Technical Note

Conjoint Tendon Tenotomy for Glenoid Exposure in the Setting of Previous Coracoid Transfer

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Abstract: Surgical exposure of the glenoid after previous coracoid process transfer is technically challenging as a result of distorted anatomy, obliterated soft-tissue planes, and adhesive scar tissue, which poses additional risk to adjacent neurovascular structures. The purpose of this article is to present a technique for glenoid exposure following coracoid transfer that involves tenotomy of the conjoint tendon to minimize the risk for neurovascular injury while leaving the well-healed coracoid bone graft in place.

Surgical exposure of the glenoid after previous coracoid transfer for recurrent instability may be needed in cases requiring revision, removal of hardware, and, most commonly, shoulder arthroplasty. However, achieving adequate glenoid exposure in such instances is technically challenging due to abundant scar tissue, obliterated soft-tissue planes, and distorted anatomy along with the close proximity of important neurovascular structures.[1,2] In addition, the subscapularis muscle becomes tethered to the anterior capsule, labrum, transferred coracoid, and the conjoint tendon, which creates difficulty in surgical dissection and identification of important structures. To achieve adequate glenoid exposure, the subscapularis must be released from tethered structures while avoiding injury to the axillary, musculocutaneous, and subscapular nerves. In the literature, few reports exist that describe exposure of the glenohumeral joint accompanied by subscapularis release, conjoint tendon medialization,[1] lengthening,[3] or z-plasty[4] while preserving the coracoid bone block. In this article and Video 1, we describe and demonstrate a technique for glenoid exposure that minimizes the risk to neurovascular structures, leaves the well-healed coracoid bone graft in place, and releases the tethered subscapularis.

Surgical Technique

Surgical Approach

The patient is placed in the beach-chair position and general anesthesia is induced without paralysis to facilitate identification of muscular intervals. An incision is made extending from the anterior aspect of the coracoid toward the humeral insertion site of the deltoid muscle via the deltopectoral groove. The deltopectoral interval is usually marked by the presence of the cephalic vein. However, the vein is often absent in the revision setting. Alternatively, the superior aspect of the interval can be identified by palpation of the

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coracoid remnant and close observation of muscle fiber orientation. It also may be helpful to locate nonabsorbable sutures from the initial surgery. When present, the cephalic vein is retracted medially to prevent excessive lateral traction or compression.

After identification of the deltopectoral interval, a few millimeters of the superior border of the pectoralis major is released to facilitate adequate exposure (Fig 1). Subdeltoid and subacromial adhesions are then released using a combination of blunt and sharp dissection techniques. Electrocautery also is used to control bleeding vessels while taking care to avoid damage to the axillary nerve.

A self-retaining retractor is used to retract the pectoralis major inferomedially and the deltoid superolaterally, thus exposing the underlying clavipectoral fascia, conjoint tendon, and the subscapularis muscle (Fig 2). The superior border of the subscapularis can be identified at the rotator interval while the inferior border lies superior to the anterior circumflex humeral vessels. The lateral border can be identified adjacent to the bicipital groove. The bicipital sheath is then opened. If present, the long head of the biceps (LHB) tendon is tenotomized and tagged for later tenodesis. Mayo scissors are used to transect the rotator interval from lateral to medial, following the path of the proximal stump of the LHB tendon as it enters the glenohumeral joint. Dissection medial to the glenoid places the proximal portion of the axillary nerve and subscapular nerves at risk for iatrogenic injury.[5,6]

The lateral edge of the subscapularis is then elevated from the humerus beginning at the bicipital groove

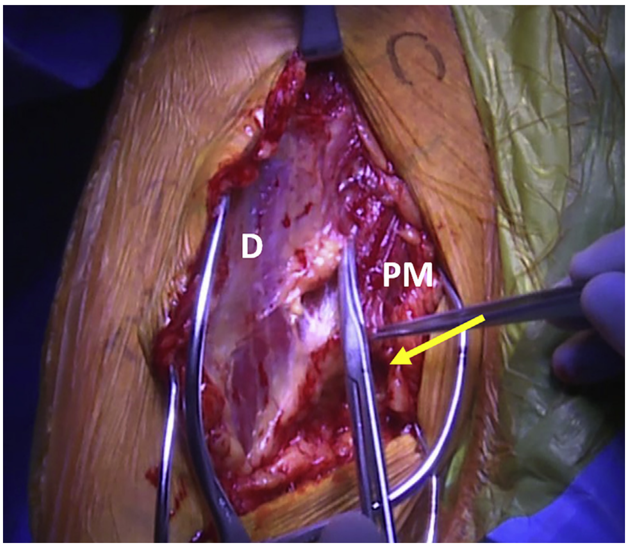

Fig 1. View of a right shoulder demonstrating the deltopectoral approach. Mayo scissors (arrow) are used to release the adhesions using a combination of blunt and sharp dissection within the deltopectoral interval. Electrocautery also may be used for hemostasis. (D, deltoid muscle; PM, pectoralis major muscle.)

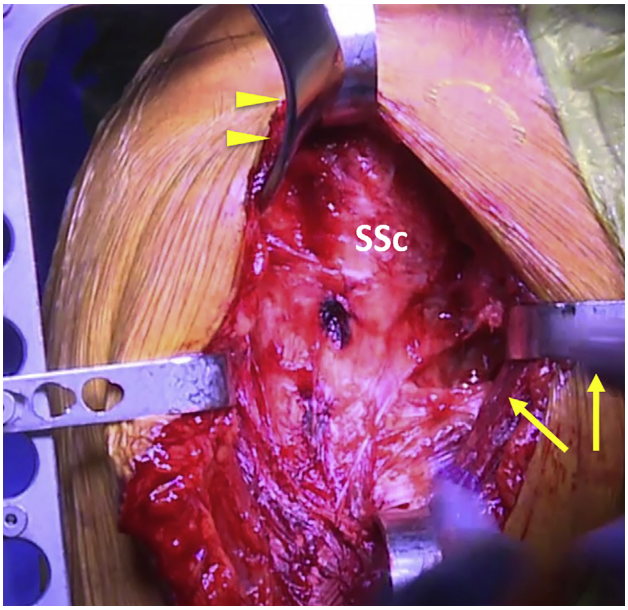

Fig 2. View of a right shoulder following a deltopectoral approach. A self-retaining retractor is used to retract the pectoralis major inferomedially (arrow) and the deltoid superolaterally (arrowheads), thus exposing the underlying clavipectoral fascia, conjoint tendon and the subscapularis (SSc).

using electrocautery (Fig 3). The anterior capsule and the LHB tendon also are elevated away from the joint to provide robust tissue for later repair. To avoid multiple tenotomy sites in the subscapularis tendon, the site of previous tenotomy can be used. Otherwise, a lesser tuberosity osteotomy also can be performed to release the subscapularis muscle tendon unit. Tag sutures are placed for tendon identification and manipulation. Exposure of the glenoid and transferred bone block can be facilitated by medial traction on the tag sutures placed through the subscapularis. Reflection of the subscapularis medially also serves to protect medial neurovascular structures. Soft tissues attached to the transferred coracoid are subperiosteally dissected using electrocautery extending from the joint line both anteriorly and medially (Fig 4).

Conjoint Tendon Tenotomy

Tenotomy of the conjoint tendon is performed from within the glenohumeral joint on the posterior aspect of the subscapularis where the coracoid graft and hardware make contact with the subscapularis muscle medially. This method avoids the neurovascular structures that lie on the anterior aspect of the reflected subscapularis muscle. If necessary, the hardware used for previous coracoid fixation can now be removed (Fig 5). Unless there is a nonunion, the coracoid graft may be left in place. The subscapularis is then mobilized from its posterior surface to avoid the altered anatomic planes anteriorly and to avoid damage to the

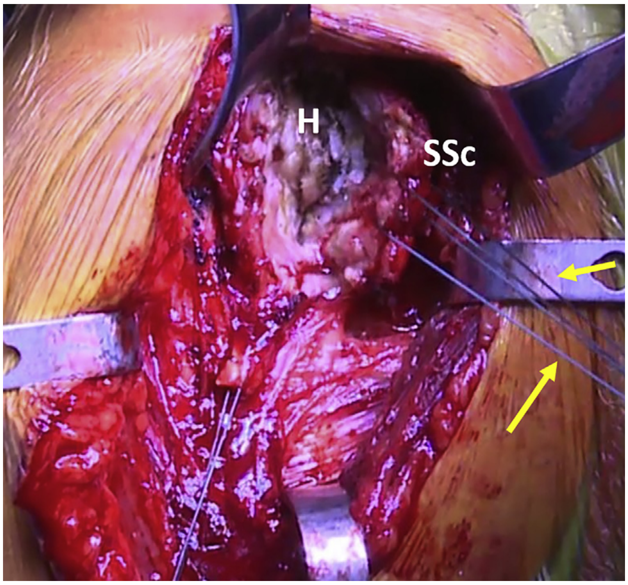

Fig 3. View of a right shoulder following deltopectoral approach. Following elevation of the lateral edge of the subscapularis (SSc) from the humerus (H), tag sutures (arrows) have been placed for tendon identification and manipulation. Exposure of the glenoid can be subsequently facilitated by medial traction on the tag sutures.

subscapular nerves which may lie in close proximity to the anterior glenoid rim[5] (Fig 6). Identification of the axillary nerve may be necessary to allow for lysis of inferior subscapular and capsular adhesions, which should allow for adequate soft-tissue balancing and appropriate glenohumeral kinematics.[6]

After mobilization of the subscapularis, the anterior capsule can be released from the humeral neck using

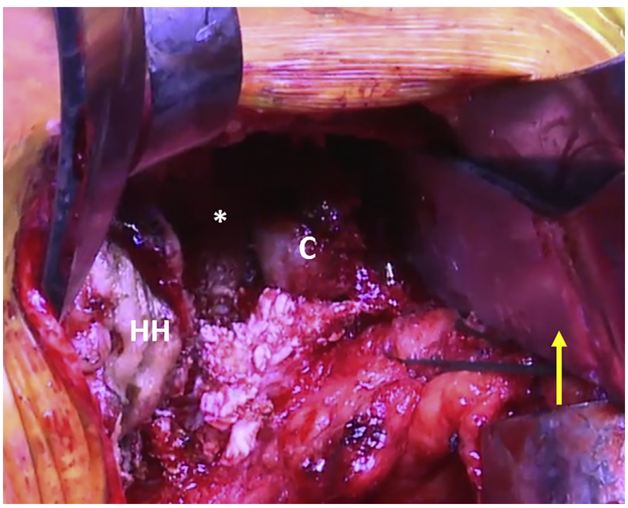

Fig 4. View of a right shoulder following deltopectoral approach. After release of the subscapularis, an anterior glenoid neck retractor (arrow) is used to expose the glenohumeral joint (*). Soft tissues attached to the transferred coracoid (C) are subperiosteally dissected using electrocautery extending from the joint line both anteriorly and medially. (HH, humeral head.)

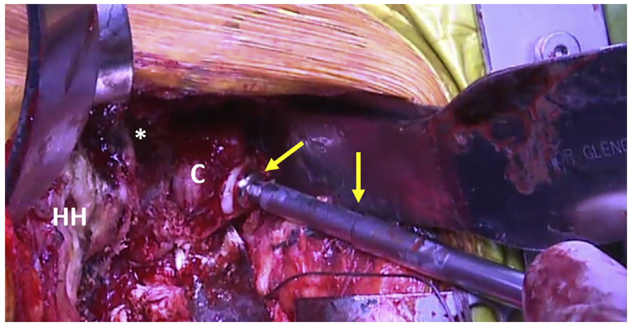

Fig 5. View of a right shoulder following deltopectoral approach and exposure of the glenohumeral joint (*). Hardware removal from previous fixation of the coracoid (C) is performed (arrow). (HH, humeral head.)

electrocautery as the humerus is slowly externally rotated. If the patient was noted to have posterior subluxation on preoperative radiographs or physical examination, capsular release should be performed, taking care to not extend beyond the anterior portion of the inferior glenohumeral ligament complex. Glenoid exposure and preparation are then completed using standard total shoulder arthroplasty techniques. Pearls and pitfalls of the exposure are outlined in Table 1.

Postoperative Rehabilitation

The postoperative rehabilitation will be determined based on the procedure (anatomic/reverse total shoulder arthroplasty) following the glenoid exposure.

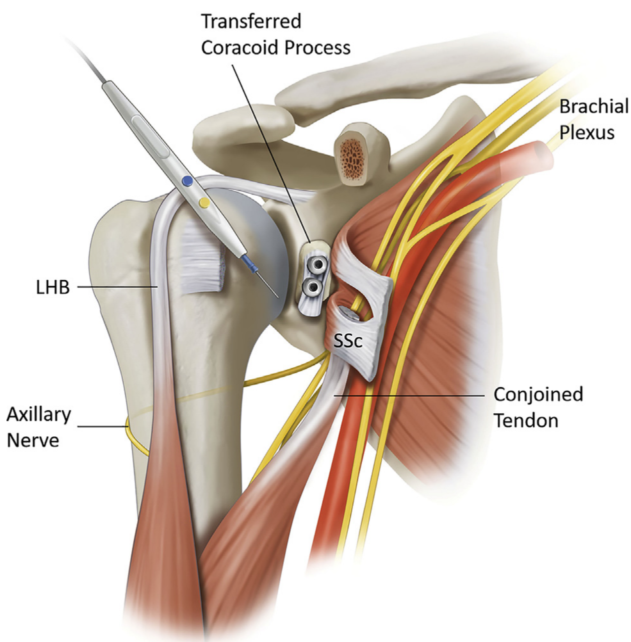

Fig 6. Glenoid exposure following coracoid transfer in a right shoulder. Note that the mobilization of the subscapularis (SSc) from its posterior surface permits avoiding damage to the neurovascular structures, which lie anterior to it. (LHB, long head of the biceps tendon.)

Table 1. Potential Problems and Solutions

Surgical Steps	Potential Problems	Solutions
Superficial dissection	Difficulty identifying altered anatomy	Follow muscle fibers of the conjoint tendon superiorly to locate the coracoid remnant. Locate a nonabsorbable suture from the initial surgery for orientation.
Dissection of the rotator interval	Iatrogenic injury of the axillary and subscapular nerves	Do not extend dissection medial to the glenoid.
Subscapularis tenotomy	Multiple tenotomy sites within the muscle	Use the site of previous tenotomy or perform a lesser tuberosity osteotomy.
Tenotomy of conjoint tendon	Iatrogenic injury to the neurovascular structures	Perform tenotomy from within the glenohumeral joint to avoid neurovascular structures anterior to the subscapularis.
Exposure of transferred coracoid	Iatrogenic injury of the axillary, subscapular, or musculocutaneous nerves	Expose the coracoid with subperiosteal elevation rather than dissection of surrounding scar tissue.

Discussion

Glenoid exposure after coracoid transfer may be necessary in cases requiring revision anterior stabilization, removal of hardware, or shoulder arthroplasty. A systematic review by Griesser et al.[7] reported a 6.9% rate of reoperation and a 2.9% rate of recurrent instability following the Bristow—Latarjet procedure. Although the rate of reoperation after coracoid transfer is relatively low when compared with other anterior stabilization procedures, orthopaedic surgeons are still faced with complex revision cases that bode significant risk to neurovascular structures and postoperative shoulder function.

Anterior stabilization procedures involving coracoid transfer also have been implicated as a cause of glenohumeral osteoarthritis due to external rotation loss and lateral overhang of the coracoid bone block.[8,9] Hovelius et al.[10] reported on 118 Bristow—Latarjet procedures after a 15-year follow-up period and found that 49% had some evidence of arthropathy whereas 14% had evidence of moderate or severe arthropathy. The high prevalence of glenohumeral osteoarthritis after coracoid transfer may lead to an increasing frequency of total shoulder arthroplasty in this patient population. In these cases, the described technique provides excellent glenoid exposure despite anatomic distortion and dense scarification.

The presented technique for glenoid exposure in the setting of previous coracoid block transfer is a safe and reliable approach that minimizes the risk of iatrogenic neurovascular injury that has been reported previously.[7] Given the changes in the neurovascular anatomy after the Latarjet preocedure,[11] the subperiosteal dissection around the transferred coracoid obviates the need to dissect through abundant anterior scar tissue, which may lead to axillary, subscapular, and/or musculocutaneous nerve injuries. Nonetheless, attention should be paid to remain strictly in the subperiosteal plane to minimize the risk of neurovascular injury. Tenotomy of the conjoint tendon allows for glenoid exposure without osteotomy of the united anterior glenoid and the previously transferred coracoid process. Yet, this may lead to weakness in elbow flexion and supination despite the adhesions of the proximal end following tenotomy. In addition, because the subscapularis tendon substance is left intact, this technique also maximizes the reparability of the subscapularis during closure, which may help improve clinical outcomes.

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