

# Essential Surgical Technique for Arthroscopic Capsular Release in the Treatment of Shoulder Stiffness

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## Introduction

Among many treatments for shoulder stiffness, which is a common debilitating condition, arthroscopic capsular release is an effective surgical method for patients who have not responded to conservative treatment<sup>1-3</sup>, as it provides visual control of the capsular release with a lower risk of potential traumatic damage than manipulation under anesthesia<sup>4,5</sup>. In addition, the accompanying shoulder pathology can be examined and treated with a simultaneous capsular release. Even though capsular release has shown favorable results, there have been many controversies regarding the extent of the release. The release of the rotator interval tissue is known to increase the range of flexion and external rotation<sup>6</sup>. Besides the rotator interval, release of the subscapularis tendon<sup>7</sup>, inferior capsule<sup>8</sup>, or global capsule<sup>9</sup> can improve elevation and internal rotation, as well as external rotation. A posterior capsular release to improve internal rotation is controversial, with some authors advocating it<sup>10,11</sup> and others stating it will not improve outcome compared with anterior release alone<sup>5,12,13</sup>.

In the present report, we demonstrate a simple way to release the anterior and inferior capsule, including the removal of rotator interval tissue, without incurring the morbidity of a posterior capsular release. The whole procedure is represented in seven steps.

## Step 1: Position the Patient

Place the patient either in the lateral decubitus position or in the beach-chair position, depending on one's preference.

- Place the patient under anesthesia before the final positioning. With the patient in the lateral decubitus position, the position of the arm is from 60° to 70° of abduction and 15° to 20° of forward flexion.

## Step 2: Portal Placement

Create a standard posterior viewing portal, an anterior portal, and a lateral portal for approaching the glenohumeral joint and the subacromial space.

### Posterior Portal

- Create a standard posterior viewing portal. The posterior portal is the first portal made during the arthroscopy that allows adequate visualization of the entire glenohumeral joint.
- Make a small vertical incision 2 to 3 cm inferior and 1 to 2 cm medial to the posterolateral corner of the acromion<sup>14</sup> (Fig. 1-A). For correct access to the glenohumeral joint, aim the direction of the trocar toward the coracoid process (Fig. 1-B). After the introduction of the trocar through the capsule, a popping sensation can be felt as the joint is entered. In a patient with severe stiffness, it is somewhat difficult for the trocar to enter the glenohumeral joint. Feeling the trocar tip placed between the humeral head and glenoid allows the correct placement of the portal within the glenohumeral joint. After proper placement of the trocar, diagnostic arthroscopy can be performed.

### Anterior Portal

- An anterior portal can be created by either an outside-in or an inside-out technique.
- Perform the outside-in technique under the visualization of the arthroscope from the posterior portal. Introduce an 18-gauge spinal needle 1 to 2 cm inferomedial to the anterolateral corner of the acromion just lateral to the tip of the coracoid process (Figs. 1-A and 1-B). Take care to avoid damaging the brachial plexus and the axillary vessels that are located inferomedially<sup>15</sup>. Placing the anterior portal too inferiorly may damage the musculocutaneous nerve and cephalic vein.

- Perform the inside-out technique by advancing the arthroscope toward the rotator interval just below the biceps tendon across the glenoid. Holding the cannula firmly, withdraw the arthroscope and insert a switching stick through the posterior portal. As advancement of the stick leads to skin tenting, make a small stab incision at the tip of the stick, which enables the stick to pass through the skin incision. Insert a cannula over the stick and gently advance it until the capsule is penetrated.

### Lateral Portal

- A lateral portal is commonly used to approach the subacromial space. Usually, it is used as a working portal for addressing the acromioclavicular joint pathology including resection of the distal end of the clavicle and acromioplasty. However, in the case of shoulder stiffness, it is used as a viewing portal for the visualization of the coracoid process and the superoanterior portion of the subscapularis.
- Make the skin incision 2 cm lateral to the anterolateral edge of the acromion. Prior insertion of the spinal needle is helpful for the appropriate placement of the portal. Placing the portal too inferiorly may damage the axillary nerve, as it lies approximately 3 cm distal to the anterolateral margin of the acromion (Fig. 1-A).

### Step 3: Remove Rotator Interval Tissue

Begin the capsular release with the rotator interval and the middle glenohumeral ligament using a 3.0-mm 90° electrocautery device (ArthroCare, Sunnyvale, California) through the anterior portal (Video 1).

- When removing the interval tissue, begin the process superiorly with resection of the superior glenohumeral ligament and coracohumeral ligament. Continue the removal of tissue until the vertically oriented fibers of the coracoacromial ligament and conjoined tendon are visualized.

### Step 4: Release the Anterior Capsule

Begin the anterior capsular release below the long head of the biceps tendon origin and preserve the glenoid labrum.

- We recommend that the middle glenohumeral ligament be resected or divided without damaging the subscapularis tendon.
- Carefully dissect the hypertrophied capsule without injuring the subscapularis (Video 2).
- To avoid damage to the subscapularis, the tip of the electrocautery device should face the articular side during the process.

- Continue the capsular release down to the 7 o'clock (right) or 5 o'clock (left) position, involving both the anterior and posterior bands of the inferior glenohumeral ligament.

### Step 5: Release the Inferior Capsule

As the electrocautery device may not reach the inferior portion of the inferior glenohumeral ligament, switch the working portal to the posterior portal for an easier approach to the inferior portion.

- After switching the portal, use the anterior portal as a viewing portal and the posterior portal as a working portal. From the posterior portal, the approach to the posterior portion of the inferior capsule is much easier (Fig. 2 and Video 3).
- Starting from the previously released anterior capsule, extend the process to the 7 o'clock (right shoulder) and 5 o'clock (left shoulder) position of the inferior capsule. The release should be extended over the posterior band of the inferior glenohumeral ligament.
- To avoid axillary nerve damage, perform the capsular release just off the glenoid rim without violating the glenoid labrum. According to Yoo et al.<sup>16</sup>, the closest distance between the axillary nerve and the glenoid, ranging from 10 to 25 mm, was with the arm in the neutral position, and the greatest distance was with the arm in abduction-neutral position. Therefore, we believe that axillary nerve damage can be prevented if the electrocautery tip stays within 10 mm of the glenoid rim. Also, the electrical conduction of the electrocautery discharge through the local tissues will stimulate the axillary nerve when it is in proximity so that damage can be prevented prior to direct injury.

### Step 6: Release the Coracohumeral Ligament and the Subscapularis

Begin this procedure with the camera in the lateral portal viewing the anterior portion of the subdeltoid space.

- Use the anterior portal as a working portal. Using the electrocautery device, find the base of the coracoid process. The part of the coracohumeral ligament that originates from the coracoid process and extends to the rotator interval is mostly removed during the process of rotator interval tissue removal. However, the coracohumeral ligament also extends over to the superior part of the subscapularis muscle and covers a broad area of the anterior surface of the subscapularis.
- For the complete release of the coracohumeral

ligament, thoroughly examine and debride the anterior and superior portion of the subscapularis (Video 4).

## Step 7: Postoperative Rehabilitation

*The goal for the patient is to achieve an immediate range of motion by performing active-assisted and passive range-of-motion exercises, including pendulum circumduction or the pulley exercise.*

- Active-assisted and passive range-of-motion exercises can be started on the first postoperative day. If a simultaneous rotator cuff repair or reconstruction is performed, only gentle passive range-of-motion exercise is recommended, with the application of an abduction brace. For such patients, we also recommend that pulley exercises be started four weeks after the surgery.
- The patient is instructed in a home-based exercise program and is encouraged to perform the exercises at least three times daily. Starting on the first day after the operation, pendulum circumduction, including gentle passive range-of-motion exercise, is done within a painless range. Pulley exercises are prescribed to increase flexion after one week. When the passive shoulder range of motion is restored to 90% of the normal range, isometric exercises in all planes are recommended. The patient is taught to perform exercises using a TheraBand (Hygenic, Akron, Ohio), strengthening exercises for the muscles stabilizing the scapula, and advanced muscle strengthening exercises using dumbbells. We recommend that the patient continue to perform all of these exercises regularly until the last visit at twelve months. No limit is imposed on the use of the shoulder within a tolerable extent.

## Results

In our recently reported series of seventy-five patients who had a rotator cuff tear with simultaneous shoulder stiffness, treatment with an anterior and inferior capsular release showed favorable results<sup>13</sup>. The twenty-two male and fifty-three female patients had an average age of 56.4 years. The patients were randomized into two groups: one group had an anterior and inferior capsular release, and the other group had a capsular release that was extended to the posterior capsule. The patients were evaluated with the American Shoulder and Elbow Surgeons scoring system, the Simple Shoulder Test, and a visual analog scale for pain, and the shoulder range of motion was assessed, before surgery; at three, six, and twelve months after surgery; and at the latest follow-up. The functional scores and range of motion at an average of 18.4 months postoperatively showed

significant improvement compared with the preoperative findings. However, no significant difference was found between the groups with regard to range of motion, pain, and functional scores with or without posterior capsular release. There were no complications from the surgical procedures. No shoulder developed recurrent stiffness or required repeat surgery.

## What to Watch For

### Indications

- A chronic phase of shoulder stiffness (continuing after more than four months of nonsurgical treatment)<sup>17,18</sup>
- A rotator cuff tear with shoulder stiffness
- Idiopathic adhesive capsulitis
- A stiff shoulder with any combined lesion

### Contraindications

- Nonsurgical treatment for a duration of less than four months<sup>17,18</sup>
- Shoulder stiffness due to osseous deformity or osteoarthritis
- Cuff tear arthropathy
- Evidence of an active joint infection

### Pitfalls & Challenges

- During the process of capsular release, be careful not to damage the subscapularis tendon and long head of the biceps tendon.
- When removing the rotator interval tissue, be aware of the musculocutaneous nerve and try not to go too far medially beyond the coracoid process.
- Axillary nerve injury is a devastating complication during the process of capsular release. When capsular release is done from the 5 o'clock to the 7 o'clock position (right side), or from the 7 o'clock to the 5 o'clock position (left side), the release should be done just off the glenoid rim without violating the glenoid labrum in order to avoid axillary nerve damage.

## Clinical Comments

- The release of the capsule should be continued until the muscle fibers are exposed.
- If manipulation under anesthesia is needed prior to the arthroscopic procedure, avoid forceful manipulation of the joint. Forceful manipulation can lead to dislocation or fractures of the humeral head or neck or the glenoid, especially during external rotation.

- We could not find any significant differences in the overall outcome between the anteroinferior capsular release and the extended posterior capsular release at each time point after capsular release. We cautiously state that there was

no apparent benefit in terms of range of motion and functional scores with the additional posterior capsular release in the patients with shoulder stiffness.

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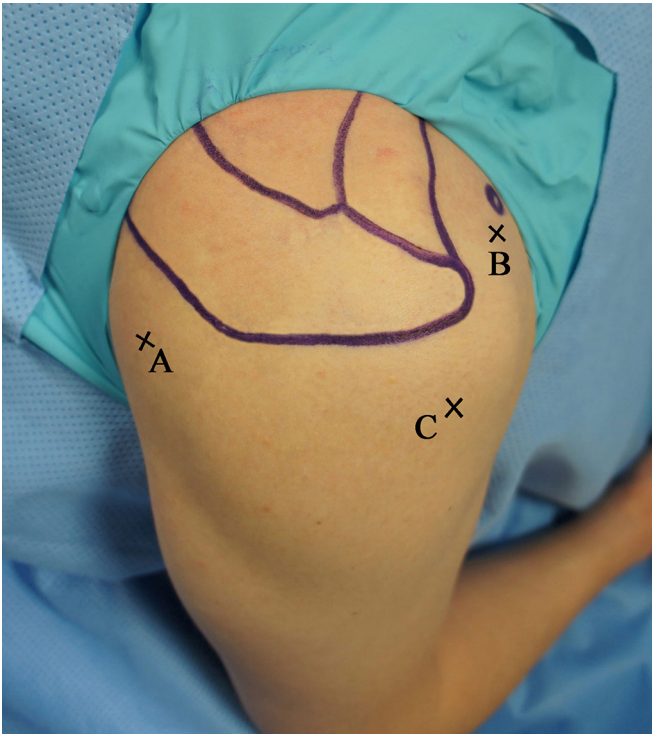
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**Fig. 1-A**

**Figs. 1-A and 1-B** Location of the portals and placement of the camera and electrocautery device. **Fig. 1-A** Portal locations are marked on the right shoulder. A = the posterior portal, B = the anterior portal, and C = the lateral portal. **Fig. 1-B** The camera is placed in the posterior portal and the electrocautery device is in the anterior portal.



**Fig. 1-B**



**Fig. 2**

The viewing and working portals are reversed compared with those shown in Figure 1-B. That is, the camera is placed in the anterior portal and the electrocautery device is placed in the posterior portal.