Arthroscopic Transosseous Bony Bankart Repair

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Abstract: Restoration of glenoid bony integrity is critical to minimizing the risk of recurrence and re-creating normal kinematics in the setting of anterior glenohumeral instability. We present an arthroscopic suture anchor–based technique for treating large bony Bankart fractures in which the fragment is secured to the intact glenoid using mattress sutures placed through the bony fragment and augmented with soft-tissue repair proximal and distal to the bony lesion. This straightforward technique has led to excellent fragment reduction and good outcomes in our experience.

In recent years, the orthopaedic community has become increasingly aware of the high prevalence and critical importance of instability-associated bony lesions in the glenohumeral joint (glenoid bone loss and Hill-Sachs defects).[1] Osseous glenoid injury is particularly common in patients who have undergone high-energy trauma and patients with recurrent instability, up to 90% of whom have some degree of glenoid bony injury.[2]

When a bony Bankart fragment is present, fixation may be achieved with either open or arthroscopic surgical techniques. Small bony fragments (<10% to 15% of anterior-to-posterior glenoid diameter) can be secured arthroscopically using techniques similar to standard Bankart repair, in which the bony fragment is incorporated into the capsulolabral repair.[3] Larger bony fragments are more clinically important and often necessitate advanced arthroscopic techniques for reduction and fixation, several of which have been described in the literature.[4-6] We present a straightforward alternative arthroscopic suture anchor–based technique for transosseous fixation of large bony Bankart fracture fragments (Tables 1 and 2).

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Surgical Technique

Patient Positioning and Portal Placement

We prefer to perform shoulder arthroscopy with the patient in the lateral decubitus position; however, this procedure can also be accomplished with the patient in the beach-chair position depending on surgeon preference and experience. After examination under anesthesia, the patient is positioned laterally on a beanbag with the operative arm held in 70° of abduction and 15° of forward flexion with 10 to 12 lb of traction.

Three portals are required for this procedure. The arthroscope is initially placed in the standard posterior portal, located 2 cm inferior and 1 to 2 cm medial to the posterolateral corner of the acromion. Anterosuperior and anterior midglenoid portals are then placed in an outside-in fashion with the aid of a spinal needle for precision. The anterosuperior portal is placed 1 cm off the anterolateral corner of the acromion and enters the joint just posterior to the biceps tendon through the superior portion of the rotator interval. The anterior midglenoid portal is then established at the level of the upper border of the subscapularis tendon, and the spinal needle is used to confirm adequate access to the anteroinferior quadrant of the glenoid for suture anchor placement and suture passage. Standard 15-point arthroscopic examination of the glenohumeral joint is then performed from both the anterior and posterior portals.[7]

Preparation

In both the acute and chronic settings, the procedure begins with debridement and mobilization of the fracture fragment (Video 1, 46 seconds). Viewing through the anterosuperior portal and working through the anterior midglenoid portal, the surgeon removes blood

Table 1. Advantages and Disadvantages

Advantages	
	Relatively simple repair construct
	Avoidance of deltopectoral approach with subscapularis disruption
	Ability to address concomitant intra-articular injury (e.g., Hill-Sachs lesion)
	Secure fixation with transosseous sutures that do not cross the articular surface
	Labral repair, capsular tensioning, and rotational stability conferred by superior and inferior anchors
Disadvantages	
	Some special equipment (long 14-gauge hip arthroscopy needles, 1.6-mm K-wire) is required.
	Similar to other bony Bankart repair techniques, advanced arthroscopic skills are required.

clots and scar tissue interposed between the fracture fragment and intact glenoid using an arthroscopic grasper and shaver. A liberator is then used to free the bony fragment from the intact glenoid. This continues until subscapularis fibers are visualized and the osseous fragment can be easily manipulated to an anatomic position with minimal tension.

Before the repair is begun, 2 additional critical steps are required for this technique. First, a curved Spectrum suture passer (ConMed Linvatec, Largo, FL) loaded with No. 1 polydioxanone (PDS) suture (Ethicon, Somerville, NJ) is passed through the capsulolabral tissues at the "hinge point," which is the junction of the Bankart fragment and the intact glenoid inferiorly (Video 1, 1 minute). Circumferential fibers of the labrum are generally intact at this location. Both limbs of this PDS suture are retrieved from the anterior midglenoid portal and then placed outside the cannula, where they may serve as traction sutures to aid in manipulation of the fracture fragment (Fig 1A).

Second, an electrofrequency device is used to clear soft tissue from the anterior surface of the fracture fragment, medial to the capsule and labrum (Video 1, 1 minute 23 seconds). This step facilitates visualization of transosseous tunnels and suture passage through these tunnels, as described later.

Table 2. Pearls and Pitfalls

Pearls	
	Mobilize the bony Bankart fragment until it is easily reducible to the intact glenoid.
	Clear soft tissue from the anterior glenoid neck to visualize the K-wire and transosseous suture exit.
	Use a grasper and hinge-point traction suture to manipulate and stabilize the bony fragment during transosseous drilling.
	Leave the guide needle in place after drilling each bone tunnel to act as a conduit for the suture.
Pitfalls	
	Placing the anchor for the transosseous sutures on the glenoid face may result in over-reduction (lateralization) of the fracture fragment.
	Failure to address a significant Hill-Sachs lesion will increase the risk of recurrent instability.
	Locking the transosseous suture knot before fully reducing the fracture fragment will result in malreduction.

Bony Bankart Repair

The repair construct typically consists of 3 anchors: 1 placed at the inferior hinge point, 1 placed in the center of the intact side of the fracture defect, and 1 placed at the superior border of the fracture. As described later, sutures from the central anchor are passed through transosseous tunnels for bony fixation whereas those from the anchors placed at the superior and inferior margins of the fracture site are used for soft-tissue repair and augmentation of the transosseous repair construct.

Before the anchors are placed, 2 tunnels are drilled from posterior to anterior through the fracture fragment (Video 1, 1 minute 28 seconds). To accomplish this, the previously placed traction suture and a grasper introduced through the anterior midglenoid portal are used to manipulate the fracture fragment laterally, exposing the fragment's subchondral bone for tunnel drilling. Next, a 14-gauge, 8-in hip arthroscopy needle (Cadence, Staunton, VA) is introduced through the posterior portal (Fig 2) and into the subchondral bone of the fracture fragment slightly inferior to its center. A 0.062-in (1.6-mm) Kirschner wire is then passed through the needle and drilled across the fracture fragment from posterior to anterior, thus creating the first tunnel. The Kirschner wire is removed, with care taken to leave the needle in position within the bony fragment. A No. 1 PDS suture is passed through the needle and across the fracture fragment from posterior to anterior, and then both limbs of the PDS suture are retrieved from the anterior cannula. The surgeon repeats these steps, creating a second tunnel and passing a second No. 1 PDS suture approximately 4 to 5 mm superior to the first tunnel (Fig 1B). These sutures are also stored outside the anterior midglenoid cannula for later shuttling.

Next, the first suture anchor is placed inferiorly at the edge of the intact articular cartilage adjacent to the hinge point (Video 1, 2 minutes 29 seconds). The posterior limb of the previously placed traction suture is used to shuttle 1 high-strength suture from the anchor around the anteroinferior capsulolabral tissue, which is then secured with a sliding-locking knot and 3 alternating half-hitches. This results in good approximation of the fracture fragment and aids in subsequent final reduction.

The second anchor is then placed in the center of the intact side of the fracture bed, between the 2 transosseous tunnels, at the osteochondral junction, not on the face of the glenoid (Video 1, 3 minutes 8 seconds). The anterior and posterior limbs of the PDS suture in the inferior tunnel are retrieved into the anterior midglenoid and posterior cannulas, respectively, and

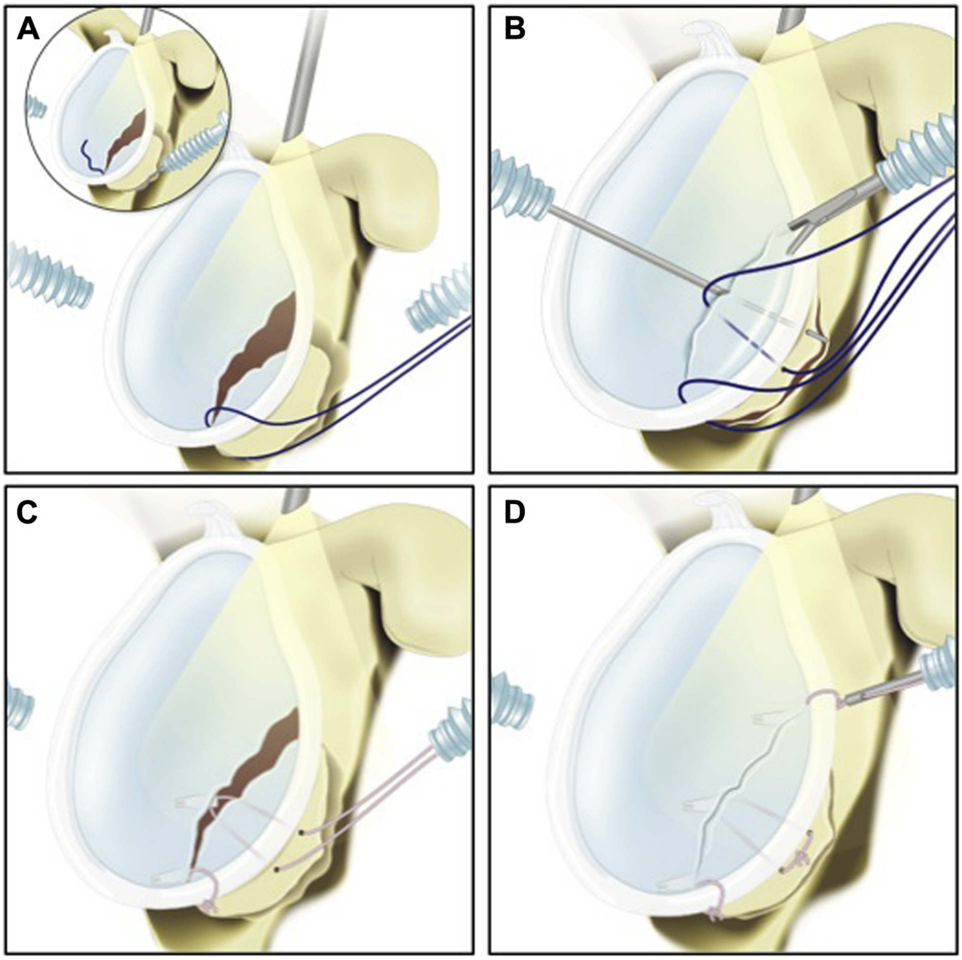

Fig 1. En face view of glenoid in a right shoulder. (A) A No. 1 polydioxanone (PDS) suture is placed around the labrum using a curved suture hook, and both tails are retrieved and stored outside the anterior midglenoid portal, where they can be used as a traction suture for manipulation of the bony fragment. (B) By use of a 14-gauge hip arthroscopy needle as a drill guide through the posterior portal, 2 posterior-to-anterior tunnels are drilled with a Kirschner wire through the bony Bankart fragment. After each tunnel is drilled, the needle is left in place and a No. 1 PDS suture is passed through each tunnel for later shuttling. During drilling, the hinge-point traction suture (through the anterior portal, outside of the cannula) and a grasper (placed through the anterior cannula) are used to manipulate the bony fragment to facilitate drilling. (C) After the inferior labrum has been secured with 1 anchor, a second anchor is placed at the osteochondral junction of the intact glenoid, centered between the 2 drill holes in the fracture fragment. The suture limbs from this anchor are then shuttled through the tunnels and out anteriorly, where they are subsequently tied over the bony fragment as a mattress stitch. (D) The final repair construct consists of 3 suture anchors, with the sutures from the inferior and superior anchors passing around the labrum and capsule and those from the middle anchor passing through the osseous fragment and being tied over the bone anteriorly.

are used to shuttle 1 suture limb from the anchor through the posterior portal through the inferior tunnel from posterior to anterior. The other limb of the suture from the anchor is then shuttled through the more superior tunnel in a similar fashion, resulting in a mattress stitch capturing the bony fragment (Fig 1C). It is then secured with a sliding-locking knot and 3 alternating half-hitches, with care taken to adequately reduce the bony fragment before locking the initial knot.

Finally, a third anchor is placed at the superior margin of the fracture site, and a soft-tissue repair is performed at this location with 1 to 2 additional simple stitches placed using a curved suture passer and standard shuttling technique (Fig 1D; Video 1, 3 minutes 49 seconds). An example of a completed repair is shown in Figure 3.

Discussion

Appropriate management of bony pathology in the setting of anterior glenohumeral instability is critical to preventing recurrent dislocation.[1] When a bony Bankart fragment is present, in either the acute or chronic setting, it is best to incorporate that fragment

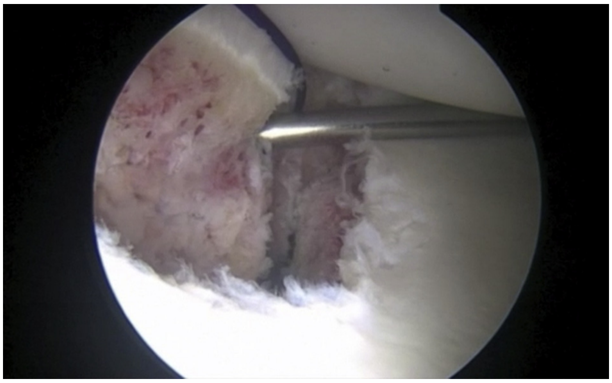

Fig 2. Right shoulder, lateral position, viewing from anterosuperior portal. By use of a No. 1 polydioxanone traction suture passed inferior to the bony Bankart fragment and a grasper through the anterior midglenoid portal, the bony Bankart fragment is manipulated into position. A 14-gauge hip arthroscopy needle placed through the posterior portal is then used as a drill guide, and a pair of transosseous tunnels are drilled from posterior to anterior through the fragment with a 1.6-mm Kirschner wire.

into the repair construct. Such repaired bony Bankart lesions heal reliably and reduce the risk of recurrent instability.[8]

In the presence of a large bony fragment, however, this can be a difficult task to accomplish arthroscopically, and several techniques for addressing this problem have been previously reported in the literature. Porcellini et al.[3] advocate an arthroscopic anchor-based technique in which sutures are wrapped around the bony fragment and labrum, and we prefer this technique for cases with small bony fragments. In addition, a variety of suture-bridge techniques have been reported.[4-6] These techniques, however, are increasingly complex and rely on permanent suture passing over the articular surface of the fracture fragment, which may not be ideal when a large portion of the glenoid is involved.

The technique described in this article is a straightforward alternative for reduction and stable fixation of large bony Bankart fractures. The arthroscopic technique allows close inspection and management of concomitant intra-articular pathology, as well as confirmation of anatomic reduction, and avoids the morbidity and complexity of an open deltopectoral incision with subscapularis detachment. Transosseous sutures provide secure fixation deep to the articular surface, whereas the superior and inferior soft-tissue repair reapproximates the labrum, restores tension to the anterior capsular ligaments, and provides added rotational stability to the bony fragment. This

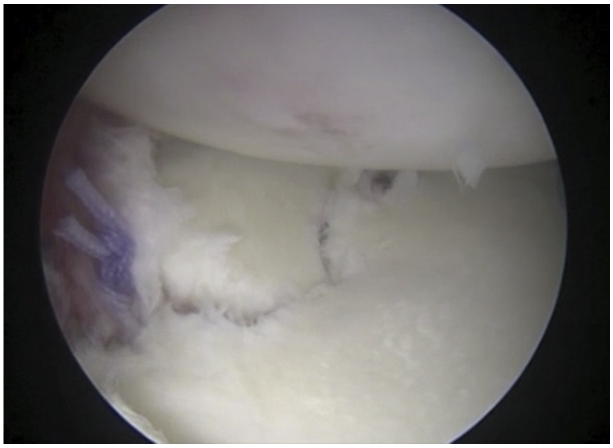

Fig 3. Right shoulder, lateral position, viewing from anterosuperior portal. Final repair construct with good reduction of fracture and adjacent soft-tissue injury.

transosseous bony Bankart repair has resulted in favorable outcomes in our experience and represents an excellent way to arthroscopically manage large bony Bankart injuries.

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