Technical Note

Arthroscopic Outside-In Shoulder Release for Patients With an Inaccessible Glenohumeral Joint

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Abstract: Rotator interval release is an important procedure used in many shoulder operations. It is currently performed through an intra-articular approach, which may result in incomplete release or tissue removal. Here, we introduce an outside-in rotator interval release technique for complete rotator interval tissue removal, which is performed mainly through the lateral portal and a distal anterior portal under the coracoacromial arch. This technique can be used for many shoulder conditions, such as severe joint contracture or fibrosis, fixed shoulder dislocation, or disorders of the long head of the biceps. Our experience indicates that this technique is easy, effective, and capable of addressing even the most difficult shoulder conditions. We believe that adoption of this technique by surgeons can facilitate the success of many shoulder operations.

Rotator interval lesions may be the main cause of symptoms in the shoulder joint. Pathologically, there may be disorders such as tissue hyperplasia, inflammation, fibrosis and contracture, and biceps pulley lesions in the rotator interval. In these cases, rotator interval tissue release or removal is the basic surgical operation for treating the disorders and relieving the symptoms. In previous studies, rotator interval release or tissue removal operations were performed with an intra-articular view, with the arthroscope placed into the joint through the posterior portal and instruments placed into the rotator interval through the anterior portal. Clinically, we found that the intra-articular approach always resulted in incomplete rotator interval tissue release and removal, and an outside-in release technique has to be performed to complete the procedure. In the case of severe contracture or fibrosis of the shoulder joint, which results in inaccessibility of the glenohumeral joint, an intra-articular rotator interval release cannot be carried out. The outside-in rotator interval release may be the only method that can be performed. Thus, we introduce the details regarding the outside-in rotator interval release technique.

Surgical Indications

The indications for arthroscopic outside-in rotator interval release are listed as follows (Table 1). First, it is performed as a routine release procedure for rotator cuff repair. In cases of rotator cuff tear with tendon retraction or defect, it is a basic procedure to shift the rotator cuff and reattach it to the footprint by releasing the rotator cuff from the surrounding structures. In all-release procedures, the release between the rotator cuff and rotator interval tissue may be the most important.

The second indication is a frozen shoulder. The thickening and contracture of rotator interval tissue in patients with frozen shoulder is the main factor causing the limitation of external rotation. Rotator interval tissue release and removal is a necessary step, in which the outside-in release is the optimal approach to completely remove the diseased tissue.

The third indication is traumatic adhesion of the shoulder. In patients with traumatic shoulder adhesion, rotator interval tissue proliferation and fibrosis are the main manifestations, in addition to fibrous proliferation and adhesion between the tissue layers. In this case, the
pathologic change in the rotator interval itself needs to be treated through release, and release and exploration is the key prior step to the subsequent debridement of various structures.

The fourth indication is long head of the biceps (LHB) disorder at the proximal bicipital groove. Surgical treatments of LHB disorders (including LHB instability or dislocation, tendinitis, or entrapment) always have a need to open the rotator interval for exposure and remove the pathologic rotator interval tissue.

The fifth indication is fixed shoulder dislocation. In cases of fixed anterior or posterior dislocation of the shoulder joint, it is very difficult to enter the glenohumeral joint through the regular entry path because of the apposition abnormality of the glenoid and humeral head. Releasing the rotator interval first and entering the joint capsule through the rotator interval is a safe and effective method.

**Surgical Procedures (With Video Illustration)**

The outside-in rotator interval release is carried out through the routine anterior portal and lateral portal, as well as a special distal anterior portal. Before the rotator interval release procedures, subacromial debridement is first performed through routine posterior and lateral portals.

The routine anterior portal is located 1 cm lateral to the coracoid tip; the routine lateral portal is located 2 cm distal to the lateral edge of the acromion on the lateral midline of the upper arm (Fig 1).

With the arthroscope placed into the subacromial space through the lateral portal, a switching stick is placed in through the anterior portal to touch the anterior side of the humeral head and then anterior-distally along the humerus to the subanterior deltoid space. Using the switching stick as a lever, the anterior deltoid is elevated. The distal anterior portal, which is located on the anterior midline of the upper arm 5 cm distal to the coracoid tip, is created (Table 2, Video 1).

**Table 1. Surgical Indications**

1. As a routine release procedure for rotator cuff repair.
2. Frozen shoulder.
3. Traumatic shoulder adhesion.
4. LHB disorders.
5. Fixed anterior or posterior shoulder dislocation.

LHB, long head of the biceps.

**Table 2. Step-by-Step Surgical Procedure**

1. Make use of the routine lateral and anterior portals. The arthroscope is placed into the subacromial space. A switching stick is placed into the anterior subdeltoid space to elevate the anterior deltoid.
2. Create an anterior distal portal, which is located in the anterior mid-line of the upper arm, 3 cm distal to the coracoid tip.
3. The CA ligament is defined with an instrument placed in through the anterior distal portal.
4. By probing along the CA ligament medially, the coracoid is touched.
5. The coracoid base is released from all attached tissue, which includes the coracoid–humeral ligament.
6. The subscapularis under the coracoid process is exposed.
7. Rotator interval tissue is removed along the superior edge of the subscapularis to fully expose it.
8. The anterior edge of the supraspinatus is defined just posterior to the coracoid base.
9. Rotator interval tissue is removed along the anterior edge of the subscapularis to fully expose it.
10. Debridement is completed to remove all the residual rotator interval tissue to expose the glenohumeral joint.

CA, coracoacromial.

**Fig 1.** Portals for arthroscopic outside-in rotator interval release (right shoulder). A switching stick is placed into the anterior subdeltoid space to elevate the anterior deltoid. The scope is then placed in through the lateral portal. Instruments are placed in through the distal anterior portal.

**Fig 2.** Debridement under the coracoacromial ligament (right shoulder viewed through the lateral portal). (CAL, coracoacromial ligament.)
A shaver (CONMED Linvatec, Utica, NY) or radio-frequency probe (Smith & Nephew, Andover, MA) is placed into the subdeltoid and subacromial space through the distal anterior portal. The coracoacromial (CA) ligament is defined with the instruments. Debridement under the CA ligament is performed (Fig 2). The CA ligament is followed to its medial end on the coracoid; the lateral edge of the coracoid is defined and exposed with the instruments (Fig 3).

The tissue at the lateral side of the turning portion of the coracoid, which includes the coracoid–humeral ligament and other tissue, is released from the coracoid. The coracoid base is fully exposed (Fig 4). At the inferior side of the coracoid and the conjoined tendon, adhesion between the coracoid or conjoined tendon and the subscapularis is released (Fig 5).

The superior edge of the subscapularis is defined. Then, along the superior edge of the subscapularis, the rotator interval tissue close to the subscapularis is removed to fully expose the subscapularis.

The anterior edge of the supraspinatus is defined just posterior to the coracoid base. Along the anterior edge of the supraspinatus, the rotator interval tissue, which includes the coracoid–humeral ligament, the capsule, and the superior glenohumeral ligament, is removed (Fig 6).

**Fig 3.** The lateral edge of the coracoid process is defined along the coracoacromial ligament (right shoulder viewed through the lateral portal). (CAL, coracoacromial ligament; CHL, coracohumeral ligament.)

**Fig 4.** Rotator interval tissue release to expose the lateral side of the coracoid (right shoulder viewed through the lateral portal). (A) Release the coracoacromial ligament. (B) Fully expose the lateral side of the coracoid. (CAL, coracoacromial ligament; CHL: coracohumeral ligament.)

**Fig 5.** Release of the subscapularis from the coracoid (A) and conjoined tendon (B) (right shoulder viewed through the lateral portal).
Debridement is further conducted to remove all tissue among the subscapularis, the supraspinatus, and the coracoid base, to expose the glenohumeral joint inside.

The arthroscope is placed through the distal anterior portal to check the accessibility of the glenohumeral joint (Fig 7).

Rehabilitation

In case of a frozen shoulder, traumatic adhesion, or LHB disorder at the proximal bicipital groove, range of motion exercises begin immediately after operation, with focus on passive and active external rotation. In case of rotator cuff repair, rehabilitation depends on the location of the rotator cuff tear and its repair. In case of fixed shoulder dislocation, immobilization in external rotation is a main method to for the first 6 weeks after reduction and reconstruction operation, followed by range of motion exercises.

Discussion

The rotator interval tissue lies within the triangle formed by the superior margin of the subscapularis tendon, the anterior margin of the supraspinatus tendon, and the coracoid process at its base edge. It is composed of the capsule layer along with the superior glenohumeral ligament and the coracohumeral ligament. Intra-articularly, the LHB passes beneath the posterior lateral part of the rotator interval. A rotator interval lesion may exist alone. However, in most cases, it exists in combination with other pathologies such as rotator cuff tear and LHB disorders. In most cases, release and removal of the pathologic rotator interval tissue is needed to fix the rotator interval lesions.

In most previous reports, the release is performed with an intra-articular view and instruments placed in through the anterior portal. Due to viewing impediment by the LHB, incomplete tissue release and rotator tissue removal may occur, especially at the posterior side of the interval, in which the coracohumeral ligament is the component and external rotation limitation structure. Furthermore, because the medial insertions CA ligament and coracohumeral ligament exist as 2 superior-inferior layers that are close to each other, intra-articular coracohumeral release always results in inadvertent release of the CA ligament.

Table 3. Pearls and Pitfalls

1. The most critical point of rotator interval release is the establishment of the distal anterior portal. A location too proximal, distal, medial, or lateral of the portal may present difficulty in subsequent instrument manipulation. Locating the distal anterior portal on the anterior midline of the upper arm with a 3 cm distance to the coracoid tip is the best choice.

2. It is sometimes difficult to find the coracoid in the case of inflammatory or fibrotic proliferation. Debridement and detection along the CA ligament is the quickest way.

3. During rotator interval removal at the anterior edge of the supraspinatus, care should be taken to avoid suctioning in shaving off the soft muscle structure.

4. When the shoulder dislocated, the structure is abnormal, and it is quite easy to injure the rotator cuff tissue during removal of rotator interval tissue. Release should begin at the lateral side and the coracoid base. In case of fixed anterior dislocation, release is performed along the anterior edge of the supraspinatus muscle. In case of fixed posterior shoulder dislocation, release is conducted along the superior edge of the subscapularis.

CA, coracoacromial.
ligament. Furthermore, in case of an inaccessible gleno-
humeral joint, which results from severe joint contracture
and structure abnormalities such as a shoulder dislocation,
intra-articular release is impossible. In these conditions
release must be performed in an outside-in manner. The
critical points in performing this procedure are listed in
Table 3.

We developed this technique for an inaccessible gle-
nohumeral joint with reference to a previous report. Now, we perform this outside-in rotator interval
release as a routine procedure to treat rotator interval
pathology. From our experience, it is not only more
effective for complete release and tissue removal of the
rotator interval, but also capable of releasing adhesion
between the rotator interval layer and the CA arch.
The main risk of this technique is inadvertent injury of
the musculocutaneous nerve during release of the sub-
scapularis and the conjoined tendon. The advantages of
disadvantages of this procedure are listed in Table 4.

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**Table 4. Advantages and Disadvantages**

1. It is easy to locate the rotator interval along the coracoacromial
ligament.
2. The rotator interval tissue can be removed in a relatively safe and
effective way.
3. This procedure can be performed more conveniently with the
patient in the beach chair position.
4. The far anterior portal is in the area of the route of the saphenous
vein. Creation of this portal sometimes results in laceration of the
saphenous vein.