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MUA versus Arthroscopic Capsular Release of Idiopathic Frozen Shoulder

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Abstract

Background: Adhesive capsulitis is adisease characterized by the spontaneous onset of shoulder pain and global limitation of both active and passive shoulder motion. The main aim of this study was to evaluate and compare early results of MUA and ACR in management of primary frozen shoulder after failure of conservative treatment. Methods: This prospective study was carried out on Thirty patients with primary frozen shoulder, half of them were treated with MUA (group 1) and the other half treated with ACR (group 2) and followed for a minimum of 6 months. The study conducted at Orthopedic Surgery department, Faculty of Medicine, Benha University. Results: In the present study, no significant difference was found between MUA and ACR. We found negative moderate correlation between age and Constant Murley score. We found also that there was statistically significant negative strong correlation between HbA1C and Flexion and External rotation, and a statistically significant positive strong correlation was found between HbA1C, OSS and internal rotation. Both MUA and ACR treatments give high satisfaction rate but cases treated with ACR were more satisfied but with no significant difference with MUA treatment. Conclusion: Successful clinical and functional outcomes can be obtained with both MUA and ACR in the treatment of refractory FS without major serious complications.

Key words: MUA, Arthroscopic Capsular Release, Idiopathic Frozen Shoulder.

1. Introduction

A clinical condition characterized by chronic pain and progressive range of motion (ROM) deficits in the shoulder joint is traditionally known as adhesive capsulitis (1). Some authors defined this situation as stiff shoulder and called primary idiopathic stiff shoulder as “frozen shoulder” [2].

Frozen shoulder is one of the most common musculoskeletal conditions affecting the shoulder, with a prevalence of 2% in the general population. The typical patient is a female between 40 years and 60 years of age. The condition is associated with a number of systemic conditions, with diabetic patients in particular having a significant predisposition to developing frozen shoulder, with a prevalence of up to 20% in this population group. [2]

Although predisposing factors such as diabetes, thyroid diseases, and smoking may exist, the cause of frozen shoulder (FS) is unknown and is not secondary to trauma or a specific shoulder disease [3]. In addition, no significant pathology other than the possible presence of osteopenia or calcific tendinitis is seen in radiographic evaluation [4].

The natural course of FS consists of three phases: freezing, frozen, and thawing, and can last up to 2–3 years. Although FS is a self-limiting pathology, chronic pain or stiffness may persist in about half of the patients, and full recovery may not be achieved [5].

Although no consensus exists in the literature regarding its treatment, oral medication, intra-articular injection, physical therapy, joint distension, and high-frequency ultrasound constitute nonoperative treatment methods (1,3). Success can be achieved with nonoperative treatment in the majority of patients, but manipulation under anesthesia (MUA) or arthroscopic capsular release (ACR) is recommended in refractory cases despite at least 6 months of nonoperative treatment [6].

Although ACR is gaining in popularity with recent advances in arthroscopic technique and has shown promising results comparable to those of other treatment modalities, MUA is a traditionally well-established treatment for FS that is nevertheless controversial due to potential complications (e.g., proximal humerus fractures, shoulder dislocation, brachial plexus stretching injury, rotator cuff injury, and recurrent stiffness) [7].

There are no good quality randomized controlled trials in favor of ACR in comparison to MUA; in two previous studies, the superior treatment was not identified and manipulation was performed under general anesthesia. Manipulation for FS is usually performed under general anesthesia, but is also performed under interscalene brachial plexus block (ISB) anesthesia and obtains favorable outcomes (8). Arthroscopic treatment of FS has become popular in the last decade. Faster recovery can be achieved with ACR compared with other treatment methods, and mid-term and long-term successful outcomes have been reported in the treatment of refractory FS with ACR [9].

The main aim of this study was to evaluate and compare early results of MUA and ACR in management of primary frozen shoulder after failure of conservative treatment.

2. Patients and Methods

Technical design

1-Study type and region:

This prospective randomized, controlled study was conducted at Orthopaedic Surgery department, Benha university hospital.

2-Study population:

This study was conducted on 30 patients with primary frozen shoulder. Arthroscopic capsular release was done for 15 patients (15 shoulders affection) (Arthroscopic group A), while manipulation under

general anasthesia was done for 15 patients (15 shoulders affection) (Manipulation group B).

3- Sample size:

Total number of 30 patients with primary frozen shoulder.

Inclusion criteria:

- At least three months history of pain and stiffness of the shoulder.
- Documented restriction of both passive and active gleno-humeral and of equal to or less than 100 degrees of elevation, and less than 50% of external rotation, as compared to the contralateral side.
- **All patients who:**
- Have primary frozen shoulder Clinically and radiologically.
- Age:40-80years.

Exclusion criteria:

Any patient with one or more of the following criteria was excluded from the study.

- a history of cancer, or rheumatic disease.
- surgery or suffered trauma.
- severe neurological deficit of the involved upper extremity.
- lost follow-ups or did not complete the follow up period.

Those patients also undergoing any concomitant procedure in addition to capsular release were excluded and any patient with:

- Associated arthritis.
- AVN
- Associated fracture

A. Operative design:

All patients were subjected for:

1. Full history taking.

2. Preoperative assessment:

- General examination
- local examination:
- Full clinical examination of the shoulder was done for every patient with special emphasis on tests to assess the active and passive range of motion in different planes, tests for the scoring of patients, and tests to exclude other related conditions.
- Range of motion tests:
- In all patients every attempt was made to relax the patient and do a careful examination so that the actual range can be detected, and we don't get misled by the painful limitations present. Range of motion tests was done for both active and passive motion to detect functional range, and limitations due to pain or muscle weakness. These range of motion tests were done for the patients at each follow-up examination, and at the final scoring.
- **Flexion:**
- **Abduction:**
- **External Rotation:**
- **Internal Rotation:**
- Examination of the shoulder was always done with special emphasis on testing the muscle strength with testing of active movement against resistance specially abduction, and flexion, and testing the points of local tenderness specially the bicipital groove, and the acromioclavicular joint. Testing of the rotator cuff was done for every case including active range of motion against resistance, and the drop arm test. The drop arm test was done by passively abducting the shoulder to 90 degrees and then asking the patient to lower it to the side slowly. Inability to lower the arm to the side slowly or the presence of severe pain when attempting to do so we considered a positive sign. The supraspinatus test and the Lift-off sign were usually difficult to do due the limited range of abduction and internal rotation in these. When possible, they were done.
- Tests to exclude subacromial impingement (impingement signs and Hawkin's test) were done. In the Hawkin's test, which was done for all patients, the shoulder of the standing (or sitting) patient was flexed to 90 degrees and then internally rotated. Pain was an indication of a positive test. Internal rotation was done gently, since forcible internal rotation will cause pain in all adhesive capsulitis patients whether or not subacromial impingement was present.
- Tests for biceps tendon pathology (Yergason's test, and Speed's test) were also always done in every case.

Radiological:

- Plain radiology was done for all the patients. It was always requested as an anteroposterior view for the shoulder.
- MRI was requested for all patients to exclude another underlaying pathology to exclude cases with secondary frozen shoulder. Thickening of the joint capsule was seen.

3. An explanation of the diagnosis, natural history of the condition and potential treatment options were given to each patient before consent to the procedure was obtained whether MUA or ACR.

Technique of MUA:

- The procedure was performed as a day case. All patients received general anaesthesia. technique used for manipulation which start with the gradual forward elevation in the sagittal plane to the maximum possible extent while the scapula was fixed. The external rotation was then performed in 0° of abduction, followed by external rotation in 90° of abduction. Lastly, internal rotation in 90° of abduction and cross-body adduction were performed. Care was taken not to fracture the humerus during manipulation. Forces for external rotation were applied very carefully by the two thumbs. A full range of motion was always achieved (Figure 30).

Fig. (1) Manipulation technique.

4. Technique of ACR:

The procedure was performed as a day case. An arthroscopic unite with a radiofequency apparatus are required (Figure 31,32). Patients under general anesthesia were placed in the lateral position with a longitudinal traction device at ٤٥° flexion and abduction of the operated limb and traction of the glenohumeral joint with 5 kg (Figure 33). After marking the bony landmarks. The posterior portal of the glenohumeral joint at 2 cm inferior and 2 cm medial of posterolateral edge of the acromion was used This access was hampered by existing capsular retraction in AC, with due care not to damage the articular cartilage of both the humeral head and the glenoid.

Fig. (2) The arthroscopic unite.

Initially, as the most important pathology is thickening and inflammation of the rotator interval ,an anterio–superior capsular release was done in the rotator cuff interval to resect the coraco-humeral ligament. The release of the coraco-humeral ligament was performed up to the base of the coracoid. Next the subscapularis tendon was identified. This tendon has to be freed intra- articularly, so as to attain an adequate subscapularis tendon gliding. With the assistant holding the arm in a position of slight external rotation, the inferior gleno-humeral ligament would become visible. Here also, capsular release and synovectomy are performed. At this point, access to the inferior gleno-humeral ligament would become relatively easy, and by performing slight abduction and external rotation, the release could be performed as close as possible to the glenoid.

Fig. (3) The radiofrequency apparatus.

Fig. (4) positioning of the patient :lateral decubitus position.

3. Results

Table (1) Comorbidities among the participants.

Variables	MUA n= 15	ACR n= 15	Test value	P value
Diabetes mellitus				
No n (%)	8 (53.3)	7 (46.7)	0.133	1.000[1]
Yes n (%)	7 (46.7)	8 (53.3)		
Thyroid diseases				
No n (%)	11 (73.3)	13 (86.7)	0.833	0.651[2]
Yes n (%)	4 (26.7)	2 (13.3)		

1: Chi square test

2: Fisher exact test

****P is significant at <0.05***

In table 1 among the MUA group there was 53.3% had no diabetes mellitus and 46.7% had diabetes mellitus while among ACR group there was 46.7% had no diabetes mellitus and 53.3% had diabetes mellitus. There was no statistically significant difference between two groups regarding diabetes mellitus. Regarding thyroid diseases there was 73.3% had no thyroid diseases and 26.7% had thyroid diseases among MUA group while there was 86.7% had no thyroid diseases and 13.3% had thyroid diseases among ACR group. There was no statistically significant difference between two groups regarding thyroid diseases.

Table (2) Affected side among the participants

Affected side	MUA	ACR	P value
Right	12 (80)	10 (66.7)	
Left	3 (20)	5 (33.3)	0.682[1]

1: Fisher Exact test

****P is significant at <0.05***

In table 2 regarding affected side there was 80% had right affected side and 20% had left affected side among MUA group while there was 66.7% had right affected side and 33.3% had left affected side. There was no statistically significant difference between two groups regarding affected side.

Table (3) Pre-treatment and follow up periods among the participants.

Variables	MUA Mean± SD	ACR Mean± SD	P value
Pre-treatment period (months)	4.67± 1.6	5.80± 1.7	0.066[1]
Follow up period (months)	7.80± 2.1	8.33± 1.7	0.445[1]

1: Chi square test

****P is significant at <0.05***

As shown in table 3 the mean pre-treatment period was 4.67± 1.6 among MUA group while the mean pre-treatment 5.80± 1.7 among ACR group. There was no statistically significant difference between two groups regarding pre- treatment period. Regarding follow up period the mean was 7.80± 2.1 among MUA group while the mean follow up period was 8.33± 1.7 among ACR group. There was no statistically significant difference between two groups regarding follow up period.

Table (4) Complications distribution among the participants.

Complications	MUA n= 15	ACR n= 15	P value
Still pain			
No n (%)	9 (60)	10 (66.7)	1.000
Yes n (%)	6 (40)	5 (33.3)	
ROM			
Full ROM n (%)	12 (80)	11 (73.3)	1.000
Less than full ROM n (%)	3 (20)	4 (26.7)	

Chi square test

****P is significant at <0.05***

According to table 4 there was 60% had no pain at last follow up visit and 40% had pain at last follow up visit among MUA group while 66.7% had no pain at last follow up visit and 33.3% had pain at last follow up visit. There was no statistically significant difference between two studied groups regarding still pain and movement.

Table (5) Correlation between HbA1C and range of motions.

Variables	r	P value
Flexion	-0.883	**<0.001***
Abduction	-0.031	0.869
External	-0.800	**<0.001***
Internal	0.888	**<0.001***

Table (6) Correlation between HbA1C and final scoring.

Variables	r	P value
CMS	-0.052	0.785
OSS	0.998	**<0.001***
VAS	-0.172	0.364

****P is significant at <0.05***

According to table 5,6 There is statistically significant negative strong correlation between HbA1C and Flexion and External movements. There is statistically significant positive strong correlation between HbA1C , OSS and internal movement while there was no statistically significant correlation between HbA1C and CMS, VAS and Abduction movements.

Table (7) Satisfaction distribution among two studied groups.

Satisfaction	MUA	ACR	X^2	P value
Satisfied n (%)	11 (73.3)	13 (86.7)		
unsatisfied n (%)	4 (26.7)	2 (13.3)	0.833	0.326[1]

1: Fisher Exact test

****P is significant at <0.05***

Regarding Satisfaction showed in table 7 there was no statistically significant difference between two studied groups and satisfaction.

4. Discussion

Regarding Comorbidities among the participants, our results revealed that among the MUA group there was 53.3% had no diabetes mellitus and 46.7% had diabetes mellitus while among ACR group there was 46.7% had no diabetes mellitus and 53.3% had diabetes mellitus. There was no statistically significant difference between two groups regarding diabetes mellitus. Regarding thyroid diseases there was 73.3% had no thyroid diseases and 26.7% had thyroid diseases among MUA group while there was 86.7% had no thyroid diseases and 13.3% had thyroid diseases among ACR group. There was no statistically significant difference between two groups regarding thyroid diseases.

Our results were supported by the study by Lee et al., [10] as they revealed that there was no statistically significant difference between two groups regarding diabetes mellitus. Twenty-four patients had diabetes mellitus (30.4%, 24 of 79 patients). Three patients had thyroid disease in group A, while none did in group B.

In agreement with our results the study by Uluyardimci & Ocguder, [6] reported that there were no statistically significant differences between two groups regarding diabetes mellitus and thyroid diseases.

As well the study by Rangan et al., [11] reported that there were no statistically significant differences between the studied groups regarding diabetes mellitus.

Furthermore Bidwai et al., (3) reported that there were (31%) had diabetes mellitus. But did not report any thyroid diseases.

Regarding affected side, we found that there was 80% had right affected side and 20% had left affected side among MUA group while there was 66.7% had right affected side and 33.3% had left affected side. There was no statistically significant difference between two groups regarding affected side.

In agreement with our results the study by Uluyardimci & Ocguder, [6] reported that there were no statistically significant differences between two groups regarding affected side.

As well the study by Rangan et al., [11] reported that there were no statistically significant differences between the studied groups regarding affected side.

Our results showed that the mean pre-treatment period was 4.67± 1.6 among MUA group while the mean pre-treatment 5.80± 1.7 among ACR group. There was no statistically significant difference between two groups regarding pre- treatment period. Regarding follow up period the mean was 7.80± 2.1 among MUA group while the mean follow-up period was 8.33± 1.7 among ACR group. There was no statistically significant difference between two groups regarding follow up period.

Our results were supported by the study by Lee et al., [10] as they revealed that the mean Pretreatment period and Follow-up period were 6.4± 3.7 and 7.68± 1.7 months for group A, and 6.6± 4.1 and 7.22± 1.6 months for group B. There was no statistically significant difference between two groups regarding Pretreatment period and follow up period.

Also results further supported by Uluyardimci & Ocguder, [6] who reported that the mean Duration of symptoms and Follow-up period were 13.6 ± 4.3 and 17.3 ± 9.8 months for MUA group and 14.1 ± 6.2 and 16.9 ± 9.1 for ACR group (longer than our reported durations), there was no statistically significant difference between two groups Duration of symptoms and follow up period.

As well the study by Rangan et al., [11] reported that there were no statistically significant differences between the studied groups regarding Duration of symptoms and follow up period.

As regard Complications distribution among the participants, we found that there was 60% had no pain at last follow up visit and 40% had pain at last follow up visit among MUA group while 66.7% had no pain at last follow up visit and 33.3% had pain at last follow up visit. There was no statistically significant difference between two studied groups regarding still pain and movement. We also found that there was no statistically significant difference between two studied groups regarding CMS, VAS, Flexion, Abduction, External and internal movements.

Our results were supported by Uluyardimci & Ocguder, [6] who reported that there was no statistically significant difference between two studied groups regarding Pain VAS, Forward flexion, External rotation and Internal rotation.

Our results were further supported by the study by Bidwai et al., [3] who reported that there was no statistically significant difference between two studied groups regarding OSS, OSS time-adjusted, EuroQOL 5-Dimension questionnaire, QuickDASH , pain (Numeric Rating Scale) and Extent of recovery.

While the study by Lee et al., [10] revealed that there was statistically significant difference between two studied groups regarding forward elevation, but there was no statistically significant difference between two studied groups regarding Pain VAS and external rotation arm at side at the last follow up visit.

In this previous study done Lee et al. [10] by there was negative moderate correlation between age and Constant Murley score $P < 0.001$ while there was no statistically significant correlation between age and other variables.

Our results revealed that there was statistically significant negative strong correlation between hemoglobin A1c (HbA1C) and Flexion and External movements. There is statistically significant positive strong correlation between HbA1C, OSS and internal rotation while there was no statistically significant correlation between HbA1C and CMS, VAS and Abduction movements.

A retrospective study by Vastamäki et al., [12] aimed to determine whether frozen shoulder heals equally well in patients with and without diabetes and whether dependency on insulin affects the outcome, the study enrolled 178 patients with idiopathic frozen shoulder; 27 patients had diabetes, at final follow up they reported that there was statistically significant

correlation between diabetes and non- diabetes groups as regards Flexion, Abduction, External rotation, Internal rotation, while there was no statistically significant difference as regards Constant–Murley score and VAS which support our results partially.

Whereas the study by Bidwai et al., [3] who reported that there was no statistically significant difference between diabetics versus non-diabetics groups regarding Forward Flexion, Abduction, External Rotation, OSS pain, OSS Function and OSS total.

Limitation of joint motions caused by diabetes mellitus was first described by Lundbaek. Musculoskeletal diseases such as Dupuytren's contracture, flexor tenosynovitis and carpal tunnel syndrome are also diabetes related diseases, and their prevalence increases together with a similar pathological mechanism of frozen shoulder disease [12]. The reason for this increase is the increase in the number of diabetic patients and their life span. Tighe and Oakley [13] stated a 38.6% prevalence of frozen shoulder disease in diabetic patients, while it was 29% according to Balci et al., [14].

It has been proved in many studies that diabetic patients generally have more limitation of joint motion than healthy people. The reason for this correlation remains enigmatic. The change in the structure of collagen as a result of the glycosylation of collagen proteins causes biomechanical differences in diabetic patients. Moreover, the cell damage caused by the accumulation of the final product formed after the advanced glycosylation can explain this correlation [15].

Thomas et al., [16] analyzed the correlation between diabetes and frozen shoulder disease based on many aspects on a large patient series. They observed that diabetic patients were more likely to have painful and stiff shoulders than general medical patients. Although it was more common among men, no statistical difference was found. Age was not stated to be a significant criterion. They stated that the prevalence of frozen shoulder was higher in type I diabetic patients than in type II; however, there was no statistically significant difference. They also could not prove that the use of insulin and glycolysed hemoglobin (A1c) was a risk factor. They only found a positive correlation between the longer duration of diabetes (more than 13 years) and an increasing risk of frozen shoulder.

Finally, regarding Satisfaction our results revealed that there was no statistically significant difference between two studied groups and satisfaction.

A significant improvement in range of motion and an overall satisfaction rate of 94% at short term is reported by Dodenhoff et al., [17]. 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 [18].

5. Conclusion

Successful clinical and functional outcomes can be obtained with both MUA and ACR in the treatment of refractory FS without major serious complications.

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