Arthroscopic Capsular Release (ACR) in Frozen Shoulder

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Introduction

Adhesive capsulitis is a common problem seen by the orthopaedic surgeon that remains difficult to diagnose and difficult to treat. It is divided into different entities, each with a different etiology and pathology. In idiopathic adhesive capsulitis no cause of shoulder stiffness is identified. Restriction of both passive and active shoulder range of motion (ROM) is present with less than 100 degrees abduction and less than 50% external rotation of the opposite shoulder as well as severe limitation in internal rotation. While the literature states that even the most severe cases recover with or without treatment in about two years, more recent opinion is that there is a residual restriction of motion in 40-60% of patients. However, functional limitations are only mild. The pathology is a decreased capsular volume, loss of axillary articular recess, loss of subscapularis bursa with a chronic inflammatory response of the synovial and fibrous layer of the capsule. Besides these factors an increase in cytokines (growth factors) is seen as well as a contracted rotator interval. While early experience in arthroscopic approaching adhesive capsultis were rather disappointing more recently arthroscopic release of the glenohumeral joint becomes popular.

The purpose of this study was to to present our surgical technique and the results after arthroscopic treatment of the adhesive capsulitis.

Materials and methods

Selection of patients: Twenty-eight patients with primary adhesive capsulitis were included between 1995 and 2000 in this study. None of these patients had loss of motion associated with advanced arthritis, and none had a full-thickness tear or more than 50% partial tear of the rotator cuff. Non of the patients had had a previous operation or were diabetic. All had failed at least 6 months (mean: 24 months) of nonoperative management. The clinical examination showed loss in passive range of motion for all plane. There were thirteen men and fifteen women. The right shoulder was involved in sixteen patients and the left in twelve patients. The mean age was forty-nine years (range: thirty-three to sixty-seven years). All of the patients had painful and substantial limitation of motion in at least two planes.

Clinical Assessment: All of the patients were evaluated preoperatively and postoperatively by the same examiner and all completed a questionnaire about their symptoms. The preoperative, intraoperative, and postoperative motion of the involved shoulder as well as the contralateral non-involved shoulder was documented and recorded on an evaluation form.

Passive ranges of motion (ROM) were measured in abduction/adduction and external/internal rotation in adduction (0 degrees of abduction) and abduction (90 degrees). The subjective symptoms and objective findings of all shoulders was graded according to the 100-point scoring system of Constant and Murley. The results are normalized to gender and age. Plain radiographs made in the anteroposterior plane in internal rotation and abduction, in the axillary plane and in the supraspinatus-tunnel view were evaluated. In all patient diagnostic ultrasound was performed by the author.

Surgical technique: First, the passive range of motion was recorded after induction of adequate anesthesia. A gentle closed manipulation was attempted for each patient, but all of our patients had a hard block to motion and this was unsuccessful. Some surgeons do not recommend the insertion of an arthroscope into a stiff shoulder, because of concerns about articular injury. In our hand we did not see a problem in a single patient. We use a standard posterior portal and place – after palpation of the glenoid joint line with a blunt troikar - the sheeth of the arthroscope in the upper triangle of the glenohumeral joint between the supraspinatus and the biceps tendon on one side an the glenoid and the humeral hand on the other side. With some experience entering the joint in this space is a safe procedure. The anterior portal is established in an outside-inside technique just superior to the subscapularis tendon. In all patients the typical findings of adhesive capsulitis were present. The joint volume was reduced. There was inflammation and fibrosis of all parts of the joint capsule. The rotator interval was filled with fibrotic tissue. The intraarticular part of the long head of the biceps tendon showed inflammation without mechanical damage. The rotator cuff was intact.

Anterior capsular release: In order to restore external rotation, the anterior aspect of the capsule need to be released. This release starts immedeate anterior to the long head of the biceps tendon. It is then performed down to the inferior edge of the glenoid. We always stay close to the glenoid insertionsite of the joint capsule with cutting the caspule in a distance of about 5mm to the labrum. In our hands a high frequency electrical knife with monopolar or even bipolar technique proofed to be the best instrument to avoid bleeding and to allow a clear picture during the procedure. The subscapularis tendon is defined and preserved. Failure to do so may result in accidentally division of the tendon. By gentle preparation the tendon could be defined in every patient. After identifying the subscapularis tenden, the tenden is freed from all adhesions and the subscapular recess is cleared off any soft tissue in order to establish a good glinding surface for the tendon. Only if this gives not sufficient external rotation, we release the upper fourth of the subscapularis tendon. In order to remove all potential immunogenic material the capsule adjacent to the release is either vaporised with the bipolar instrument or resected with a shaver which usually results in a almost complete synovectomy. The first has the advantage to decrease intraoperative bleeding; the second usually

allow faster resection. The tissue removal is especially performed at the rotator interval to incise and partially resect the coracohumeral ligament.

Inferior capsular release: We also release the entire axillary pouch. This is the rule in patients without a previous operation. With the electrical knife one can usually reach down to the 5 o´clock position. The most inferior fibers are cut with a small angled manual mensicus cutter with the inferior capsule put under tension in arm abduction. Again the adjacent capsule is carefully resected with the VAPR™ or a shaver. A previous operation may distort the anatomy and cause the axillary nerve to become attached with scar tissue to the inferior aspect of the capsule. Thus, the nerve may be injured if the capsular release is performed in this region. In these situations we do not recommend inferior release, but rather gentle manipulated to regain motion after release of only the anterior and posterior aspect of the capsule. Next all inflammed areas of the capsule superior to the biceps tendon is vaporized vith a VAPR™.

Posterior capsular release: Since all patients had marked loss of internal rotation, the posterior aspect of the capsule was released via a posterior portal. The posterior capsular release is performed with the arthroscope placed through a cannula in the anterior-superior portal in order to visualize the posterior portion of the glenohumeral joint. Before starting the dorsal release the amount of anterior release is inspected via the anterior portal. Next the electrocautery device, placed through the posterior portal, is used to divide the posterior aspect of the capsule. The incision again is performed adjacent to the glenoid rim and starts just posterior to the biceps tendon. The posterior aspect of the capsule is cut parallel to the glenoid rim in a distance of about 5mm to the dorsal labrum. The thickness of the capsule can be determined by the surgeon very easy, since immediately superficial to the capsule muscle fibres of the infraspinatus and teres minor are located. This tissue can be seen clearly when the complete thickness of the capsule is incised. The most inferior part of the posterior capsule again can be incised by a curved manual meniscal cutter. Again the adjacent capsule is resected.

Postoperative Treatment: Immediate range-of motion exercises of the shoulder were performed by a physiotherapist at the day of surgery. All of our patients were able to begin a program of active range-of-motion exercises immediately after arthroscopic release, and none of them used a sling at any time.

Results

The mean duration of follow-up was twenty-two months (range: six to fourty-eight months). The score of Constant and Murley improved a mean of 41 points (range: 28 to 62 points). The mean preoperative score was 44 ± 14 points which increased to 85 ± 9 points postoperatively. Range of motion for all planes significantly improved ($p<0.01$). Abduction improved from 75° preoperatively

to 165° intraoperatively; six weeks after surgery mean abduction was 168° and at time of follow-up 167°. The mean postoperative abduction of the affected shoulder was within 8 ± 10 degrees of that of the contralateral, normal shoulder. Mean external rotation in adduction improved from 3° preoperatively to 75° intraoperativeley. After 6 weeks mean external rotation in adduction was 72° and at time of follow-up the external rotation reached 76°. Mean external rotation in abduction improved from 4° preoperatively to 81° intraoperatively, 80° after 6 weeks and 85° at time of last follow-up. Postoperatively, external rotation with the arm in adduction was within a mean of 8 ± 13 degrees of that of the normal shoulder and external rotation with the arm in abduction was a mean of 9± 10 degrees less than that of the normal shoulder. Internal rotation in abduction was 17° preoperatively. Intraoperatively mean internal rotation was 59°. At six weeks follow-up an angle of 58° and at last follow-up an angle of 63° was documented. Final internal rotation in abduction was a mean of 2 degrees less than that of the normal shoulder.

Conclusion

Shoulder stiffness is a common problem that remains difficult to diagnose and difficult to treat. It is divided into four separate entities, each with a different etiology, pathology, nonoperative and operative treatment (posttraumatic stiffness, diabetic stiff shoulder, idiopathic adhesive capsulitis, post-surgical stiffness). In the present study we included only patients with idiopathic adhesive capsulitis. These are characterized with restriction of both passive and active shoulder ROM without any primary cause for the stiffness. The clinical course is charaterized with 3 phazes: a painful "freezing phase", a „frozen phase“ and a „thawing phase“.

Ogilvie-Harris and Wiley (1986) were the first who described the technique of arthroscopic anterior capsulotomy in the treatment of frozen shoulder and did not recommend the inferior release to avoid possible injury to the axillary nerve. Pollock et al. (1994) suggested that arthroscopy was useful mainly in the treatment of concomitant pathological disorders after a closed manipulation of the shoulder. They also were concerned about the risk of injury of the axillary nerve if the capsular release was continued more inferiorly than the superior edge of the subscapularis tendon. However, this procedure can only partially solve the problem, because the inferior capsule is the one that limits abduction as well as internal and external rotation to a certain amount. In our patients, the anterior and posterior capsular release was carried out in combination with a complete inferior release and the axillary nerve was not injured in any of them.

To perform such a procedure safely the relation of the axillary nerve to the glenohumeral joint capsule should be known from an intraarticular position. In a cadaver study we (Jerosch et al. 2002) could demonstrate, that the axillary nerve has a close relation to the shoulder capsule between the 5

and 7 o'clock positions, which means that the release in this region is potentially hazardous. This was already known by other previous anatomical studies. One specific additional information of this study is, that the axillary nerve is closer to the humeral than to the glenoidal insertion of the capsule. The second special importance of this study was the documentation of the change in the relation between the capsule and the nerve in different positions of the humerus. It is known that abduction of the arm causes the axillary nerve to become taut. But the position of the axillary nerve in relation to the glenohumeral joint capsule in various positions of the shoulder have not been clear yet. We could demonstrate that the axillary is shifted anteriorly and laterally away from the glenoidal insertion of the capsule with the shoulder in abduction during external rotation.

One of the major advantage of ACR compared to open capsular release is, that the patient can initiate physical therapy immediate after surgery. While in open release the subscapular tendon is taken off the reach the glenohumeral joint capsule, in ACR this tendon is left intact, which allows very early range of motion without having the risk of a rupture of the subscapular tendon. Additionally all inflammed tissue can be removed. This may reduce the autoimmune response, which is discussed to be one possible reason for adhesive capsulitis.

In summary the benefits of Arthroscopic Capsular Release (ACR) are:

1. Valuable in patients that are osteopenic and difficult to manipulate
2. Not as destructive as a manipulation
3. Can release rotator interval, anterior capsule, inferior pouch and posterior capsule
4. Can clean up the subscapularis tendon
5. Allows removal of synovial tissue
6. Allows denervation of pain fibers in the glenohumeral joint capsule
7. Allows immediate physical therapy after surgery

Clincal relevance: In conclusion, we believe that 360° arthroscopic capsular release (ACR) is effective in selected patients who have primary adhesive capsulitis of the shoulder. Contraindications are known extra-articular contractures, although the arthroscopic approach can be converted successfully to an open release in patients in whom the former procedure is unsuccessful.

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