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Arthroscopic release in adhesive capsulitis of the shoulder: a retrospective study with 2 to 6 years of follow-up

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Background: This study aimed to evaluate the response rate to arthroscopic release treatment in adhesive capsulitis of the shoulder (ACS) for patients with refractory to conservative treatment.

Methods: In this retrospective study, 51 patients (age mean, 49.1±5.6 years) with unilateral adherent capsule underwent arthroscopic releasing surgery for the shoulder capsule. Etiologies of the ACS in 30 patients were idiopathic: 10 patients were affected after surgery and 11 patients following trauma. The patients were evaluated in terms of shoulder function, satisfaction rate, pain intensity, and joint range of motion (ROM) based on a Constant score, a Simple Shoulder Test, the visual analog scale, and four movements, respectively.

Results: The mean Constant score before surgery was 48.2±3.5 and reached 74.4±6 and 77.0±6.3 at 6 months and the final follow-up, respectively (p<0.001). The mean scores of pain intensity, a Simple Shoulder Test, and ROM showed significant improvement at all follow-ups (p<0.001). Sex, age, and diabetes did not have any significant effect on patient recovery. However, patients who experienced ACS after surgery had poorer results than others at all follow-up points.

Conclusions: Arthroscopic releasing surgery of the shoulder in patients with ACS refractory to conservative treatment produces rare complications and an effective injury response. It seems that patients suffering ACS following surgery have a weaker response to the treatment.

Keywords: Frozen shoulder; Adhesive capsulitis; Arthroscopy; Shoulder

INTRODUCTION

Two to 5% of patients referred to orthopedic clinics suffer from adhesive capsulitis of the shoulder (ACS), also known as frozen shoulder [1,2]. In 1945, Neviaser initially proposed this term for chronic inflammation of the joint capsule with fibrosis and adhesion leading to pain and limited range of motion (ROM) of the shoulder joint [3,4]. The dominant demographic characteristics of this disease are 40–60-year-old women with or without any comorbidity (diabetes, thyroid disorders, or cardiovascular diseases) [5,6]. The disease manifests itself in three consecutive phases: a freezing stage when there is a gradual increase in pain with nocturnal peaks and stiffness. Continuation of the disease process involves shoulder joint stiffness. The final thawing phase can last from a few weeks to several years and comprises gradual improvement in shoulder function and decrease in pain intensity

[7,8]. The time of the patient's visit among these phases, the wide range of clinical symptoms, and various underlying factors have led to the suggestion of various treatments [1,9,10].

Most patients respond well to conservative treatments [11,12], and most orthopedists recommend such a procedure for at least 6 months [5,6]. Manipulation under anesthesia is another option for orthopedists, but it can lead to iatrogenic fracture [13,14]. Open (more invasive) and arthroscopic surgeries have had satisfactory results [5,6], although open surgical procedures involve more intraoperative bleeding and morbidity and possibly longer hospitalization than do arthroscopic procedures [15,16]. However, arthroscopic techniques are not free of complications, with the possibility of iatrogenic damage to the axillary nerve and chondrolysis [17,18].

ACS is a multifactorial disease whose demographic characteristics, etiology of disease onset (idiopathic, after surgery, and following trauma), and comorbidities can each affect the process and severity of the disease. It is unclear which of the above factors is most impactful in the onset and severity of the disease. The aim of this study was to evaluate the objective and subjective criteria and the response rate to arthroscopic release treatment in ACS patients refractory to conservative treatment. The secondary purpose was to investigate the effects of underlying factors of age, sex, comorbidities, and disease etiology on patient response rates. Our study hypothesized that, in patients with ACS, the arthroscopic release method leads to effective improvement in shoulder function and significant reduction in pain.

METHODS

The protocol for this study was approved by the Institutional Review Board of Guilan University of Medical Sciences (IRB No. 725). Owing to the retrospective design, the requirement for informed consent was waived. All collection data forms were blinded and without the patients names.

In this retrospective study, all patients with unilateral stiffness of the shoulder refractory to conservative treatment (the second stage of the disease or the frozen stage) who underwent arthroscopic releasing surgery of the capsule from 2011 to 2016, were evaluated for eligibility. The inclusion criteria of the study were (1) normal findings on radiographic images of the shoulder joint; (2) pain during shoulder movement; (3) no improvement or progress after at least 6 months of nonsurgical, conservative treatment; (4) restriction in forward flexion to less than 100° and reduction of external and internal rotation to less than 50% of the normal limit [19,20]; and (5) patient follow-up for at least 2 years. The patients with evidence of degenerative changes in the shoulder joint (glenohumeral arthritis) or rotator-cuff tear and patients with uncontrolled diabetes (based on laboratory tests) were excluded. All patients underwent magnetic resonance imaging (MRI) to rule out other shoulder joint pathologies, and all underwent nonsurgical treatment for at least 6 months. Nonsurgical treatment included administration of analgesics and oral corticosteroids, intra-articular corticosteroid injections, and shoulder physiotherapy.

Surgical Method
All surgeries were performed by the first author of the study. For surgery, the patient was placed in a beach-chair position, and the patient's limb was stretched longitudinally with a weight of 2 kg. Using standard anterior and posterior portals, the rotator interval areas were released. Then, the middle glenohumeral ligament was released, and the anterior capsule was released from the biceps muscle origin. The subscapularis tendon was released from the anterior capsule. The release of the lower capsule was extended to the six o'clock position, and posterior capsular release was performed. During arthroscopy, the subacromial bursa was evaluated for the presence or absence of subacromial bursitis, and if necessary, a bursectomy or acromioplasty was performed. Then, gentle manipulation of the shoulder joint was performed, and the shoulder joint ROM was evaluated.

Rehabilitation and Postoperative Evaluations
Initially, basic information such as demographic characteristics (age and sex), diabetes, and disease etiology (idiopathic, after surgery, or following trauma) was recorded from the patient's files. The patients were hospitalized for 24 hours, and physiotherapy was initiated including passive movements of the shoulder joint. After being discharged, the patients were asked to continue their physiotherapy and begin daily activities. The patients were followed for 6 months after operation for shoulder functional status (based on Constant score [CS]), satisfaction rate (based on Simple Shoulder Test [SST]), pain intensity based on the visual analog scale (VAS), and joint ROM (in forward flexion, abduction, internal rotation, and external rotation in comparison with the normal amount in the opposite shoulder). The values of joint ROM were expressed as percentage in comparison with the contralateral shoulder. In the final follow-up, the patients were recalled and re-evaluated for these measures.

Statistical Analysis
Demographic characteristics and other research variables were analyzed using IBM SPSS ver. 19 (IBM Corp., Armonk, NY, USA). All data were analyzed statistically using the general linear model

and repeated measure test. Significance was noted at p-value of 0.05 in all tests.

RESULTS

A total of 73 patients was included in the study, of which 15 were lost to follow-up, and seven were excluded because of glenohumeral arthritis found on MRI. The mean age and follow-up period of the 51 eligible patients who completed all follow-up sessions (before surgery, 6 months after surgery, and final visit) were 49.1±5.6 years and 49.3±13.6 months, respectively. Table 1 shows other demographic information of the patients. Table 2 shows the etiology of ACS by age, sex, and diabetes.

In general, all outcome scores (VAS, CS, SST, and ROM) improved over time. The passage of time was an effective factor in improving outcomes (Table 3); also, there was no statistically significant difference between the outcome scores over these time periods (before surgery, 6 months after surgery, and the final visit) based on sex, age, or diabetes (p > 0.05).

We divided patients into three etiological groups of idiopathic, after surgery, and following trauma. The results showed that the outcome scores improved over time based on etiology ($P_{time} < 0.05$). In addition, the group effect was significant ($P_{group} < 0.05$), as was the group-by-time interaction effect. The variations between groups differed by visit ($P_{int.time \times group} < 0.05$). The results of the post hoc test performed with the Tukey method showed that, before surgery, only the SST level in the after-surgery group was lower than that of the idiopathic group (p < 0.05). At 6 months after surgery, the levels of VAS, CS, and SST were poorer in the after-surgery group than in the other groups (p < 0.05). Also, in the ROM examination at this time, only forward flexion and internal and external rotation in the after-surgery group were significantly smaller

Table 1. Demographic characteristics of patients

Variable	Value
Age (yr)	49.2±5.6
< 50	30 (58.8)
≥ 50	21 (41.2)
Sex	
Male	32 (62.7)
Female	19 (37.3)
Etiology	
Idiopathic	30 (58.8)
after surgery	10 (19.6)
after trauma	11 (21.6)
Diabetes	
Yes	23 (45.1)
No	28 (54.9)
Side of the conflict	
Right	24 (47.1)
Left	27 (52.9)
Dominant hand	
Right	45 (88.2)
Left	6 (11.8)

Values are presented as mean±standard deviation or number (%).

Table 2. Etiology of ACS by age, sex, and diabetes

Variable	Idiopathic	After surgery	Following trauma
Age (yr)	50.1±1.01	50.6±1.7	45.4±1.4
Diabetes			
Yes	21 (70)	1 (10)	1 (9.1)
No	9 (30)	9 (90)	10 (90.9)
Sex			
Male	19 (63.3)	6 (60)	7 (63.6)
Female	11 (36.7)	4 (40)	4 (36.4)

Values are presented as mean±standard deviation or number (%).
ACS: adhesive capsulitis of the shoulder.

Table 3. Functional outcomes

Variable	Before	6-Month follow-up	Final follow-up	p-value
Pain				
VAS	7.4±0.5	2.6±0.8	2±0.8	< 0.001
Shoulder function				
CS	48.2±3.5	74.4±6.0	77.0±6.3	< 0.001
Satisfaction				
SST	3.1±0.9	7.5±1.0	9.4±1.6	< 0.001
Range of motion (%)				
Forward flexion	25.9±5.4	66.5±7.3	76.8±8.7	< 0.001
Abduction	26.1±5.5	67.0±7.6	78.2±8.3	< 0.001
Internal rotation	25.7±5.2	67.9±6.8	78.8±8.9	< 0.001
External rotation	25.8±5.4	67.2±7.1	78.9±9.0	< 0.001

Values are presented as mean±standard deviation.
VAS: visual analogue scale, CS: Constant score, SST: Simple Shoulder Test.

than those of the idiopathic group (p < 0.05). At the final follow-up, the outcome scores in the after-surgery group were poorer than in the other two groups (p < 0.05). The outcome scores of the idiopathic group and following trauma group were not significantly different at any time point (p > 0.05) (Table 4).

DISCUSSION

This study showed that patients, regardless of underlying factors, had significant improvements in pain, functional scores (CS and SST scores), and ROM in the short-term (6 months) and final (at least 2 years) follow-up after treatment. Also, Jerosch et al. [21] and Ranalletta et al. [22] achieved good results after arthroscopic release in patients with ACS. The CS in our study improved from 48.2 to 74.4 and 77.02 at 6 months and the final follow-up, respectively; these scores improved from 41 to 83 in the Jerosch et al.'s study [21] and from 42 to 86 in the Ranalletta et al.'s study [22].

The response to treatment and patient satisfaction rate (SST score) indicated successful surgery. The SST score increased from 3.1 to 7.5 at the 6-month follow-up and to 9.4 at the final follow-up. Segmüller et al. [23] in a 13.5-month follow-up and Le Lievre and Murrell [24] in a 7-year follow-up assessed patient satisfaction rate, noting good to excellent satisfaction in 88% and 85% of patients, respectively.

From an anatomopathological point of view, the most important feature of the disease is the presence of scars in the rotator interval involving the supra glenohumeral and coracohumeral ligaments [25]. In the present study, rotator interval release and subsequent global capsular release improved ROM in the shoulder joint. Cohen et al. [26] and Berghs et al. [27] achieved similar results.

There is a debate in the literature about the rate of arthroscopic release. Some consider release of the coracohumeral ligament and

Table 4. Functional outcomes in different by time periods according to different and etiologies

Functional outcome		Etiology	Before	6-Month follow-up	Final follow-up	p-value
Pain	VAS	Idiopathic	7.5 ± 0.1	2.4 ± 0.1	1.8 ± 0.1	< 0.001
		After surgery	7.5 ± 0.2	3.5 ± 0.2	2.8 ± 0.2	< 0.001
		Following trauma	7.2 ± 0.2	2.4 ± 0.2	1.7 ± 0.2	< 0.001
		p-value	$P_{time} < 0.001, P_{group} = 0.001, P_{int.time \times group} = 0.006$			
Shoulder function	CS	Idiopathic	47.9 ± 3.3	76 ± 4.9	78.9 ± 5.2	< 0.001
		After surgery	47.8 ± 4.2	66.4 ± 2.8	68.6 ± 2.7	< 0.001
		Following trauma	49.2 ± 3.5	77.4 ± 4.7	79.5 ± 5.3	< 0.001
		p-value	$P_{time} < 0.001, P_{group} < 0.001, P_{int.time \times group} < 0.001$			
Satisfaction	SST	Idiopathic	2.8 ± 0.9	7.7 ± 0.9	9.8 ± 1.5	< 0.001
		After surgery	3.7 ± 0.5	6.4 ± 0.5	7.9 ± 1.2	< 0.001
		Following trauma	3.1 ± 0.9	8 ± 0.9	9.7 ± 1.3	< 0.001
		p-value	$P_{time} < 0.001, P_{group} = 0.006, P_{int.time \times group} < 0.001$			
Range of motion (%)	Forward flexion	Idiopathic	24.7 ± 5.2	69.5 ± 6.9	79.7 ± 7.1	< 0.001
		After surgery	28 ± 4.2	59.5 ± 5.5	66.5 ± 5.3	< 0.001
		Following trauma	27.3 ± 6.1	64.5 ± 4.2	78.2 ± 8.4	< 0.001
		p-value	$P_{time} < 0.001, P_{group} < 0.001, P_{int.time \times group} < 0.001$			
	Abduction	Idiopathic	25.5 ± 4.9	68.8 ± 8.9	81 ± 6.9	< 0.001
		After surgery	28.5 ± 5.3	63.5 ± 3.4	69.5 ± 4.4	< 0.001
		Following trauma	24.5 ± 6.9	65.5 ± 4.7	78.6 ± 9.5	< 0.001
		p-value	$P_{time} < 0.001, P_{group} = 0.022, P_{int.time \times group} = 0.001$			
	Internal rotation	Idiopathic	24.5 ± 4.4	70 ± 7.2	82 ± 6.9	< 0.001
		After surgery	28.5 ± 5.3	63 ± 4.2	68.5 ± 4.1	< 0.001
		Following trauma	26.4 ± 6.4	66.8 ± 5.1	79.5 ± 10.1	< 0.001
		p-value	$P_{time} < 0.001, P_{group} = 0.005, P_{int.time \times group} < 0.001$			
	External rotation	Idiopathic	24.5 ± 4.4	69.5 ± 7.6	82.2 ± 7.7	< 0.001
		After surgery	28 ± 5.9	62.5 ± 5.4	69 ± 5.2	< 0.001
		Following trauma	27.3 ± 6.8	65.4 ± 4.7	79.1 ± 8.9	< 0.001
		p-value	$P_{time} < 0.001, P_{group} = 0.006, P_{int.time \times group} < 0.001$			

Values are presented as mean±standard deviation.
VAS: visual analogue scale, CS: Constant score, SST: Simple Shoulder Test, int: interaction.

the rotator interval to be sufficient [28], whereas some surgeons support the release of other joint structures such as the inferior and posterior capsules or advocate global capsular release [29]. In this study, we first released the interval rotator, followed by that of existing contracted remnants in the anterior and/or the posterior area if needed. However, Ranalletta et al. [22] released only the anteroinferior portion of the capsule and obtained suitable therapeutic results. In future prospective studies that measure patient limitations in various shoulder movements, it might be possible to estimate the desired extent of capsular release before surgery. The potential complications of this surgical procedure include infection, iatrogenic injuries causing chondral lesions, and axillary nerve damage, none of which were found in our study.

In this study, we also examined the impact of underlying factors of sex, diabetes, and etiology of the disease on the recovery rate, functional outcome, and ROM improvement. Sex did not affect patient response to treatment, and women showed equal improvement in performance and ROM to men. To our knowledge, no study has found these factors to affect the effectiveness of arthroscopic treatment in patients with ACS. In a study that also examined the underlying factors in manipulative treatment under anesthesia, Theodorides et al. [30] found that the functional scores of women improved more than those of men. However, their study did not note the etiological cause of ACS. We divided patients into three etiological groups of idiopathic, after surgery, and following trauma. In patients with idiopathic underlying cause and in patients with trauma etiology, pain and function scores (CS and SST) improved significantly and more effectively than for the group of post-surgery patients. Also, the ROM in patients who had ACS because of a previous shoulder surgery showed weaker recovery than that in the other two groups. These differences might be attributed to the manipulations following the previous surgery that triggered inflammatory cascades and arthritic processes in that area. Because the shoulder joint does not have high blood supply like other ball and socket joints, patient healing might have been delayed even after the joint was released. Another reason for the differences in group outcomes could be the formation of adhesion bands in several areas of the shoulder joint complex.

One of the strengths of our study was the careful selection of patients with no structural problems. Also, because different people have different ROMs and joint strength, we compared each involved shoulder with the contralateral one of the same individual. Another strength of this study is the use of subjective scores for the shoulder using the CS and SST questionnaires along with objective scores. Some studies consider only patient-reported criteria and subject the study to subjective/objective bias. Another advantage of our study was the performance of all surgeries by the same expert surgeon with 8 years of experience in arthroscopic shoulder surgery to avoid the bias of multiple surgeons and the differences in degree of expertise. However, performance by a single surgeon limits the generalizability of the study. In addition, the small sample size, lack of a control group, and retrospective nature of the study are weaknesses.

In patients with ACS refractory to conservative treatment, arthroscopic releasing surgery of the shoulder involves rare complications and effective response in terms of pain relief and increased function and in the appropriate increase of shoulder ROM. The surgeon should be aware that patients with adhesive capsulitis following a previous surgery might have a weaker response to treatment compared with that of those with idiopathic or injury etiology.

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REFERENCES

1. Barnes CP, Lam PH, Murrell GA. Short-term outcomes after arthroscopic capsular release for adhesive capsulitis. J Shoulder Elbow Surg 2016;25:e256-64.

2. Manske RC, Prohaska D. Diagnosis and management of adhesive capsulitis. Curr Rev Musculoskelet Med 2008;1:180-9.

3. Le HV, Lee SJ, Nazarian A, Rodriguez EK. Adhesive capsulitis of the shoulder: review of pathophysiology and current clinical treatments. Shoulder Elbow 2017;9:75-84.

4. Neviaser JS. Adhesive capsulitis of the shoulder: a study of the pathological findings in periarthritis of the shoulder. JBJS 1945;27:211-22.

5. Fernandes MR. Arthroscopic treatment of adhesive capsulitis of the shoulder with minimum follow up of six years. Acta Ortop Bras 2015;23:85-9.

6. Miyazaki AN, Santos PD, Silva LA, Sella GD, Carrenho L, Checchia SL. Clinical evaluation of arthroscopic treatment of shoulder adhesive capsulitis. Rev Bras Ortop 2016;52:61-8.

7. Hsu JE, Anakwenze OA, Warrender WJ, Abboud JA. Current review of adhesive capsulitis. J Shoulder Elbow Surg 2011;20:502-14.

8. Wong CK, Levine WN, Deo K, et al. Natural history of frozen shoulder: fact or fiction? A systematic review. Physiotherapy 2017;103:40-7.

9. Jenkins EF, Thomas WJ, Corcoran JP, et al. The outcome of manipulation under general anesthesia for the management of frozen shoulder in patients with diabetes mellitus. J Shoulder Elbow Surg 2012;21:1492-8.

10. Wang JP, Huang TF, Ma HL, Hung SC, Chen TH, Liu CL. Manipulation under anaesthesia for frozen shoulder in patients with and without non-insulin dependent diabetes mellitus. Int Orthop 2010;34:1227-32.

11. Levine WN, Kashyap CP, Bak SF, Ahmad CS, Blaine TA, Bigliani LU. Nonoperative management of idiopathic adhesive capsulitis. J Shoulder Elbow Surg 2007;16:569-73.

12. Tasto JP, Elias DW. Adhesive capsulitis. Sports Med Arthrosc Rev 2007;15:216-21.

13. Loew M, Heichel TO, Lehner B. Intraarticular lesions in primary frozen shoulder after manipulation under general anesthesia. J Shoulder Elbow Surg 2005;14:16-21.

14. Magnussen RA, Taylor DC. Glenoid fracture during manipulation under anesthesia for adhesive capsulitis: a case report. J Shoulder Elbow Surg 2011;20:e23-6.

15. Lafosse L, Boyle S, Kordasiewicz B, Aranberri-Gutiérrez M, Fritsch B, Meller R. Arthroscopic arthrolysis for recalcitrant frozen shoulder: a lateral approach. Arthroscopy 2012;28:916-23.

16. Robinson CM, Seah KT, Chee YH, Hindle P, Murray IR. Frozen shoulder. J Bone Joint Surg Br 2012;94:1-9.

17. Jerosch J, Aldawoudy AM. Chondrolysis of the glenohumeral joint following arthroscopic capsular release for adhesive capsulitis: a case report. Knee Surg Sports Traumatol Arthrosc 2007;15:292-4.

18. Jerosch J, Filler TJ, Peuker ET. Which joint position puts the axillary nerve at lowest risk when performing arthroscopic capsular release in patients with adhesive capsulitis of the shoulder. Knee Surg Sports Traumatol Arthrosc 2002;10:126-9.

19. Bulgen DY, Binder AI, Hazleman BL, Dutton J, Roberts S. Frozen shoulder: prospective clinical study with an evaluation of three treatment regimens. Ann Rheum Dis 1984;43:353-60.

20. Rouhani A, Mardani-Kivi M, Bazavar M, et al. Calcitonin effects on shoulder adhesive capsulitis. Eur J Orthop Surg Traumatol 2016;26:575-80.

21. Jerosch J, Nasef NM, Peters O, Mansour AM. Mid-term results following arthroscopic capsular release in patients with primary and secondary adhesive shoulder capsulitis. Knee Surg Sports Traumatol Arthrosc 2013;21:1195-202.

22. Ranalletta M, Rossi LA, Zaidenberg EE, et al. Midterm outcomes after arthroscopic anteroinferior capsular release for the treatment of idiophatic adhesive capsulitis. Arthroscopy 2017;33:503-8.

23. Segmüller HE, Taylor DE, Hogan CS, Saies AD, Hayes MG. Arthroscopic treatment of adhesive capsulitis. J Shoulder Elbow Surg 1995;4:403-8.

24. Le Lievre HM, Murrell GA. Long-term outcomes after arthroscopic capsular release for idiopathic adhesive capsulitis. J Bone Joint Surg Am 2012;94:1208-16.

25. Neer CS 2nd, Satterlee CC, Dalsey RM, Flatow EL. The anatomy and potential effects of contracture of the coracohumeral ligament. Clin Orthop Relat Res 1992;(280):182-5.

26. Cohen M, Amaral MV, Brandão BL, Pereira MR, Monteiro M, Filho GD. Assessment of the results from arthroscopic surgical treatment of adhesive capsulitis. Rev Bras Ortop 2013;48:272-7.

27. Berghs BM, Sole-Molins X, Bunker TD. Arthroscopic release of adhesive capsulitis. J Shoulder Elbow Surg 2004;13:180-5.

28. Itoi E, Arce G, Bain GI, et al. Shoulder stiffness: current concepts and concerns. Arthroscopy 2016;32:1402-14.

29. Harryman DT 2nd, Sidles JA, Harris SL, Matsen FA 3rd. The role of the rotator interval capsule in passive motion and stability of the shoulder. J Bone Joint Surg Am 1992;74:53-66.

30. Theodorides AA, Owen JM, Sayers AE, Woods DA. Factors affecting short- and long-term outcomes of manipulation under anaesthesia in patients with adhesive capsulitis of the shoulder. Shoulder Elbow 2014;6:245-56.