Shoulder adhesive capsulitis: manipulation and arthroscopic arthrolysis or intra-articular steroid injections?

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Abstract

Purpose The aim of this study was to compare shoulder manipulation and arthroscopic arthrolysis with glenohumeral steroid injections in patients affected by idiopathic adhesive shoulder capsulitis.

Methods In this prospective study we randomly assigned patients to enter group A (23 patients, shoulder manipulation and arthroscopic arthrolysis) and group B (21 patients, glenohumeral steroid injections). Patients were followed-up at three, six and 12 weeks, and at six and 12 months with the Constant and Murley, ASES, UCLA and SST evaluation scales. Moreover, passive forward flexion, abduction, and internal and external rotations were recorded.

Results Range of motion showed satisfactory results in both groups at final follow-up: in group A the mean ABD increased from 60° to 154°, ER from 20° to 40°, and FF from 75° to 174°; in group B, ABD raised from 76° to 145°, ER from 20° to 35°, and FF from 115° to 164°. All the evaluation scales performed increased significantly at final follow-up in both groups. However, while patients of group A had already reached significant improvement at the six-week follow-up ($p < 0.03$), in group B this happened only at the 12 week follow-up ($p < 0.03$).

Conclusions Both types of treatment were effective in improving final range of motion; however, while patients of group A accomplished their goal by the six-week follow-up, in group B the same result was obtained at the 12-week follow-up.

Introduction

Shoulder adhesive capsulitis is a disease characterised by a significant reduction of active and passive range of motion of the glenohumeral joint along with pain. After the first description by Duplay in 1872 [1], it was better described by Codman [2] as “frozen shoulder”; however, it was only in 1945 that Neviaser [3] coined the term “adhesive capsulitis”, after a cadaveric study, in which he found that the capsule was thickened and highly adherent to the humeral head while the bursa was unaffected, suggesting a chronic inflammatory condition. However, Lundberg et al. [4] as well as Bunker et al. [5] found no significant inflammatory cells and reported that the morphology of the contracted tissue was similar to that of Dupuytren’s contracture. In 1975 Reeves et al. [6] proposed three different phases to stage the disease: the painful phase, the frozen phase, and the thawing phase, with an overall estimated duration varying from 12 to 42 months.

The purpose of any treatment is to relieve the patient from pain and to restore a satisfying range of motion (ROM). Nonoperative treatments include analgesics [7], systemic or intra-articular steroids [8], physical therapy [9], muscle stretching, and distension arthrography [10]. Operative treatments consist of manipulation under general anaesthesia [11] and arthroscopic release of the joint capsule followed by an early rehabilitation protocol [12].

This study prospectively evaluates and compares the efficacy of intra-articular steroid injections with manipulation under general anaesthesia and arthroscopic arthrolysis.

Specifically, it was our goal to determine if intra-articular steroid injections are less effective in pain relief and in restoring ROM compared to shoulder manipulation and arthroscopic release.

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Material and methods

Eighty-two patients affected by shoulder adhesive capsulitis were seen in our Orthopaedic Department between 2002 and 2006. Inclusion criteria to enter this study were: a clinical history of pain and restriction of passive and active ROM of the shoulder for at least three months, a diagnosis of stage II adhesive capsulitis according to Reeves et al. [6], and an unsatisfactory outcome after a conservative protocol consisting of physical therapy and use of oral nonsteroidal anti-inflammatory medications. Moreover, all the patients underwent an X-ray examination of the shoulder, whereby the presence of calcific tendonitis or severe glenohumeral arthritis were judged as exclusion criteria for this study.

As a result, out of 82 patients, 46 (46 shoulders) were judged eligible to participate in the study and were subsequently randomly assigned by draw to group A (25 patients) or group B (21 patients). Patients of group A were treated by shoulder manipulation under general anaesthesia and subsequent arthroscopic arthrolysis, while patients of group B were treated by intra-articular steroid injections.

The mean age of group A (25 patients) was 57 years (range, 26–68), with 11 men and 14 women. Four patients were affected by diabetes mellitus.

The mean age of group B (21 patients) was 54 years (range, 43–65), with ten men and 11 women. Two patients were affected by diabetes mellitus.

Before treatment, a thorough accurate medical history was taken with particular attention focused on the onset of the disease and on the presence of concomitant diseases. Objectively, they were evaluated with the Constant-Murley scale (CM) [13], the University of California at Los Angeles shoulder score (UCLA) [14], the American Shoulder and Elbow Surgeons score (ASES) [15], and the Simple Shoulder Test (SST) [16]. Side-to-side (S/S) passive forward flexion (FF), abduction (ABD), internal rotation (IR) (measured depending on which vertebra the patient was able to reach), and external rotation (ER) in neutral abduction, were recorded with the patient in the standing position.

Group A: manipulation and arthroscopic arthrolysis

Patients were placed in supine position, with the assistant stabilising the scapula to the posterior part of the chest, and the surgeon then moving the arm in the scapular plane while trying to use a short lever arm in order to minimise the risks of humeral fractures. The shoulder was moved into flexion first, then into abduction, applying gentle pressure to break the adhesions. Subsequently, at three different grades of abduction (0°, 45° and 90°), the arm was externally and internally rotated until a satisfactory recovery of range of motion was obtained.

Afterwards, the patient was positioned in a lateral decubitus and the arthroscopic procedure was started; an accurate inspection of the glenohumeral joint was performed to focus on areas of synovitis and to visualise possible lesions as a result of the manipulation. A glenohumeral circumferential capsular release was performed using radiofrequency.

Passive exercises were always allowed the first post-operative day and the use of a sling was never allowed longer than two weeks. Active strengthening started at the beginning of the fifth post-operative week.

Group B: steroid injection procedure

Glenohumeral steroid injections were performed with the patient in lateral decubitus, in the same way as for the surgical arthroscopic procedure under ultrasonographic view. While the affected arm was held by the assistant, a peri-capsular injection of 2–3 cc of 2% lidocaine with an 18-gauge needle was performed through the posterior “soft spot”. Subsequently, with the same needle in place, it was gently introduced through the posterior capsule (heading toward the coracoid process), then into the glenohumeral joint. A solution composed of 4 cc of 2% lidocaine and 1 cc of methylprednisolone acetate (Depo-medrol) was then slowly injected. Ultrasonographic assistance was used for better accuracy in entering the joint capsule. All patients underwent a cycle of three steroid infiltrations—one each week for three weeks.

Patients started an intensive physical therapy protocol the day after the first injection. A manual schedule of exercises led exclusively by a physiotherapist was performed along with a self-exercise schedule of pendulum exercises and wall-climbing movements.

Follow-up evaluation

Patients were followed up at three, six and 12 weeks, and at six and 12 months after the procedure (in patients of group A, data on range of motion were also recorded the day immediately after the operation). Subjectively, they were asked to judge the outcome of the treatment performed as excellent, good, fair or poor using the visual analog scale (VAS).

Objectively, they were assessed using clinical evaluation scales (CM [13], UCLA [14], ASES [15], SST [16]). An independent examiner evaluated the residual passive ROM of the shoulder at each follow-up.

Statistical analysis

A one-way analysis of variance (ANOVA) was conducted to determine overall significance among the two groups. A

probability level of $p < 0.05$ was considered statistically significant. The analysis was performed through the software MINITAB release 15.

Results

Group A

Group A was composed of 23 patients, including nine men and 14 women (mean age 54 years; range, 26–61). Two patients were unavailable for follow-up.

No cases of intraoperative fractures, humeral dislocations or neurovascular injuries were recorded during the shoulder manipulation. The subsequent arthroscopic procedure showed a tear of the anterior capsule in 15 out of the 23 patients (65.2%); furthermore, in all patients (100%), large areas of capsular hyperaemia along with concomitant reactive synovitis were detected and always removed. No bony Bankart lesions were ever found.

During the subacromial phase, a bursectomy was performed in all patients while an acromioplasty was never performed.

At the final 12-month follow-up, patients of group A showed a mean VAS of 9.2 (range, 7–10); patient satisfaction registered was excellent in 16 patients

(69.7%), good in five patients (21.7%) and fair in two patients (8.6%).

Objectively, the ROM increased significantly at the final follow-up. In ABD the mean value of movement increased from 60° (pre-op) to 154° (+156.6%) ($p < 0.03$), ER increased from 20° (pre-op) to 40° (+ 100%) ($p < 0.04$), and FF increased from 75° (pre-op) to 174° (+132%) ($p < 0.03$) (Fig. 1). IR improved from the sacral spinous process to the T12 spinous process.

As shown in Fig. 1, at the three-week follow-up, we registered a worsening of all mean values of range of motion when compared with the values gained during the surgical procedure (as confirmed by the evaluation performed the day immediately after the procedure). However, at six-week follow-up, range of motion became significantly positive again ($p < 0.03$), with only smaller incremental improvements registered at subsequent follow-ups, which were never statistically significant ($p > 0.08$). At final follow-up, side-to-side ROM was completely restored in nine out of the 23 patients (39.2%), higher than 70% (S/S) in 12 patients (52.2%), and lower than 70% (S/S) in two patients (8.6%).

As for the recovery of range of motion, shoulder evaluation scale results were already satisfactory at the first three-month follow-up, with only slight further improvements at the remaining evaluations (Table 1).

Fig. 1 Modifications of range of motion in different planes at the follow-ups

Table 1 Overall results of the evaluation scales used at different follow-ups

Evaluation	UCLA		ASES		CONST		SST	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
Pre	44.2	34.2	48.6	35.1	37.5	55	15.6	30.1
3 weeks	47.1	36.1	51.8	37	40.4	55.1	16.1	40
6 weeks	88.2	38	82.4	39.3	79.7	55.9	88.8	40.9
12 weeks	90.6	62.2	87	70.2	84.7	63.2	92.1	80.1
6 months	91.6	83.7	90.2	76.3	88	74.1	94.3	84.5
12 months	91.9	85.4	88.3	77.9	91.2	79.5	91.1	86.2

Group B

No complications were ever detected during the glenohumeral shoulder infiltrations, either in regard to cases of post-infiltrative acute pain or allergic reactions.

At final follow-up (12 months) patients reported a mean VAS of 8.4 (range, 5–10); patient satisfaction registered was excellent in nine patients (42.8%), good in eight patients (38%) and fair in four patients (19.2%).

Objectively, range of motion recovery raised significantly at the final 12-month follow-up. ABD increased from a mean value of 76° to 145° (+90%) ($p < 0.03$), ER increased from a mean value of 20° to 35° (+ 75%) ($p <$

0.04), and FF increased from a mean value of 115° to 164° (+42%) ($p < 0.04$) (Fig. 2). IR improved from the sacral spinous process to the L5 spinous process.

With regard to range of motion, Fig. 2 shows how group B results were not as statistically significant at the six-week follow-up ($p > 0.06$), as they were for group A. It was only at the 12-week follow-up that we detected significant improvements in all the articular planes in group B ($p < 0.03$) (compared to pre-operative results).

The overall recovery of range of motion was complete (S/S) in seven patients (33.3%), higher than 70% in ten patients (47.7%) and lower than 70% in four patients (19%).

Evaluation scale results are shown in the details of Table 1.

Fig. 2 Modifications of range of motion in different planes at the follow-ups

Discussion

Even though shoulder adhesive capsulitis is considered a self-limiting disease, it often severely restricts the functional, working, and sports activities of patients, sometimes leading to a very long immobilisation of the shoulder [17]. Moreover, some patients, because of personal or working problems, cannot wait an unpredictable length of time to regain their shoulder activity, and so prefer to undergo treatment with the aim of restoring normal shoulder function at the earliest possible time. In a long-term follow-up study on untreated patients, Reeves et al. [6] showed a complete recovery of shoulder range of motion in only 39% out of 41 patients, while Shaffer et al. [12], in a group 62 patients, showed persistence of pain and rigidity in 50% of them at a mean follow-up of seven years.

In spite of the many options available to treat this pathology, there is not wide agreement yet among authors as to which is the best treatment and in which phase of the disease it should be performed. Some authors [7, 9, 11] have published satisfactory results after conservative treatment consisting of physical therapy along with home, self-administered stretching exercises or the use of analgesics; in contrast, Weber et al. [18] reported poor results after conservative treatment, thus recommending more aggressive solutions, such as manipulation of the shoulder under general anaesthesia [19, 20], with or without a following or a previous arthroscopic procedure. Yet Baums et al. [21] reported their positive experiences after unique arthroscopic capsular debridement, both in terms of recovery of the ROM and in terms of reduction of pain.

Despite the satisfactory results reported by Weber et al. [18] after only a manipulation treatment, it is our opinion that the risks of complications such as fractures, dislocations or cuff tendon tears might be very high because of excessive stress transmitted to the shoulder to gain a satisfactory ROM; furthermore, Janda and Hawkins [22] showed how this type of treatment has a risk of recurrence varying from 5% to 20%, especially in patients affected by diabetes mellitus. For this reason we decided to perform both manipulation and arthroscopic arthrolysis, in order to finish breaking residual adhesions and to treat possible concomitant lesions, such as small or partial cuff tears. The lack of complications we registered after the manipulation phase was maybe due to the nonaggressive movements we performed.

The results obtained from patients in group A of our study concur with the above cited studies, providing satisfactory and significant recovery of range of motion in all of the articular planes at the six-week follow-up ($p < 0.03$). What is more, all the results gained in this second follow-up were maintained in the remaining follow-ups and gradually improved by the final 12-month evaluation.

An interesting fact from the evaluation of group A results is the significant loss of range of motion we detected in all the mean articular plane values at three-week follow-up when compared with the immediate post-op values; then, at six-week follow-up, all patients reached even higher range of motion mean values ($p < 0.03$).

As a matter of fact, mobilisation under anaesthesia and arthroscopic arthrolysis were effective in restoring a satisfactory range of motion in a very short time (six weeks) and remained satisfactory through final follow-up (ABD, from 76° to 145°; ER, from 20° to 35°; FF from 115° to 164°).

The use of intra-articular steroid injections still seems to be controversial in literature. Some systematic reviews about this type of treatment [23–25] concluded that the majority of the studies analysed should not be taken into consideration because of both the incorrect randomisation of patients and the small number of patients included [23, 25]. Nevertheless, most of these studies showed how the use of steroid injections would provide a fair result at mid-term follow-up without any guarantee for long-term follow-up [25]. On the contrary, other authors have supported the use of steroid injections stating that they can significantly reduce glenohumeral synovitis, thus shortening the physiological length of the disease. Carrette et al. [26], in a prospective randomised study, showed how the use of a single steroid injection greatly improved the efficacy of the conservative physical therapy program, promoting its use in conservative treatment. Similarly, Bal et al. [8] showed that a single steroid injection is more effective than physical therapy alone at six-month follow-up and showed how clinical improvement is strictly dose-dependent. Along with these authors, our study showed how performing conservative treatment through a cycle of three glenohumeral joint infiltrations of anaesthetic and steroid drugs yields effective results at short–mid-term follow-up. Indeed, despite the fact that the first two follow-ups (three and six weeks) did not show significant results, they allowed patients to slowly improve their range of motion and to report a gradual, constant, improvement of subjective and objective status (Table 1). It was finally at the 12-week follow-up that patients of group B started gaining very satisfactory results, in terms of recovery of ROM, similar to those of group A at the six-week follow-up.

All patients of both groups showed very satisfactory results at the final (12-month) follow-up, thus showing the efficacy of both types of treatments. The only difference detected was the amount of postoperative time before patients started gaining significant results, which was *six weeks* for patients of group A and *12 weeks* for patients of group B.

For this reason now the first step of our actual therapeutic protocol consists of infiltrative steroid injec-

tions. We reserve surgical procedure in the few cases in which we did not reach a satisfactory outcome with the infiltrative protocol, in those patients in which a faster recovery of range of motion is needed, and in those patients in which a concomitant surgical procedure (such as acromioplasty for an impingement syndrome or tendon repair for a cuff lesion) is required.

Conclusion

In this study we compared the use of manipulation and arthroscopic release to glenohumeral steroid injections in patients affected by idiopathic adhesive shoulder capsulitis. Both of these treatments seemed to be effective in restoring a satisfactory range of motion and decreasing the painful symptomatology, even though in a different amount of time. Indeed, while manipulation and arthrolysis of the shoulder accomplished the goal in six weeks, the steroidal infiltrative treatment required 12 weeks.

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