Management of the Stiff Shoulder

Arthroscopic capsular release for shoulder stiffness: techniques and possibilities

Yang-Soo Kim, M.D., Hyo-Jin Lee, M.D, In Park, M.D., Sung-Ho Bae, M.D., Sung-Eun Kim, M.D., Sung-Eun Kim, M.D., Hyung-Lae Cho, M.D.

1. Department of Orthopaedic Surgery, Catholic University School of Medicine, Seoul, Korea
2. Department of Orthopaedic Surgery, Armed forces capital hospital, Seongnam, Korea
3. Department of Orthopaedic Surgery, Good Samsun hospital, Busan, Korea

Introduction

In 1934, Codman first introduced the term “frozen shoulder” to identify a clinical entity difficult to define, to treat, and to explain. Neviaser, in 1945, found thickening and contracture of the capsule, and that the thickened capsule peeled from the humeral head like adhesive plaster from skin. Adhesive capsulitis, also known as frozen shoulder, is a musculoskeletal disorder characterized by pain and restriction of motion of the shoulder joint. In the primary or idiopathic form, no causative finding in the history or examination explains the onset of the disease. Secondary adhesive capsulitis relates to those cases that develop following trauma or surgery. The true incidence of primary adhesive capsulitis in general population varies from 2 to 5 %.

Yet, despite the large number of patients affected by this condition, our understanding of its etiology is limited. Middle aged people seem to be more at risk, with women more so than men. It often presents bilaterally, but does not seem to affect the same shoulder twice. Comorbidities such as diabetes, hypothyroidism, and Parkinson’s disease have been associated with the condition, with diabetes having the strongest association. Adhesive capsulitis is believed to be involved in inflammatory and fibrotic conditions of the shoulder. The pathophysiology first involves inflammation of the synovium, subsynovial fibrosis, and capsular fibrosis and thickening, consequently leading to glenohumeral joint contracture. In this review, we presume the term “shoulder stiffness” as adhesive capsulitis, frozen shoulder, as it is the most commonly used and avoids the ambiguities associated with terms that attempt to describe the underlying pathology.
Management

Initially, shoulder stiffness is treated non-operatively. A large variety of non-operative treatments, such as medications, corticosteroid injection, and physical therapy, showed satisfying results in 60% to 80% of cases. For patients who do not respond to non-operative treatment, surgical treatment options are available. Due to recent advances in arthroscopic techniques, arthroscopic release of the joint capsule has shown promising results comparable with other treatment options.

Nonoperative Treatments

- Physical Therapy

Physical therapy uses modalities such as application of moist heat or cold, ROM and strengthening exercises, stretches and manual therapy, along with providing patient education and a home exercise program. Physical therapy is the most prescribed treatment for adhesive capsulitis. However, there are few supporting evidences that provide its benefit. Despite the lack of high-grade evidence clearly supporting the usefulness of physical therapy, many lower-level studies report its benefit, and its use in the treatment of adhesive capsulitis is almost universal.

- Intra-articular Steroid Injections

The efficacy of these injections has been extensively studied. Carette et al. in a controlled trial showed that a single injection of 40 mg of triamcinolone produced significantly improved Shoulder Pain and Disability Index (SPADI) scores as compared with control groups. However, there were no differences in SPADI scores beyond 3 months’ time. In a well-designed level I study, Ryans et al. confirmed these findings of more rapid improvement in patients treated with intra-articular triamcinolone injection as compared to controls, which dissipates after longer follow-up beyond 6 weeks. Intra-articular injections may provide earlier relief from pain than placebo, although this has not been shown to change the long-term outcome.

Operative Treatments

Many studies reported an approximately 10% of patients do not respond to the variety of non-operative treatments. Levine et al. identified those patients who failed to improve or were worse after 4 months as most likely to fail non-operative treatment. However, the indications for more invasive options remain highly subjective and need to be individualized to each patient.
Manipulation Under Anesthesia

Manipulation under Anesthesia (MUA) has been used extensively with consistently satisfactory results in both short- and long-term follow-up although it has reported complications including humeral fracture, subscapularis rupture, labral tears, and injury to the biceps tendon. These complications are minimized with proper technique. Kivimaki et al. performed a level I study to compare MUA with a home-based exercise program. The manipulation group had slightly better mobility at 3-month follow-up examinations with statistically significant improvement in shoulder flexion. Those who do not respond to physical therapy appear to benefit most from MUA, whereas it may not be as beneficial in less severe disease.

Arthroscopy

With the advent of arthroscopy, surgeons have chosen to address this condition arthroscopically in addition to or instead of MUA. Arthroscopic capsular release has become the most popular method of treating refractory adhesive capsulitis and has replaced MUA as the treatment of choice. Patients appear to achieve more significant and rapid improvements in motion and pain than the less precise manipulation and do not face the same risk of complications. Furthermore, arthroscopic procedure permits to confirm diagnosis and staging of disease. If necessary, a synovectomy can be performed at the same time, and potential secondary causes of symptoms can be recognized. However, regarding the extent of release, there have been many controversies. Many studies have revealed that release of rotator interval tissue increases the range of flexion and external rotation. Besides the rotator interval, release of the subscapularis tendon, inferior capsule, or global capsule has been recommended in several studies to improve elevation and internal rotation, as well as external rotation. A number of authors have also recommended posterior capsular release to improve internal rotation. However, according to Snow et al., additional posterior capsular release was not associated with any significant difference in the outcome when compared with anterior release. Chen et al. derived a similar result with extended posterior capsular release, showing that there was no advantage in function or range of motion (ROM). Kim et al. performed level I study to compare anterior and inferior capsular release with anterior, inferior and posterior capsular release. In one year follow-up, there were no significant differences in ROM and functional scores between two groups.

Arthroscopic Treatment: Surgical Technique

Step 1: Position

Patient can be placed either in lateral decubitus position or in beach-chair position depending on the preference of the surgeon. The patient is anesthetized before the final positioning. In lateral decubitus position, the position of the arm is from 60 to 70 degrees of abduction and 15 to 20 degrees of forward flexion.
Step 2: Portal placement

1. Posterior portal
   - Create a standard posterior viewing portal. The posterior portal is the first portal made during the arthroscopy which allows adequate visualization of the entire glenohumeral joint.
   - A vertical, small incision is made 2 to 3cm inferior and 1 to 2cm medial to the posterolateral corner of the acromion. For the access into the glenohumeral joint, the direction of the trocar is recommended to aim the coracoid process. After the introduction of the trocar through the capsule, popping sensation can be felt as the joint is entered. Localizing the joint line by palpating humeral head and glenoid allows the correct placement of the portal within the glenohumeral joint. After proper placement of trocar, diagnostic arthroscopy can be performed.

2. Anterior portal
   - Anterior portal can be created either by outside-in or inside-out technique.
   - Outside-in technique is performed under the visualization of the arthroscope from the posterior portal. A 18-gauge spinal needle is introduced 1-2cm inferomedial to the anterolateral corner of the acromion just lateral to the tip of the coracoid process. Care must be taken not to damage brachial plexus and the axillary vessels that are located inferomedially. Further inferior placement of the anterior portal may damage musculocutaneous nerve and cephalic vein.
   - In case of inside-out technique, the arthroscope is advanced toward the rotator interval just below the biceps tendon across the glenoid. Holding the cannula firmly, the arthroscope is withdrawn and a switching stick is inserted through the posterior portal. Advancement of the stick leads to skin tenting and a small stab incision is made at the tip of the stick which enables the stick pass through the skin incision. A cannula is inserted over the stick and gentle advance is required until the capsule is penetrated.

If glenohumeral joint access cannot be safely obtained due to severe adhesion and joint stiffness, prior manipulation under anesthesia (MUA) is recommended. MUA should be performed in gentle manner with holding the proximal portion of the arm. Forward flexion is recommended to be tried at first and followed by abduction and external rotation. This procedure usually leads to sufficient distraction of the joint permitting safe insertion of the portal.
Step 3: Removal of rotator interval tissue and middle glenohumeral ligament.

The capsular release began with rotator interval and middle glenohumeral ligament using a 3.0mm 90° electrocautery (Arthrocare, Sunnyvale, CA) through anterior portal. When removing the interval tissue, the process begins superiorly with resection of the superior glenohumeral ligament and coracohumeral ligament. If needed, the process can be proceeded as far medial as the coracoid process. The removal of tissue can be continued until the visualization of vertical-oriented fibers of the coracoacromial ligament and conjoint tendon. The middle glenohumeral ligament are recommended to be resected or divided without damaging subscapularis tendon.

Step 4: Release of the anterior capsule

Anterior capsule release began below the biceps origin preserving the glenoid labrum. The hypertrophied capsule is carefully dissected without injuring subscapularis. The capsular release carried down 7-o'clock position involving both the anterior and posterior band of inferior glenohumeral ligament.

Step 5: Release of the inferior capsule

If the approach of electrocautery probe from the anterior portal to the posterior portion of the inferior glenohumeral ligament is not available, the portals can be switched to assess inferior capsule. In order to avoid axillary nerve damage, the capsular release was done just off the glenoid rim without violating glenoid labrum. According to Yoo et al\textsuperscript{15}, the closest distance range of axillary nerve from glenoid is 10 to 25mm in the neutral position and in the greatest distance in abduction-neutral position. Therefore, we believe the axillary nerve damage can be prevented if the electrocautery stayed just off the glenoid rim. Also, electrical stimulation of electrocautery was helpful in detecting proximity to the axillary nerve prior to direct injury.

Step 6: Postoperative rehabilitation

The goal for the patient is immediate ROM by performing active assistive-passive ROM exercise including pendulum circumduction or pulley exercise. This can be started from the first postoperative day. In case of simultaneous rotator cuff repair, only gentle passive ROM exercise is recommend with the application of the abduction brace. Pulley exercise is recommend 4 weeks after the surgery.

The patient is instructed in a home-base exercise program and encouraged to perform the exercises more than three times daily. Once the patient has reached full range of motion without pain, the strengthening phase of the shoulder exercise can be started.
Conclusion

The treatment of adhesive capsulitis remains controversial despite an extensiveness of published literature on the subject. Oral and intra-articular steroids provide early pain relief, but benefit cannot be sustained beyond several weeks. Traditional treatments of physical therapy and NSAIDs which are most popular world-wide, have not been shown to alter the natural course of the. In patients who have failed nonoperative treatments, more invasive therapy should be considered. Hydrodilation and SSNB have been reported to be successful, but studies are limited by short term follow-up and small sample numbers. MUA might be a reliable means of improving function for patients with refractory disease. However arthroscopic capsular release can provide similar benefits with less pain and allows global assessment for concomitant pathologies.

References

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