Arthroscopic capsular release and subacromial decompression for treatment of refractory posttraumatic frozen shoulder

Tarek M. Ghandour, Amr A. Abdelrahman

Department of Orthopedic, Faculty of Medicine, Ain Shams University, Cairo, Egypt

Correspondence to Tarek M. Ghandour, MD, Department of Orthopedic, Faculty of Medicine, Ain Shams University, Cairo, 145674, Egypt. Tel: +20 102 027 8000; e-mail: tarekghndr@yahoo.com

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Introduction
Bony or soft tissue trauma to the shoulder can lead to a degree of posttraumatic stiffness or pain. The stiffness is due to a combination of capsular contracture and extracapsular adhesions. The initial management is usually conservative. When it fails, treatment that is more aggressive should be done.
Objectives
To evaluate the effectiveness of arthroscopic capsular release and subacromial decompression for treatment of refractory posttraumatic frozen shoulder.
Patients and methods
The study included 22 patients, with mean age of 43.5±12.2 years. A total of 12 patients had fracture proximal humeral end, three patients had mid-shaft fracture, and seven patients had shoulder soft tissue injury. Patients underwent arthroscopic circumferential capsular and subacromial release under general anesthesia, without violation of the subscapularis tendon or the labrum
Results
Collective visual analog pain scores (at rest, with normal activities, with strenuous activities) showed progressive highly statistically significant decrease throughout the follow-up period from 18.8±2.6 preoperatively to 4±1.6 6 months postoperatively (P=0.0001). The mean modified American shoulder and elbow surgeon scores improved from 45.5 preoperatively to 59.3 postoperatively. Forward flexion improved from 93° preoperatively to 140° postoperatively. Adduction-external rotation improved from 26.9 preoperatively to 42.2° postoperatively. Abduction external rotation improved from 24.8° preoperatively to 47° postoperatively.
Conclusion
Arthroscopic capsular release and subacromial decompression is an effective method in the treatment of refractory posttraumatic frozen shoulder, alleviating pain and restoring a functional range of motion to the shoulder.

Keywords:
frozen, shoulder-posttraumatic, stiff

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Introduction

Stiffness of shoulder is a common disorder in which there is restriction of passive and active range of motion of the shoulder, which is associated with pain. Stiff shoulder can be divided by etiology into primary or secondary, determined by the presence or absence of causes, such as trauma [1,2] Secondary shoulder stiffness may occur after surgery or trauma such as fracture, dislocation, or injury of the soft tissue. Posttraumatic frozen shoulder owing to bony or soft tissue trauma to the shoulder girdle may lead to posttraumatic pain or stiffness [3,4]. The stiffness is typically due to a combination of capsular contracture and extracapsular adhesion [2,5,6]. Pain can be controlled early, but stiffness can persist even if the initiating factor like fracture has healed [7].

The initial treatment is always conservative with manipulation under general anesthesia a treatment option but has been associated with complication including humeral fracture. Other treatment options include locoregional anesthesia and conventional rehabilitation below the pain threshold [visual analog scale (VAS) <6] with installation of an interscalene catheter and hydraulic capsule distension [8–10] Several studies have shown cases with refractory shoulder stiffness where conservative treatment fails and where there is long-term residual pain and limitation of motion. This type of patient needs surgery [2,5,6,11]. Arthroscopic capsular release is useful treatment for posttraumatic stiff shoulder [5].

The purpose of this prospective study was to evaluate the effectiveness of arthroscopic capsular release and subacromial decompression for treatment of refractory

posttraumatic frozen shoulder that resists conservative treatment.

Patients and methods

This prospective study was stretched over a period of 36 months (from August 2010 until September 2013). The study was approved by the institutional ethics committee in the Orthopedic Department of Orthopaedic Surgery, Ain Shams University, Cairo, Egypt. The study included 22 patients (14 males and eight females), with a mean age of 43.5±12.2 years (range, 22–65 years). Cause of initial trauma was vehicle accident in 13 patients, four patients were fractured secondary to sliding/falling trauma, three patients had rotator cuff repair, and two patients had recurrent shoulder dislocation repair. A total of 12 patients had fracture proximal humeral end, three patients had mid-shaft fracture, and seven patients had shoulder soft tissue injury. The duration of symptoms was less than 12 months in 16 patients and more than 12 months in six patients. We assessed the patients according to modified American shoulder and elbow surgeon scores and VAS.

Inclusion criteria for patients were as follows:

(1) Patients with a frozen shoulder, at least 3 months of pain and stiffness of shoulder.
(2) The cause of the frozen shoulder should be definably posttraumatic.
(3) Restricted passive and active glenohumeral and scapulothoracic range of motion (<100° of abduction and <50% of external rotation as compared with the contralateral side).

Our exclusion criteria were as follows:

(1) Primary frozen shoulder.
(2) Insulin-dependent diabetic patients.
(3) Degenerative arthritis of glenohumeral joint.
(4) Full-thickness rotator cuff tear at time of surgery.
(5) Recent fracture or trauma.
(6) Severe neurological deficit of the affected limb.
(7) Rheumatoid arthritis (excluded using 2010 ACR-EULAR classification criteria for rheumatoid arthritis) [12].

Preoperative planning

We used plain radiography of the shoulder, including true glenohumeral anteroposterior radiographs with the arm in maximal internal and external rotation and an axillary view, in addition to MRI of the glenohumeral articulation to assess the cause of stiffness and to exclude patients with full-thickness rotator cuff tear at the time of surgery.

Surgical technique

All patients were operated on in the beach-chair position. Passive range of motion was documented under general anesthesia and before surgery. We used standard posterior portal. After insertion of the arthroscope, we established anterior portal in the rotator interval from outside in. Arthroscopic examination of the glenohumeral joint was done. The humeral head was tightly opposed to the glenoid, and the capsule was thicker and less compliant than in other shoulder conditions. We start by releasing of the rotator interval using radiofrequency 3.0-mm 90° Arthrowand (Arthro Care, Sunnyvale, California, USA) through anterior portal without the use of a cannula until we see a conjoint tendon of the coracoid process to completely release the coracohumeral ligament. Then. the release of the anterior capsule proceeded inferiorly where the anterior capsule and glenohumeral ligaments were released just lateral to glenoid labrum without violation of the labrum and subscapularis tendon. Then we shifted the scope to the anterior portal, and the radiofrequency probe was introduced through the posterior portal to release the posterior capsule just lateral to the glenoid labrum to meet anterior release at 6 o'clock position of glenoid. Then, subacromial examination was done through posterolateral portal where intrabursal and /or extrabursal adhesions were found and released using radiofrequency probe and motorized shaver through anterolateral portal. Acromioplasty was done in 10 patients.

Postoperative care

Postoperative care included pendulum exercises, which were started from the first day postoperatively, elevation in the scapular plane, passive external rotation with a stick, and internal rotations were emphasized. Patients were instructed to do their exercises at home three to four times a day, with each session lasting only 10–15 min. Warm moist heat was used before and ice after the sessions.

Patients underwent outpatient physical therapy from the second postoperative day, three times per week for 6 weeks, and only range of motion was emphasized; no machines, resistive exercises, or weights were allowed until pain-free motion had been restored. After that, usually at 6–8 weeks, light resistive strengthening was started.

Results

All patients passed smooth intraoperative course without complications, with a mean operative duration of 45±13.5 min (range, 30–75 min). The mean postoperative hospital stay was 18.6±4.3 h (range, 12–24 h).

Collective VAS score, VAS score at rest, VAS score with normal activities, and VAS score with strenuous activities showed progressive significant decrease throughout the follow-up period till 6-month postoperatively compared with preoperative scores (Table 1).

At 6 months postoperatively, the mean total American shoulder and elbow surgeon was 59.3±5.4 (range, 50–69) compared with 45.5±7.9 (range, 28–56) preoperatively (P=0.0003) (Table 2).

Mobility

At 6 months postoperatively, the forward flexion improved from 93° (range, 65–132°) preoperative to 140° (range, 120–160°) postoperative (P=0.0004). Adduction-external rotation improved from 26.9° (range, 9–45°) preoperative to 42.2° (range, 25–70°) postoperative (P=0.0009). Abduction-external rotation improved from 24.8° (range, 12–55°) preoperative to 47° (range, 30–80°) postoperative (P=0.0008) (Table 3).

Table 1 Differential and collective pain scoring at follow-up visits compared with preoperative scores

Mean VAS scores	Preoperative	1-month PO	3-month PO	6-month PO
At rest	4.7±0.8	2.1±0.7	1.2±1	0.6±0.7
With normal activities	6.5±1.4	4±1.1	2±1.6	1±0.7
With strenuous activities	7.6±0.7	5.4±1.2	3.3±0.9	2.3±0.6
Collective VAS pain score	18.8±2.6	11.5 ±2.3	6.5±2.5	4±1.6

Data are presented as mean±SD. PO, postoperative; VAS, visual analog scale.

Table 2 Components and total American shoulder and elbow surgeon score determined at 6 months postoperatively compared with preoperative scores

	Preoperative	6-month PO	Statistical analysis
Collective pain VAS score	18.8±2.6 (15–23)	4±1.6 (2–7)	t=22.024, P=0.0001
Total ASES score	45.5±7.9 (28–56)	59.3±5.4 (50–69)	t=14.336, P=0.0003

Data are presented as mean±SD (range). ASES, American shoulder and elbow surgeon; PO, postoperative; VAS, visual analog scale.

Patient satisfaction after surgery and after the rehabilitation

Six months after the surgery, the patients were asked to what extent they were satisfied with their shoulder function. A total of18 patients reported that they are very satisfied. Two patients were satisfied; they attributed this due to presence of pain with strenuous activity which necessitates the intake of analgesics. Two patients claimed that they were not satisfied as they were manual workers and their arm function did not fulfill their work needs.

Discussion

Posttraumatic shoulder stiffness is a common complaint. As opposed to idiopathic stiff shoulder, physical therapy does not show significant results in a certain number of patients with posttraumatic contracture, which is the result of a fracture, dislocation, or damage of soft tissue structures, and especially in patients who did not undergo adequate physical therapy. In such cases, after failure of conservative treatment, it is necessary to perform surgery. The most common cause of posttraumatic contracture is shortening of soft tissue, primarily inflammations, and later capsular thickening [2,5,13,14]. The subacromial space is more commonly involved in the posttraumatic stiffness than in case of idiopathic frozen shoulder [2,14–16]. Arthroscopic release has been a successful method of addressing patients who developed a stiff shoulder after a prior trauma. It allows precise and controlled release of capsular contractures in cases of posttraumatic shoulder stiffness [17,18]. However, we recommend that in case of pain and stiffness owing to degenerative arthritis of glenohumeral joint, untreated full-thickness rotator cuff tear, recent fracture or trauma, and severe neurological deficit of affected limb, the primary problem must be addressed first before considering arthroscopic release.

Table 3 Angle of movements assessed at 6-month postoperative compared with preoperative measurements of studied patients

Movement	Preoperative	6-month PO	Statistical analysis
Forward flexion	93±18.4 (65–132)	140±11.2 (120–160)	t=11.832, P=0.0004
Adduction-external rotation	26.9±11.1 (9–45)	42.2±14.9 (25–70)	t=4.147, P=0.0009
Abduction-external rotation	24.8±10.3 (12–55)	47±16.8 (30–80)	t=5.248, P=0.0008
Abduction-internal rotation	37.6±19.9 (12–80)	66±20.2 (35–110)	t=4.878, P=0.0009

Data are presented as mean±SD (range). PO, postoperative.

Gerber *et al.* [19] reported on the results of arthroscopic capsular release in 45 patients with shoulder stiffness. They divided the patients according to the etiology of stiffness into three groups: idiopathic (nine patients), postoperative (21 patients), and posttraumatic (15 patients). They found that the outcome after treatment of idiopathic stiffness was better than after postoperative stiffness and that the results of treatment for posttraumatic stiffness were least favorable. They reported that all patients improved regarding function and pain, but the only improvement that did not reach statistical significance was the improvement in the ability to work.

Nicholson [14] reported a considerable improvement of mobility and shoulder function along with reduced pain in the group of 68 patients who were divided into five groups and who underwent arthroscopic capsular release. The groups were postsurgical in 20, idiopathic in 17, posttraumatic in 15, diabetic in eight, and impingement syndrome in eight. Nicholson reported that arthroscopic capsular release was equally effective across the five identified etiologic groups and provided significant pain relief, restoration of motion, and function within an average of 3 months.

In the current study, range of motion significantly improved compared with preoperative values. Our results are comparable to the results of Trsek *et al.* [2], who reported 50 patients, where 25 of them had posttraumatic stiffness (second group). The mean active forward flexion, external rotation, and internal rotation increased from 95°, 13°, and the L4 vertebral level to 170°, 49°, and the L1 vertebral level, respectively. In 2001, Holloway *et al.* [15] reported on 50 patients with capsular contracture who were treated with arthroscopic capsular release. They demonstrated results comparable to our results regarding improvement in range of motion.

Levy *et al.* [5] reported that the group, consisting of 21 patients who suffered from posttraumatic shoulder contracture as a consequence of fracture, underwent an arthroscopic capsular release, and experienced a considerable mobility improvement. Mobility was decreased in the first 6 months, but after that, the patients' condition improved. The authors explained that the patients were on their own in the first 6 months, where physical therapy was involved. After the period of 6 months, a natural healing process occurred. Trsek *et al.* [2] reported that the most important parameters of mobility in their study occurred 48 h after the surgery while the patients had still been under the influence of analgesics. After that, a month after the surgery, a decreased shoulder mobility occurred in both groups, but in the period of 6 months after the surgery, mobility gradually increased; however, it did not increase to the level of mobility just after the surgery. The reason for that is a complete lack of pain owing to analgesic effect immediately after the surgery and a later tendency to soft tissue structure shortening, especially the joint capsule. In our study, the shoulder mobility increased gradually postoperatively to reach the intraoperative level by the sixth-month postoperatively. We attributed this to the immediate postoperative rehabilitation program, which started on the first day of surgery, and the home exercises program and the close follow-up of the patients during the first 6 months postoperatively.

Complications occurring after arthroscopic capsular release involved recurrence, axillary nerve palsy, and postsurgical shoulder dislocation [16,20,21]. In our cases, none of these complications were encountered.

We did release of the anterior and posterior capsule, without violation or release of the subscapularis tendon followed by subacromial decompression and recession of the coracoacromial ligament. We agreed with Levy *et al.* [5]. The subscapularis tendon is not contractured, and it is not necessary to be released.

Arthroscopic capsular release combined with subacromial decompression is therefore a reliable treatment for improving range of motion in patients with refractory post-traumatic frozen shoulder. Advantages of the proposed technique include a minimally invasive approach, decreasing manual manipulation force required, and the opportunity to examine the patient under anesthesia. Limitations to this technique include a lack of available data to support the treatment over physical therapy.

The points of weakness of this article are the small sample size, when the data were stratified, and we were unable to define which type of pathology resulted in a less favorable outcome after arthroscopic capsular release for post-traumatic shoulder stiffness.

Conclusion

Arthroscopic capsular release and subacromial decompression offers a safe and effective method for the treatment of refractory posttraumatic frozen shoulder, alleviating pain and restoring a functional range of motion to the shoulder.

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Conflicts of interest
There are no conflicts of interest.

References

1 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 Suppl 1969; 119:1–59.

2 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; 38:1205–1211.

3 Goldberg BA, Scarlat MM, Harryman DTII. Management of the stiff shoulder. J Orthop Sci 1999; 4:462–471.

4 Koval KJ, Gallagher MA, Marsicano JG, Cuomo F, McShinawy A, Zuckerman JD. Functional outcome after minimally displaced fractures of the proximal part of the humerus. J Bone Joint Surg Am 1997; 79:203–207.

5 Levy O, Webb M, Even T, Venkateswaran B, Funk L, Copeland SA. Arthroscopic capsular release for posttraumatic shoulder stiffness. J Shoulder Elbow Surg 2008; 17:410–414.

6 Warner JJ, Allen A, Marks PH, Wong P. Arthroscopic release for chronic, refractory adhesive capsulitis of the shoulder. J Bone Joint Surg Am 1996; 78:1808–1816.

7 Bunker TD, Anthony PP. The pathology of frozen shoulder. A Dupuytren-like disease. J Bone Joint Surg Br 1995; 77:677–683.

8 Detaille V, Busnel F, Ravary H, Jacquot A, Katz D, Allano G. Use of continuous interscalene brachial plexus block and rehabilitation to treat complex regional pain syndrome of the shoulder. Ann Phys Rehabil Med 2010; 53:406–416.

9 Gleyze P, Clavert P, Flurin PH, Laprelle E, Katz D, Toussaint B, *et al.* Management of the stiff shoulder. A prospective multicenter comparative study of the six main techniques in use: 235 cases. Orthop Traumatol Surg Res 2011; 97(8 Suppl):S167–S181.

10 Halverson L, Maas R. Shoulder joint capsule distension (hydroplasty): a case series of patients with 'frozen shoulders' treated in a primary care office. J Fam Pract 2002; 51:61–63.

11 Hill JJJr, Bogumill H. Manipulation in the treatment of frozen shoulder. Orthopedics 1988; 11:1255–1260.

12 Villeneuve E, Nam J, Emery P. ACR-EULAR classification criteria for rheumatoid arthritis. Rev Bras Reumatol 2010; 50:481–483.

13 Tauro JC, Paulson M. Shoulder stiffness. Arthroscopy 2008; 24:949–955.

14 Nicholson GP. Arthroscopic capsular release for stiff shoulders: effect of etiology on outcomes. Arthroscopy 2003; 19:40–49.

15 Holloway GB, Schenk T, Williams GR, Ramsey ML, Iannotti JP. Arthroscopic capsular release for the treatment of refractory postoperative or post-fracture shoulder stiffness. J Bone Joint Surg Am 2001; 83-A:1682–1687.

16 Warner JJ, Allen AA, Marks PH, Wong P. Arthroscopic release of postoperative capsular contracture of the shoulder. J Bone Joint Surg Am 1997; 79:1151–1158.

17 De Carli A, Vadala A, Perugia D, Frate L, Iorio C, Fabbri M, *et al.* Shoulder adhesive capsulitis: manipulation and arthroscopic arthrolysis or intra-articular steroid injections?. Int Orthop 2012; 36:101–106.

18 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: 942–946.

19 Gerber C, Espinosa N, Perren TG. Arthroscopic treatment of shoulder stiffness. Clin Orthop Relat Res 2001; 390:119–128.

20 Watson L, Dalziel R, Story I. Frozen shoulder: a 12-month clinical outcome trial. J Shoulder Elbow Surg 2000; 9:16–22.

21 Harryman DTII. Shoulders: frozen and stiff. Instr Course Lect 1993; 42:247–257.