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Comparison of arthroscopic capsule release and manipulation under anaesthesia for frozen shoulder: a prospective randomized single blinded interventional study

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ABSTRACT

Background: Adhesive capsulitis (frozen shoulder) is a common cause of shoulder pain, affecting approximately 2% of the population. Despite its prevalence, the exact aetiology remains unclear, leading to varied treatment protocols. Among the available interventions, manipulation under anaesthesia (MUA) and arthroscopic capsular release (ACR) are widely used for refractory cases, though comparative data on their outcomes are limited. Aim: To compare early clinical outcomes, complications and pain relief between MUA and ACR in patients with refractory adhesive capsulitis.
Methods: A prospective, randomized, single-blinded study was conducted from November 2020 to April 2022 at a tertiary care hospital. Forty-four patients with refractory adhesive capsulitis were randomized into two groups: MUA (n=22) and ACR(n=22). Preoperative evaluations included clinical and ultra-sonographic examinations. Postoperative outcomes were assessed at 2, 4 and 12 weeks using the Visual Analogue Scale (VAS), Oxford Shoulder Score (OSS) and range of motion (ROM) measurements.
Results: Both groups demonstrated significant improvements in pain and ROM. However, ACR yielded superior results, with a greater reduction in VAS scores (8 to 1in ACR vs. 8 to 3 in MUA) and better ROM at 12 weeks. Forward flexion improved from80º to 180º in the ACR group, compared to 70º to 170º in the MUA group. External and internal rotation improvements were also significantly greater in the ACR group.
Conclusions: Arthroscopic capsular release, combined with an exercise regimen, provides significantly better pain relief and functional recovery compared to MUA in refractory adhesive capsulitis.

Keywords: Adhesive capsulitis, Arthroscopic capsular release, Frozen shoulder, Functional outcomes, Manipulation under anaesthesia, Orthopaedics, Pain relief, Range of motion, Rehabilitation, Shoulder pain

INTRODUCTION

Shoulder pain is the third most common musculoskeletal complaint, following low back and cervical pain.[1] Among the various causes, adhesive capsulitis, also known as frozen shoulder or periarthritis shoulder, is one of the leading contributors. First described by Nevasier in 1945, adhesive capsulitis typically begins with pain, followed by a gradual restriction in both active and passive shoulder movements, with external rotation being most affected.[2,3] It can be classified into two types: primary, where there is no associated disease or trauma and secondary, which occurs following trauma, surgery or other diseases. The incidence of adhesive capsulitis in the general population is about 2-5%, but it rises to 10-38% in patients with diabetes or thyroid disorders.[4,5]

In India, frozen shoulder affects approximately 2% of the population, with a higher prevalence in females (up to 70% of cases).[6,7] The condition predominantly affects individuals aged 40-65 years and is more common in the non-dominant arm.[8,9] Around 14% of cases have bilateral

involvement and those with one affected shoulder have a 5-34% increased risk of contralateral involvement.[10] The exact cause of adhesive capsulitis remains unclear. It is diagnosed based on clinical symptoms and the exclusion of other shoulder pathologies. The disease follows a typical progression through three stages as described by Reeves.[11]

Stage 1 (freezing) with predominant pain, stage 2 (frozen) where pain subsides but motion is severely restricted and Stage 3 (Thawing) where mobility is restored, though it may take up to three years. Some studies suggest that 20-50% of patients may experience long-term range of motion deficits lasting up to 10 years, raising doubts about the self-limiting nature of the disease.[12] Early and aggressive intervention is critical to prevent disease progression.

Various treatments have been explored, including NSAIDs, steroids, physiotherapy, joint mobilization, regional nerve blocks, manipulation under anaesthesia (MUA) and surgery, among others.[13,14] MUA has long been used to treat refractory adhesive capsulitis, but complications such as proximal humerus fractures, brachial plexus palsy and rotator cuff tears have been reported. Similarly, arthroscopic capsular release (ACR) has shown improvements in pain, range of motion and patient outcomes in cases resistant to nonsurgical treatments.[14]

Aim and objectives

The primary aim of this study is to compare the early clinical outcomes of MUA and ACR in patients with refractory adhesive capsulitis.

Primary objective

To evaluate and compare the outcomes of arthroscopic capsular release and manipulation under anaesthesia in patients with frozen shoulder.

Secondary objectives

To assess complications associated with both MUA and ACR.

Lacunae in literature

While arthroscopic capsular release has emerged as a promising treatment for adhesive capsulitis, there are limited prospective comparative studies to establish the superiority of ACR over MUA. This study aims to address this gap in the literature.

METHODS

This prospective, randomized, single blinded interventional study was conducted at Tata Motors Hospital, Jamshedpur, India, between November 2021 and April 2022. The study included patients diagnosed with idiopathic adhesive capsulitis in the 'frozen' or 'thawing' phase of the disease who had failed at least two months of non-operative therapy. Inclusion and exclusion criteria were carefully defined to rule out secondary causes of adhesive capsulitis. Exclusion factors included prior shoulder surgery, radiating neck pain, rotator cuff tear, gleno humeral osteoarthritis, calcific tendonitis, impingement and other conditions such as cervical radiculopathy or neoplasms. Patients who were medically unfit for general anaesthesia or unable to follow postoperative protocols were also excluded. A total of 44 patients who met the inclusion criteria were randomly assigned to two groups using a simple randomization method. Both groups were informed about the study's purpose and the Visual Analogue Scale (VAS) and Oxford Shoulder Score (OSS) for assessing pain and shoulder functionality. Informed consent was obtained from all participants.

Intervention groups

Manipulation under anaesthesia

The first group underwent manipulation under anaesthesia. Patients received an inter-scalene nerve block under ultrasonography guidance by the same anesthesiologist. After the block, patients were placed in a supine position and the shoulder joint was manipulated by the orthopaedic surgeon to achieve full range of motion, including abduction, external rotation, internal rotation and flexion.[17-20] Soft tissue release was observed during manipulation.

Arthroscopic capsular release

The second group underwent arthroscopic capsular release under aseptic precautions. Patients were placed in the lateral position with the affected limb in traction. Two portals were created: a posterior portal for viewing and a lateral anterior portal for instrument access. Diagnostic arthroscopy was performed and the capsule and ligaments were released in all 360 degrees using electro cautery, taking care to avoid damage to the subscapularis muscle. Range of motion was checked intraoperative.

Post-procedure care

Both groups received post-operative analgesia with paracetamol (500 mg) as needed. Patients were supervised for 7 days of physiotherapy and were then instructed to continue exercises at home. Exercises included active-assisted range of motion (AAROM) for forward flexion and abduction, passive external rotation and pendulum exercises.

Compliance was monitored through diaries and weekly follow-up calls. Patients were asked to return for follow-up assessments at 2, 4 and 12 weeks, with evaluations of range of motion, pain (VAS), functionality (OSS) and analgesia usage.

Statistical analysis

Data were analysed using the Statistical Package for Social Sciences (SPSS) version 20. The normality of data was tested using the Shapiro-Wilk test and parametric tests were applied ($p<0.05$).Descriptive statistics were used to summarize participant characteristics and inferential statistics, including independent t-tests and paired t-tests, were used to compare outcomes between and within groups.

RESULTS

The study aimed to compare the effectiveness of MUA and ACR in treating adhesive capsulitis (frozen shoulder). The analysis was based on preoperative and 12 weeks post-operative assessments, focusing on pain relief (VAS scores), functional outcomes (Oxford shoulder score OSS) and various shoulder movements (flexion, abduction, internal rotation, external rotation, extension).

Demographics

The mean age of participants in the study was 51.84±4.00 years, with no significant age difference between the MUA (51.73±3.86 years) and ACR (51.95±4.22 years) groups. The study included total of 44 patients, with 14 males (31.81%) and 30 females (68.18%). In the MUA group, 77.27% were female and 22.72% were male, while in the ACR group, 59.09% were female and 40.9% were male.

Pain assessment (VAS scores)

Pre-operative VAS scores, indicating pain severity, were similar between the MUA and ACR groups (9.00±0.92 and 8.86±0.77, respectively), with no statistically significant difference ($p=0.599$). After 12 weeks, the mean VAS score decreased to 2.41±0.79 in the MUA group and1.41±0.59 in the ACR group. The ACR group showed significantly lower VAS scores than the MUA group ($p=0.000$), suggesting superior pain relief in the ACR group. Both groups experienced significant pain reduction at the 12-week follow-up, with pre-operative scores of 9.00±0.92 in the MUA group and 8.86±0.77 in the ACR group, reducing to 2.41±0.796 and 1.41±0.59, respectively, at 12 weeks. The difference between the groups remained significant ($p=0.000$).

Functional outcomes (OSS)

The OSS, which measures shoulder function, showed no significant difference between the two groups at the 12-week follow-up, with the MUA group scoring 43.18±2.363 and the ACR group scoring 44.36±1.70 ($p=0.064$). Pre-operatively, the average flexion score was slightly higher in the ACR group (60.45±12.14) compared to the MUA group (53.64±12.16), but the difference was not statistically significant ($p=0.070$).

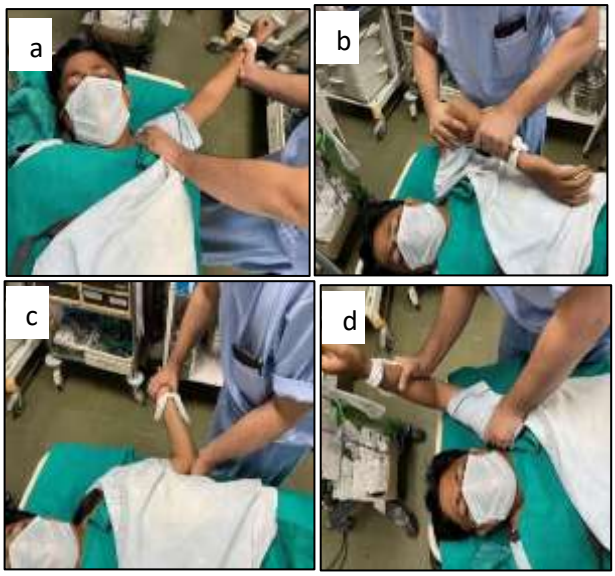

Figure 1: (a, b, c, d) Manipulation of shoulder joint after nerve block.

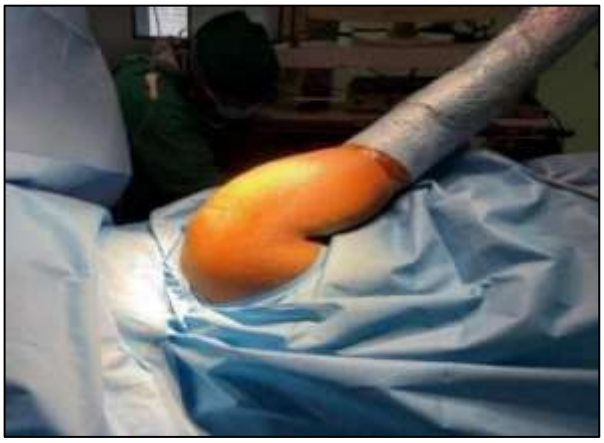

Figure 2: Positioning of patient in OT table.

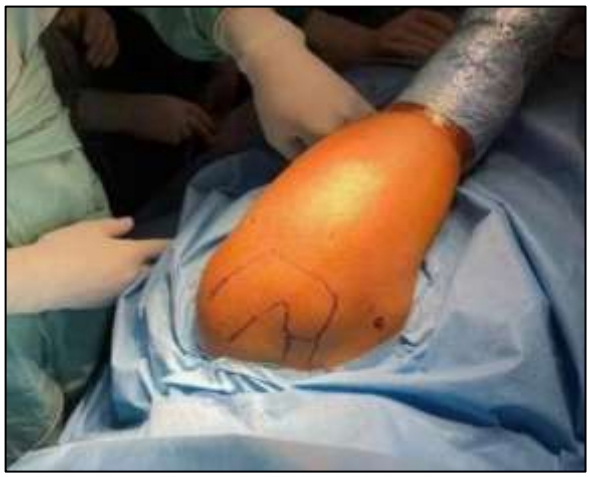

Figure 3: Anterior and-posterior portal position.

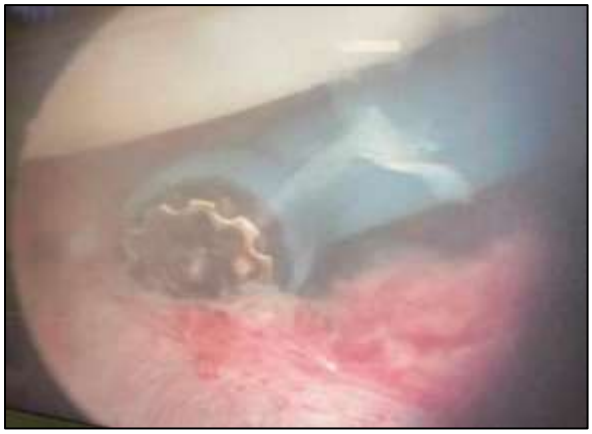

Figure 4: Releasing capsule with electrocautery.

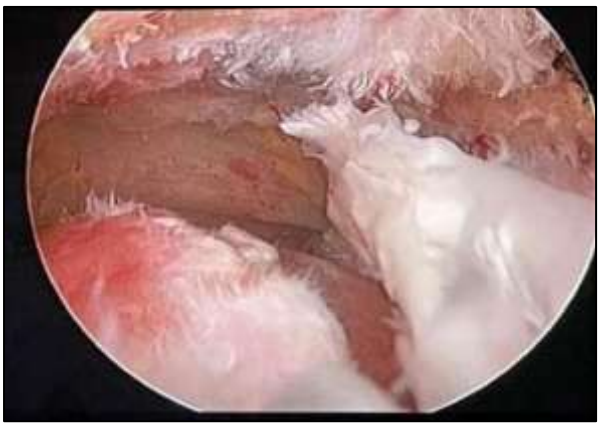

Figure 5: Capsule and soft tissue of shoulder joint after release.

Range of motion

The study also evaluated several shoulder movements at the 12 weeks follow-up, including flexion, abduction, internal rotation, external rotation and extension (Table 1).

Flexion

The MUA group showed a mean flexion score of 153.64±11.35, whereas the ACR group demonstrated a significantly higher mean flexion score of 170.45±10.90 (p=0.000). Both groups showed significant improvement from their pre-operative flexion scores, with the MUA group increasing from 53.64±12.16 to 153.64±11.35 and the ACR group from 60.45±12.14 to 170.45±10.90 (p=0.000 for both groups).

Abduction

The ACR group had significantly better results than the MUA group after 12 weeks, with the mean abduction score in the MUA group being 150.00±10.235 compared to 164.55±9.625 in the ACR group (p=0.000). Both groups showed significant improvements from their pre-operative abduction scores, with the MUA group improving from 42.73±10.77 to 150.00±10.235 and the ACR group from 44.55±11.01 to 164.55±9.625 (p=0.000 for both groups).

Internal rotation

The mean internal rotation score after 12 weeks was higher in the ACR group (57.73±3.355) than in the MUA group (54.77±4.75), with the difference being statistically significant (p=0.022). Both groups showed significant improvement from pre-operative internal rotation scores, with the MUA group improving from 33.86±7.06 to 54.77±4.75 and the ACR group from 34.77±7.47 to 57.73±3.355 (p=0.000 for both groups).

External rotation

Similar to internal rotation, the ACR group outperformed the MUA group in external rotation after 12 weeks, with the mean external rotation score being 71.14±7.549 in the ACR group compared to 59.77±8.92 in the MUA group (P=0.000). Both groups had substantial improvements in external rotation from their pre-operative scores, with the MUA group improving from 32.27±7.97 to 59.77±8.92 and the ACR group from 34.77±7.63 to 71.14±7.54 (p=0.000 for both groups).

Extension

The ACR group showed a higher mean extension score of 57.73±3.69 compared to the MUA group's 53.41±4.97 at 12 weeks (p=0.002). Both groups showed significant improvement in extension, with the MUA group improving from 28.86±6.89 to 53.41±4.97 and the ACR group improving from 30.23±7.47 to 57.73±3.69 (p=0.000 for both groups).

Table 1: Comparison of pre-operative and 12 weeks post-operative outcomes between MUA and ACR groups.

Parameter	MUA Group (n=22)	ACR Group (n=22)	P value
Demographics			
Mean age (in years)	51.73±3.86	51.95±4.22	0.878
Male/Female (%)	22.72% Male, Female 77.27%	40.90% Male, Female 59.09%	
Pain assessment (VAS scores)			
Pre-operative VAS score	9.00±0.92	8.86±0.77	0.59
12-weekpost-operative Vas score	2.41±0.79	1.41±0.59	0.000*
Functional outcomes (OSS)			
Pre-operative OSS	39.50±6.48	39.82±5.92	0.85012
12-week OSS post-operative	43.18±2.36	44.36±1.70	0.064

Continued.

Parameter	MUA Group (n=22)	ACR Group (n=22)	P value
Range (ROM) of motion			
Flexion (°)	53.64±12.16→153.64±11.35 (12 weeks)	60.45±12.14→170.45±10.90 (12 weeks)	0.000*
Abduction (°)	42.73±10.77 → 150.00±10.24 (12 weeks)	44.55±11.01→164.55±9.63 (12 weeks)	0.000*
Internal rotation (°)	33.86±7.06 → 54.77±4.75 (12 weeks)	34.77±7.47→57.73±3.36 (12 weeks)	0.022*
External rotation (°)	32.27±7.97 → 59.77±8.92 (12 weeks)	34.77±7.63→71.14±7.54 (12 weeks)	0.000*
Extension (°)	28.86±6.89 → 53.41±4.97 (12 weeks)	30.23±7.47→57.73±3.69 (12 weeks)	0.002*

*Indicates statistical significance ($p<0.05$).

DISCUSSION

Adhesive capsulitis or frozen shoulder, is a common and debilitating condition marked by pain, stiffness and restricted motion in the shoulder joint, which can severely impact daily life and functional activities. Although it often resolves over time, typically within 2–3 years, the prolonged course of the condition without intervention has prompted clinicians to explore more aggressive treatments. There is no universally accepted treatment protocol for adhesive capsulitis, but common interventions include nonsteroidal anti-inflammatory drugs (NSAIDs), steroid injections, physiotherapy, joint mobilization, manipulation under anaesthesia (MUA) and arthroscopic capsular release (ACR).[13-16]

The primary goal in treating adhesive capsulitis is to alleviate pain and restore range of motion by addressing the underlying capsular adhesions.[25,26] However, pain often limits the patient's ability to engage in rehabilitation exercises. Our study, prospective, randomized, single-blinded trial, compared the effectiveness of MUA and ACR in improving shoulder function in patients with adhesive capsulitis. The study included 44 patients who were randomly assigned to either the MUA or ACR group. Both groups underwent a week of supervised physiotherapy and were assessed at 2, 4 and 12 weeks for pain relief (via the VAS score), shoulder range of motion (measured with a goniometer) and functional outcomes (using the OSS score).

The results demonstrated that both MUA and ACR led to significant pain reduction and improvements in shoulder range of motion. The ACR group showed superior outcomes in both pain relief and mobility, with the VAS score dropping more substantially (from 8 to 1) compared to the MUA group (from 8 to 3). This difference was statistically significant at the 4 weeks follow-up. Furthermore, the ACR group demonstrated greater improvements in forward flexion, external rotation and abduction, suggesting that the ACR procedure, which involves a more extensive release of adhesions, contributes to a better range of motion compared to the more conservative MUA procedure. However, both procedures resulted in similar functional improvements, as reflected by the OSS scores, which showed no significant difference between the groups at the 12 weeks follow up. Both interventions were well tolerated, with minimal complications. The ACR group reported minor localized discomfort in a few patients, but there were no significant adverse events such as rotator cuff injuries in either group. These findings support the safety of both MUA and ACR in treating adhesive capsulitis. Findings align with previous research, including studies by Kim et al and Houck et al, which reported similar improvements in pain and range of motion following MUA and ACR. However, the ACR group consistently exhibited superior outcomes, particularly in restoring external rotation and overall shoulder mobility. While MUA remains a viable option for patients who may not be suitable candidates for surgery, our results suggest that ACR might offer more significant long-term benefits, especially for those with more severe shoulder impairment.

Additionally, our study observed a higher prevalence of adhesive capsulitis in women, with 68% of participants being female, which is consistent with previous literature indicating a higher incidence in females. In conclusion, both MUA and ACR are effective treatment options for adhesive capsulitis. However, ACR maybe preferable for patients with more significant shoulder impairment due to its superior outcomes in both pain reduction and restoration of range of motion. Future studies with larger sample sizes and longer follow-up periods are needed to confirm these results and refine treatment strategies for adhesive capsulitis. Analgesics were given beforehand at each follow up, which might have influenced its consumption. Our study population is from a localized region. Population from wider area would probably produce a data that would enable us to extrapolate the results onto general population. Sample size is small. So, generalization about the results cannot be made.

CONCLUSION

This study found that both MUA and ACR resulted in significant improvements in pain relief and shoulder function, with both groups showing marked reductions in VAS scores and substantial gains in range of motion across various movements. However, the ACR group demonstrated superior outcomes in terms of pain reduction and range of motion in all assessed movements, including flexion, abduction, internal and external rotation and extension. While both treatments were effective in improving shoulder function, ACR was more effective than MUA, making it a preferred option for patients with adhesive capsulitis, especially in terms oblong-term outcomes. Further research with larger sample sizes and

longer follow-ups would be beneficial to confirm these findings and optimize treatment protocols.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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