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Arthroscopic capsular release and manipulation under anaesthesia for refractory shoulder stiffness

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Abstract
Objective: To retrospectively evaluate the results of the arthroscopic capsular release followed by manipulation (MUA) for refractory adhesive capsulitis of the shoulder with one to five years of follow-up, comparing the pre-and postoperative range of motion.
Methods: This was a retrospective study of 45 patients who underwent arthroscopic capsular release followed by manipulation (MUA) for refractory shoulder stiffness. The mean age was of 55.09+/-10.34 years (range: 35 to 75), with male predominance 24 (53.3%) and eighteen cases left shoulders. There were 24 primary (53.3%) and 21 secondary cases (46.7%). Arthroscopic capsular release followed by manipulation (MUA) was performed in all patients after a mean of 9.33 months of physical therapy (range: 6 to 20 months) with a mean follow-up of 20.9 months (range: 8 to 38 months).
Results: The active range of motion improved in all planes at the final follow up. There was a significant difference between the pre-and postoperative range of motion ($p< 0.001$). The mean absolute improvement in passive forward flexion, abduction and external rotation was 92.5^0, 99.6^0, and 23.6^0 respectively. At the final follow up, the amount of internal rotation achieved was up to T7 in twenty-one shoulders, T10 in twenty and T12 in four shoulders. According to the constant-murley functional score (rom), the value increased from 27.4 (preoperative mean) to 77.1 points (postoperative mean).The average total score increased from 28.4 to 77.4 points with the use of ASES score. Postoperatively, all patients showed diminished shoulder pain, with the average pain score on visual analog scale of shoulder index ASES improved by 6.5 points.
Conclusion: arthroscopic capsular release combined with manipulation (MUA) is an effective treatment for refractory shoulder stiffness.

Keywords: frozen shoulder, capsular release, arthroscopy, manipulation under anaesthesia, refractory shoulder stiffness

Introduction

Adhesive capsulitis, frozen shoulder, and stiff shoulder are terms used for a common, poorly understood disorder whose hallmark is a restriction of active and passive range of motion associated with pain. Multiple etiologies of this disease have been reported. A primary idiopathic form develops with no specific cause, with a prevalence of 2%, and the secondary form arises after surgery, trauma, or systemic disease, such as diabetes and hypothyroidism [1, 3].Frozen shoulder is a clinical entity which can generally be diagnosed after a thorough history and physical examination. Plain radiographs are typical without abnormalities. Osteoarthritis of the glenohumeral joint can easily be ruled out. Calcifications in the rotator cuff is a common incidental finding. Ultrasonography is not required for the diagnosis but is appropriate to screen for rotator cuff or biceps tendon abnormalities when suspected. Magnetic resonance imaging (MRI) arthrography can show thickening of the coracohumeral ligament and joint capsule in the rotator interval. Also, synovial thickening in the axillary pouch correlates with the stage of adhesive capsulitis [4]. However, magnetic resonance imaging should not be routinely ordered in the evaluation of the frozen shoulder.

Methods

This was a retrospective study of 45 patients who underwent arthroscopic capsular release followed by manipulation (MUA) for refectory shoulder stiffness, operated on between August of 2016 and August of 2018. All data were collected as part of a patient database. A refractory shoulder stiffness patient was defined as an individual who presented constant and severe pain (0 points in the pain category of the Constant-Murley score) [5], with no or minimal improvement with nonoperative management for a six-month period, and limited active and passive shoulder range of motion, such as forward elevation up to 130º, external rotation up to 50º, and internal rotation up to L5 vertebral level. The inclusion criteria were patients with stiff shoulder diagnosis; in stage II of the disease [6]; age between 35 and 75 years; operated on by the same surgeon; and who had a follow-up of at least one years. The exclusion criteria were concomitant glenohumeral osteoarthritis, partial or full thickness cuff tear, humerus fracture or dislocation, infection, and incomplete follow-up. The abovementioned conditions were excluded by X-ray, MRI, or joint inspection. Preoperatively, all patients underwent a supervised rehabilitation for a six-month period; with failure to regain a functional motion with minimal or no pain. The radiographic evaluation was performed with true anteroposterior, scapular-Y, and axillary views. The range of motion was measured pre-and postoperatively, in accordance with the American Academy of Orthopedic Surgeons criteria [7]. The Constant-Murley score was used to evaluate the shoulder

function [5] and the criteria by Zuckerman et al. was used to classify the stiffness and its clinical severity [8]. The primary endpoint was the shoulder range of motion. This study was approved by the Research Ethics Committee of the IMS&SUM Hospital, Bhubaneswar.

Statistical analysis

Data analysis was performed using the Statistical Package for Social Sciences (SPSS) version 20.0. The Kolmogorov-Smirnov test was initially used to verify the normality of the values. Then, the active and passive forward elevation and external rotation pre-and postoperative values were compared by Student's parametric paired *t*-test. Internal rotation was analyse by Friedman's test, with the risk assumed by the researcher of 5% and probability of rejecting the null hypothesis < 0.05.

Surgical technique

All patients were operated upon in the lateral decubitus position. After positioning the patient in the operating room, passive range of motion was documented while the patient was under anesthesia. The entire upper extremity was then prepared in a sterile fashion, and the glenohumeral joint was approached from the posterior arthroscopic portal. After an articular inventory of the synovium, biceps tendon, humeral head, capsule, and rotator cuff, the anterior superior portal was made and a cannula was inserted directly underneath the long head biceps (inside-out) and above the subscapular is tendon. First, a synovectomy was performed. The next key step in all cases was to release the rotator interval region, which was represented as contracted capsule between the anterior edge of the supraspinatus tendon and the superior border of the subscapular is tendon, with subsequent release of the coracohumeral ligament, which was identified by probe palpation of the coracoid process. This release allowed the humeral head to move laterally away from the glenoid, and the stiff anterior capsule could then be released. The next step was the anterior capsule division. The release was made from the two o'clock position to the five o'clock position along the glenoid rim, and continued down to the six o'clock position. Afterwards, the arthroscope was first placed through the anterior cannula with inflow switched to that cannula, and the radiofrequency device was changed to the posterior portal to proceed with the posterior capsule release for persistent loss of internal rotation. This was performed along the glenoid rim, from directly behind the biceps tendon down to approximately the eight o'clock position on the glenoid. Finally, the inferior capsule was released for flexion and abduction restrictions.

After the arthroscopic release, manipulation was performed. Different techniques have been described, but a fixed order of manipulations is recommended. The use of a small lever arm and scapular stabilization is recommended to prevent fractures and brachial plexus traction injuries [9]. First the arm was brought in to full flexion, then cross body adduction followed by external rotation with the elbow adducted against the trunk. Then the arm was abducted and moved into internal and finally external rotation. The addition of an intra-articular injection with corticosteroids and local Anesthesia agent was used at the end of the procedure. Early significant improvement in shoulder range of motion with relief of pain and maintenance of these results at long term are reported [10, 11, and 12].

Postoperative treatment and pain management

An important aspect after ACR and MUA is to start physiotherapy immediately, from day one after the surgical intervention. Postoperative pain management included pre-operative regional interscalene block [13], a local intra-articular analgesic injection with corticosteroid (at the end of the procedure), oral analgesics and icepacks. Immobilisation in a sling was discouraged at all times to prevent the shoulder joint from getting stiff again [11]. With adequate pain management, both procedures are assumed to be very well tolerated with minimal postoperative pain [14, 15]. Intensive supervised physiotherapy twice or three times a week, possibly supplemented by a home exercise program [12, 13].

Results

Table 1: (Sex Distribution)

Sex	Frequency	Percentage
F	21	46.7
M	24	53.3
Total	45	100

Table 2: (Age Distribution)

Age(Years)	Number of patients
<30	0
31-40	5
41-50	10
51-60	17
61-70	9
71-80	4

Table 3: (Outcome Scores)

Outcome Scores	N	Pre-Op		Post-Op		P value
		Mean	SD	Mean	SD	
ASES Score	45	28.4	7.56	77.4	9.26	0.0000
CONSTANT Score	45	27.4	7.57	71.1	7.44	0.0000

Table 4: (Range of Motion)

Movement	N	Pre-op		Post-op		P value
		Mean	SD	Mean	SD	
Forward Elevation	45	44.8	19.25	137.3	24.62	0.0000
Abduction	45	35.6	22.79	135.2	23.74	0.0000
External Rotation	45	28.2	13.57	51.8	15.85	0.0000

Table 5: (Internal Rotation)

Pre-op IR	Post-op IR			Total
	T12	T10	T7	
L1	0	0	1	1
L3	0	4	9	13
L5	0	1	0	1
S1	4	15	10	29
T12	0	0	1	1
Total	4	20	21	45

The active range of motion improved in all planes at the final follow up. There was a significant difference between the pre-and postoperative range of motion ($p < 0.001$). The mean absolute improvement in passive forward flexion, abduction and external rotation was 92.5^0, 99.6^0, and 23.6^0 respectively. At the final follow up, the amount of internal rotation achieved was up to T7

in twenty-one shoulders, T10 in twenty and T12 in four shoulders. According to the constant-murley functional score (rom), the value increased from 27.4 (preoperative mean) to 77.1 points (postoperative mean).The average total score increased from 28.4 to 77.4 points with the use of ASES score. Postoperatively, all patients showed diminished shoulder pain, with the average pain score on visual analog scale of shoulder index ASES improved by 6.5 points.

Discussion

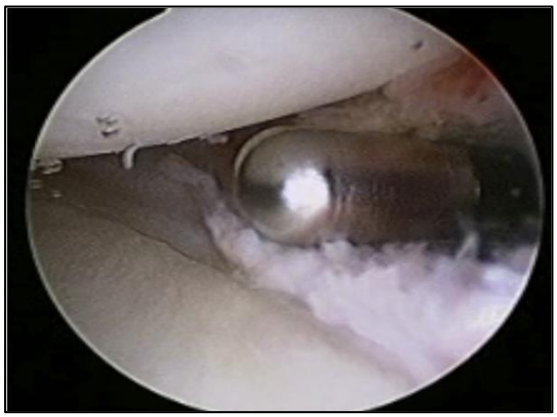
In this article, we described a technique of arthroscopic capsular release with the patient in the lateral decubitus position. Classically, this procedure has been described in the beach-chair position, but the lateral decubitus position improves visualization and access to the inferior capsule. This facilitates a complete capsular release, and minimizes the risk for iatrogenic injury. Ultimately, complete release of the inferior capsule in the lateral decubitus position has been shown to improve range of motion, including abduction, and internal and external rotation. [16] Jerosch et al. [17] demonstrated that the axillary nerve is in close relation to the capsule between the 5 and 7 o'clock positions, therefore care should be taken when operating in this vicinity. The advantages and disadvantages of lateral decubitus patient positioning versus beach-chair have been well described. [18] Ultimately, surgeons' preference for patient positioning based on training experience is a key factor, as their level of comfort dictates decision-making. The advantages of performing an arthroscopic shoulder surgery in the lateral decubitus position includes the ability to use traction to increase visualization, particularly in the axillary recess and inferior glenohumeral joint, and improved cerebral perfusion. For capsular release specifically, the lateral decubitus position permits improved access for release of the inferior capsule, allowing for a full 360° release, which is a technical challenge in the beach-chair position. Before the improvement in arthroscopic shoulder surgery, MUA was the standard treatment of a frozen shoulder if conservative treatment had failed. Different techniques have been described, but a fixed order of manipulations is recommended. The use of a small lever arm and scapular stabilization is recommended to prevent fractures and brachial plexus traction injuries [9]. First the arm is brought in to full flexion, then cross body adduction followed by external rotation with the elbow adducted against the trunk. Then the arm is abducted and moved into internal and finally external rotation. Consistently satisfactory results in both short- and long-term follow-up are reported with MUA. A significant improvement in range of motion and an overall satisfaction rate of 94% at short term is reported by Dodenhoff et al [9]. A major cause of satisfaction was to regain the ability to perform normal daily tasks within days of the manipulation. Long term results confirm that the results do not deteriorate after 15 years [19]. Equal range of motion to the contralateral shoulder and no pain was reported in 90% of the patients after 23 years of follow up in a small cohort [20].

Conclusion

In conclusion, the arthroscopic capsular release in the lateral decubitus position combined with MUA provides a comprehensive surgical treatment for patients with refractory adhesive capsulitis by addressing inflamed/scarred capsular tissue in its entirety.

Conflicts of interest

The author declares no conflicts of interest.



Pictures 1: Posterior capsular release

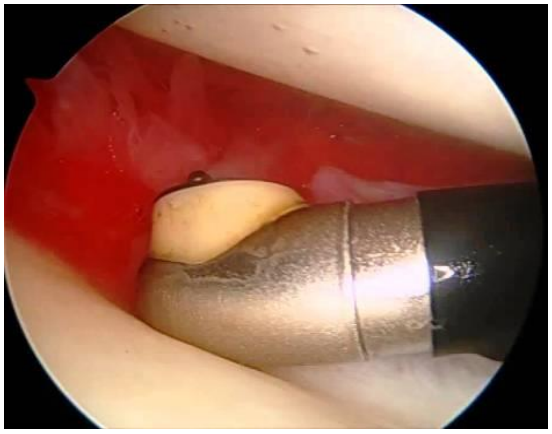


Fig 1: A - Synovectomy of the rotator interval and superior capsule.

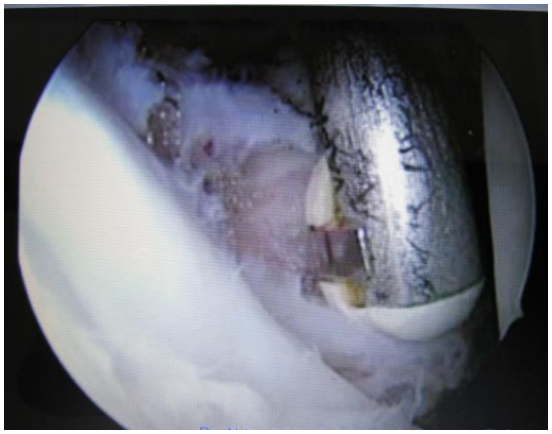


Fig 1: B - Release of middle and inferior gleno-humeral ligaments and capsule.

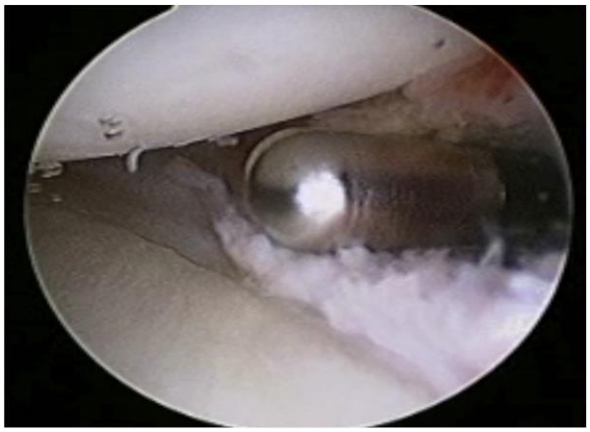


Fig 1: C Release of posterior capsule.

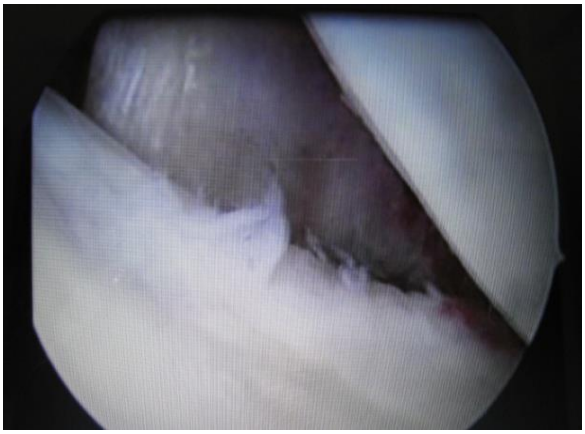


Fig 1: D - After the anterior capsular release the shiny subscapular is tendon can be seen.

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