Acta Orthopaedica et Traumatologica Turcica 52 (2018) 245–248

Contents lists available at ScienceDirect

Acta Orthopaedica et Traumatologica Turcica

journal homepage: https://www.elsevier.com/locate/aott

Effect of nonoperative concomitant intraarticular pathologies on the outcome of arthroscopic capsular release for adhesive capsulitis of the shoulder

Fatih Yildiz [a, *], Abdulkadir Sari [b], Anil Pulatkan [a], Vahdet Ucan [a], Alauddin Kochai [c], Kerem Bilsel [a]

[a] Department of Orthopedics and Traumatology, Bezmialem Vakif University School of Medicine, Istanbul, Turkey
[b] Department of Orthopedics and Traumatology, Namık Kemal University School of Medicine, Tekirdag, Turkey
[c] Department of Orthopedics and Traumatology, Sakarya University School of Medicine, Sakarya, Turkey

ARTICLE INFO

Article history:
Received 26 November 2017
Received in revised form
30 January 2018
Accepted 11 April 2018
Available online 24 April 2018

Keywords:
Frozen shoulder
Adhesive capsulitis
SLAP
Rotatory cuff
Concomitant pathologies

ABSTRACT

Objective: The aim of this study was to investigate whether coexistent intraarticular lesions are negative prognostic factors for the results of arthroscopic capsular release in frozen shoulder patients.
Methods: Seventy-two patients who met inclusion criteria and underwent arthroscopic capsular release between March 2011 and August 2015 for the frozen shoulder were retrospectively evaluated. The patients were divided into two groups according to existence of concomitant intraarticular pathologies detected during arthroscopy. Preoperative and postoperative functional results were assessed with Constant score and shoulder ranges of motion; and the amount of pain was evaluated using visual analog scale (VAS).
Results: Group I consisted of 46 patients (mean age 47.2 years and mean follow-up 26 months) without concomitant shoulder pathologies and group II consisted of 26 patients (mean age 48.6 years and mean follow-up 15 months) with coexistent lesions (SLAP lesions, n = 8; SLAP and partial rupture of the RC, n = 4; SLAP, partial rupture of RC and impingement, n = 10; SLAP and impingement, n = 2; and AC arthritis and impingement, n = 2). Preoperatively, the mean ranges of forward flexion (p = 0.221), abduction (p = 0.065), internal rotation (p = 0.564), Constant (p = 0.148) and VAS (p = 0.365) scores were similar between the groups. After a minimum 12 months of follow-up, all patients significantly improved but no statistically significant difference was detected in the mean ranges of forward flexion (152 vs 150; p = 0.902), abduction (137 vs 129; p = 0.095), external rotation (45 vs 40; p = 0.866), internal rotation (5 vs 5 point; p = 0.474), Constant (82 vs 82.3; p = 0.685) and VAS (1.2 vs 1.2; p = 0.634) scores between the groups.
Conclusion: The presence of concomitant shoulder pathologies does not appear to affect the clinical outcomes in patients undergoing arthroscopic capsular release for frozen shoulder.
Level of evidence: Level III, Therapeutic study.

Introduction

Frozen shoulder, also called as adhesive capsulitis, is a common disorder, which causes active and passive movement restriction at the shoulder joint and severe morbidity. Histologically, transformation of fibroblasts of the joint capsule into myofibroblasts causes a decrease in the volume of the joint and contracture occurs.[1–3] The disease is divided into two groups according to the etiology: primary without a known reason and secondary, which can be caused by a surgery or a trauma. Currently, secondary cases classified into three main groups by Zuckerman: intrinsic, extrinsic

This manuscript has not been published, submitted or under consideration for publication elsewhere.

* Corresponding author. Bezmialem Vakif University, Dept. of Orthopedics and Traumatology, Vatan Cd. Fatih, 34093 İstanbul, Turkey. Tel.: +90 212 4531700 2505.
E-mail address: yildizfatih@hotmail.com (F. Yildiz).

Peer review under responsibility of Turkish Association of Orthopaedics and Traumatology.

https://doi.org/10.1016/j.aott.2018.04.002

and systemic.[4] Although its pathology is still unclear, several conservative and surgical treatment options as well as manipulation under anesthesia have been described.[5–9] It is a self-limited disease and most of the times conservative treatment methods provide remission. However about 20%–40% of the patients with adhesive capsulitis do not improve, which is called as resistant, and surgical treatment is needed.[10] Arthroscopic capsular release has been increasingly preferred for this reason.[11,12]

In the treatment of frozen shoulder, arthroscopic capsular release has been reported as a successful method.[13–15] One of the advantages of the arthroscopic capsular release is detection and simultaneous treatment of coexistent intraarticular pathologies such as superior labrum anterior to posterior lesion (SLAP), partial or total tear of the rotatory cuff (RC) and cartilage lesions. In the literature, it is not clear whether additional intraarticular shoulder pathologies are predictors of fair results of the arthroscopic capsular release. Hypothesis of the study was that the results of arthroscopic treatment of the frozen shoulder could be adversely affected by concomitant intraarticular pathologies. The purpose of this study was to compare the results of arthroscopic treatment of the frozen shoulder with or without coexistent shoulder pathologies.

Materials and methods

This study was performed according to the Declaration of Helsinki. One-hundred-ten patients who were diagnosed with frozen shoulder according to the criteria of Codman and Zuckerman, between March 2011 and August 2015, and did not improve after a minimum of six months of conservative treatment period (intraarticular steroid injection and physiotherapy) were included in this retrospective study. The patients with the diseases that neurologically affect the shoulder mobility such as Parkinson disease (n = 2), stroke (n = 2), radicular neuropathy due to cervical lesions (n = 4), thoracic outlet syndrome (n = 2), rheumatoid arthritis (n = 4), undergoing fracture (n = 4) and tumor (n = 2) in the same shoulder were not included in the study. Repaired coexistent full-thickness rotatory cuff (RC) ruptures (n = 8), repaired SLAP (n = 6) and labral tear lesions (n = 4) were excluded from the study because their postoperative rehabilitation protocols were different. However, partial thickness RC tears and SLAP lesions which were not repaired included in the study. The remaining 72 patients who underwent arthroscopic capsular release only were included in the study.

Preoperative and postoperative physical examinations of the shoulders including active and passive ranges of motions (ROMs) were evaluated by a specific shoulder surgeon. The ranges of motions were measured as forward flexion (FF) in scapular plane, abduction (ABD) in coronal plane, external rotation (ER) when elbow in 90° flexion and in arm close to the body, and internal rotation of patient's thumb reaching to spinal column. The ranges were measured using a goniometer, except the range of IR, which was given a score from 0 to 6 according to the level of the thumb (Greater Trochanter: 0 points; Glutea: 2 points; L5-S1: 4 points; L3: 6 points). All patients' shoulder pathologies were evaluated with direct radiographs of the affected shoulders and Magnetic Resonance Imaging (MRI) before surgery. Interventional shoulder arthroscopy was applied to all patients by one specific shoulder surgeon.

Surgical technique

Scalene block anesthesia, which was supported with general anesthesia, was applied to all patients. Patients were prepared in beach chair position and ROMs were evaluated without manipulation under anesthesia (MUA). Standard posterior viewing portal and anterior working portal were used during the release. Postero-inferior portal was also used to reach axillary pouch. Diagnostic arthroscopy was completed for all patients. Existence and the degree of synovitis, capsular and ligamentous thickness, existence of additional shoulder pathologies (SLAP, cuff tear, impingement) in addition to rotator interval width were evaluated. For the additional SLAP lesions, biceps tenotomy; for partial RC tears, debridement; for impingement, subacromial decompression and acromioplasty were performed with standard arthroscopic pancapsular release. The rotator interval was opened, thickened capsular structure, middle glenohumeral ligament (MGHL), coracohumeral ligament and inferior glenohumeral ligament (IGHL) were released. Through postero-inferior accessory portal inferior axillary pouch was reached and released. After the posterior capsular release, a total of 360-degree relaxation was achieved and, shoulder movement was re-evaluated and if satisfactory, the arthroscopy was finalized.

Postoperative care and rehabilitation

Standard rehabilitation protocol was applied to all patients. In order to control pain during the early postoperative rehabilitation period in the hospital, interscalen blockage was continued through a cathater. On the day of surgery, passive forward flexion, abduction and external and internal rotation had been started by a physiotherapist. Active ROMs were allowed as well as the patient tolerated. The patients were discharged at the fifth day postoperatively and daily physiotherapy had been continued under control of a physiotherapist at least for one month.

Seventy-two patients were divided into two groups according to detection of additional lesions in arthroscopy and the groups were compared according to the clinical outcomes including preoperative and postoperative ROMs of the shoulders (FF, ABD, ER and IR), Constant and Visual Analog Scale (VAS) scores. Group I included patients without coexistent shoulder pathologies and group II included patients with additional shoulder lesions, such as partial thickness RC tear, SLAP lesion and subacromial impingement according to MRI and/or arthroscopy, which did not require repair. Age, gender, affected and dominant limbs, conservative treatment periods, postoperative follow-up periods, secondary systemic causes of the frozen shoulder and duration of postoperative interscalen blockage were also recorded from the files of the patients. The lesions were staged clinically according to Reeves and classified arthroscopically according to Nevasier.[16,17] Intraoperative and postoperative complications were also recorded.

Statistical analyses

Categorical data were compared between the groups using Pearson Chi-Square and Fisher's exact tests. The differences between the groups were evaluated by the Mann–Whitney U test. Assessment of the groups individually was made with Wilcoxon signed rank test. The correlation between variables was evaluated using Spearman's rank correlation coefficient of r. $P < 0.05$ was defined as statistical significance.

Results

Group I consisted of 46 patients without additional shoulder pathologies and group II consisted of 26 patients with accompanying lesions, which were detected during shoulder arthroscopy (Table 1). All patients were staged clinically and classified arthroscopically according to Reeves and Nevasier (Table 2). In the second group, eight patients had concomitant SLAP lesions, four patients had SLAP and partial rupture of the RC, ten patients had SLAP + partial rupture of RC + impingement, two patients had SLAP + impingement and two patients had AC arthritis and impingement.

Table 1
Demographic data of the groups.

		Group I (n = 46)	Group II (n = 26)	p-value
Mean age (years)		47.2 (4.1)	48.6 (8.3)	0.463
Sex	Male	2	10	**<0.001**
	Female	44	16	
Affected limb side	Right	42	18	**<0.001**
	Left	4	8	
Dominant limb side	Right	38	24	0.311
	Left	8	2	
Number of secondary systemic causes of frozen shoulder		16	10	0.755
The mean conservative treatment period (mth)		7.9 (2.1)	8 (2.3)	0.751
The mean f-u. (mth)		26 (8.4)	15 (3.6)	**<0.001**

Bold values were statistically significant differences between the groups in terms of gender distribution, affected limb sides and mean follow up times.

Table 2
Clinical staging and arthroscopic classifications of the patients in each group.

	Clinical staging (Reeves)		Arthroscopic classification (Nevasier)	
	Group I	Group II	Group I	Group II
Type 1	22	4	8	–
Type 2	18	22	16	8
Type 3	6	–	22	18

Although distribution of the genders and affected extremity sides were not equal between the groups, distribution of the mean ages, dominant limb sides and of the number of secondary systemic causes of the frozen shoulder were homogenous between the groups. Group I consisted of 16 secondary systemic causes of frozen shoulder in 15 patients: Diabetes mellitus in 14 patients and thyroid gland pathologies in 2 patients. In group II, two patients had guatr and 8 patients had diabetes mellitus ($p = 0.755$). The mean conservative treatment periods were also similar between the groups. Even though there was a significant difference between the mean postoperative follow-up periods of the groups, each patient had been followed-up for at least one year.

The mean preoperative ranges of FF, ABD and IR, Constant and VAS scores were similar between the groups (Table 3). Although the mean preoperative ER range was found statistically higher in group I than the group II ($-5°\pm6°$ vs. $5°\pm10°$; $p < 0.001$), this difference is very small and may not have clinical significance.

Within each group, range of motions in every direction, Constant and VAS scores of the patients were found to be significantly improved at the last follow-up, compared to their preoperative values ($p < 0.001$ for each outcome parameter). Between the groups, the mean ranges of postoperative FF, ABD, ER and IR, Constant and VAS scores were not different statistically.

Table 3
The mean ROMs of the shoulders (degree), and Constant and VAS scores, pre- and postoperatively.

		Group 1	Group 2	p-value
Forward flexion	Preop	43 (4)	52 (21)	0.221
	F-u	152 (11.1)	150 (14)	0.902
Abduction	Preop	45 (6)	54 (20)	0.065
	F-u	137 (17)	129 (17)	0.095
External rotation	Preop	−5 (6)	5 (10)	**<0.001**
	F-u	45 (13)	40 (7)	0.866
Internal rotation[a]	Preop	2 (1)	2 (2)	0.564
	F-u	5 (1)	5 (2)	0.474
Constant score	Preop	21 (4)	24 (8)	0.148
	F-u	82 (7)	82 (9)	0.685
VAS score	Preop	7.8 (0.5)	7.7 (1)	0.365
	F-u	1.2 (0.6)	1.2 (0.8)	0.634

F-u: The last follow-up.
Bold values signifies the mean amount of preoperative external rotation was statistically higher in group 2.
[a] Internal rotation amount defined as the point referring to the levels that the thumb reaches (Greater trochanter: 0 point; Glutea: 2 points; L5-S1: 4 points and L3: 6 points). Other ROM measures are in angle of rotation.

The mean interscalen blockage durations were 4 ± 2 days in group I and 4 ± 1 days in group II ($p = 0.523$). In the study, duration of scalen block was found to be correlated with postoperative VAS ($r = -0.532$, $p < 0.001$), Constant ($r = 0.580$, $p < 0.001$) scores and ranges of FF ($r = 0.634$, $p < 0.001$), ABD ($r = 0.384$, $p < 0.001$), IR ($r = 0.422$, $p < 0.001$) and ER ($r = 0.571$, $p < 0.001$).

In the study, no correlation was found between age of the patients, conservative treatment periods or postoperative follow-up times and the functional results, Constant or VAS scores.

There was not any complication in group I, however in group II, one patient had transient Horner's syndrome due to the scalene catheter, two patients had superficial infections who were treated with medications, and three patients had recurrence of frozen shoulder disease. Only one complication affected the final result of a patient.

Discussion

When Codman first described the term 'frozen shoulder' in 1934, he stated that 'A class of cases which are difficult to define, difficult to treat and difficult to explain from the point of view of pathology'.[18] Although several conservative and surgical treatment options have been developed for the treatment of adhesive capsulitis, today, we know that it is a self-limited disease and most of the time it resolves spontaneously within months to years. However, its pathology, interaction with other intra and extraarticular lesions and best treatment options still need to be explained.

In the diagnosis of adhesive capsulitis with the MRI or during its arthroscopic treatment, some coexistent intraarticular pathologies such as partial or total RC tears, SLAP lesions or subacromial impingement are sometimes diagnosed. In the literature, prognostic factors for the operative and nonoperative treatment of stiff shoulder have been identified as etiology of stiffness, age of 60 years or over and external rotation under 0° on the first visit.[15,19] However, effect of concomitant intraarticular lesions on the results of arthroscopic release of the frozen shoulder remains unclear. This study was performed to investigate whether the concomitant intraarticular shoulder pathologies are predictors of unfavorable outcomes of the arthroscopic capsular release. We found that, at the final follow up, the mean ROMs of the shoulders, Constant and VAS scores had been improved significantly compared to their preoperative values, however they were not significantly different between the groups with or without additional shoulder lesions. We think the reason for the similar outcomes between the groups was that frozen shoulder resulted from the disease of the joint capsule containing coracohumeral and glenohumeral ligaments, and other intraarticular lesions such as SLAP, partial RC tear or

impingement do not have an adverse effect on the joint capsule and the ligaments.[20,21] In the pathology of the frozen shoulder, several studies showed that it is not an inflammatory condition and do not involve the synovium.[2] However, intrinsic etiologies of the secondary frozen shoulder include RC disorders, biceps tendonitis or calcific tendonitis.[4]

In our study, we excluded patients who underwent arthroscopic capsular release and RC repair in the same session, but in a recent study by McGrath et al, 25 patients who received a concomitant RC repair and MUA with or without arthroscopic capsular release for stiffness in the same shoulder compared with 170 RC repair-only patients and they found no difference in ROM except in the range of internal rotations, at 2 years.[22] Although preoperative ranges of FF (104° vs. 51°), ABD (81° vs. 43°), ER (29° vs. −4.8°) and IR (S2 level vs. below gluteal level) were apparently better in their stiffness group compared to our concomitant lesion group (group II), our final results were similar to their results FF (150°), ABD (129°), ER (40°) and IR (T12) at two years.

Continuous interscalane nerve block is an effective method for pain management after arthroscopic release of adhesive capsulitis.[23] It is also useful for maintenance of effective physical therapy early in the postoperative period. In our study, the mean interscalen blockage durations were similar between the groups. More importantly we found that duration of scalen blockage was significantly correlated with the postoperative functional results and pain. We had one complication related to scalene catheter but we believe that the anesthesiologists who specialized in the application of regional anesthesia can overcome the potential complications.

The functional results and pain after the arthroscopic capsular releases were not found to be different between the groups however, the number of complications was higher in the shoulders with the coexistent pathologies. Our complication rate was similar to the literature.[24,25] There was no complication in stiff shoulder-only group (0/46), however we observed six complications in coexistent lesions group (6/26). One of these complications was transient Horner's syndrome and we think that this complication was not related to the surgery or additional intraarticular pathology but caused by inappropriate placement of the scalene cathater.

One of the strengths of this study was having a control group. To our knowledge, no other studies in the literature compared the early clinical results of the arthroscopic capsular release in the treatment of frozen shoulder with or without concomitant intraarticular pathologies. Another strength of the study was having one single surgeon performed all the surgeries and measurements of the preoperative and postoperative ranges of motions.

Limitations

We had some limitations in this study. First, it was not a randomized, controlled study but was a retrospective study design. Comparing with one another group including concomitant RC repair and capsular release, which is a recent interest in the literature could be better. Small number of patients and differences in the mean follow-up periods between the groups were another limitations.

Conclusion

In the treatment of adhesive capsulitis, existence of additional internal shoulder pathologies, which do not require surgical reconstruction or repair such as RC repair, does not deteriorate clinical outcomes of the arthroscopic capsular release.

Conflicts of interest

All authors state that they have no conflict of interest.

References

1. Hand GC, Athanasou NA, Matthews T, Carr AJ. The pathology of frozen shoulder. *J Bone Joint Surg Br*. 2007;89(7):928–932.
2. Bunker TD, Anthony PP. The pathology of frozen shoulder. A Dupuytren-like disease. *J Bone Joint Surg Br*. 1995;77(5):677–683.
3. Bunker TD, Reilly J, Baird KS, Hamblen DL. Expression of growth factors, cytokines and matrix metalloproteinases in frozen shoulder. *J Bone Joint Surg Br*. 2000;82(5):768–773.
4. Zuckerman JD, Rokito A. Frozen shoulder: a consensus definition. *J Shoulder Elbow Surg*. 2011;20(2):322–325.
5. Uppal HS, Evans JP, Smith C. Frozen shoulder: a systematic review of therapeutic options. *World J Orthop*. 2015;6(2):263–268.
6. Griggs SM, Ahn A, Green A. Idiopathic adhesive capsulitis. A prospective functional outcome study of nonoperative treatment. *J Bone Joint Surg Am*. 2000;82-A(10):1398–1407.
7. Arslan S, Celiker R. Comparison of the efficacy of local corticosteroid injection and physical therapy for the treatment of adhesive capsulitis. *Rheumatol Int*. 2001;21(1):20–23.
8. Dodenhoff RM, Levy O, Wilson A, Copeland SA. Manipulation under anesthesia for primary frozen shoulder: effect on early recovery and return to activity. *J Shoulder Elbow Surg*. 2000;9(1):23–26.
9. Canbulat N, Eren I, Atalar AC, Demirhan M, Eren SM, Ucak A. Nonoperative treatment of frozen shoulder: oral glucocorticoids. *Int Orthop*. 2015;39(2):249–254.
10. Snow M, Boutros I, Funk L. Posterior arthroscopic capsular release in frozen shoulder. *Arthroscopy*. 2009;25(1):19–23.
11. Warner JJ, Allen A, Marks PH, Wong P. Arthroscopic release for chronic, refractory adhesive capsulitis of the shoulder. *J Bone Joint Surg Am*. 1996;78(12):1808–1816.
12. Berghs BM, Sole-Molins X, Bunker TD. Arthroscopic release of adhesive capsulitis. *J Shoulder Elbow Surg*. 2004;13(2):180–185.
13. Nicholson GP. Arthroscopic capsular release for stiff shoulders: effect of etiology on outcomes. *Arthroscopy*. 2003;19(1):40–49.
14. Andersen NH, Sojbjerg JO, Johannsen HV, Sneppen O. Frozen shoulder: arthroscopy and manipulation under general anesthesia and early passive motion. *J Shoulder Elbow Surg*. 1998;7(3):218–222.
15. Trsek D, Cicak N, Zunac M, Klobucar H. Functional results and patient satisfaction after arthroscopic capsular release of idiopathic and post-traumatic stiff shoulder. *Int Orthop*. 2014;38(6):1205–1211.
16. Neviaser RJ, Neviaser TJ. The frozen shoulder. Diagnosis and management. *Clin Orthop Relat Res*. 1987;223(2):59–64.
17. Reeves B. The natural history of the frozen shoulder syndrome. *Scand J Rheumatol*. 1975;4(4):193–196.
18. Codman E. Tendinitis of the short rotators. In: Todd T, ed. *The Shoulder: Rupture of the Supraspinatus Tendon and Other Lesions in or about the Subacromial Bursa*. 1934. Boston MA.
19. Ando A, Sugaya H, Hagiwara Y, et al. Identification of prognostic factors for the nonoperative treatment of stiff shoulder. *Int Orthop*. 2013;37(5):859–864.
20. Hagiwara Y, Ando A, Onoda Y, et al. Coexistence of fibrotic and chondrogenic process in the capsule of idiopathic frozen shoulders. *Osteoarthr Cartil*. 2012;20(3):241–249.
21. Lundberg BJ. The frozen shoulder. Clinical and radiographical observations. The effect of manipulation under general anesthesia. Structure and glycosaminoglycan content of the joint capsule. Local bone metabolism. *Acta Orthop Scand*. 1969;40(Suppl. 119):1–59.
22. McGrath JP, Lam PH, Tan MT, Murrell GA. The effect of concomitant glenohumeral joint capsule release during rotator cuff repair-a comparative study. *J Shoulder Elbow Surg*. 2016;25(5):714–722.
23. Ilfeld BM. Continuous peripheral nerve blocks: a review of the published evidence. *Anesth Analg*. 2011;113(4):904–925.
24. Dattani R, Ramasamy V, Parker R, Patel VR. Improvement in quality of life after arthroscopic capsular release for contracture of the shoulder. *Bone Joint J*. 2013;95-B(7):942–946.
25. Le Lievre HM, Murrell GA. Long-term outcomes after arthroscopic capsular release for idiopathic adhesive capsulitis. *J Bone Joint Surg Am*. 2012;94(13):1208–1216.