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Functional Outcome After Arthroscopic Capsular Release in Management of the Shoulder Adhesive Capsulitis

Elias Emhemed Yousef Alazabi*, Adel Mohammad Salama, Mohmed A. Abdel Salam, Hany Mohamed Abd Elfattah Bakr

Department of Orthopedic Surgery, Faculty of Medicine, Zagazig University, Egypt

***Corresponding author:** Elias Emhemed Yousef Alazabi, **Mobile:** (+20)01145521737, **Email:** eliasalazabi1979@gmail.com

ABSTRACT

Background: When adhesive capsulitis develops, it causes shoulder pain and limits ranges of motion in the 2 passive and active ways. Following an arthroscopic release of the frozen shoulder, the pain intensity and frequency were found to be significantly reduced.

Objective: This work was performed to assess the clinical findings after use of arthroscopic capsular release in management of shoulder adhesive capsulitis that had not responded to at least six months of conservative treatment prior and to study how much is the regaining of functions of shoulder after the operation.

Patients and methods: A total of 18 Egyptian patients with frozen shoulder recruited and treated by arthroscopic capsular release. Preoperative evaluation was done and 1 week, 6 weeks, 12 weeks, and 24 weeks of follow-up after surgery. We used Constant score for assessment of shoulder functions and pain.

Results: All of internal rotation, external rotation, abduction, forward flexion, and range of motion significantly increased from pre- to last follow up as follows 3.66 ± 1.2, 3.77 ± 1.25, 4.77 ± 1.21, 4.88 ± 1.40, and 17.11 ± 3.83 pre-operative versus 8.44 ± 1.46, 8.33 ± 1.41, 8.55 ± 1.14, 9.0 ± 1.57, and 31.88 ± 7.52 respectively in last post-operative follow up. Strength of abduction significantly increased from 13.33 ± 1.71 preoperative to 20.50 ± 3.01 in last follow up postoperative. Pain Constant score significantly increased from 5.94 ± 1.43 to 13.44 ± 2.66. Total shoulder Constant score significantly increased from 48.16 ± 6.31to 84.50 ± 11.96.

Conclusion: Shoulder adhesive capsulitis that has not well responded to conservative treatment can be successfully treated with arthroscopic surgery.

Keywords: Adhesive capsulitis of shoulder, Arthroscopic capsular release.

INTRODUCTION

"Frozen shoulder" or adhesive capsulitis affects the 2 passive and active ranges of motion made by shoulders [(1)]. Adhesive capsulitis has been linked to systemic disorders such as cardiovascular diseases, tuberculosis, diabetes, hypothyroidism, hyperthyroidism, hypoadrenalism, hyperlipidemia, and Parkinson's disease. In addition, there are traumatic causes such as post-shoulder surgery, Rotator cuff tear, calcified tendinitis, and so forth [(2)]. Adhesive capsulitis usually progresses through three distinct stages of clinical development. There is a pain and restriction of shoulder movement in the first stage (freezing stage). The pain tends to be worse at night. All glenohumeral movements has been significantly decreased, particularly, external rotation, occurs during the second stage (Frozen stage). Spontaneous improvement in mobility occurs in the last stage. In the meantime, though, limited range of motion and pain could be prolonged [(5)].

In Orthopedic Outpatient Clinics, adhesive capsulitis affects 2 to 4 percent of patients. In women, this condition is more common in middle age, peaking at 55 years of age (ranging from 45 to 60 years) [(3)]. Controlling the pain and restoring or improving shoulder range of motion are the primary goals in managing this condition. Management is based on physical therapy combined with home exercise programs [(4)]. Other non-operative treatments include medications such as anti-inflammatory drugs and analgesics, steroid injections into the affected joint itself as well as the physical therapy. They may reduce pain, but they have not been shown to speed up the healing process [(6)].

Anesthesia manipulation, open release, and arthroscopic release are some of the surgical options for adhesive capsulitis treatment. Pain and range of motion can be improved by arthroscopic release of the rotator interval, tight middle glenohumeral ligament (MGHL), and tight intra-articular structures. To complicate the procedure is the possibility of iatrogenic shoulder instability [(7)]. Seven years after arthroscopic release of frozen shoulder, pain intensity and frequency were reduced and shoulder range of motion improved (range, 5-13 years). More than a year after capsular release for adhesive capsulitis, several other studies have shown positive results. Nevertheless, a capsular release can cause iatrogenic instability [(8, 9)].

We aimed in this work to assess the clinical findings after use of arthroscopic capsular release in management of shoulder adhesive capsulitis that had not responded to at least six months of conservative treatment prior and to study how much is the regaining of the functions of shoulder after the operation.

PATIENTS AND METHODS

This was a prospective study that had been conducted on 18 patients with frozen shoulder who admitted to Zagazig University in the Orthopedic Department, in the duration between February 2021 and

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August 2021. They were treated by arthroscopic capsular release.

Ethical approval:

All participants provided written informed consents, and the study was approved by the Research Ethical Committee of Faculty of Medicine, Zagazig University (IRB#:6756-21-2-2021). This work was done in accordance with the Declaration of Helsinki, the ethical code of the world medical association for human studies.

Inclusion Criteria: Shoulder adhesive capsulitis patients admitted for arthroscopic capsular release surgery, idiopathic frozen shoulder {the affected shoulder has no history of major traumas, infections, or surgery}, the shoulder's active and passive range of motion is painfully restricted, and not responding to non-operative management.

Exclusion criteria: Patients with post-surgical and post traumatic shoulder stiffness and patients having shoulder pathology (Osteoarthritis, Rheumatoid arthritis, T.B and Tumor or avascular necrosis).

A- Operational design:

For all included patients, the following were done:

- **Detailed clinical history:** Name, age, sex, causes and duration of symptoms, any previous treatment or surgical intervention, any medical comorbidity and medication.
- **Detailed clinical examination.**
- **Plain X-ray shoulder joint (AP & lateral views).**
- **MRI shoulder.**
- **Routine Laboratory investigation:** Liver and kidney function tests, viral screen, coagulation studies (PT/PTT), random blood sugar and completed blood picture were done.

Surgical technique:

Induction of anaesthesia was preceded by the administration of broad-spectrum antibiotics in the form of intravenous cephalosporin. According to the anesthesia specialist, general anesthesia or combined GA with interscalene block was performed.

Seven steps make up the entire process:

Step 1: Positions of the patient:

Patient positions included lateral decubitus and beach chair, with the facility and patient's preferences in mind. Patients were anaesthetized prior to final positioning in our study, which used a beach chair position. The patient was seated in a beach chair. The entire extremities including the axilla and side of the chest were scrubbed from the fingers to the base of the neck. Affected arm was exposed from neck to elbow **(**Figure 1).

Figure (1): Beach chair position.

Step 2: Portal placement:

We created a standard posterior viewing portal, as well as an anterior portal and a lateral viewing portal for accessing the glenohumeral joint. Prior to the procedure, basic arthroscopic portals and anatomic landmarks were marked. Furthermore, acromion, clavicle, AC joint and the coracoid process anatomic landmarks were clear (Figure 2)

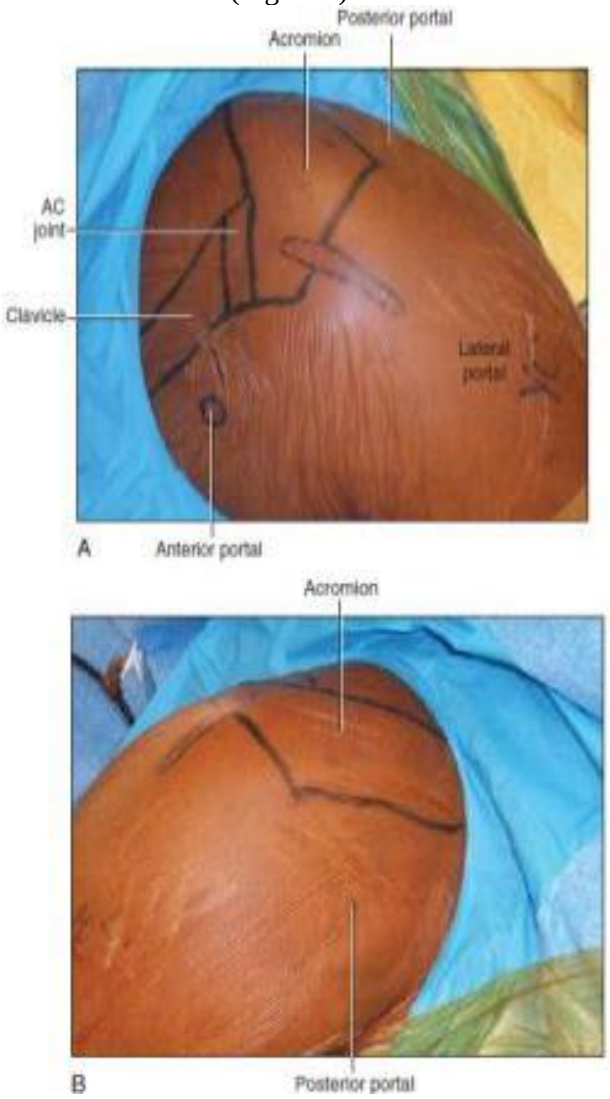

Figure (2): Portals.

Posterior portal:

We created a standard posterior viewing portal. After the anterior portal, the glenohumeral joint was viewed clearly through the posterior portal. Then, entry between the infraspinatus and teres minor muscles where on the posterolateral corner of the acromion, a small incision was made 2 to 3 cm inferiorly and 1 to 2

cm medially. We used the trocar in the coracoid process for proper glenohumeral joint access. Following trocar insertion through capsule, a popping sound was heard as the joint was entered. Getting the trocar into the glenohumeral joint can be challenging in patients with severe stiffness. As soon as the trocar tip was placed between the humeral head and glenoid, the patient was asked to feel it, in the glenohumeral joint, the portal was correctly positioned. Trocar was properly inserted, and then it was time to perform the diagnostic arthroscopy. Diagnostics that are routine were done including an arthroscope on the elbow and noted pathological changes in the elbow's synovium, labrum and capsule as well as in the rotator cuff's ligaments and capsule.

Anterior portal:

Inside-out technique or the outside-in technique was used to create the anterior portal. A posterior portal arthroscope was used to observe the outside-in technique.

18-gauge spinal needle 1 to 2 cm inferomedially to the anterolateral corner of the acromion just lateral to the coracoid process was introduced. The inferomedial brachial plexus and axillary vessels were protected. After inserting the arthroscope into the rotator interval, across the glenoid, just below the biceps tendon, inside-out technique was performed. A switching stick is inserted into an arthroscope's posterior portal while the cannula was held tightly in place by a surgeon. The tip of the stick was stabbed to allow it to pass through the skin incision.

Lateral portal:

The subacromial space was approached via a lateral portal. Acromioclavicular joint pathology is usually treated through it, including clavicle resection and acromioplasty.

In cases of shoulder stiffness, the coracoid process and the superoanterior portion of the subscapularis are seen through it. The acromion's anterolateral edge was incised by a 2-cm skin incision. When placing the portal, the spinal needle should be inserted first. The axillary nerve.

Step 3: Removal of rotator interval tissue:

Through the anterior portal, a 3.0-mm 90° electrocautery device was used; the rotator interval and the middle glenohumeral ligament were the first areas of the capsular release.

The superior glenohumeral ligament and the coracohumeral ligament were resected after the interval tissue was removed. The tissue was removed until the coracoacromial ligament and conjoined tendon fibers could be seen.

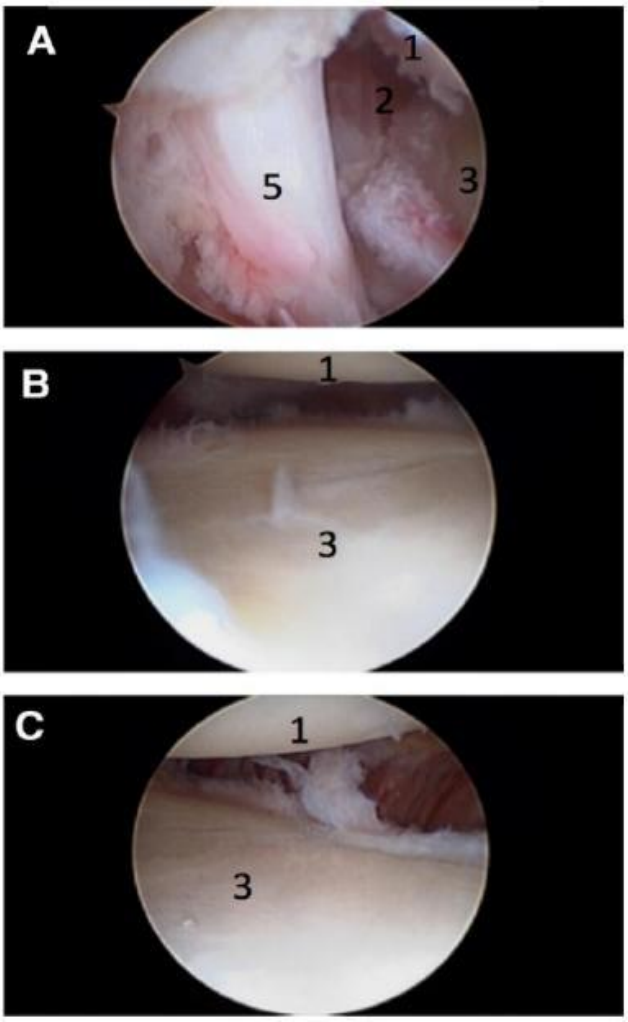

Figure (3): Arthroscopic images demonstrate completed 360° capsular release from the posterior viewing portal (A) anteriorly and (B) inferiorly. (C) The posterior release is viewed from the anterior portal. 1: humeral head, 2: subscapularis, 3: glenoid and 5: long head of the biceps tendon.

Step 4: Release the anterior capsule

We released biceps tendon' anterior capsular beneath its long head and preserved the glenoid labrum. The middle glenohumeral ligament was removed or divided during the procedure without causing any damage to the subscapularis. The hypertrophied capsule was carefully dissected without causing any damage to the subscapularis muscle. The subscapularis was protected by the electrocautery device's point facing the joint. The anterior and posterior bands of the inferior glenohumeral ligament were released at the 7 o'clock position (right) or 5 o'clock position (left).

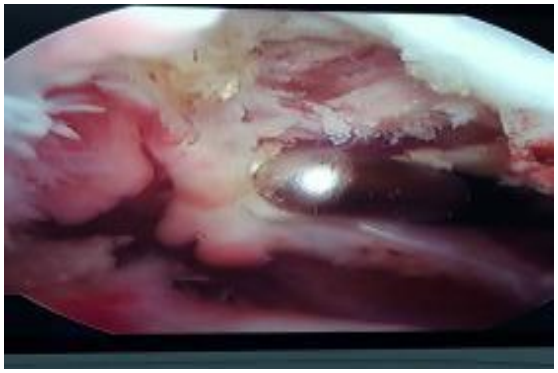

Figure (4): Anterior capsular release.

Step 5: Release the Inferior Capsule:

To better access the inferior glenohumeral ligament, the posterior portal should be used instead. Following a switch in portals, the anterior one is used for viewing and the posterior one is used for working.

Approaching the inferior capsule from the posterior portal was much easier. Extending the anterior capsule release process to the inferior capsule positions were completed at 7 and 5 o'clock (right and left shoulders). The inferior glenohumeral ligament's posterior band has been released.

Step 6: Release of coracohumeral ligament:

For the anterior subdeltoid space, we used the lateral portal's camera and an electrocautery device to locate the coracoid process's base. The coracohumeral ligament must be removed from the coracoid process to the rotator interval in order to remove the rotator interval tissue. If you want to get rid of the coracohumeral ligament completely, you should thoroughly examine and debride the subscapularis anterior and superior. Lesions in the biceps were treated concurrently with pathology lesions of the biceps and partial tears of the Rotator Cuff. In addition to fishing, insertion of the drain, stitching the wound, and the application of a dressing were done.

Step 7: Postoperative care:

To begin active motion, all patients underwent standard postoperative care, physiotherapy and range of motion (ROM) including passive range (forward flexion, abduction, external rotations, and internal rotations). Importantly, the shoulder joint's range of motion exercises should not exceed the level of discomfort.

Clinical outcome:

Before each consultation (preoperative evaluation and 1 week, 6 weeks, 3 months, and 6 months of follow-up), each patient was assessed based on the Constant score.

Clinically: By ROM compared to the opposite side.

- Visually, we measured range of passive motion (abduction, flexion, forward flexion) as well as external and internal rotation.
- Hand-held force gauges were used to measure strength, adduction, supraspinatus, subscapularis, and internal and external rotation.

Follow-up:

- The shoulders have been evaluated using the Constant score [10].
- The pain component of the Constant score has been used to measure pain.

Statistical analysis

The collected data were coded, processed and analyzed using the SPSS (Statistical Package for Social Sciences) version 22 for Windows® (IBM SPSS Inc, Chicago, IL, USA). Data were tested for normal distribution using the Shapiro Walk test. Qualitative data were represented as frequencies and relative percentages. Chi square test ($\chi 2$) to calculate difference between two or more groups of qualitative variables. Quantitative data were expressed as mean ± SD (Standard deviation). Independent samples t-test was used to compare between two independent groups of normally distributed variables (parametric data). P value < 0.05 was considered significant.

RESULTS

Age was distributed as 51.11 ± 5.91 with minimum 45 and maximum 65 years old. Regarding sex distribution, males were 38.9% and females were 61.1% (Table 1). 50% of patients were with no underlying causes as a primary and 50% were secondary distributed as 33.4% (6 cases) were DM and 16.6% were thyroid dysfunction (3 cases) (Table 2).

All of internal rotation, external rotation, abduction, forward flexion, and range of motion were significantly increased from pre- to last follow up as follows 3.66 ± 1.2, 3.77 ± 1.25, 4.77 ± 1.21, 4.88 ± 1.40, and 17.11 ± 3.83 preoperative versus 8.44 ± 1.46, 8.33 ± 1.41, 8.55 ± 1.14, 9.0 ± 1.57, and 31.88 ± 7.52 respectively in last postoperative follow up. Strength of abduction significantly increased from 13.33 ± 1.71 to 20.50 ± 3.01 (Table 3). Pain Constant score significantly increased from 5.94 ± 1.43 to 13.44 ± 2.66 (Table 4). Total shoulder Constant score significantly increased from 48.16 ± 6.31 to 84.50 ± 11.96 (Table 5).

Table (1): Demographic data distribution among studied group (N=18)

		Age	
Mean± SD		**51.11±5.91**	
Median (Range)		**50.0 (45-65)**	
		N	**%**
Sex	**Female**	**11**	**61.1**
	Male	**7**	**38.9**
	Total	**18**	**100.0**

Table (2): Risk factors and underlying causes distribution

		N	%
Risks	**NA**	**9**	**50**
	DM	**6**	**33.4**
	Thyroid dysfunction	**3**	**16.6**
Primary or secondary	**Primary**	**9**	**50**
	Secondary	**9**	**50**
Shoulder associated injury	**No**	**11**	**61.2**
	Yes	**7**	**38.8**
	Total	**18**	**100.0**

Table (3): Range of motion items total distribution and strength of abduction pre- and post- follow up

	Pre	Last follow up	Paired t	P
Internal rotation	**3.66±1.2**	**8.44±1.46**	**13.035**	**0.00****
External rotation	**3.77±1.25**	**8.33±1.41**	**14.443**	**0.00****
Abduction	**4.77±1.21**	**8.55±1.14**	**24.782**	**0.00****
Forward flexion	**4.88±1.40**	**9.0±1.57**	**16.171**	**0.00****
Range of motion	**17.11±3.83**	**31.88±7.52**	**10.146**	**0.00****
Strength of abduction	**13.33±1.71**	**20.50±3.01**	**10.288**	**0.00****

Table (4): Pain score distribution pre and at last follow up

	Pre	Last follow up	Paired t	P
Pain	**5.94±1.43**	**13.44±2.66**	**12.052**	**0.00****

Table (5): Total shoulder constant score distribution pre and at last follow up

	Pre	Last follow up	Paired t	P
Total shoulder constant score	**48.16±6.31**	**84.50±11.96**	**17.641**	**0.00****

DISCUSSION

In general population, orthopaedic surgeons encounter frozen shoulder. Pain and disability are the result of this problem. A person's symptoms can last for up to two years or more [(1)]. There are many different names for frozen shoulder, including shoulder periarthritis and adherent subacromial bursitis. In the current lexicon, they are often used interchangeably to refer to frozen shoulder and adhesive capsulitis [(11)].

Frozen shoulder is a term used to describe a condition in which active and passive shoulder motion is restricted in all directions for no apparent reason. It is believed to be a self-limiting disease in the long run, but some patients did not regain their normal range of motion. A known cause such as traumatic injury, diabetes, cervical disease, hyperthyroidism or ischemic heart disease can cause secondary frozen shoulder [(12)].

Treatments include physical therapy, intra-articular steroid injection, and non-steroidal anti-inflammatory drugs in addition to surgical options such as open or arthroscopic soft tissue release procedures and manipulation under anaesthesia, among others. Anesthesia-induced fractures of the humerus, nerve injuries, and dislocations have been reported as serious complications. One of the main drawbacks of open procedures is large dissection and a difficult recovery after surgery. Both of which can be challenging. A number of recent arthroscopic procedures have been reported to be successful. The arthroscopic technique allows for the diagnosis and treatment of diseases with minimal morbidity, as well as the ability to intervene with other intra-articular pathologies that may be present [(13)].

In our study, age was distributed as 51.11 ± 5.91 with minimum 45 and maximum 65 years old. Our findings are comparable to other studies, which showed that adhesive capsulitis of shoulder is common in third and fourth decade of life [(14)]. Other conducted studies showed average age of 52 years (28-68) [(10, 13)]. But, **Paxton *et al.*** [(15)] found that the average age of patients was 59.1 with range 45–69 years. Our results disagree with Knesek, [(16)] who announced that average age was 45.7 ± 8.3 year. Also, **Dalley *et al.*** [(17)] from the result of National Joint Registry of England and Wales defined that the mean age of adhesive capsulitis shoulder patients was 41 years (range: 29–56 years). **Di Giacomo *et al.*** [(18)] defined that average age at surgery was 53.2 years (range 30–61). The abovementioned findings established that adhesive capsulitis of shoulder is the disease of middle age with a peak onset at 55 years (ranging from 45 to 60 years) [(12)].

As regards sex distribution in our study, male were 38.9% and female were 61.1%. This is covenant with findings of **Franceschi and Franceschetti** [(19)] who defined that 35.5% of patients were females. Also, **Di Giacomo *et al.*** [(18)] found that males to females ratio was 3--1 ratio. In contrast, **Dalley *et al.*** [(17)] reported that male/female ratio was 0.5:1 among patients operated by arthroscopic capsular release to manage shoulder adhesive capsulitis.

In present study, underlying cause of shoulder adhesive capsulitis of studied group was 50% with no underlying causes as a primary and 50% were secondary distributed as 33.4% (6 cases) were DM and 16.6% were thyroid dysfunction (3 cases). Also, **Paxton *et al.*** [(15)] found that 50.0% were idiopathic, 11.1 % were due to DM, 11.1 % were due to hyperlipidemia and 5.5% were due to thyroid disease. In contrary, **Dalley *et al.*** [(17)] stated that arthroscopic capsular release to manage shoulder adhesive capsulitis was operated to 86.7% of patients due to idiopathic causes.

At follow up: As regard ROM in our study, all significantly increased from pre- to last follow as follow: Internal rotation increased from 3.66 ± 1.2 to 8.44 ± 1.46 and external rotation was 3.77 ± 1.25 and became 8.33 ± 1.41. Abduction was preoperatively 4.77 ± 1.21 then at last follow up was 8.55 ± 1.14, forward flexion was 4.88 ± 1.40 then became 9.0 ± 1.57 and ROM was 17.11 ± 3.8 and increased to 31.88 ± 7.52. 31.88 ± 7.52 at last follow up is coincident with other

study that reported that after arthroscopic capsular release in managing shoulder adhesive capsulitis, there was an increase of 28.8 degrees of ROM in forward elevation, 5.3 degrees in external rotation, and 4.0 degrees vertebral levels in internal rotation. There was statistically significant increase in the Constant-score, Murley's forward elevation, and internal rotation but not in external rotation [20]. In other study, it was found that the mean Constant-score at 6 months postoperatively was 83.4 % of the values at the final follow-up. External rotation, and internal rotation at 6 months postoperatively were 74.0%, and 83.9%, respectively and forward elevation was 95.1% at the final follow up [21].

As a result of arthroscopic capsular release, other studies have found that the overall results are favourable and comparable to those previously reported. After surgery, pain, functional scores of the shoulders and ranges of motion were significantly improved [20, 22-30]. There were a number of clinical parameters at 6 months post-operatively that were lower when compared to those at the final follow-up [31, 32].

According to numerous reports, arthroscopic capsular release results in rapid pain and motion improvement showed that 33 patients (45 percent) who had complete symptom resolution at their initial 4-day assessment, according to **Watson *et al.*** [31] who found that pain was resolved in a mean of 2.24 weeks (range, 4 days–8 weeks). It took on average 5.5 weeks (1.4–12 weeks) for the contralateral side's range of motion to return to normal. To reach a final pain-free range of motion, **Di Giacomo and Costantini** [18] reported that it took an average of two months (range, 1.6–5.8 months). They reported that in 14 patients (87.5%) who were satisfied with the procedure, complaints of pain and limitation disappeared at a mean 3.5 months (range, 15 days–12 months). Three months after surgery, 73% of patients recovered excellent function according to **Harryman *et al.*** [33]. At 4 weeks, they found that pain and function had significantly improved, and that 91 percent of patients were able to maintain their good condition for an average of 7.5 years after the treatment. According to research, arthroscopic capsular release facilitates achieved a rapid recovery, and the natural progression of adhesive capsulitis may be reduced [23, 29].

There were some limitations for our study. There were no enough groups of patients with adhesive capsulitis and other pathologies to compare. Another limitation of our study was that it did not include a comparison group that received conservative treatment alone. Our patients' postoperative management protocols were different. We agree that postoperative exercise programs that are continuous, regular and individualized are crucial after any form of operative intervention for shoulder stiffness. In our study, the number of patients was small, and the duration of follow-up was short, making it difficult to determine the long-term prognosis of the patients.

CONCLUSION

From the previous results, shoulder adhesive capsulitis that has not responded to conservative treatment can be successfully treated with arthroscopic surgery.

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Conflict of Interest: Nil.

REFERENCES

1. **Rangan A, Brealey S, Keding A *et al.* (2020):** Management of adults with primary frozen shoulder in secondary care (UK FROST): a multicentre, pragmatic, three-arm, superiority randomised clinical trial. The Lancet, 396 (10256): 977-989.
2. **Robinson C, Seah K, Chee Y *et al.* (2012):** Frozen shoulder. The British Journal of bone and joint surgery, 94 (1): 1-9.
3. **Kraal T, Beimers L, Sierevelt I *et al.* (2019):** Manipulation under anaesthesia for frozen shoulders: outdated technique or well-established quick fix. EFORT Open Reviews, 4(3): 98-109.
4. **Jerosch J, Nasef N, Peters O *et al.* (2013):** Mid-term results following arthroscopic capsular release in patients with primary and secondary adhesive shoulder capsulitis. Knee Surgery, Sports Traumatology, Arthroscopy, 21 (5): 1195-1202.
5. **Barnes C, Lam P, Murrell G (2016):** Short-term outcomes after arthroscopic capsular release for adhesive capsulitis. Journal of Shoulder and Elbow Surgery, 25 (9): 256-264.
6. **Grant J, Schroeder N, Miller B *et al.* (2013):** Comparison of manipulation and arthroscopic capsular release for adhesive capsulitis: a systematic review. J Shoulder Elbow Surg., 22: 1135-45.
7. **Jerosch J (2001):** 360 arthroscopic capsular release in patients with adhesive capsulitis of the glenohumeral joint—indication, surgical technique, results. Knee Surg Sports Traumatol Arthrosc, 9: 178–186.
8. **Le Lievre H, Murrell G (2012):** Long-term outcomes after arthroscopic capsular release for idiopathic adhesive capsulitis. J Bone Joint Surg Am., 94: 1208-16.
9. **Barnes C, Lam P, Murrell G (2016):** Short-term outcomes after arthroscopic capsular release for adhesive capsulitis. Journal of Shoulder and Elbow Surgery, 25 (9): 256-264.
10. **Constant C, Murley A (1987):** A clinical method of functional assessment of the shoulder. Clin Orthop Relat Res., 214: 160–164.
11. **Robinson C, Seah K, Chee Y *et al.* (2012):** Frozen Shoulder. The Journal of Bone and Joint Surgery, British, 94 (1): 1-9.
11. **Codsi M (2007):** The painful shoulder: When to inject and when to refer. Cleveland Clinic Journal of Medicine, 74 (7): 473-474.
12. **Barnes C, Lam P, Murrell G (2016):** Short-term outcomes after arthroscopic capsular release for adhesive capsulitis. Journal of Shoulder and Elbow Surgery, 25 (9): 256-264.
13. **Le Lievre H, Murrell G (2012):** Long-term outcomes after arthroscopic capsular release for idiopathic adhesive capsulitis. J Bone Joint Surg Am., 94:1208-16.
14. **Paxton S, Backus J, Keener J *et al.* (2013):** Shoulder arthroscopy: basic principles of positioning, anesthesia, and portal anatomy. JAAOS-Journal Am Acad Orthop

Surg., 21: 332–342.

15. **Knesek M, Skendzel J, Dines J *et al* (2013):** Diagnosis and management of superior labral anterior posterior tears in throwing athletes. Am J Sports Med., 41: 444–460.
16. **Dalley A, Agur A, Moore K (2015):** Essential clinical anatomy. Philadelphia : Wolters Kluwer Health. Pp: 686. https://cmc.marmot.org/Record/.b49656995
17. **Di Giacomo G, Costantini A (2004):** Arthroscopic shoulder surgery anatomy: basic to advanced portal placement. Oper Tech Sports Med., 12: 64–74.
18. **Franceschi F, Franceschetti E (2019):** Shoulder Arthroplasty: Intact Rotator Cuff Muscles. In Rotator Cuff Across the Life Span, Springer, Pp: 415–418.
19. **Warner J, Allen A, Marks P *et al.* (1996):** Arthroscopic release forchronic, refractory adhesive capsulitis of the shoulder. J Bone Joint Surg Am., 78 (12): 1808-16.
20. **Yoo J, Koh K, Shon M *et al.* (2018):** Clinical Outcome after Arthroscopic Capsular Release for AdhesiveCapsulitis of the Shoulder. Clinics in Shoulder and Elbow, 3: 127-133.
21. **Brue S, Valentin A, Forssblad M *et al.* (2007):** Idiopathic adhesive capsulitis of the shoulder: a review. Knee Surg Sports Traumatol Arthrosc., 15 (8): 1048-54.
22. **Baums M, Spahn G, Nozaki M *et al.* (2007):** Functional outcome and general health status in patients after arthroscopic release in adhesive capsulitis. Knee Surg Sports Traumatol Arthrosc., 15 (5): 638-44**.**
23. **Griggs S, Ahn A, Green A (2000):** Idiopathic adhesive capsulitis prospective functional outcome study of nonoperative treatment. J Bone Joint Surg Am., 82 (10): 1398-407**.**
24. **Holloway G, Schenk T, Williams G *et al.* (2001):** Arthroscopic capsular release for the treatment of refractory postoperative or post-fracture shoulder stiffness. J Bone Joint Surg Am., 83 (11): 1682-7**.**
25. **Ogilvie-Harris D, Biggs D, Fitsialos D *et al.* (1995):** The resistant frozen shoulder. Manipulation versus arthroscopic release. Clin Orthop Relat Res., 319: 238-48.
26. **Ogilvie-Harris D, Wiley A (1986):** Arthroscopic surgery of the shoulder. A general appraisal. J Bone Joint Surg Br., 68 (2): 201- 207.
27. **Pollock R, Duralde X, Flatow E *et al.* (1994):** The use of arthroscopy in the treatment of resistant frozen shoulder. Clin Orthop Relat Res., 304: 30-6.
28. **Segmüller H, Taylor D, Hogan C *et al.* (1995):** Arthroscopic treatment of adhesive capsulitis. J Shoulder Elbow Surg., 4 (6): 403-8.
29. **Warner J, Allen A, Marks P *et al.* (1997):** Arthroscopic release of postoperative capsular contracture of the shoulder. J Bone Joint Surg Am., 79 (8): 1151-8.
30. **Watson L, Dalziel R, Story I (2000):** Frozen shoulder: A 12-month clinical outcome trial. J Shoulder Elbow Surg., 9(1): 16- 22.
31. **Yoo J, Ahn J, Lee Y *et al.* (2009):** Magnetic resonance arthrographic findings of presumed stage-2 adhesive capsulitis: focus on combined rotator cuff pathology. Orthopedics, 32 (1): 22-26.
32. **Harryman D, Matsen F, Sidles J (1997):** Arthroscopic management of refractory shoulder stiffness. Arthroscopy, 13 (2): 133-47.