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Background

Coracoid fractures are uncommon and comprise 2-13% of all scapular injuries (1). Typically, they occur from high-energy direct trauma such as motor vehicle collisions or falls from height (2). Ogawa et al reviewed 67 patients with fractures of the coracoid process and classified them based on the relationship between the fracture site and the coracoclavicular ligament. Fractures located proximal to the coracoclavicular ligaments are classified as type I, while fractures distal to the CC ligament is classified as type II (3). Treatment of these fractures are based on fracture type and displacement. Isolated type II fractures with minimal displacement can be treated conservatively while displaced type II and the majority of type I fractures should be treated surgically (4). The most common method of surgical fixation of coracoid fractures is with screw fixation, however, Kennedy et al reported good outcomes in their technical note using suture anchors (5).

Isolated injury to the coracoid is rare and definitive treatment should take concomitant shoulder injuries into account. Ogawa and Knapic showed that acromioclavicular dislocations, clavicular and acromial fractures, scapular spine fractures, rotator cuff tears, and anterior shoulder dislocations are all commonly associated with coracoid injury (1, 3). The case report by Cottias et al described an open Latarjet procedure for treatment of persistent instability in a patient that suffered a greater tuberosity fracture, coracoid fracture and anterior glenoid bone loss in one shoulder after bilateral shoulder dislocation (6). Schneider et al reported a successful outcome in a patient with chronic anterior shoulder instability and avulsion fracture of the coracoid treated with an open Latarjet procedure (7).

The purpose of this Technical Note is to describe our technique used to treat a displaced Ogawa Type-II coracoid process fracture with concomitant anterior shoulder dislocation and a fragmented bony Bankart lesion using an arthroscopic Latarjet technique.

Case Description

- CC: Right Shoulder Pain and Instability
- HPI: 16 y/o Male sustained an injury falling on an extended arm while playing ice hockey. The shoulder was found to be dislocated in the anterosuperior direction and subsequently reduced by an athletic trainer on the sideline. He was then sent to the emergency department for further evaluation. He was placed in a sling and made non-weightbearing and sent for orthopedic follow up.
- PMH: Negligible, PSH: Negligible
- Physical Exam: Tenderness over coracoid to palpation, 2+ Load and Shift test, and a positive apprehension/relocation sign
- No previous history of subluxation or dislocation events
- The Instability Severity Injury Score developed by Boileau et al. (8) predicted continued instability with soft-tissue only procedure in this patient
- The patient underwent an arthroscopic Latarjet procedure to address the multiple sites of pathology of the shoulder by utilizing the fractured coracoid to address the glenoid bone loss

Pre-Operative Imaging

Figure 1

Axillary View showing displacement of coracoid fracture, bony bankart lesion and loss of anterior glenoid contour

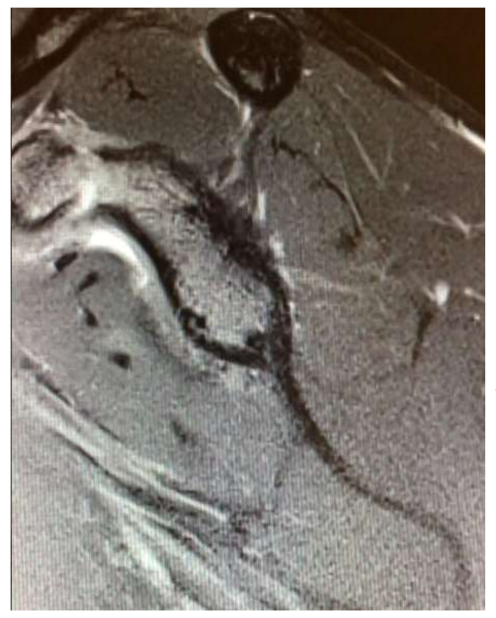

Figure 2

Sagittal MRI showing edema surrounding coracoid base fracture

Figure 3

Axial MRI showing displaced bony Bankart lesion

Figure 4

3-D Reconstruction from CT demonstrating anterior bone loss as well as fracture of coracoid base

Operative Technique

Anatomic landmarks are drawn and portial sites D,E,H,M and J are marked in accordance with Lafosse's arthroscopic Latarjet technique (9) (Figure 5). A slightly medialized posterior portal is utilized and a standard diagnostic arthroscopy is conducted to assess the 15 points of Snyder. In this case, there was tearing of the superior and anterior labrum as well as significant anterior glenoid bone loss. The anterior (E portal) is made through the rotator interval under visualization with an outside-in technique. After confirmation that the bony Bankart lesion is not viable, the anterior labrum and anterior rim of the glenoid is debrided and skeletonized using a radio frequency wand (VAPR® Suction Electrodes, Depuy Synthes, Raynham, MA) and shaver (Excaliber, Arthrex, Naples, FL). In this case, the shoulder was ranged and a large engaging Hill-Sachs lesion was revealed, confirming an off track lesion as described by Giacomo et al (10). Given the amount of glenoid bone loss and engagement of the humeral head, a Latarjet procedure that utilized the fractured coracoid was deemed appropriate and necessary.

Next the joint capsule is opened using the VAPR, exposing the subscapularis tendon through the E portal. The rotator interval is cleaned out to find the coracoid and the coracoacromial ligament is partially removed. Next, the D portal is created 1 cm lateral and inferior to the anterolateral corner of the acromion to gain better viewing of the anterior structures. Visualization from this portal provides a view of the anterosuperior and anteroinferior bone loss (Figure 6). The anterior and posterior space around the subscapularis is then carefully defined using radiofrequency ablator and shaver. The axillary nerve is encountered inferior and medial to the coracoid in its predictable position. The D and E portals are used until the coracoid is clearly defined. In this case, the fracture was clearly visible as being distal to the coracoclavicular ligaments but still proximal to where the osteotomy is routinely made for a Latarjet procedure.

The M, and J portals are then developed (Figure 5) and used to better define the conjoint tendon and pectoralis minor. The coracoacromial ligament is removed off the coracoid, leaving the conjoined tendon attached. Next, the scope is placed in the J portal to view the axis of the coracoid process. A switching stick through the D portal is used to lift the deltoid superior and improve visualization of the coracoid. A spinal needle is used to determine the H portal location over the coracoid (Figure 7). Through this portal the proprietary coracoid drill guide can be placed (Depuy Synthes, Raynham, MA). In this case, counterpressure was needed on the coracoid to prevent displacement of the fracture. The alpha hole on the coracoid drill guide must be approximately 1cm proximal to the tip of the coracoid process. The guide then can be removed and the coracoid step drill is used over the guide wires into the alpha and beta positions.

Next the subscapularis split is created. A switching stick is placed in from the posterior portal across the glenoid face and into the subscapularis to define the appropriate position. The subscapularis split is made at the union between ⅔ superior and ⅓ inferior of the muscle at the same plane as the future graft site location. The split is made using the radiofrequency ablator until the glenoid is appropriately exposed. Care must be taken to avoid injury to the axillary nerve while completing the split medially. The conjoint tendon can also be visualized medial to the longitudinal split. The anterior glenoid is then prepared to accept the graft using the shaver and burr. It is important to make sure there is no soft tissue interposition.

Next, the coracoid osteotomy is performed. The osteotomy is made using straight and curved osteotomes through the H portal. Two coracoid screws are placed into the alpha and beta holes of the osteotomized coracoid through the M portal (Depuy Synthes, Raynham, MA). Decortication of the inferior coracoid is performed. The coracoid is then mobilized through the subscapularis split. The switching stick from the posterior portal is used to widen the split and facilitate mobilization of the graft across through the subscapularis unto the prepared glenoid neck.

The scope is then placed back into the J portal and the coracoid is placed in the desired position on the anterior rim of the glenoid in the 2 o'clock to 5 o'clock position. The graft is lined up with the subchondral bone roughly 3-4 mm medial to the glenoid cartilage. Once satisfied with the position, a k-wire can be drilled through the cannulated coracoid screw in the alpha hole across the glenoid until it penetrates out the posterior shoulder where it is clamped. This process is repeated for the beta hole in the same fashion. The coracoid screw is then removed from the alpha hole and a 3.2 mm drill is used over the wire into the glenoid. Next, the length is measured and an appropriate length 4.5 mm Latarjet cortical screw is placed over the wire into the coracoid and glenoid. The same process is repeated for the beta hole. In our case, both screws obtained excellent purchase and compressed the graft nicely against the glenoid (Figure 8). Fixation should be assessed through multiple views along with confirmation of no soft tissue interposition.

Intra-Operative Imaging

Figure 5

Patient positioned in modified beach chair with portal sites drawn out

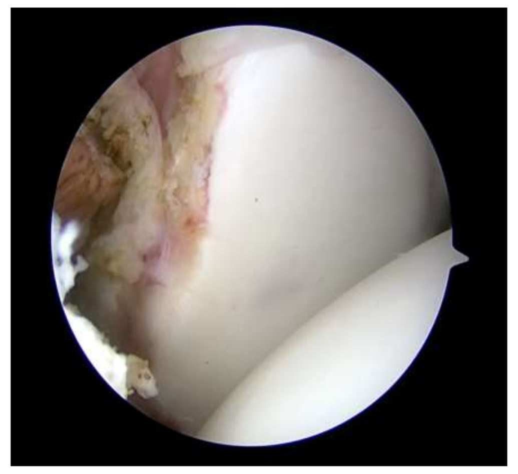

Figure 6

Arthroscopic view from D portal demonstrating anterosuperior & inferior bone loss of glenoid

Figure 7

Arthroscopic view from the J portal showing skeletonized coracoid with spinal needle

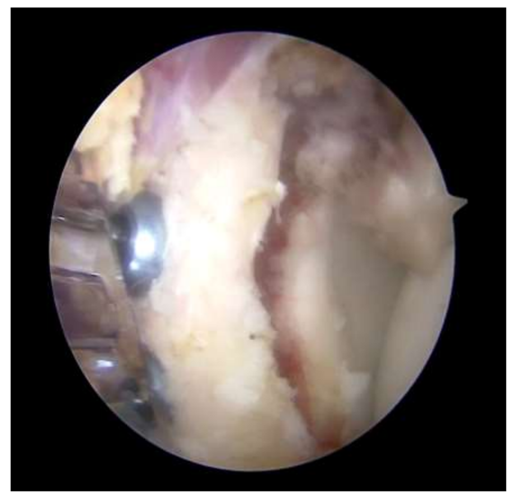

Figure 8

Arthroscopic view form J portal showing graft fixation to glenoid in the 2-5 o'clock position with cannulated screw

Outcome and Post-Operative Imaging

- The patient is placed in a padded abduction shoulder sling at the end of the procedure
- Immediate post-operative protocol consisted of pendulums and biceps isometrics for 2 weeks
- After 2 weeks formal physical therapy was initiated with PROM advancing to active assisted ROM and then active ROM
- At the 3 month follow up visit, the patient had full ROM and no instability
- Follow-up CT scan at 3 months showed healed coracoid and a healed graft to the anterior glenoid (Figure 11)
- The patient was allowed to return to sport at 3 months post-operatively with no restrictions
- The patient has continued to do well at 18 months post op with no incidence of recurrent instability.

Figure 9

Post-operative Bernageau view demonstrating intact coracoid graft and proper screw placement

Figure 10

Post-operative Scapular-Y view demonstrating intact coracoid graft and proper screw placement

Figure 11

CT Shoulder at 3 months post op with humeral subtraction showing incorporation of graft

Discussion

Although rare, coracoid injury due to high-energy trauma and sporting activity has been described in the literature. Knapic et al. conducted a systematic review of literature from 1970 – 2017, looking at the prevalence of coracoid fractures sustained during sporting activities, as well as the management and outcome of treatment. They found 21 cases of coracoid fractures sustained during sporting activity with 16 of these secondary to acute trauma, while the remaining were fatigue fractures. Non-operative management was utilized in 16 of the patients with 3/16 reporting complications; 1 patient had subcoracoid impingement that was treated with physiotherapy and another had a non-union that was treated with an electric bone stimulating device. The third complication, a case report published by Chammaa et al., where the patient developed anterior shoulder instability and required arthroscopic bony Bankart repair (1,12). Knapic's review showed that return to sport was not statistically different based on fracture mechanism, management, or the presence or absence of acromioclavicular joint injury (1).

The uniqueness of this case involves the associated anterior shoulder instability sustained after anterosuperior dislocation during sport. The reported literature shows that isolated coracoid fractures have good outcomes when treated conservatively. However, a significant proportion of those with concomitant shoulder injury that were treated conservatively required future surgical intervention. The case reports by Cottias and Schneider reported good outcomes when performing an open Latarjet procedure in patients with coracoid fractures and associated anterior shoulder instability (6,7). Aggressive workup and treatment should be conducted in those with coracoid injury as concomitant shoulder injury necessitating surgical intervention is likely. This includes the use of advanced imaging to better understand the pathology.

The described technique is our preferred method to successfully treat a type-II coracoid fracture with an unstable, off track anterior shoulder dislocation using an arthroscopic Latarjet procedure.

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