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# A COMPARATIVE STUDY OF MANIPULATION UNDER ANAESTHESIA VERSUS ARTHROSCOPIC CAPSULAR RELEASE IN ADHESIVE CAPSULITIS OF SHOULDER

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**Abstract**

**Background:** Adhesive capsulitis is not completely known, and recent studies have shown that it can lead to long-term disability over the course of several years[13,17,27]Long-term follow-up studies have shown that patients underestimate the amount of objective motion lost and that the duration of symptoms before medical care is sought may be correlated with recovery. Patients seeking care earlier usually recover more quickly.

**Materials and Methods:**

In Department Of Orthopaedics, R.G.Kar Medical College, Kolkata from november 2011 to september 2013 patients presenting to the outdoor patient department with clinical features of Adhesive Capsulitis of shoulder are evaluated with variables like Age, Sex, Dominance of extremity, Diabetes, Duration of symptoms. A total of 44 patients satisfied the inclusion criteria. 4 patients were lost to follow up and thus 40 patients were available for follow up and evaluated.

**Results:** A total of 40 patients were evaluated. The MUA group consisted of 23 patients and the ACR group consisted of 17 patients. The mean improvement in the MUA group of patients at the final follow up of 6 months was 50.69 on the CMS score. The mean pre-operative CMS score was 22.0(± 4.7) and rose to 72.69 (± 7.87) at 6 months. The mean pre-operative CMS score for ACR patients was 18.47(±4.47) and rose to 82.41 (± 6.69) at 6 months follow up, with an improvement of 63.94 points.

**Conclusion:** Overall the results of ACR were encouraging over MUA across all stratifications. Abduction and internal rotation were in particular significantly better and pain reduction was earlier for ACR group of patients. This accounted for better functional scores in these patients.

**Keywords:** Arthroscopic capsular, Adhesive Capsulitis, Shoulder

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**Introduction**

Adhesive capsulitis or Frozen shoulder is a common condition encountered in the outpatient clinic. It is characterized by the spontaneous onset of shoulder pain and global limitation of both active and passive shoulder motion.

This condition was first described by Codman in 1934.[1] and was most recently defined by the American Academy of Orthopaedic Surgeons as ‘‘a condition of varying severity characterized by the gradual development of global limitation of active and passive shoulder motion where radiographic findings other than osteopenia are absent.’’[2].

The risk of being affected appears to be increased by trauma, thoracic surgery, and a variety of medical conditions, including cervical disc disease, myocardial infarction, intracranial pathology and pulmonary infection. [3,4,5]

Adhesive capsulitis is commonly described as passing through three stages [6,7,8]. Stage 1 is referred to as ‘‘freezing’’ and consists of increasing pain and stiffness lasting for period of as long as nine months. Stage 2 is termed ‘‘frozen’’ and involves a steady state for a period lasting between four and twenty months.

Finally, Stage 3 is termed ‘‘thawing,’’ which is a period of spontaneous recovery lasting anywhere from five to twenty-six months.

The goal of treatment is restoration of normal, pain-free shoulder function. Many therapeutic regimens have been advocated but there is no unanimous opinion regarding proper method of treatment. Multiple interventions have been studied including oral medications, corticosteroid injections, exercises, joint mobilization, distension, manipulation, nerve blocks, and surgery.

MUA and Arthroscopic Capsular Release both offer the advantage of early relief from symptoms and rehabilitation. Our aim is to compare these two modes of treatment.

**AIMS AND OBJECTIVES**

The aim of our study was to do a comparative study of manipulation under anaesthesia versus arthroscopic capsular release for adhesive capsulitis of shoulder.

The specific objectives were to evaluate the results of manipulation under anaesthesia for adhesive capsulitis of shoulder. to evaluate the results of arthroscopic capsular release for adhesive capsulitis of shoulder and to compare the results of manipulation under anaesthesia and arthroscopic capsular release in patients presenting to the outdoor patient department with clinical features of Adhesive Capsulitis of shoulder. Study variables are Age, Sex, Dominance of extremity, Diabetes, Duration of symptoms.

**Materials and Method**

This is a prospective and interventional study

**PATIENT SELECTION -**

**INCLUSION CRITERIA –** Patients fit for anaesthesia, having symptoms of at least one month, abduction less than $90^0$ , external rotation restriction of at least 50 % compared with unaffected shoulder and not improving with 3 months of conservative treatment.

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**EXCLUSION CRITERIA-**Post-surgical stiffness, post traumatic stiffness and patients unfit for anaesthesia

**SAMPLE SIZE-**According to feasibility. A total of 44 patients satisfied the inclusion criteria. 4 patients were lost to follow up and thus 40 patients were available for follow up and evaluated.

**STUDY TOOLS -** Arthroscope, surgical viewing monitor, probe, scissors, motorized shaver trocar, radiofrequency ablator ,normal saline irrigation system ,skin marking pencil, weights, surface traction kit , arthroscopy pump ,injection methyl prednisolone +injection 1% lignocaine , goniometer and other general instruments for operation.

**STUDY TECHNIQUE -** The study was conducted after clearance from ethical committee of our institution.

All patients signed a written informed consent form before they were included in the study.
Pre-operative evaluation –patients satisfying the inclusion criteria were evaluated for their shoulder function through the CONSTANT –MURLEY (CMS) and PAIN VISUAL ANALOGUE SCALE (VAS) and SHOULDER PAIN AND DISABILITY INDEX (SPADI)
A preoperative radiograph of the shoulder was obtained to rule out any bony pathology

Patients were counseled about the two intervention procedures and were allowed to choose either of them.
The MUA group comprised of 26 patients initially. At final follow up 23 were available for evaluation.

The arthroscopy group consisted of 18 patients initially. At final follow up 17 were available for evaluation.

Intraoperative for MUA – Patients were administered general anaesthesia. Shoulder was manipulated after fixing the scapula in a sequence comprising of flexion >extension> abduction>adduction>external rotation and internal rotation. After the procedure 4 ml of injection methylprednisolone and 1% lignocaine was introduced in the joint.
A radiograph of the shoulder was obtained to rule out any fracture that may have occurred.
Intraoperative for arthroscopy –after administration of regional anaesthesia (general anaesthesia was used when indicated), the patient was positioned in lateral decubitus position with the use of surface traction kit and weights (12.5 pounds) in $30^0$ abducted position. Bony landmarks were marked.

A standard posterior portal was made 2 centimetres inferior and medial to the angle of acromian. The long head of the biceps tendon was identified and noted for any pathology. Any superio-labral antero-posterior lesion (SLAP) was also noted. An anterosuperior portal

was made by the outside in technique just superior to the superior border of subscapularis. The tissue in the rotator interval was released to the anterior border of long head of biceps.
The anterior and antero-inferior part of the capsule was cut lateral to the glenoid labrum using a radiofrequency ablator. Through the posterior portal, the inferior and posterior aspect of the capsule were released. Release of the inferior pouch was restricted to within 1 cm of the glenoid labrum to avoid damage to the axillary nerve. 4 ml of injection methyl prednisolone and injection 1% lignocaine was introduced in the joint. Sutures were applied and a light dressing was done.

Post operative protocol - Beginning on the day of intervention ,all patients performed an exercise program .They were instructed to perform each of the five exercises two minutes six times a day.

I. Assisted passive forward elevation in supine position
II. Passive external rotation with arm by the side.
III. Passive external rotation with arm in abduction.
IV. Assisted passive internal rotation up the back.
V. Assisted passive cross body adduction.

Oral analgesics were prescribed for 3 to 5 days. For arthroscopy patients stitches were removed at 2 weeks interval.All patients were evaluated at intervals of 2 weeks, 6 weeks, 3 months, 6 months.

**RESULTS**

A total of 44 patients satisfied the inclusion criteria and underwent the study; however 4 patients were lost to follow up. Eventually our sample size available for evaluation was of 40 patients. The MUA group comprised of 23 patients and the ACR group comprised of 17 patients.

There were no intra-operative or post-operative complications apart from occasional dizziness and headache, which was managed accordingly.
For the MUA group of patients, while performing the manipulation ,severing of adhesions was audible in most of the cases and full passive range of motion was achieved intra-operatively.

For the ACR group of patients the capsule was found to be thickened and contracted
Follow up evaluation was done at intervals of 2 weeks, 6 weeks, 3 months and 6 months.
Distribution of patients are MUA 23(57.5%) and arthroscopic capsular release 17 (42.5%) of 40 patients . Age distribution for MUA are 40-49 yrs (7), 50-59yrs(9) and 60-69yrs(7) and for ACR are 40-49 yrs (5), 50-59yrs(8) and 60-69yrs(4). Sex distribution for MUA are male(10) /female(13) and for ACR are male(10) /female(7). Side distribution for MUA non-dominant hand is 14 and dominant hand is 9 and for ACR non-dominant hand is 10 and dominant hand is 7. Distribution of patients according to duration of symtoms in months in MUA are 4-5 months(2), 5-6 months(4),6-7 months(6),7-8 months(9) and more

than 8 months(2) and ACR are 4-5 months(2), 5-6 months(8),6-7 months(6),7-8 months(1) and more than 8 months(0)

**TABLE 1: CMS SCORE IN MUA PATIENTS ACCORDING TO SEX (N=23)**

| Sex | No. of Patients | Percen-tage (%) | Pre-operative Mean score | At 2 (Two) weeks | | At 6 (Six) weeks | | At 3 (Three) months | | At 6 (Six) months | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Score | Diff. | Score | Diff. | Score | Diff. | Score | Diff. |
| MALE | 10 | 43.5% | 22.5 | 49.6 | 27.1 | 62.8 | 40.3 | 68.8 | 46.3 | 73.8 | 51.3 |
| FEMALE | 13 | 56.5% | 21.61 | 48.15 | 26.53 | 60.53 | 38.92 | 66.46 | 44.84 | 71.84 | 50.23 |

T = .389; Df = 22; P= 0.701

**TABLE 2: CMS SCORE IN MUA PATIENTS ACCORDING TO DOMINANCE OF SHOULDER (N=23)**

| Side | No. of Patients | Percen – tage (%) | Pre-operative Mean | At 2 (Two) weeks | | At 6 (Six) weeks | | At 3 (Three) months | | At 6 (Six) months | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Score | Diff. | Score | Diff. | Score | Diff. | Score | Diff. |
| Non- | 14 | 60.9% | 21.14 | 47.21 | 26.07 | 61.35 | 40.21 | 67.42 | 46.28 | 72.64 | 51.5 |
| Dominant | 9 | 39.1% | 23.33 | 51.22 | 27.88 | 61.77 | 38.44 | 67.55 | 44.22 | 72.77 | 49.44 |

T = 0.743; Df = 22; P= 0.466

**TABLE 3: CMS SCORE FOR DIABETIC / NON-DIABETIC PATIENTS UNDERGOING MUA (N=23)**

| Diabetic status | No. of Patients | Percen - tage | Pre-operative Mean score | At 2 (Two) weeks | | At 6 (Six) weeks | | At 3 (Three) months | | At 6 (Six) months | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Score | Diff. | Score | Diff. | Score | Diff. | Score | Diff. |
| Diabetic | 5 | 21.7% | 19.4 | 45.8 | 26.4 | 57.6 | 68.2 | 61.6 | 42.2 | 65.0 | 45.6 |
| Non- | 18 | 78.3% | 22.72 | 49.61 | 26.88 | 62.61 | 39.88 | 69.11 | 46.38 | 74.83 | 52.11 |

T = -2.174; Df = 22; P< =0.05

**TABLE 4: CMS SCORE IN MUA PATIENTS ACCORDING TO DURATION OF SYMPTOM (N =23)**

| Duration (In months) | No. of Patients | Percen-tage | Pre-operative Mean | At 2 (Two) weeks | | At 6 (Six) weeks | | At 3 (Three) months | | At 6 (Six) months | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Score | Diff. | Score | Diff. | Score | Diff. | Score | Diff. |
| 4 – 5 | 2 | 8.7% | 18 | 45.5 | 27.5 | 58.0 | 40.0 | 62.0 | 44.0 | 67.0 | 49.0 |
| 5 – 6 | 4 | 17.4% | 24.75 | 51.25 | 26.5 | 63.25 | 38.5 | 70.5 | 45.75 | 75.0 | 50.25 |
| 6 – 7 | 6 | 26.1% | 22.66 | 48.66 | 26.0 | 62.33 | 39.66 | 68.66 | 46.0 | 71.33 | 48.66 |
| 7 – 8 | 9 | 39.1% | 21.88 | 48.77 | 26.88 | 62.77 | 40.88 | 68.55 | 40.88 | 74.66 | 52.77 |
| More | 2 | 8.7% | 19.0 | 47.5 | 28.5 | 53.5 | 34.5 | 58.5 | 39.5 | 69.0 | 50.0 |

T = 33.83; Df = 22; P<=0.005

**TABLE 5: PAIN VAS SCORE IN MUA PATIENTS (N=23)**

| No. of Patients | Pre-operative Mean score | At 2 (Two) weeks | | At 6 (Six) weeks | | At 3 (Three) months | | At 6 (Six) months | |
|---|---|---|---|---|---|---|---|---|---|
| | | Score | Diff. | Score | Diff. | Score | Diff. | Score | Diff. |
| 23 | 8.26 | 5.21 | 3.05 | 3.60 | 4.66 | 2.30 | 5.96 | 1.91 | 6.35 |

**TABLE 6: ABDUCTION IN DEGREES FOR MUA PATIENTS**

| No. of Patients | Pre-operative Mean score | At 2 (Two) weeks | | At 6 (Six) weeks | | At 3 (Three) months | | At 6 (Six) Months | |
|---|---|---|---|---|---|---|---|---|---|
| | | Score | Diff. | Score | Diff. | Score | Diff. | Score | Diff. |
| 23 | 50.65 | 95.65 | 45.0 | 112.39 | 61.74 | 124.78 | 74.13 | 134.78 | 84.13 |

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**TABLE 7: FLEXION IN DEGREES FOR MUA PATIENTS**

| No. of Patients | Pre-operative Mean score | At 2 (Two) weeks | | At 6 (Six) weeks | | At 3 (Three) months | | At 6 (Six) Months | |
|---|---|---|---|---|---|---|---|---|---|
| | | Score | Diff. | Score | Diff. | Score | Diff. | Score | Diff. |
| 23 | 45.0 | 82.39 | 37.39 | 104.34 | 59.34 | 118.69 | 73.69 | 130.43 | 85.43 |

**TABLE 8: INTERNAL ROTATION (IN VERTEBRAL LEVELS) FOR MUA PATIENTS (N=23)**

| No. of Patients | Pre-operative Mean score | At 2 (Two) weeks | | At 6 (Six) weeks | | At 3 (Three) months | | At 6 (Six) months | |
|---|---|---|---|---|---|---|---|---|---|
| | | Score | Diff. | Score | Diff. | Score | Diff. | Score | Diff. |
| 23 | 1.91 | 4.6 | 2.69 | 5.13 | 3.22 | 5.47 | 3.56 | 6.08 | 4.17 |

## DISCUSSION

We adopted an approach, whereby we allowed all patients having a clinical presentation of adhesive capsulitis, a chance to recover by non-operative means.This primarily consisted of home exercise therapy and NSAIDS for pain relief. Only those patients who reported no benefits were considered eligible for our study.

The timing of intervention after a trial of conservative treatment remains controversial. We adopted the protocol suggested by Wang et al[9] and Sabat and Kumar[35], where failure to respond by 3 months was considered reason enough to intervene.

Several authors have advocated the use of intraarticular steroids either alone or in combination with other treatment modalities[10,11,12,13]. According to Buchbinder et al [11] intraarticular steroids offer short term benefits. We included a single dose of intraarticular

steroid in both the procedures, thus eliminating any confounding effect, at the same time maximizing benefits for the patient with a relatively safe procedure.
Only primary adhesive capsulitis cases were considered in our study and post-surgical cases and post-traumatic cases were omitted.

A total of 40 patients were evaluated. The MUA group consisted of 23 patients and the ACR group consisted of 17 patients. The mean improvement in the MUA group of patients at the final follow up of 6 months was 50.69 on the CMS score.The mean pre-operative CMS score was 22.0(± 4.7) and rose to 72.69 (± 7.87) at 6 months.The mean pre-operative CMS score for ACR patients was 18.47(±4.47) and rose to 82.41 (± 6.69) at 6 months follow up, with an improvement of 63.94 points.The difference in improvements offered by the two procedures was statistically significant ($p<=0.05$) with the ACR procedure being advantageous.

The mean improvement in the SPADI score was 57.35 and 59.65 respectively at 6 months. The results were better for ACR though the values did not reach significant levels. This could be attributed to the entirely subjective assessment in the SPADI scale where only patient reported scores were plotted and no objective evaluation was possible by us.

While evaluating the results of MUA we included certain patient characteristics, namely age, sex, dominant or non-dominant shoulder, diabetes and duration of symptom to give a more detailed analysis.

In our study, the mean age of patients was 54.62 (s.d=6.8), the youngest being 42 years and the eldest being 66 years which corresponded to the age distribution of frozen shoulder as mentioned in numerous literature [14,15]. We stratified our patients in the age group of 40-49 years, 50-59 years and 60 69 years. The results of MUA were encouraging overall, however, the results were better in younger age groups as compared to older age groups and this difference was significant .($p<0.005$)

At the same time it must be emphasized that the strength of the normal shoulder deteriorates with age and so does the Constant score in a normal population, the difference being most notable in those aged 70 years and more, as suggested by Kakolik et al[36]. Since our study group comprised of patients less than 70 years, our results can be largely attributed to the intervention itself.

A similar outcome which was statistically significant was noted for the ACR group of patients. ($t=3.274$ $p=0.005$)When comparing the results of MUA and ACR for each age group of patients, the results were significant in all albeit least in the 60-69 years group of patients.
The reduction of pain VAS score was overall better for the ACR group across all ages. All patients had either mild or moderate pain with a pain VAS score of <=5 by 6 weeks of intervention irrespective of the procedure adopted and the benefits were well maintained at 6 months. The difference of pain reduction was most evident in the 60-69 years group, thus establishing the superiority of ACR.

The range of abduction improved more for the ACR group of patients and the results were statistically significant. By 2 weeks all our patients were able to achieve an abduction of $90^0$ or more and were able to work at the shoulder level. This accounted for the rapid increment in the CMS score at 2 weeks ($p<0.005$) as the strength parameter came into play.

While for MUA patients, final abduction (in degrees) and change (in degrees) was nearly same as flexion, for the ACR group the mean final abduction and flexion were $154.41^0$ and $137.35^0$ respectively. This could be attributed to variable amount of release of the posterior capsule in contrast to the inferior capsule, which was routinely released up to 1 centimeter of the glenoid margin.

The amount of improvement in internal rotation was substantial in both the treatment procedures. At 6 weeks, nearly 52% of MUA patients and 82% of ACR patients were able to achieve internal rotation up to L-3 vertebral level. Thus ACR offered significant advantage over MUA in restoring internal rotation. However beyond 6 weeks there was no further advantage.

Dodenhoff et al[93] found no correlation between pre-operative Constant score and the final outcome for patients undergoing MUA. In our study ,we have found that a better pre-operative Constant score correlated with a better score at 6 months follow up(correlation =0.422). However, the improvement was not well correlated with severity of symptoms.

A true estimate of advantage of ACR over MUA is difficult to measure. While ACR is recommended for post-surgical and post-traumatic stiffness, for the idiopathic variety of frozen shoulders, the recommendations are still not standardized. Studies by Sivardeen et al[32] in 2008 and Sameh & Chokalingam[33] in 2009 established the superiority of ACR over MUA, however the results were not statistically significant. These studies had a minimum follow up of 9 months.

Recent analysis by Akhtar et al [34] found MUA with steroid to be superior to ACR at follow up of 14.6 months. Their recommendation was MUA with intra-articular steroids when conservative measures had failed. Grant et al [29] compared MUA and ACR by performing a systematic review and found almost comparable results.

The post-operative rehabilitation protocol was done under supervision only for the first 2 or 3 days before the patients were discharged and it was not possible to determine whether all patients of each group were following the instructions with equal motivation. Patients who had undergone ACR out of choice may have been more motivated to do the exercises as compared to MUA but this cannot be assumed with certainty.

Our aim was to compare ACR and MUA for adhesive capsulitis of shoulder and we have found in our study that overall ACR offered better outcomes in reducing pain and restoring motion and functional status.

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## CONCLUSION

We have tried to compare manipulation under anaesthesia (MUA) and arthroscopic capsular release (ACR) in treating adhesive capsulitis of shoulder.

We included only those patients who were not responding to conservative measures over a three month period while omitting secondary cases of frozen shoulder.The subjects gave written informed consent and the study was carried out after clearance by the Ethical Committee.

Overall the results of ACR were encouraging over MUA across all stratifications. Abduction and internal rotation were in particular significantly better and pain reduction was earlier for ACR group of patients. This accounted for better functional scores in these patients.

Both the procedures were found to be safe and reliable in producing the desired results. Arthroscopy was slightly more expensive and longer procedure for the patients. At the same time it was valuable in noting other pathologies of the shoulder and performing the release under direct vision.

## IMAGES

Assisted passive forward elevation in supine position

PASSIVE EXTERNAL ROTATION WITH ARM IN ABDUCTION

PASSIVE INTERNAL ROTATION

Passive external rotation with arm by the side

PASSIVE EXTERNAL ROTATION WITH ARM IN ABDUCTION

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ARTHROSCOPY IMAGES

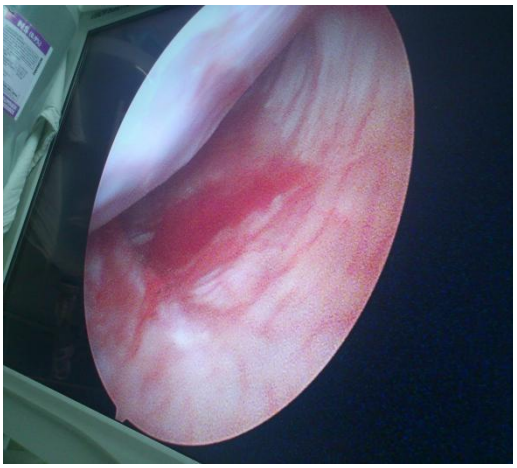


IMAGE SHOWING THICKENED & INFLAMMED POSTERIOR CAPSULE

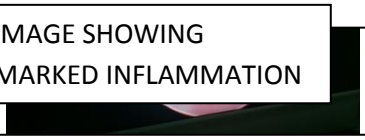


IMAGE SHOWING MARKED INFLAMMATION

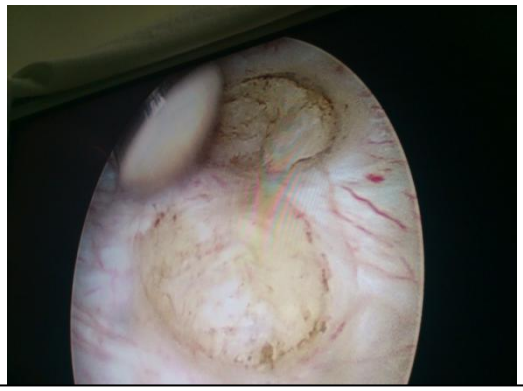


IMAGE SHOWING CAPSULE THICKENING AND RESECTION OF POSTERIOR PART

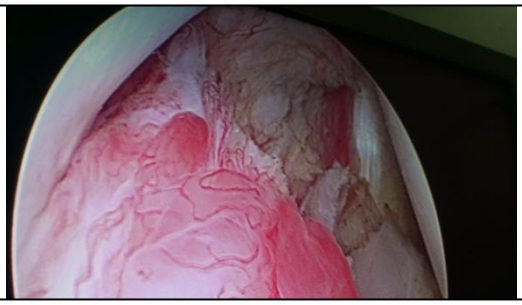


IMAGE SHOWING RESECTION OF INFERIOR PART OF CAPSULE AND THICKENED AND INFLAMMED SUPERIOR GLENOHUMERAL LIGAMENT

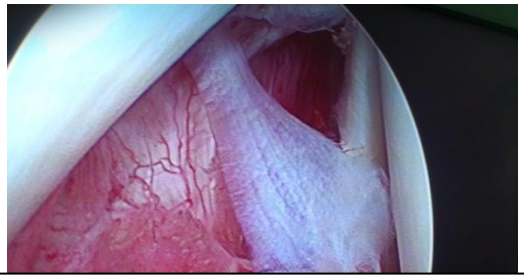
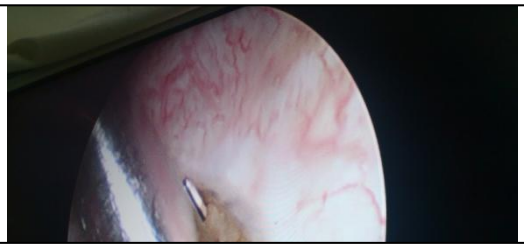


IMAGE SHOWING ADHESION IN ANTERIOR CAPSULE



RESECTION OF CAPSULE WITH RADIO – FREQUENCY ABLATOR

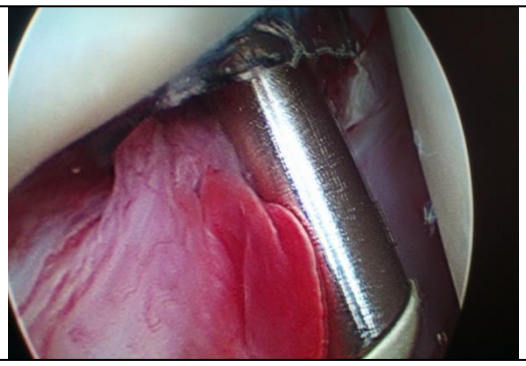


IMAGE SHOWING RESECTION OF CORACO HUMERAL LIGAMENT

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**CASE - ARTHROSCOPY**


ABDUCTION OF 140 DEGREES AT 2 WEEKS

ABDUCTION OF 170 DEGREES AT 6 MONTHS

FLEXION OF ABOUT 80 DEGREES AT 2 WEEKS

FLEXION OF 130 DEGREES AT 6 MONTHS

EXTERNAL ROTATION AT 2 WEEKS

FULL EXTERNAL ROTATION AT 6 MONTHS

INTERNAL ROTATION UPTO BUTTOCK AT 2 WEEKS

INTERNAL ROTATION UPTO L3 AT 6 MONTHS

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**BIBLIOGRAPHY**


1) Codman E. The shoulder: rupture of the supraspinatus tendon and other lesions in or about the subacromial bursa. Boston: T. Todd Company; 1934.

2) Zuckerman JD, Cuomo F. Frozen shoulder. In: Matsen FA 3rd, Fu FH, Hawkins RJ, editors. The shoulder: a balance of mobility and stability. Rosemont, IL: American Academy of Orthopaedic Surgery; 1993. p 19-109.

3) *Brucker FE, Nye CIS: A prospective study of adhesive capsulitis of the shoulder in a high risk population. Q I Med 198: 19 1-204, 198 1*

4) *Dickson* /A, *Crosby EH: Periarthritis of the shoulder: An analysis of two hundred cases. lAMA 99:2252-2257, 1932*

5) *Ernstene AC, Kinell I: Pain in the shoulder as a sequel to myocardial infarction. Arch lntern Med 66300-806, 1940*

6) Lorbach O, Anagnostakos K, Scherf C, Seil R, Kohn D, Pape D. Nonoperative management of adhesive capsulitis of the shoulder: oral cortisone application versus intra-articular cortisone injections. J Shoulder Elbow Surg. 2010;19:172-9.

7) Bal A, Eksioglu E, Gulec B, Aydog E, Gurcay E, Cakci A. Effectiveness of corticosteroid injection in adhesive capsulitis. Clin Rehabil. 2008;22:503-12.

8) Jacobs LG, Smith MG, Khan SA, Smith K, Joshi M. Manipulation or intra-articular steroids in the management of adhesive capsulitis of the shoulder? A prospective randomized trial. J Shoulder Elbow Surg. 2009;18:348-53.

*9)* Jung-Pan Wang, Tung-Fu Huang, Shih-Chieh Hung, Hsiao-Li Ma, Jiunn-Ger Wu, and Tain-Hsiung Chen, Comparison of idiopathic, post-trauma and post-surgery frozen shoulder after manipulation under anesthesia, Int Orthop. 2007 June; 31(3): 333–337.

*10)* Van der Windt DA, Koes BW, Deville W, Boeke AJ, de Jong BA, Bouter LM. Effectiveness of corticosteroid injections versus physiotherapy for treatment of painful stiff shoulder in primary care: randomised trial. *BMJ*. 1998;317:1292- 1296.

*11)* Buchbinder R, Green S, Youd JM. Corticosteroid injections for shoulder pain. Cochrane Database Syst Rev. 2003;1:CD004016.

12) Carette S, Moffet H, Tardif J, et al. Intraarticular corticosteroids, supervised physiotherapy, or a combination of the two in the treatment of adhesive capsulitis of the shoulder: a placebo controlled trial. *Arthritis Rheum.* 2003;48:829- 838.

13) Jacobs LG, Smith MG, Khan SA, Smith K, Joshi M. Manipulation or intra-articular steroids in the management of adhesive capsulitis of the shoulder? A prospective randomized trial. J Shoulder Elbow Surg. 2009;18:348-53.

14) Neviaser JS. Adhesive capsulitis and the stiff and painful shoulder. *Orthop Clin North Am.* 1980;11:327-331.

15) Neviaser RJ. Painful conditions affecting the shoulder. *Clin Orthop Relat Res.* 1983;63-69.

16) Aydeniz A, Gursoy S, Guney E. Which musculoskeletal complications are most frequently seen in type 2 diabetes mellitus? *J Int Med Res.* 2008;36:505-511.

17) Binder AI, Bulgen DY, Hazleman BL, Tudor J, Wraight P. Frozen shoulder: an arthrographic and radionuclear scan assessment. *Ann Rheum Dis.* 1984;43:365-369.

18) Hannafin JA, Chiaia TA. Adhesive capsulitis. A treatment approach. *Clin Orthop Relat Res.* 2000;95-109.

19) Sheridan MA, Hannafin JA. Upper extremity: emphasis on frozen shoulder. *Orthop Clin North Am.* 2006;37:531-539.

20) *Fareed DO, Callivan WR: Office management of frozen shoulder syndrome: Treatment with hydraulic distension under local anesthesia. Clin Orthop 242: 177-183, 1989*

21) *Rizk TE, Pinals RS: Frozen shoulder. Semin Arthritis Rheum 11:440-452, 1982*

22) Balci N, Balci MK, Tuzuner S. Shoulder adhesive capsulitis and shoulder range of motion in type II diabetes mellitus: association with diabetic complications. *J Diabetes Complications.* 1999;13:135-140.

23) Milgrom C, Novack V, Weil Y, Jaber S, Radeva-Petrova DR, Finestone A. Risk factors for idiopathic frozen shoulder. *Isr Med Assoc J.* 2008;10:361-364.

24) Massoud SN, Pearse EO, Levy O, Copeland SA. Operative management of the frozen shoulder in patients with diabetes. J Shoulder Elbow Surg. 2002 Nov-Dec;11(6):609-13.

25) Cinar M, Akpinar S, Derincek A, Circi E, Uysal M. Comparison of arthroscopic capsular release in diabetic and idiopathic frozen shoulder patients. Arch Orthop Trauma Surg. 2010 Mar;130(3):401-6.

26) Beaufils P, Prévot N, Boyer T, Allard M, Dorfmann H, Frank A, Kelberine F, Kempf JF, Molé D, Walch G. [Gleno-humeral arthroscopic arthrolysis for shoulder stiffness. Apropos of 26 cases. Société Française d'Arthroscopie]. Rev Chir Orthop Reparatrice Appar Mot. 1996;82(7):608-14.

27) Ng CY, Amin AK, Narborough S, McMullan L, Cook R, Brenkel IJ. Manipulation under anaesthesia and early physiotherapy facilitate recovery of patients with frozen shoulder syndrome. Scott Med J. 2009 Feb;54(1):29-31

28) Thomas WJ, Jenkins EF, Owen JM, Sangster MJ, Kirubanandan R, Beynon C, Woods DA.Treatment of frozen shoulder by manipulation under anaesthetic and injection: does the timing of treatment affect the outcome. J Bone Joint Surg Br. 2011 Oct;93(10):1377-81

29) Grant JA, Schroeder N, Miller BS, Carpenter JE. Comparison of manipulation and arthroscopic capsular release for adhesive capsulitis: a systematic review. J Shoulder Elbow Surg. 2013 Aug;22(8):1135-45

30) Flannery O, Mullett H, Colville J., Adhesive shoulder capsulitis: does the timing of manipulation influence outcome: Acta Orthop Belg. 2007 Feb;73(1):21-5.

31) Dodenhoff RM, Levy D, Wilson A, et al. Manipulation under anesthesia for primary frozen shoulder. Effect on early recovery and return to activity. J Shoulder Elbow Surg. 2000;9:2–26.

32) K.A.Z. Sivardeen, M. Green, S.N.F. Massoud and D.J.A. Learmonth frozen shoulder – manipulation under anaesthesia or manipulation under anaesthesia and arthroscopic capsular release. Which is the better treatment modality? *J Bone Joint Surg Br 2008 vol. 90-B no. SUPP II 350.*

33) Sameh Ansara, Sab. Chokkalingam and S. Geeranavar. Arthroscopic shoulder capsular release for frozen shoulder. Is it effective?*J Bone Joint Surg Br 2009 vol. 91-B no. SUPP II 205-206*

34) Akhtar A, Gajjar S, Redfern T. MUA with steroid injection vs. arthroscopic capsular release for adhesive capsulitis: A prospective randomised study.Surgeon. 2013 Jun 3. pii: S1479-666X(13)00060-7

35) Sabat D, Kumar V. Early arthroscopic release in stiff shoulder. Int J Shoulder Surg 2008;2:36-40

36) Leonid I. Katolik, MD,a Anthony A. Romeo, MD,b Brian J. Cole, MD,b Nikhil N. Verma, MD,b Jennifer K. Hayden, MSN,b and Bernard R. Bach, MD,b *Seattle, WA, and Chicago, ILJ Shoulder Elbow Surg Volume 14, Number*