uncommon in patients aged younger than 40 years. If there is concern for a high-grade partial-thickness tear, the location is marked with a suture and the arthroscope is introduced into the subacromial space for further evaluation.

Once it is determined that fixation is feasible, an 8.25-mm cannula is placed into the anterior portal. An anterior-superior rotator interval portal is then created, just inferior to the biceps insertion on the supraglenoid tubercle. A 6-mm cannula is placed into this portal. The arthroscope is introduced into the anterior-superior



**Fig 3.** In the left shoulder of a patient positioned in the lateral decubitus position, anterior-superior (AS) and anterior (A) rotator interval portals are marked on the skin with respect to the coracoid (C).

portal to provide a “bird’s-eye” view of the fragment and soft-tissue pathology. The fracture hematoma is evacuated with a shaver through the anterior portal. This helps better define the bony fragment. A 30° angled freer elevator is used to elevate the fragment and capsulolabral tissue from the glenoid. Adequate mobilization is confirmed by visualizing subscapularis muscle fibers. Anatomic reduction without undue tension is confirmed by use of a grasper through the anterior portal. Residual bone loss is once again quantified because reduction of the fragment often restores this below the critical value of 25%. The footprint is then decorticated with a bone-cutting shaver until a bleeding cancellous bed is obtained. The marrow elements emanating from the footprint assist with bony healing.

**Table 2.** Portals for Arthroscopic Bony Bankart Fixation

Portal	Description
Posterior	2 cm distal to posterior-lateral corner of acromion
Anterior rotator interval	Superior to upper rolled border of subscapularis, 1 cm medial to its insertion on humerus
Anterior-superior rotator interval	Inferior to biceps insertion on supraglenoid tubercle
Posterolateral	4 cm lateral to posterolateral acromion

A posterolateral portal is created under needle localization. This is located 4 cm lateral to the posterolateral acromion (Table 2). A cannula can then be placed into this portal if preferred by the surgeon. This portal allows ease of suture passage into the inferior capsulolabral complex from the 5- to 7-o’clock position. Suture passage in this tissue is critical in the setting of anterior-inferior instability to avoid failed stabilization due to residual inferior instability.

A bioresorbable single-loaded suture anchor (2.8-mm biocomposite Acuflex Twinfix anchor containing No. 2 Ultrabraid suture [Smith & Nephew, Andover, MA] or 3-mm biocomposite SutureTak anchor containing No. 2 FiberWire suture [Arthrex]) is percutaneously placed through the upper one-third of the subscapularis onto the glenoid at a 30° angle. Depending on the type of instability and intraoperative findings, this is typically placed at the 7-o’clock or 6:30 clock-face position on the glenoid (left shoulder). Trans-subscapularis placement enables ease of placement on the inferior glenoid without risk of inferior cortical blowout if approached through a more superior cannula. Maintaining the guide within 2 cm of the upper border of the subscapularis minimizes the risk of injury to the axillary nerve. An angled suture-passing device (Spectrum II; ConMed Linvatec, Largo, FL) is used to pass a suture shuttle (No. 1 polydioxanone suture; Ethicon, Somerville, NJ) into the anterior band of the inferior glenohumeral ligament (IGHL) through the posterolateral portal. One of the free suture limbs from the anchor is retrieved and passed through the tissue. Both sutures are then retrieved through the posterolateral portal to maintain suture organization.

Another anchor is placed at the 8-o’clock position (left shoulder), typically through the anterior portal. The sutures are retrieved through the posterolateral portal. The suture shuttle passer is introduced through the anterior portal and is passed around the entire bony fragment and capsulolabral complex. We use a 30° or 45° passer so that the radius of curvature is large enough to pass around the entire fragment. In a fashion similar to the method described earlier, 1 of the suture limbs is then passed through and both sutures are retrieved through the posterolateral portal. The previously mentioned steps are then repeated for 1 or 2 additional anchors, depending on the size of the lesion, which are placed at the 9- and 10-o’clock positions (left shoulder). The sutures for these anchors are typically retrieved through the posterior portal. The simple loop configuration of sutures allows for compression at the footprint site when tied.

Once all sutures are passed, each pair of sutures is retrieved and tied through the anterior portal in sequential fashion beginning with the inferior-most sutures, working anterior-superiorly. Knots are tied in this direction to ensure anatomic reduction of the IGHL, which is typically avulsed and retracted posteriorly. This



**Table 3.** Key Technical Pearls for Arthroscopic Bony Bankart Fixation

1. Preoperative planning: Obtain computed tomography to evaluate size of fragment/degree of comminution.
2. Positioning and examination under anesthesia: Assess for anterior and inferior instability.
3. Portal placement: Perform anterior, anterior-superior, and posterolateral portal placement (Fig 2).
4. Perform visualization through anterior-superior portal.
5. Evacuate hematoma, mobilize IGHL and fracture fragment, and identify subscapularis fibers.
6. Posterolateral portal placement: Perform anatomic suture passage through IGHL.
7. Perform percutaneous trans-subscapularis anchor placement into 7-o'clock position on glenoid, and maintain guide within 2 cm of upper border of subscapularis. Place additional anchors through anterior portal at 8-, 9-, and, if necessary, 10-o'clock positions.
8. Perform suture shuttle passage around fragment and capsulolabral tissue; ensure low radius of curvature instrument. Place simple looped sutures.
9. Tie sutures through anterior portal in sequential fashion with joint reduced, beginning with inferior-most sutures.
10. Reassess stability with repeat examination of patient under anesthesia and confirm no displacement of fragment after examination.

serves as a guide for anatomic reduction of the bony fragment. Suture tying is performed away from the articular surface to avoid suture knot prominence. A sliding knot is preferred, followed by alternating half-hitches to ensure compression between the fragment and the footprint (Video 1).

Before wound closure, the arm is removed from traction and a gentle anterior-inferior translation test is performed to confirm stability without dislocation. The arthroscope is reintroduced into the joint to confirm maintenance of reduction and suture integrity after this stress test. Once confirmed, the portals are closed and the patient is placed in a shoulder abduction sling. Table 3 shows key technical pearls.

Postoperatively, passive range of motion is begun at 2 weeks with forward elevation to 90° and external rotation with the elbow at the side to 30°. Sling use is discontinued at 4 weeks, and the patient is advanced to active-assisted and active range of motion between weeks 4 and 8, avoiding combined shoulder abduction and external rotation. At week 10, active external rotation at 45° of abduction is initiated. At week 12, full active range of motion is allowed and strengthening is initiated. During this process, serial radiographs are obtained at 2 weeks, 6 weeks, and 3 months to ensure healing without displacement. Return to throwing and unrestricted work is begun at 6 months.

### Discussion

Our modified technique differs from the Sugaya technique in that it is performed in the lateral position and

uses the posterolateral portal for suture passage into the IGHL, as well as a percutaneous trans-subscapularis placement of the low inferior anchor. It has many advantages because it is reproducible and straightforward. The lateral position allows for excellent visualization of the inferior glenoid and labrum compared with the beach-chair position. The anterior-superior portal allows for direct visualization of the fracture fragment and anterior glenoid neck. Using the posterolateral portal and percutaneous trans-subscapularis placement of anchors facilitates anatomic suture placement and reduction of the IGHL. Anatomic reduction of the IGHL serves as a guide, facilitating reduction of the bony fragment. In addition, failure to restore the IGHL sling can lead to failed stabilization due to residual inferior instability.

The classic technique of visualization through the standard posterior portal can make it difficult to see the anterior glenoid neck and confirm appropriate mobilization of the fragment. In addition, passing suture through the anterior portal into the IGHL at the 5- to 7-o'clock positions can be difficult.

Arthroscopic soft-tissue Bankart repair techniques have undergone an evolution with outcomes comparable to open repair.<sup>2</sup> This technique focuses on extensive fracture hematoma evacuation, anatomic soft-tissue and fracture reduction with compression, and fragment stabilization. The key to optimizing these steps is using the previously mentioned portals to provide appropriate visualization and fixation.<sup>3</sup> In addition, placing sutures in a simple loop configuration, as well as tying in a sequential fashion, ensures reduction and compression of the fracture. Placing additional sutures above and below the fragment also facilitates stability of the bony fixation by distributing the loads to the surrounding soft tissues.

Recent prospective studies evaluating arthroscopic suture anchor fixation of bony Bankart lesions have reported good to excellent outcomes, a low incidence of recurrent instability, and maintenance of the bony fragment over time.<sup>4,5</sup> Moreover, acute repair yields superior results to chronic repair by avoiding the need for a salvage bony augmentation procedure such as a distal tibial allograft or Latarjet procedure.<sup>6</sup> The typical fragment size, if left untreated, can resorb and result in critical glenoid bone loss, leading to recurrent instability and/or soft-tissue Bankart repair failure.<sup>7</sup> Thus a bony Bankart injury typically requires acute recognition and effective arthroscopic treatment, differentiating it from soft-tissue Bankart tears, which are often treated conservatively in the acute setting.

One of the challenges of this technique is avoiding "overcrowding" of the 2 anterior rotator interval portals. The surgeon must be methodical in choosing the location of these portals to ensure proper spacing. In addition, it is recommended to dilate the soft tissue with cannula-specific dilators to avoid loss of the capsular

soft-tissue bridge between the 2 cannulas. Another potential challenge is a lack of familiarity with visualizing through the anterior portal. Most surgeons are trained to perform shoulder arthroscopy by visualizing through the posterior portal. We believe that the birds-eye view provided by the anterior-superior rotator interval portal requires less manipulation of the camera and lens to see the anterior-inferior glenoid and the associated fragment during suture passage and fixation.

Another challenge is avoiding “roll-in” of a larger (>1 cm) fragment. Large fragments can have the tendency to rotate toward the glenoid face and extrude medially if there is only a single point of fixation at or near the glenoid articular surface. This can lead to nonanatomic fixation and a resulting articular step-off. For such fragments, a double-row repair has been described to avoid this phenomenon. With this technique, 1 anchor is placed medial to the fragment and its sutures are passed around the fragment. These sutures are fed into another anchor that is then placed on the glenoid surface.<sup>8</sup>

In summary, the arthroscopic treatment of acute bony Bankart injuries is an effective means to restore glenohumeral stability while avoiding the potential morbidity associated with an open intervention. This technique along with video demonstration provides surgeons with a reproducible means by which to address this injury in a minimally invasive, reproducible fashion.

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