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# Arthroscopic Global Capsular Release in the Refractory Frozen Shoulder

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**— Abstract —**

Forty two patients who had been treated arthroscopically for idiopathic frozen shoulder were evaluated subjectively and objectively at 15 months to 38 months for follow up(average; 26 months). Most of these patients had severe pain, especially aggravated night pain and markedly restricted humeroscapular motion. The preoperative range of motion averaged 95 degrees of forward elevation, 17 degrees of external rotation, and internal rotation to the level of the fifth lumbar spinous process. In the arthroscopic finding, congested synovitis, especially at anterosuperior capsule existed in all. Synovitis of the biceps tendon was found in 36%, subscapular recess was obliterated in 64%, the superior glenohumeral ligament and the middle glenohumeral ligament each in 92 and 73percent was thickened, around all had thickened inferior glenohumeral ligament. We debrided these hyperemic synovial tissue and released the whole global capsule that might restrict the glenohumeral motion. Thirty two patients(76%) were completely free of pain at the last follow up, seven patients(17%) had intermittent pain only on extreme motion, but all of them could do the activities of daily living well. Three patients(7%) who were diabetics had persistent pain and unsatisfactory final results. Forward elevation was improved upto 168 degrees, external rotation to 55 degrees, and internal rotation to the level of the tenth thoracic spinous process. The average preoperative UCLA rating score was 42 points, while the average postarthroscopic UCLA rating score was improved upto 84 points. Therefore arthroscopic global capsular release could be recommended in the treatment of refractory frozen shoulders which failed to respond to conservative management.

**Key Words** : Shoulder, Frozen shoulder, Arthroscopic release

## Introduction

Frozen shoulder is a common cause of chronic shoulder pain and disability, yet one of the most poorly understood disorders of shoulder motion. Frozen shoulder has been regarded as a condition in which recovery is always certain confidently expected within one or two years. Despite

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these optimistic predictions, however, it has been our experience that, in some patients, a frozen shoulder remains to show so much severe pain and markedly restricted humeroscapular motion that only the scapulothoracic motion is possible, usually overactivated in compensation for the loss of humeroscapular motion. We wondered if frozen shoulder is a self-limited disorder that can resolve spontaneously or if it requires further surgical treatment. The role of arthroscopy in the treatment of frozen shoulder is still poorly defined, some believe this technique to identify associated pathology and assist with distension of the joint and debride abnormal intra-articular pathology, and release the contracted capsular structures[5-7,10,12,13,18]. The purpose of this report is to discuss the arthroscopic technique and evaluate the efficacy of arthroscopic capsular release in the treatment of refractory frozen shoulder.

## Materials and Methods

Forty two patients underwent the arthroscopic capsular release at Kyung Hee University Hospital from April 1994 through February 1996. The criteria in selection for this study consisted of intractable pain that there were history of failed conservative management at least three months, or have been severe difficult problem on daily active living, or the markedly limited glenohumeral elevation, the internal and external rotation as compared with the motion of the contralateral shoulder. Patients were excluded from this study if they had intrinsic problems in the shoulder, such as impingement syndrome, a tear of the rotator cuff, calcific tendinitis. These patients were followed up for an average 26 months ranging from 15 to 38 months. This study consisted of 17 male patients(40%) and 25 female patients(60%). The ages ranged from 38 to 82 years(average; 53 years). The dominant shoulder was affected in 19 patients(45%). The symptoms had been present for a range of 2 to 48 months(average; 9 months) at the time of the initial evaluation. Thirty six patients (86%) had a history of pain at night, which often was associated with inability to sleep on the affected side. Sixty two percents had no history of trauma and/or inciting event, and 16 patients(38%) had a history of minor trauma. Fourteen patients(33%) had insulin-dependent diabetes mellitus, 5 patients(12%) had tuberoculosis, and 6 patients(14%) had congestive heart failure. We evaluated the severity of pain at preoperative and postoperative follow-up period. We also evaluated the period it took to relieve the pain during the postoperative follow-up period. The severity of subjective pain were graded from 0 to 10, 0 referring to no pain, 10 meaning severe pain. Preoperative range of motion of both shoulders were assessed by an established protocol. We checked the forward flexion(FF), external rotation at the side(ERS), external rotation with abduction(ERA), internal rotation with abduction(IRA), cross body adduction(CBA) and internal rotation measured on the basis of the spinal level that the patient could reach with the tip of the thumb behind the back(IRP). The average values were 95 degrees for FF, 17 degrees for ERS, 33 degrees for ERA, 20 degrees for IRA, 35 cm for CBA and L5 level for IRP. The compensatory scapulo-

**Table 1.** Simple Shoulder Test

| | No of patients(%) | |
|---|---|---|
| | Preop. | Postop. |
| 1. Is your shoulder comfortable with your arm at rest by your side? | 9(21.4) | 39(92.9) |
| 2. Does your shoulder allow you to sleep comfortably? | 6(14.2) | 36(85.7) |
| 3. Can you reach your back with your hand? | 5(11.9) | 27(64.3) |
| 4. Can you comb your posterior hair? | 7(16.7) | 37(88.1) |
| 5. Can you place a coin on a shelf at the level of your shoulder without bending your elbow? | 9(21.4) | 39(92.9) |
| 6. Can you lift one pound to the level of your shoulder without bending your elbow? | 7(16.7) | 37(88.1) |
| 7. Can you lift eight pounds to the level of your shoulder without bending your elbow? | 6(14.2) | 31(73.8) |
| 8. Can you carry twenty pounds at your side with the affected extremity? | 3( 7.1) | 26(61.9) |
| 9. Can toss a soft ball under-hand ten yards with the affected extremity? | 9(21.4) | 33(78.6) |
| 10. Can toss a soft ball over-hand twenty yards with the affected extremity? | 2( 4.8) | 25(59.5) |
| 11. Can you wash the back of your opposite shoulder with the affected extremity? | 9(21.4) | 39(92.9) |
| 12. Would your shoulder allow you to work full-time at your regular job? | 3( 7.1) | 33(78.6) |

thoracic movement and tilting of the trunk was seen in all of these patients due to markedly limited glenohumeral motion. We documented a brief questionnare with Simple Shoulder Test(SST) established by the Seattle Shoulder Team[9] (Table 1). We compared the preoperative and last follow-up shoulder condition with the UCLA score1) which evaluates pain, motion, and function. Also we evaluated results of the SST, and UCLA score on patients who had diabetes compared with those who did not. The UCLA score of preoperative shoulder were average 42 points. All data were entered into a standard database spreadsheet(Excel 4.0, Microsoft). Significance was set at the 95% confidence interval.

**Arthroscopic Capsular Release**

The operative procedure involved three basic components; shoulder arthroscopy, manipulation and subacromial arthroscopy. Shoulder arthroscopy was performed under the general anesthesia in 23 patients and interscalene regional block in 19 patients. The patient was placed in the beach chair position. After adequate anesthesia was obtained in the operating room, the range of motion of the shoulder was reassessed. Shoulder arthroscopy was performed if the shoulder did not respond to gentle manipulation. A posterior arthroscope portal was used and preliminary joint distension was not attempted. The skin was incised with a no. 11 blade, and the arthroscope cannula and blunt obturator entered the joint in the direction of the coracoid process. A 4.0㎜ 30-degree arthroscope was employed. A systematic inspection was then undertaken to inspect and determine the sites and severity of any synovitis and capsular contracture. The anterior portal was established by placing the arthroscope against the anterior wall beneath the biceps tendon in a triangular space immediately superior to the subscapularis tendon. The arthroscope was removed and a Wissinger rod was passed through the sheath at the posterior portal. An anterior skin incision was made over the protruding tip of the rod, and the rod was then advanced through the incision. A cannula was placed over the rod in a retrograde fashion before removal of the

rod, to establish the anterior portal for viewing, probing, and instrumentation. After creating the anterior portal, pathological changes of the synovium, capsuloligaments, biceps and rotator cuff were recorded(Table 2). The inflammed synovium was usually found around the rotator interval and biceps tendon. These congested and hypertrophied synovium of the rotator interval, in superior glenohumeral ligament and anterosuperior capsule, was aggressively debrided with a shaver. The superior glenohumeral ligament was released completely and the rotator interval was opened near the base of the coracoid(Fig. 1). Electrocautery was usual-ly used to control bleeding at this time. Thickened middle glenohumeral ligament was incised and the obliterated subsca-pular recess was reopened with scissors and shaver. After complete release of the middle glenohumeral ligament, the ante-rior band of inferior glenohumeral liga-ment was incised at first with scissors and then released all the way down in the 6 O' clock direction with a 30 degree meniscectomy knife along the anteroin-ferior glenoid rim margin, and so that the anteroinferior muscle fibers could be vi-sualized within the arthroscopic field(Fig. 2). Care was taken to avoid the axillary nerve injury during this procedure(Fig. 3). Once the release of the anterior con-tracted capsule and the glenohumeral ligaments was completed, the scope then was changed to the anterior portal. The meniscectomy knife was inserted into the joint through the posterior portal, the perilabral incision of the thickened poste-rior capsule was done until the circle re-lease was com-

**Table 2.** Arthroscopic pathology in the frozen shoulder

| | |
|---|---|
| anterosuperior | diffuse synovitis |
| | contracture of coracohumeral ligament |
| | thickened superior glenohumeral ligament |
| anteromiddle | thickened middled glenohumeral ligament |
| | obliteration of the subscapular ligament |
| anteroinferior | thickened inferior glenohumeral ligament |
| | diffuse synovitis |
| | contracture of axillary recess |
| posterior | contracted posterior capsule |
| subacromial | chronic bursitis |
| | congestion on the coracoacromial ligament and the undersurface of acromion |

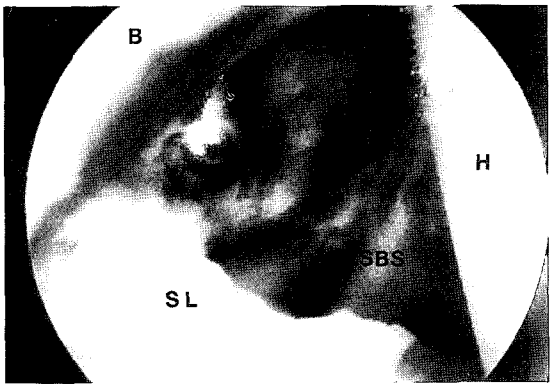


**Fig. 1.** An arthroscopic release of the thickened anterosuperior capsular region was performed with a motorized shaver. B;biceps, H;humeral head, SBS;subscapularis, SL;superior labrum

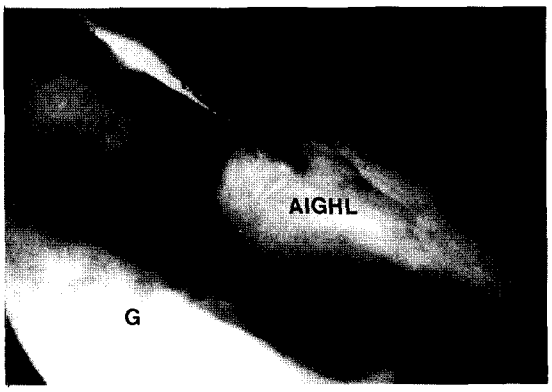


**Fig. 2.** The contracted anteroinferior aspect of the capsule was divided along 1 cm peripheral to the glenoid rim through an anterior portal with use of a 30° meniscectomy knife. AIGHL; anteroinferior glenohumeral ligament, G;glenoid

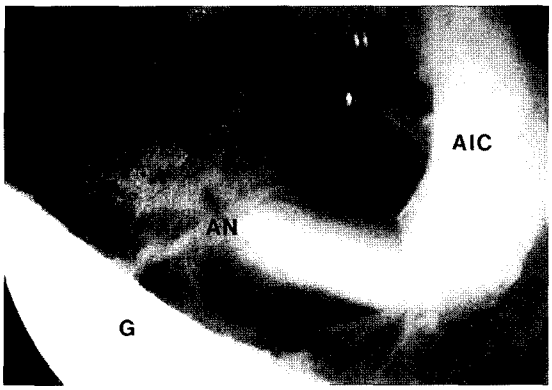


**Fig. 3.** Care should be taken to avoid the axillary nerve injury. Axillary nerve was shown up under the inferior border of the subscapularis muscle after inferior capsular release. AIC;anteroinferior capsule, AN;axillary nerve, G;glenoid

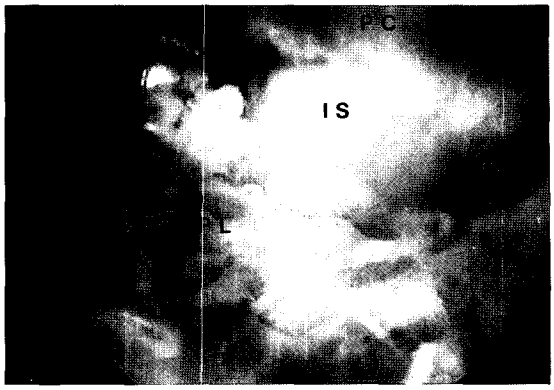


**Fig. 5.** After posterosuperior capsule was transected with use of a meniscectomy knife, the thickened capsule was debrided with a motorized shaver until the infraspinatus muscl was exposed. G; glenoid, IS;infraspinatus, PC;posterior capsule, PL;posterior labrum

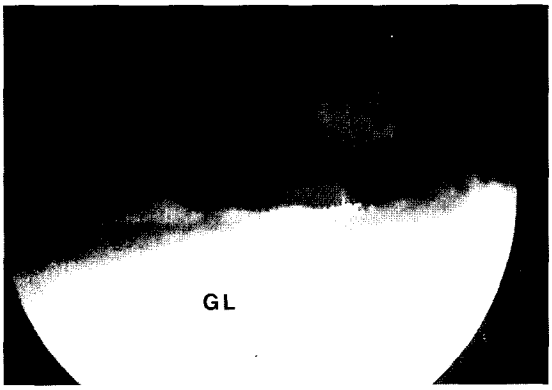


**Fig. 4.** Posteroinferior capsular release was done through the posterior portal until it connected with the anteroinferior transection. IC;inferior capsule, IM;inferior muscles, GL;glenoid

pleted, then the edge of the divided capsule was shaved(Fig. 4). The posterior rotator cuff muscle was visible from inside the joint(Fig. 5). After the arthroscopic capsular release was done, gentle manipulation was underta-ken. The arm was first elevated in the scapular plane with the involved limb grasped near the proximal arm. There was no popping during this maneuver if the complete capsular release was done, but audible popping could be sensed if capsular release was incomplete. The shoulder was then placed at zero degree abduction and gradually externally rotated at varying degrees of abduction and internally rotated in a scarecrow rotation. Finally, the cross body adduction was accomplished and the cycle was repeated (Table 3). After a closed manipulation, the subacromial space was inspected and subacromial bursal adhesions were debrided. We recommend the manipulation prior to a subacromial arthroscopy because it would not be easy to manipulate the swollen shoulder if the subacromial arthroscopy was performed before manipulation. Arthroscopic subacromial decompression was done if a patient had had fibrillations or thickening on the undersurface of the acromion, and the hooked type of the acromion or the prominent anterior acromion and osteophyte was seen in prearthroscopic radiography. Similarly, if hypertrophic coracoacromial ligament or fibrillation on the undersurface of the acromion and the rotator cuff were obser-

**Table 3.** The limited motion and the related structures in the frozen shoulder

| limited motion | related structures |
|---|---|
| external rotation at the side(ERS) | eSGHL, CHL, rotator interval |
| flexion and ER in midrange | MGHL, subscapular recess |
| flexion and ER in exreme motion | IGHL, axillary recess |
| cross body adduction | superior posterior capsule |
| internal rotation at the po sterior(IRP) | middle posterior capsule |
| internal rotation with abduction (scarecrow position) | inferior posterior capsul |

ved, then arthroscopic acromioplasty was also performed. But these secondary frozen shoulders due to impingement syndrome were excluded from this study. Postoperatively the patient began physical therapy on the day of surgery. The basic home program for the stretching exercise included the following four directions : overhead reach, external rotation at the side, cross-body reach, and back reach. Strengthening exercises were allowed after a minimum of 6 weeks and symptoms improved. We recommended this stretching program to be done three times a day for 10 minutes, and each stretch was done at maximum for 20 seconds before relaxing.

## Results

We evaluated duration from onset of pain to the time of operation. In the case of seven patients(17%) duration was at least 3 months, in 11 patients(26%), 3 to 6 months, 10 patients(24%) suffered for 6 to 9 months, and 6 patients(14%) for 9 to 12 months, in 2 patients pain lasted 12 to 15 months, 1 patient had a 15 to 18 months, the duration in 2 patients was 18 to 21 months, and more than 2 years in 3 patients.

Severity of subjective pain which patient had felt at preoperation and the follow-up period was graded from 0 to 10. Before operation, the pain which patients felt at rest was graded 0 to 6(mean 3.1) and severe pain during the activities of daliy living occasionally was graded 6 to 10 (mean 7.7). After operation the pain which patients felt at rest was graded 0 to 3(mean 0.3) and severe pain during the activities of daliy living occasionally were graded 2 to 7(mean 3.0). At the last follow-up, 32 patients(76%) were completely free of pain, 7 patients (17%) had intermittent pain only on extreme motion, but all of them could do the activities of daily living well. 3 patients(7%) had persistent pain and were unsatisfied with the final results. In 11 patients(26%), pain was relieved within 1 week, in 15 patients(36%), 1 week to 1 month. It took 1-3 month to relieve pain in 9 patients (21%) and 3-6 months in 2 patients(5%). After 6 months to 1 year, 2 patients(5%) were free of pain. The patients that complained persistent pain till the last follow up were three. Thirty five patients(83%) were relieved from pain within 3 months after arthroscopic capsular release.

Arthroscopic findings showed synovitis at anterosuperior capsule in 100%, synovitis of biceps tendon in 36%, subcapsular recess obliteration in 64%, SGHL thickening in 92%, MGHL thickening in 73%, and IGHL thickening in all cases(Table 2).

The range of motion at the last follow-up was improved to 168 degrees in forward flexion, 55 degrees in external rotation at the side, 67 degrees in exter-

nal rotation with abduction, 47 degrees in internal rotation, 22 ㎝ in cross-body adduction, and T10 level in internal rotation up the back. Range of motion gained within 1 months to 3 months according to pain relief. Twelve of 12 functional self-assesssment questions on the Simple Shoulder test(SST) were significantly improved(6 of 12 SST questions at $P < .001$ and 6 at $P < .006$). Questions that were answered "Yes" above eighty percents after arthroscopic release were 1) Is your shoulder comfortable with your arm at rest by your side ?(21.4 to 92.9), 2) Does your shoulder allow you to sleep comfortably ?(14.2 to 85.7), 3) Can you comb your posterior hair ?(16.7 to 88.1), 4) Can you place a coin on a shelf at the level of your shoulder without bending your elbow ?(21.4 to 92.9), and 5) Can you lift one pound to the level of your shoulder without bending your elbow ?(16.7 to 88.1). 6) Can you wash the back of your opposite shoulder with the affected extremity ?(9.5 to 92.9). The questions that did not improve among the 12 questions about SST were 1) Can you reach your back with your hand ?(11.9 to 64.3), 2) Can you lift eight pounds to the level of your shoulder without bending your elbow ?(14.2 to 73.8). 3) Can you carry twenty pounds at your side with affected extremity(7.1 to 61.9) ?, and 4) Can you toss a soft ball over-hand(4.8 to 59.5)?(Table 1).

The UCLA score[1] was improved from 42 to 84 points. The UCLA score in 14 diabetic patients were 40 points at the preoperative shoulder condition, and 79.5 points at the last follow up shoulder condition. The UCLA score in 28 patients who did not have diabetes were 46 points at the preoperative shoulder condition, and 88 points at the postoperative shoulder condition. No statistical differences in SST, and UCLA score identified between the patients who had diabetes and those who did not when significance was set at the 95% confidence interval. However, we did note that patients with diabetes spent longer hospitalization than other patients and had lower satisfaction with this procedure. Three patients who had persistent pain and were unsatisfied with the final result were diabetics. One patient could not gain satisfactory shoulder motion because she had ipsilateral weakness due to CVA attack after operation. The other two patients could not gain satisfactory shoulder motion after operation because of continuation of pain of unknown origin that they had had before operation. Patients could be easily resolved resting pain, to lift shoulder to the level of own's shoulder and to wash own's opposite shoulder but not easily resolved were reach own's back, to lift eight pounds and to throw a ball overhand. Hence it was somewhat difficult to resolve posterior capsular tightness completely. In fact movement above shoulder was resolved easily but exercise to spend force or muscle weakness was not easily improved.

## Discussion

The frozen shoulder is a syndrome or condition that attacks with painful global restriction in active and passive shoulder motion with an uncertain etiology. In 1934 Codman[4] stated that frozen shoulder was a condition difficult to define, difficult to treat, and difficult to explain from the point of view of pathology. Even though a

number of treatment has been proposed after this decade, treatment of frozen shoulder still remains controversial so far. Rest and analgesics, nonsteroidal antiinflammatory medications, local or oral corticosteroids, physiotherapy, hydraulic distention, manipulation under anesthesia, open surgery or a combination of these have been advocated as the main treatment strategies available. It has been generally assumed that primary frozen shoulder is a self-limiting disease, so that eventual recovery could be expected over months or years even though untreated. However, despite these optimistic findings, other investigators have reported residual restriction and persistent symptoms at the least 5 years follow-up[2]. Clarke[3] et al. documented 42 percent of patients had persisting limitation of motion, predominantly in external rotation and abduction. Binder[2] et al. reported 45 percent had residual pain and 40 percent had some restriction of motion in a prospective study of forty patients who had been treated with a variety of nonoperative modalities. The findings of Shaffer[14] et al. were in agreement with these observations in that, half of their patients remained symptomatic, years after the onset of symptoms and 43 percent had residual restriction of motion in at least one plane. Therefore, the severity of pain and long duration of disability in the activities of daily living frequently justify surgical treatment, whatever it may be arthroscopic or open.

The goals of treatment are to decrease pain and to restore and return the patient back to the previous state. Manipulation under anesthesia is commonly advocated for cases not responding to the conservative management[8]. Advantages of manipulation are easy techniques, economic procedures and the possibility of management as outpatient, but it is at risk to fracture due to osteoporosis and can be associated with soft tissue damage during forceful manipulation, so severe contracture of the shoulder joint is not a good candidate for manipulation[8]. Additionally incomplete and irregular capsular release can occur so new scar formation may come about. This is called rebound phenomenon which occurs after only manipulation. Vastamaki[16] documented that 25 percent of frozen shoulders in his experience could not recover after manipulation, and they developed adhesive capsulitis again during the first week after manipulation. Hydraulic distension is also a simple, safe, and economic procedure to reduce the morbidity of this condition. Sharma[15] et al. suggested that it would be of more value if carried out at an early stage of the disorder and recommeded that hydraulic distension should be offered to all patients with frozen shoulder[16]. But disadvantages of hydraulic distension are the difficulty to insert a needle, distension only at weak areas, and an unidentifiable associated pathology if presented only with this procedure. It is impossible to distend the severe contracted capsule if there is no glenohumeral motion, so we consider hydraulic distension only in the eary stiff phase.

Arthroscopic procedure in the frozen shoulder provide information that may not have been identified during clinical evaluation and provide some therapeutic options, a capsular distension, debridement of intra-articular adhesions, and release of contracted capsular structures[5,17]. Oglivie-Harris and Wiley[11] reported suc-

cessful results after arthroscopic distension followed by manipulation. Pollock13) et al. achieved satisfactory results in 83 percents of their series treated with manipulation under anesthesia followed by arthroscopy. We performed arthroscopic capsular release before manipulation because it eliminated need to lavage the blood from the ruptured structures and a systematic inspection was possible to determine the sites and severity of any contracture and synovitis when arthroscopy was done prior to manipulation[17]. Harryman[6,7] described precise perilabral circumferential capsular release including the anterior glenohumeral ligaments, rotator interval and posterior capsule followed by manipulation. He documented that the motions of flexion, external rotation at the side, and external rotation in 90 degrees abduction improved to within 90 percents of the motion of the opposite side after three months from the arthroscopic global capsular release, even though internal rotation up the back and internal rotation with the arm abducted 90 degrees improved to somewhat less. Harryman et al.[7] described no statistical differences in SST functions nor measured motions between the patients who had diabetes and those who did not. However it was noted that patients with diabetes spent a significantly greater number of days in the hospital than non diabetics and experienced overall lower satisfaction with the procedure. In our studies, forward elevation was improved upto 168 degrees from 95 degrees, external rotation to 55 degrees from 17 degrees, and internal rotation to the level of the tenth thoracic spinous process from fifth lumbar level. Average preoperative UCLA rating score to test shoulder conditions was 42.2 points, but average postarthroscopic UCLA rating score was improved upto 84 points. In our studies, 3 unsatisfactory results of the 42 patients were indeed all diabetics. We might suspect a diabetes affected adversely on the final outcome after arthroscopic capsular release in the frozen shoulder although it has no statistical meaning.

Therefore arthroscopic global capsular release could be recommended in the treatment of refractory frozen shoulder.

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**— 국문초록 —**

# 불응성 동결견에 대한 관절경하 관절낭 유리술

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저자들은 42명의 불응성 동결견에 대해서 관절경하 관절낭 유리술을 시행하여 이에 대한 결과를 객관적 및 주관적으로 분석하였다. 추시기간은 평균 26개월(15-38개월)이었다. 모든 환자는 특히 야간에 심해지는 심한 동통을 호소하였고 심한 상완견갑운동 제한이 있었다. 술전 관절운동 범위는 전방굴곡이 평균 95도, 외회전이 평균 17도, 내회전이 평균 제 5요추 부였다. 수술시 관절경적 소견으로는 모든 환자에서 전반적인 활액막염으로 활액막의 증식 을 특히 전상방 부위에서 볼 수 있었으며 이두박근 장두 주위의 활액막염은 36%에서 볼 수 있었다. 견갑하와는 64%에서 섬유화로 폐쇄되어져 있었으며, 상관절와상완인대와 중관절와 상완인대는 각각 92%와 73%에서 두꺼워져 있었고 하관절와상완인대는 모든 환자에서 두꺼 워져 있었다. 저자들은 이러한 울혈된 활액막을 제거하고 관절와상완운동을 제한하는 모든 관절낭을 유리하였다. 최종 추시시 32명(76%)의 환자에서 동통이 없었으며 7명(17%)의 환자에서는 외회전시 간헐적인 동통을 호소하였으나 일상 생활에는 별 문제가 없었다. 당뇨병이 있었던 3명(7%)의 환자는 지속적인 동통이 있어 불만족스러운 결과를 보였다. 술후 관절운동 범위는 전방굴곡이 평균 168도, 외회전이 평균 55도였으며 내회전은 평균 제 12흉추부위로 향상되었다. UCLA 견관절 평가 지수는 술전 평균 42점에서 술후 평균 84점으로 향상되었다. 결론적으로 보존적 요법으로 실패한 불응성 동결견에 대해서 관절경하 관절낭 유리술은 권장할 만한 술식이라 사료된다.

**핵심단어** : 견관절, 동결견, 관절경하 유리술