

Arthroscopic Arthrolysis for Recalcitrant Frozen Shoulder: Double Posterior Approach



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Abstract: Arthroscopic capsular release is required in some patients with frozen shoulder (FS). In some cases of recalcitrant FS, arthroscopic capsular release is difficult because of the abnormal narrowing of the joint space. The aim of this article is to introduce an arthroscopic double posterior approach combined with lateral and anterior approaches that is used to complete release of the glenohumeral joint capsule at 360°, subacromial debridement, and long head of biceps tenotomy. This article shows that this double posterior technique is a safe and highly effective totally intra-arthroscopic release technique for recalcitrant FS.

Frozen shoulder (FS) is spontaneous joint capsulitis associated with progressive active and passive limitation.¹ The incidence of primary FS is 2% to 5% in the general population and as high as 10% to 38% in patients with diabetes or hypothyroidism.² The highest incidence of FS occurs between the ages of 40 and 60 years, and the incidence of FS is higher in women than in men.³

Although FS is a common disease with a high incidence, there are still many difficulties and controversies regarding its treatment. FS is generally considered a self-limiting disease (1- to 2-year recovery period),^{4,5} but various studies have shown that many of the symptoms associated with FS, such as stiffness and pain, persist for many years in 20% to 50% of patients.⁶ In addition, some patients receiving conservative treatment complain of severe symptoms, extensive activity restriction, and substantial muscle loss, and these patients have a poor prognosis.⁷ We find that most patients with poor conservative therapeutic effects and severe complaints of subjective and objective symptoms need to undergo arthroscopic capsular release (ACR).⁸

In these patients, manipulation under anesthesia (MUA) combined with ACR can be used for surgery; however, after anesthesia, we find that the glenohumeral joint resistance is very high in some patients during MUA. In these patients during ACR, the glenohumeral joint space is often found to be abnormally narrow, and it is not possible to enter the glenohumeral joint via the classic posterior approach—let alone observe the rotator cuff interval—so it is difficult to complete ACR by the conventional posterior approach combined with the anterior approach.

Faced with this situation, we have adopted a totally intra-arthroscopic release technique with a double posterior approach. The main purpose of this article is to introduce and describe this totally intra-arthroscopic release technique, with less trauma, a high surgical success rate, and a good safety record.

Surgical Technique

The patient receives general anesthesia combined with brachial plexus—blocking anesthesia (Video 1). After the patient is placed in the lateral decubitus position, the range of motion of the affected shoulder is recorded, including forward flexion, abduction, and lateral rotation angles. MUA is attempted in all patients after this recording is completed. A shoulder joint—lifting tower is used to lift the affected limb to a position of 45° to 60° of abduction and 20° of forward flexion using a 5-kg traction weight.

Double Posterior Portals

The surgical field is routinely sterilized. The bone contours of the acromion, clavicle, coracoid process, and spine of the scapula are marked using a skin pen.

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The glenohumeral space is entered through the conventional posterior shoulder approach (portal A), which is 2 cm below and 2 cm medial to the posterolateral corner of the acromion (Fig 1). The standard posterior approach is used to observe the condition of the articular space. Because of the extremely narrow glenohumeral space, the lens cannot observe the rotator cuff interval through the glenohumeral space—or even into the glenohumeral space—but only the posterior and superior glenohumeral rim space (Fig 2), so the anterior approach cannot be established. At this time, a posteroinferior approach is established (portal B, about 3 cm lower than the conventional posterior approach, as shown in Fig 1). Before making the portals, we use a spinal needle to localize the suitable position (Fig 3). It should be noted that portal B should not be too close to portal A; otherwise, the operation will be seriously affected.

Posterior Half of Glenohumeral Joint Capsule Release and Long Head of Biceps Tenotomy

From the portal B approach, a shaver (Arthrex) is used to clean the synovial membrane around the lens and the posterior joint capsule, and a radiofrequency wand (Arthrex) is used to clean the hemostat and loosen the posterior and inferior joint capsule (Fig 4). Some of the posterior joint capsule of the FS is tough, and a basket biter forceps is used to cut it to avoid excessive use of the radiofrequency wand, which could damage the cartilage. When releasing the inferior capsule, it is necessary to keep close to the glenoid labrum to avoid injury to the axillary nerve. Then, the approach is switched: Portal B is used as the observation

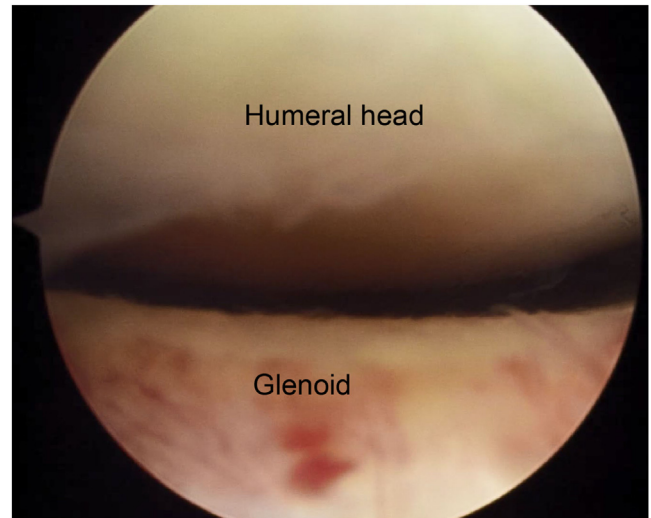


Fig 2. The posterior approach show that the glenohumeral space is extremely narrow and cannot be entered (right shoulder).

approach, whereas portal A is used to clean the synovium with a shaver, loosen the posterior and superior capsule with a radiofrequency wand, and cut off the long head of the biceps tendon (LHBT) endpoint at the glenoid. When releasing the posterior glenohumeral joint capsule, attention is paid to the perfusion water pressure. Low water pressure is not conducive to expansion of the joint capsule, resulting in visual field limitation and difficulty in the operation. Next, the scope is switched again to portal A, where the glenohumeral joint space is obviously enlarged. At this time, the scope can be moved forward to the joint cavity to observe the rotator cuff interval; however, if moving

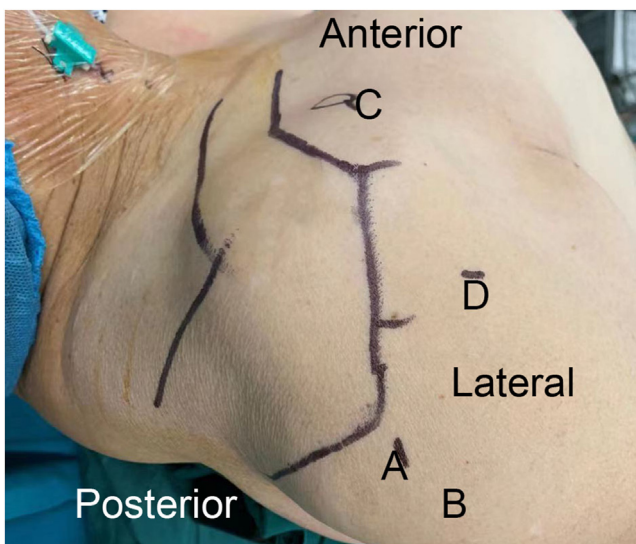


Fig 1. Right shoulder (lateral position). Portal A is the posterior approach, portal B is the posteroinferior approach, portal C is the anterior approach, and portal D is the lateral approach.

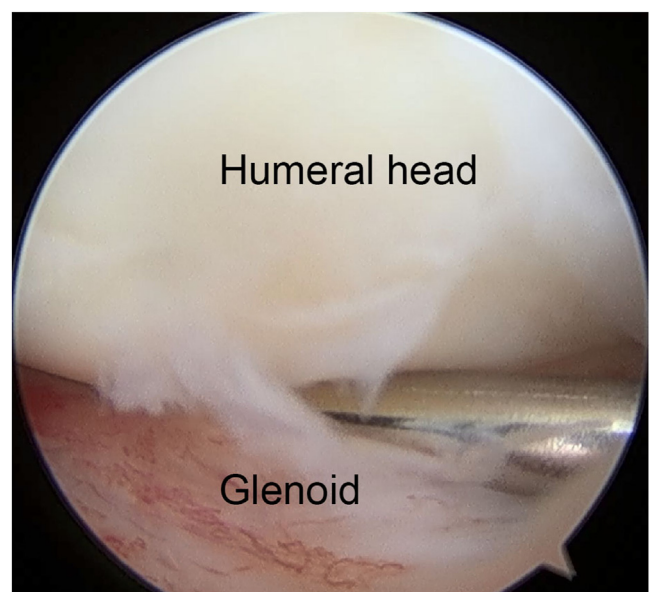


Fig 3. With observation from portal A, portal B is established after the puncture needle is located (right shoulder).

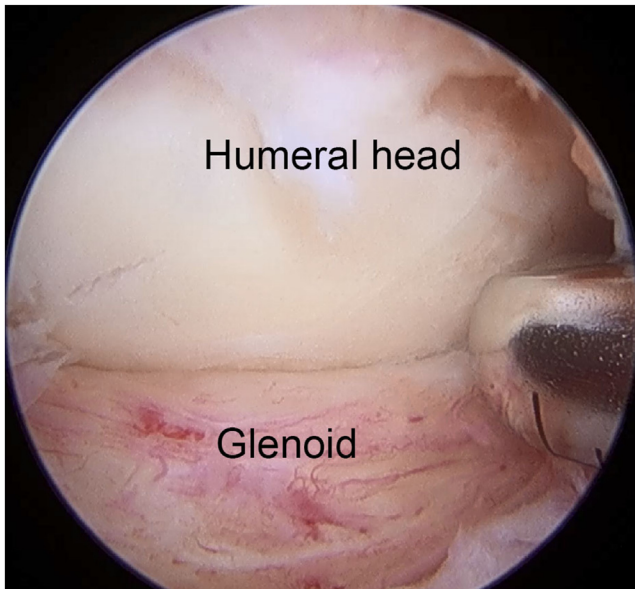


Fig 4. With observation from portal A, the posteroinferior approach is used to release the posterior joint capsule with a shaver and radiofrequency wand (right shoulder).

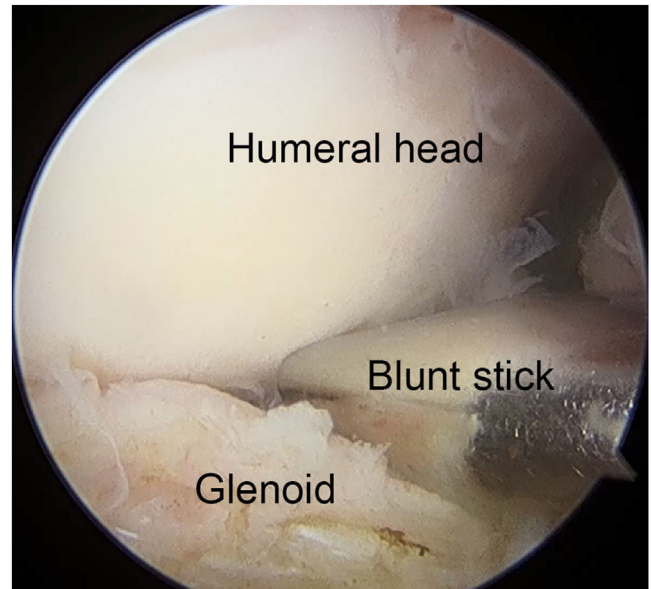


Fig 5. After release of the posterior half of the glenohumeral joint capsule is completed, the humeral head is lifted with a blunt stick (right shoulder).

the scope forward is still difficult, it should not be pushed forcibly. The humeral head can be lifted with a blunt stick through portal B, significantly expanding the glenohumeral space (Fig 5). At this time, the observation field is satisfactory, and the anterior approach (portal C) is established.

Anterior Half of Glenohumeral Joint Capsule Release and Subacromial Debridement

The rotator cuff interval and part of the anterior joint capsule are released using a radiofrequency wand, and the middle glenohumeral ligament and the anterior bundle of the inferior glenohumeral ligament are gradually released downward to meet the release of the inferior joint capsule (Fig 6). The scope is then placed under the acromion via portal A, the lateral approach (portal D) is made, and the shaver and radiofrequency wand are used to complete subacromial debridement and probe the superior surface of the rotator cuff. Finally, our practice is to inject 9 mL of 0.25% ropivacaine and 1 mL of Diprospan (Merck) into the glenohumeral joint space and subacromial space.

Postoperative Management

The full range of active and passive shoulder joint rehabilitation exercises begins on the first day after surgery, with infrared treatment for 15 minutes before each exercise and ice application to the shoulder for 15 minutes after exercise.

Discussion

When conservative treatment of FS is performed, the continuous activity disturbance and pain cause great

distress in some FS patients. These patients will eventually need to undergo MUA or arthroscopic surgery. MUA is the passive stretching of the shoulder joint in all directions after anesthesia, thereby improving joint motion. Several studies on MUA have shown that more than 80% of patients treated with MUA have improved outcomes.^{9,10} However, owing to the fear of complications caused by rotation when performing MUA, MUA does not improve external rotation as well as

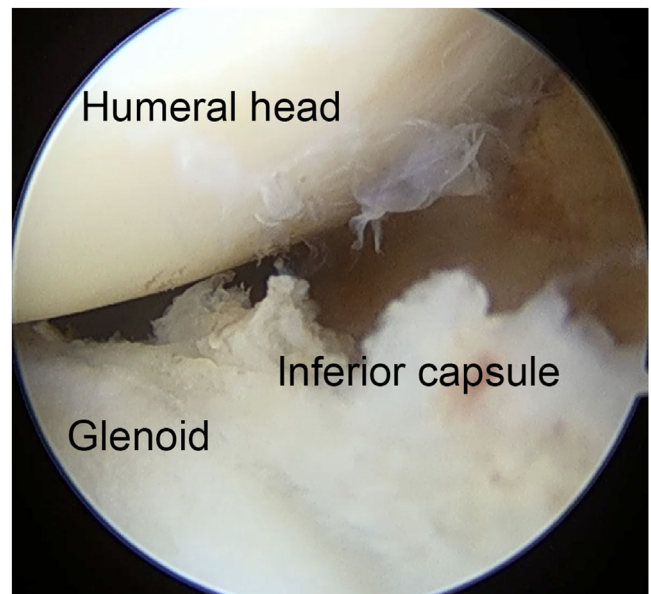


Fig 6. After the anterior glenohumeral capsule is released, it is reunited with the posterior capsular release (right shoulder).

forward flexion and abduction.¹¹ There are different views on the timing of MUA. Some studies have argued that MUA is feasible after the diagnosis of FS,⁹ whereas others have argued that MUA should be performed after 1 year of ineffective conservative treatment after the diagnosis of FS.^{12,13} The complication rate of MUA is about 0.4%, and the complications include humeral shaft fracture, rotator cuff injury, glenohumeral dislocation, glenoid labral injury, nerve injury, and complex regional pain syndrome.^{14,15} On the basis of these advantages and disadvantages of MUA, many surgeons conduct ACR after MUA to achieve more satisfactory surgical results.

For ACR after MUA, some scholars advocate ACR alone. They believe that MUA only loosens the weak glenohumeral space—but not the seriously adhesively attached parts—and MUA has a higher complication and recurrence rate than ACR.^{10,16} Our recommendation on whether ACR should be combined with MUA is based on the habit and surgical proficiency of the surgeon. In some cases of FS, the glenohumeral space is enlarged after MUA, and the level of surgical difficulty is reduced, so ACR after MUA is more suitable for beginners. In our practice, we find that some FS patients have severe glenohumeral joint space stenosis and elastic fixation of the glenohumeral joint is felt when MUA is performed, making it difficult to complete MUA well. In these patients, the scope cannot achieve good observation of the rotator cuff interval through a conventional posterior approach, and in some severe cases, the scope cannot enter the glenohumeral space at all. For these patients, Lafosse et al.¹⁷ recommended first establishing a lateral acromial approach, followed by finding the rotator cuff interval, releasing the rotator cuff interval from the outside in, entering the joint cavity, and then releasing the entire glenohumeral joint in 360°, which is a totally endoscopic technique.

For stubborn FS, we have designed a double—posterior approach technique to establish an inferior approach 3 cm below the conventional posterior approach, and we use the double posterior approach to release the posterior, superior, and inferior glenohumeral capsule. With the dual—posterior approach technique, there is no need to consider whether to perform MUA before ACR. In fact, for recalcitrant FS, we do not routinely perform MUA before ACR because the dual posterior technique can be applied to all cases of recalcitrant FS. In our screening process of enrolled patients, we selected patients in whom the glenohumeral space could not be entered through the posterior approach when MUA is combined with ACR. The objective of this report is to explain that there are still some patients with obvious glenohumeral space stenosis after MUA, resulting in ACR that cannot be completed by the conventional

single posterior approach combined with the anterior approach. These cases are truly severe intractable FS cases, and endoscopic release surgery is the most difficult.

Lafosse et al.¹⁷ recommended that in patients evaluated for stubborn FS, the first approach for ACR should be midlateral to the acromion, with ACR administered from the outside in from the subacromial space. We find that when performing ACR with this technique, inaccurate identification of the rotator cuff space can lead to injury to the subscapularis or supraspinatus tendon or even the humeral head cartilage. Moreover, owing to the poor visual field of observation for the inferior articular capsule, the glenoid labrum or axillary nerve may be injured when releasing the inferior articular capsule.

In our technique, we first establish a conventional posterior approach to observe the degree of glenohumeral space stenosis. If serious stenosis is observed, portal B is established to perform ACR. The establishment of portal B has certain technical difficulties. Placement too close to portal A will result in an interaction between the observation approach and the operation approach. If portal B is too far inferior, there is a risk of vascular and nerve injury, and when portal B is used as the operation path, the operation is difficult owing to the lack of angle between the operating instrument and the axillary sac. Moreover, when the lower portal B is used as the observation approach, portal A was introduced with operating instrument, which will affect the release of the upper joint capsule because of the inappropriately low observation approach. In summary, portal B inadequacy may result in iatrogenic injury and failure to release the posterior half of the glenohumeral joint capsule. Therefore, the proper position and angle should be selected by the needle under the supervision of the portal A lens, and the ideal portal B should be marked from the inside and outside. After successful establishment of the double posterior approach, it is necessary to pay attention to the perfusion water pressure of the joint cavity because appropriate perfusion pressure fills and expands the joint capsule, which is conducive to the operation. The posterior double approach can release the posterior half of the glenohumeral joint capsule and even close to two-thirds of the capsule. After the completion of half of the capsule release, the joint space will be significantly expanded in most cases. In some patients with insignificant glenohumeral joint space expansion, the space can be expanded by simply lifting with a blunt tool to allow the arthroscope of portal A to pass through. We consider that this may be caused by the negative suction effect between the glenoid and the humeral head. After the glenohumeral space is enlarged, the establishment of the anterior approach and the release of the anterior joint capsule become

Table 1. Technique Pearls and Pitfalls

Proper water pressure is conducive to expanding the joint during the posterior capsule release.
Portal B inadequacy may result in iatrogenic injury and failure to release the posterior half of the capsule of the glenohumeral joint.

relatively easy routine procedures. Care should be taken to protect the axillary nerve during release at the lower axillary sac. It is recommended to perform 45° of abduction and 20° of forward flexion of the shoulder when the patient is lying on his or her side in the decubitus position. Then, the axillary nerve is far away from the inferior margin of the glenoid, approximately 1 cm on average.¹⁸ When loosening the axillary sac, a radiofrequency wand or a basket biter is used. We recommend using a radiofrequency wand. When loosening the axillary sac area, if there is a contraction of the deltoid muscle, it indicates that the radiofrequency wand is operating close to the axillary nerve, which can actually be seen as a protective mechanism. During the release of the anterior and inferior axillary capsule, portal C is used as the operation approach whereas portal B can be used as the observation approach to look directly at the inferior axillary capsule, and the risk of axillary nerve injury is lower.

For intractable FS, we choose to sever the LHBT during a 360° release of the joint capsule. There are 2 reasons for cutting off the LHBT: First, when the posterior half of the joint capsule is released by the double posterior approach, the LHBT impedes the release of the upper joint capsule. Second, we believe that cutting off the LHBT reduces the risk of residual pain. When we cut the LHBT, we chose to cut at the endpoint on the glenoid. We believe that this cut enlarges the end of the LHBT and prevents the LHBT from being pulled out of the LHBT interscalene groove. None of our patients have had symptoms such as Popeye deformity or complained of biceps spasm. We believe that this is because of the expansion of the end of the LHBT, which kept it in position in the interscalene groove, and the formation of a postoperative scar, resulting in fixation of the LHBT in the interscalene groove.

The double posterior approach is mainly used to overcome the difficulty of accessing the glenohumeral

joint cavity with conventional posterior-approach arthroscopy, and the joint capsule release is no different from that of conventional endoscopic surgery. Pearls and pitfalls associated with the technique are described in Table 1. Advantages and disadvantages of using this technique are outlined in Table 2. However, as mentioned earlier, only a minority of FS patients need ACR, and most of these patients can meet the requirements for routine endoscopic surgery in the glenohumeral space of ACR after MUA, the glenohumeral space was enlarged, and then, the routine ACR (endoscopic surgery) could be completed smoothly, so the number of patients who really need to be treated using the double-posterior approach technique is small. In addition, there is a learning curve involved in use of the double-posterior approach technique, and its successful establishment and use require certain technical skills, which means that surgeons need to be more highly skilled.

In conclusion, this article describes the treatment of intractable FS by double posterior and all-inside technique, which—combined with anterior and lateral approaches—is able to satisfy all the ACR clearance procedures and has shown excellent therapeutic outcomes at follow-up. We recommend that arthroscopic surgeons master this holistic technique for the management of intractable FS.

Disclosures

Both authors (Y.H., L.S.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Table 2. Advantages and Disadvantages of Double Posterior Approach

Advantages
Less morbidity (no need to perform MUA before operation)
Decreased risk of iatrogenic injury
Effective for truly severe intractable FS
Disadvantages
Learning curve

FS, frozen shoulder; MUA, manipulation under anesthesia.

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