# Arthroscopic rotator interval release for frozen shoulder

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**Background**
Frozen shoulder, first described by Codman in 1934, is the third most common cause of pain in the musculoskeletal system. It can be classified as either primary or secondary. The long period of pain and disability has been the reason for many different types of intervention. Various interventions, including analgesics, steroids, distension, physical therapy, manipulation under anesthesia, and arthroscopy or open surgery, were reported with mixed results. There is controversy in the literature as to the optimal method of release.

**Objectives**
The aim of our study was to assess the effectiveness of arthroscopic rotator interval release in patients with frozen shoulder.

**Patients and methods**
Rotator interval release was performed for 40 shoulders in 39 patients (17 men and 22 women). The mean age of the patients was 48.5 years. The right side was affected in 25 patients, the left side was affected in 13 patients, and one patient had bilateral affection. The dominant side was affected in 30 patients.

**Results**
The mean duration of follow-up was 6 months. With respect to range of motion, the mean of flexion improved by 100°, the mean of external rotation at 0° improved by 70°, the mean of abduction improved by 120°, and the mean of internal rotation at 0° increased by seven points according to the constant shoulder score. There was a marked improvement in pain postoperatively; 32 patients had no pain, whereas seven patients with eight shoulders had mild pain.

**Conclusion**
Arthroscopic rotator interval release is a simple and effective method for treating patients with frozen shoulder, allowing for early postoperative rehabilitation.

**Keywords:**
frozen shoulder, rotator interval, subacromial decompression

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## Introduction

Frozen shoulder, first described by Codman in 1934, is the third most common cause of pain in the musculoskeletal system [1–4].

Its prevalence in the general population is about 2–5%, and it is more common at the age of 40–60 years [1,2,5–7]. The nondominant side is more often affected, 6–17% of patients have bilateral involvement, and there is a slight female preponderance with a female-to-male ratio of about 1.4 [1,8].

Frozen shoulder can be classified as either primary or secondary. The primary form has an idiopathic pathogenesis, whereas secondary frozen shoulder is diagnosed when restricted motion is related to a known cause such as trauma, diabetes mellitus, cervical disease, hyperthyroidism, ischemic heart disease, and others [5,9–11].

The natural history of idiopathic frozen shoulder syndrome is considered benign [4]. Although the literature states that even the most severe cases recover with or without treatment in about 2 years, more recent opinion is that there is a residual restriction of motion in 40–60% of patients. However, functional limitations are only mild [4,12].

The underlying pathology is still uncertain; genetic factors and abnormal production of cytokines have been described, leading to reactive fibrosis of the capsule and of the rotator interval with decreased capsular volume, loss of axillary articular recess, and loss of subscapularis bursa [4,12].

The long period of pain and disability has been the reason for many different types of intervention [4]. The primary objective in the treatment of frozen shoulder with stiffness is to improve or restore the shoulder range of motion. Various interventions, including analgesics, steroids, distension, physical therapy, manipulation under anesthesia, and arthroscopy or open surgery, were reported with mixed results [4,13].

Manipulation under anesthesia is the established method of treatment [14]. It may, however, be

associated with a risk for fracture of the surgical neck/humeral diaphysis, lesions of the rotator cuff, or injury to the long head of the biceps [5]. With advances in the arthroscopic technique, arthroscopic release was believed to be an effective method for the recalcitrant patients resistant to conservative treatment, as well as a safe procedure with fewer potential risks for injury to the rotator cuff or biceps tendon or fracture of the humeral surgical neck [5,10,13].

There is controversy in the literature as to the optimal method of release. Some authors recommend subscapularis release in association with the standard anteroinferior release. A number of authors have also recommended posterior capsular release to improve internal rotation [5,15,16].

The aim of our study was to assess the effectiveness of arthroscopic rotator interval release with or without subacromial decompression in patients with frozen shoulder. Our hypothesis was that arthroscopic rotator interval release with or without subacromial decompression would be effective in treating patients with primary and secondary frozen shoulder.

## Patients and methods

Between May 2008 and November 2010, we performed rotator interval release with or without subacromial decompression for 40 shoulders in 39 patients in Ain Shams University Hospitals.

Inclusion criteria were:

(1) Patients with shoulder limitation in all directions, especially in external rotation in 0°.
(2) Night pain and/or shoulder dysfunction affecting the patient's occupation or sleep.
(3) No response to conservative treatment (NSAID, physiotherapy, local corticosteroid injection) for at least 3 months.

Patients were excluded from our study if a significant tear of the labrum, biceps tendon, or rotator cuff was found during arthroscopy because the rehabilitation protocol is different from only capsular release.

Of the 40 patients, there were 17 men and 22 women; the right side was affected in 25 patients, the left side was affected in 13 patients, and one patient had bilateral affection. The dominant side was affected in 30 patients.

Fifteen patients were known to be diabetic at the time of presentation (12 noninsulin dependent and three insulin dependent), whereas three patients were discovered to be diabetic during the preoperative investigations and did not receive any treatment before for diabetes mellitus.

Three patients had ischemic heart disease and had undergone cardiac catheterization before.

The mean age of the patients was 48.5 years (range 38–60 years); the mean age of the female patients was 51.1years and the mean age of the male patients was 44.8 years.

Eleven patients related their condition to a history of minor trauma such as sudden unusual movement, lifting heavy object, or direct hit of the affected shoulder.

The preoperative range of motion was examined and measured with the patient seated with scapular fixation. The internal rotation was assessed according to the constant shoulder score.

### Radiologic assessment

Plain radiographs were performed as a routine in all patients. Anteroposterior (AP) view and AP view in maximum abduction were performed; no significant finding was detected in AP view except for osteopenia in 10 patients. Scapular rotation was noticed in AP views in abduction.

MRI was not performed routinely in all patients; it was performed in patients with suspected shoulder impingement. Fourteen patients with primary frozen shoulder had already undergone MRI; the MRI showed indistinct edematous inferior capsule (axillary pouch) on T2WI on coronal and axial images, with thickening and increased signal on T2WI of rotator interval, with intact labrum and rotator cuff muscles.

### Surgical technique

Patients were operated upon in the beach chair position under general anesthesia.

Examination of the passive shoulder range of motion was carried out, with no attempt to perform manipulation under anesthesia. Injection of adrenaline saline in the ratio of 1 : 200 000 in the glenohumeral and subacromial space was given after sterilization of the operative field. Then, diagnostic shoulder arthroscopy was initially performed. In all patients, the typical findings of frozen shoulder were present, the joint volume was reduced, the rotator interval was filled with fibrotic tissue, and the intra-articular part of the long head of the biceps tendon showed inflammation without mechanical damage Fig. 1a and b.

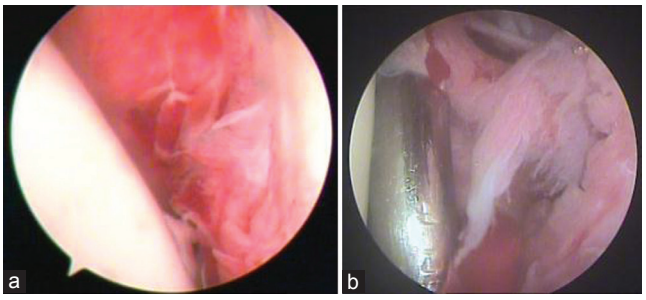
With the arthroscope in the posterior portal and the radiofrequency probe in the anterior portal, the rotator interval capsule was completely released (Fig. 2). We began the release superiorly with the coracohumeral and superior glenohumeral ligament. Thereafter, we continued the release until the coracoid and the conjoint tendon were visualized to insure that the coracohumeral ligament has been completely divided (Fig. 3).

Through two lateral portals, the subacromial space was examined. In all, 32 patients had associated hypertrophy and inflammation of the subacromial bursa (Fig. 4); of those, 14 patients were found to have acromial spurs and/or osteophytes in the acromioclavicular joint.

Arthroscopic bursectomy was performed, with removal of the spurs and osteophytes using bur (Fig. 5).

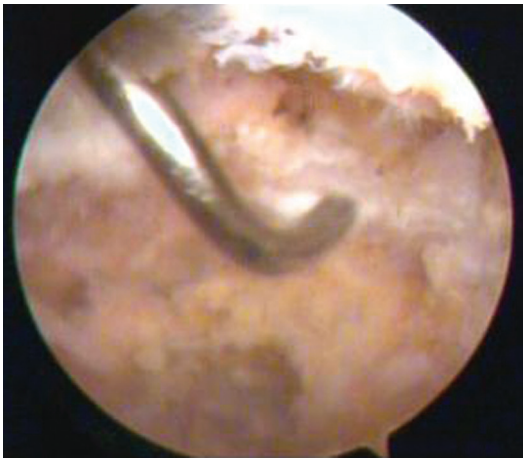
Assessment of the postoperative range of motion was carried out under anesthesia and was compared with the preoperative range of motion. Subacromial injection of 10 ml of marcaine was given to help decrease the postoperative pain.

**Figure 1**




(a, b) Inflamed hypertrophied synovium in rotator interval.

**Figure 3**



The hook is pointing to the coracoid.

### Postoperative rehabilitation

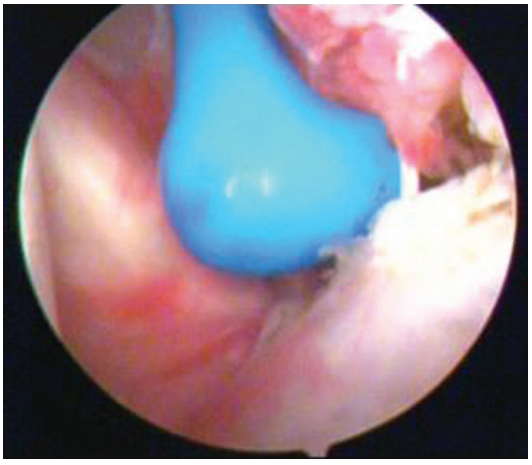
All patients were referred to the Physiotherapy Department from the second day postoperative, and they started range of motion exercises. In addition, we learned the patients exercises to be performed at home.

The patients were followed up in the outpatient clinic at weekly interval for the first 4 weeks postoperative, then at monthly interval until 3 months postoperative, and then at 3 months interval until the end of the follow-up.

## Results

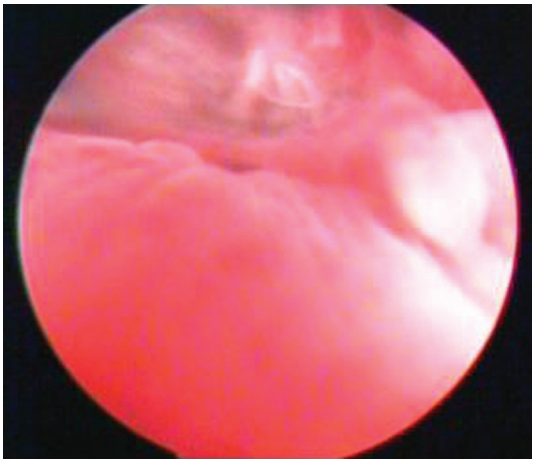
This study included 39 patients with 40 shoulders operated upon.

**Figure 2**



Release of the rotator interval.

**Figure 4**



Hypertrophied inflamed subacromial bursa.

The ratio of right-side to left-side affection was 13 : 7 and the ratio of dominant-side to nondominant-side affection was 3 : 1.

The mean duration of follow-up was 6 months (range 5–12 months).

In all, 34 patients with 35 shoulders had severe pain affecting their sleep according to the constant shoulder score preoperatively, and five patients had moderate pain. There was a marked improvement in pain postoperatively; 32 patients had no pain, whereas seven patients with eight shoulders had mild pain.

With respect to range of motion, the mean of flexion improved by 100°, the mean of external rotation at 0° improved by 70°, the mean of abduction improved by 120°, and the mean of internal rotation at 0° increased by seven points according to the constant shoulder score (Table 1).

Arthroscopic bursectomy was performed in 32 patients, and removal of acromial spurs and osteophytes from the acromioclavicular joint was performed in 14 patients.

## Discussion

Frozen shoulder is a disease that causes pain, affects daily activities negatively, and may restrict shoulder functions drastically [17]. It is a common problem that remains difficult to diagnose and difficult to treat [12]. There is no consensus about optimal management of frozen shoulder. Many publications have introduced various methods with different outcomes [13]. Although many studies reported the therapeutic value of manipulation under anesthesia [18], caution is still needed when selecting it because of iatrogenic damage or even fracture risk [19,20]. Hill and Bogumill [21] found that elevation and abduction can be significantly improved with manipulation, but restricted rotation was a persisting problem. Because bone is weakest in torsion, fracture risk is greatest during this part of the manipulation, and therefore the fear of fracture may reduce its effectiveness.

With the advances in arthroscopic surgery, arthroscopic capsular release has been shown to be a useful tool in the treatment of resistant frozen shoulder. It is a minimally invasive method aimed at pathologic tissue; it allows precise and controlled release of the capsule and ligaments, reducing the potential complications of a more traumatic manipulation. Intensive and precise arthroscopic debridement of the inflamed tissue or other associate pathology and control of any potential hemarthrosis would relieve the postoperative pain significantly [5,13].

On the basis of data from histologic research, open exploration, and arthroscopic observations, the CHL and rotator interval were recognized as the major affected area in frozen shoulder and should be released to restore passive external rotation [22,23].

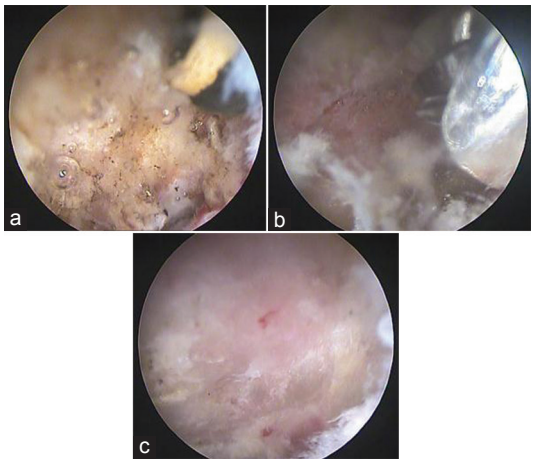
Therefore, it was believed that the anterior capsular structures were required to be released to restore external rotation and abduction [24].

Pearsall *et al.* [25] recommended releasing the intra-articular subscapularis tendon without significant morbidity.

In addition to release of the anterior capsule, there has been controversy about whether the posterior or inferior structures should be released [13]. Many authors have recommended release of the posterior capsule, and it was believed to have benefits regarding the recovery of internal rotation [12,24,26]. However, Snow *et al.* [5] performed a retrospective study and found that there was no significant difference in the overall outcome with the addition of a posterior release.

Chen *et al.* [13] performed a prospective study including 74 patients; 42 underwent an anterior release from the superior glenohumeral ligament to the anterior band of the IGHL (group 1), whereas 32 underwent

**Figure 5**




Subacromial decompression (a) using radiofrequency probe, (b) bur for acromioplasty, (c) after subacromial decompression.

**Table 1 Preoperative and postoperative range of motion**

| | Preoperative | Postoperative |
|---|---|---|
| Forward flexion | 70° | 170° |
| External rotation at 0 | 5° | 75° |
| Abduction | 45° | 165° |
| Internal rotation (constant shoulder score) | 1.5 points | 8.5 points |

release of the inferior and posterior portion of the IGHL in addition to anterior release (group 2). They found that range of movement recovered more rapidly in group 2 within the first 3 months after operation. However, there were no statistical differences ($P$>0.05) for all movements between both groups 6 months postoperatively.

In our study, we performed release of rotator interval capsule and of coracohumeral ligament in 40 shoulders with subacromial bursectomy in 32 patients, and acromioplasty and removal of osteophytes from the acromioclavicular joint were performed in 14 patients. There was a marked improvement in pain postoperatively, with improvement in all range of movements in all patients with no associated postoperative complications.

## Conclusion

Arthroscopic rotator interval release is a simple and effective method for treating patients with frozen shoulder, allowing for early postoperative rehabilitation.

## Acknowledgements

### Conflicts of interest

There are no conflicts of interest.

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