

A Comparative Study of Efficacy of Ultrasound-guided Intra-articular Steroid Injection through Glenohumeral versus Subacromial Approach in the Treatment of Adhesive Capsulitis

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Abstract

Objective: To compare the efficacy between glenohumeral and subacromial approach of intra-articular steroid injection under ultrasound guidance in the management of adhesive capsulitis.

Study Design: Randomised controlled parallel group open level study.

Study Duration: 18 months (January 2012 to June 2013)

Study Setting: Department of Physical Medicine and Rehabilitation, IPGMER, SSKM Hospital, Kolkata.

Participants: Patients having stage1 or stage2 adhesive capsulitis of shoulder (n=56) attending PMR OPD, IPGMER, SSKM Hospital, Kolkata during the study period.

Intervention: After randomisation 56 patients were allocated in two groups (glenohumeral and subacromial) consisting 28 patients in each group. Glenohumeral and subacromial group received intra-articular injection of 40mg methylprednisolone acetate with 2ml of lignocaine 2% through glenohumeral and subacromial approach respectively under ultrasound guidance along with physical therapy. Outcome measure was range of motion measured by goniometry.

Results: At 3 weeks post-injection glenohumeral group showed statistically significant improvement in passive flexion, active and passive abduction. At 6 weeks there was improvement in active and passive flexion in glenohumeral group but not in abduction. There was no difference in improvement of external rotation in any visit.

Key words: Ultrasound-guided injection, approach, adhesive capsulitis.

Introduction:

Adhesive capsulitis is one of the most common causes of pain and stiffness of shoulder. Primary adhesive

capsulitis of shoulder is an idiopathic, progressive, self-limiting restriction of active and passive range of motion¹. Its pathogenesis is not fully understood till now. Probably it is the end result of many different pathological conditions of shoulder². Adhesive capsulitis is 2 to 4 times more common in female than male and is most commonly seen in individuals between 40 and 60 years of age³. It is common in non-dominant shoulder and in 34% cases this condition is bilateral⁴. It is well known to be a self limiting condition⁵. Non-surgical intervention appears to be the initial treatment of choice for adhesive capsulitis⁶. Management of adhesive capsulitis includes local ice compression, application of moist heat, activity modification, shoulder mobilisation exercises, physical modalities (UST, TENS, iontophoresis, etc.), NSAIDs, intra-articular injection of steroid or combined steroid and lignocaine, suprascapular nerve block, acupuncture⁷⁻⁹. But the use of NSAIDs does not appear to offer any great advantage¹⁰. Systemic steroids also do not offer any long term benefit¹⁰. Surgical treatment options are considered

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when there is functional limitation with no improvement after 1 year of conservative treatment which include closed manipulation under general anaesthesia, over distension of joint by injecting a large volume (50 - 200ml) of sterile saline under pressure, therapeutic arthrography, arthroscopic release¹¹⁻¹³.

Local injection of glucocorticoids or combined intra-articular injection of corticosteroid and local anaesthetic into the shoulder joint provides symptomatic relief, improves tolerance to physical therapy and also limits the development of fibrosis, thus shortens the natural history of the disease in adhesive capsulitis¹⁴⁻¹⁷. Pre-adhesive stage (stages 1 and 2) adhesive capsulitis patients typically respond well to an intra-articular steroid injection, given the inflammatory nature of the disease^{2,3,13,18}. But there is no indication for intra-articular corticosteroid injection in stage 3 and stage 4 of adhesive capsulitis as these are not inflammatory stage¹⁵. Intra-articular steroid injection in shoulder joint can be given under ultrasound guidance or even without any radiological guidance. But ultrasound guided injection provides better outcome than blind technique^{19,20}.

There are different techniques of infiltration of steroid into the shoulder joint. Both the glenohumeral or subacromial approach can be effective²¹⁻²⁵. But there are scarcity of literature about the comparative efficacy of those two different approaches. This project is a humble attempt to find out which approach of intra-articular steroid injection (glenohumeral or subacromial) is more efficacious in adhesive capsulitis.

Aims and Objectives:

To compare the efficacy between ultrasound-guided glenohumeral versus ultrasound-guided subacromial approach of intra-articular steroid injection in the management of adhesive capsulitis.

Materials and Methods:

Before starting the study approval was taken from institutional ethics committee, IPGMEandR, SSKM Hospital, Kolkata. Informed written consent was taken from each patient before including them in this study. Every patient was explained about the disease, its present available management, the outcome and complications in a language that was understandable to them. All participants were informed that they can withdraw themselves from the study whenever they want.

Study area: Department of Physical Medicine and Rehabilitation, IPGMER and SSKM Hospital, Kolkata.

Study population: Patients with adhesive capsulitis attending the OPD of the department of Physical Medicine and Rehabilitation at IPGMER and SSKM Hospital, Kolkata.

Study period: 18 months.

Sample size: n=56 (28 in each group).

For the purpose of sample size calculation the range of motion of individual movement in shoulder joint was taken as primary outcome measure. Earlier studies suggest that a difference of 5 degree of range of motion may be detected and the standard deviation for this parameter were in the range of 3 to 7 degree²⁶. We estimated that 22 subjects would be required in each group in order to detect 5 degree difference in range of motion with 90% power and 5% probability of type 1 error, assuming standard deviation to be 5 degree. Assuming 20% drop out rate this translates a recruitment target of 28 patients/group. Since there was two groups, our overall recruitment target was 56 subjects. Randomisation was done with subjects stratified by injection site.

Study design: This study was a randomised controlled parallel group open level study.

INCLUSION CRITERIA:

- 1) Patients with unilateral stage 1 and stage 2 adhesive capsulitis.
- 2) Age between 18 years to 65 years

EXCLUSION CRITERIA:

- 1) Patients with stages 3 and 4 adhesive capsulitis.
- 2) Age less than 18 years or more than 65 years.
- 3) Patients with rotator cuff tear.
- 4) Patients with diabetes, hypothyroidism, rheumatoid arthritis or other inflammatory arthritis, post myocardial infarction, post stroke, post mastectomy, prolonged immobilisation.
- 5) Overlying soft tissue infection, infection in the joint, uncontrolled bleeding diathesis, presence of a joint prosthesis.
- 6) Patients who got intra-articular injection in shoulder within last one year.
- 7) Adhesive capsulitis secondary to brachial plexopathy or other peripheral nerve injury.
- 8) Adhesive capsulitis with recent bony injury or malignancy around that shoulder.
- 9) Patients with bilateral adhesive capsulitis.

Parameters studied: Active and passive range of motion (flexion, abduction, internal rotation and external rotation) of affected shoulder by goniometry.

Assessment: At 0 week, 3 weeks, 6 weeks.

Study Tools:

- Disposable syringe and needles.
- Sterile gloves.
- Povidone iodine.
- Chlorhexidine.
- Inj depot methylprednisolone acetate.
- Lignocaine 2%.
- Band aid.
- Sponge holding forceps.
- Gauze piece.
- Goniometer.
- Sphygmomanometer.
- Stethoscope.
- Ultrasonography machine (Philips HD-7).
- Linear probe, etc.

Study Technique:

In this study patients suffering from adhesive capsulitis were selected for intervention according to the inclusion and exclusion criteria. Routine blood examination, fasting blood sugar and TSH were measured. X-ray and USG of affected shoulder were done prior to giving injection. Before doing the intervention selected patients were examined regarding their body weight, vitals, shoulder range of motion (ROM) and were enquired about the pain severity in VAS scale (0 to 10) on the day of injection (visit-1/V1). Physician's global assessment and patient's global assessment were also measured at the visit-1.

The selected patients were divided into two groups randomly. Every patient was given intra-articular injection under ultrasound guidance (Figs 1-3) with 1ml of depot methylprednisolone acetate (40mg) and 1ml of 2% lignocaine under strict aseptic condition. One group was given through glenohumeral approach and second

group was given through subacromial approach in the shoulder joint.

In USG-guided glenohumeral approach (Fig 4) of injection patient was sitted comfortably on a stool, antiseptic dressing was done. The glenohumeral joint space was located by USG. The needle was introduced 1 cm below and lateral to the coracoid process and advanced into the glenohumeral joint space. Direction of needle was horizontal and little lateral to avoid injury to axillary nerve. Before injecting aspiration was done to check for any vessel puncture. In USG-guided subacromial approach (Fig 5) of injection maintaining strict asepsis the subacromial space was located with the help of USG. The needle was introduced 1 cm below the acromian angle and the rest of the procedure was same.

Both groups received education regarding life style modification, shoulder mobilisation exercises (Codman's exercises, pulley exercises, wall climbing exercises, cross body reach, overhead stretching, etc.) for 2 to 3 sittings daily with 10 to 15 times of repetition/sitting and 5 days course of aceclofenac (100mg) twice daily, pantoprazole (40mg) once daily, oral antibiotic (amoxicillin/cefixime). No patient had any contraindication for any of those drugs.

After administering injections, the patients were examined and assessed at the interval of 3 weeks (visit-2) and 6 weeks (visit-3). Shoulder range of motion (active and passive) was assessed with goniometer. Shoulder flexion, abduction, external and internal rotation were measured on both follow-up visits. Pain severity was again assessed according to VAS scale and physician's global assessment and patient's global assessment. Using the parameters mentioned above the results were analysed according to the standard statistical methods. Data had been summarised by descriptive statistics, that is mean and standard deviation for numerical variables and counts and percentages for categorical variables. Numerical variables had been compared between groups by student's independent sample t- test where normally



Fig 1: Steroid Injected in Subacromial Space



Fig 2: Steroid Injected in Glenohumeral Joint



Fig 3: Fluid in Bicipital Groove

distributed and by Mann-Whitney U test where not normally distributed followed by Dunn's test. Chi-square test/Fisher's exact test has been employed for comparison of independent proportion. All analyses were 2-tailed and $p < 0.05$ has been considered as statistically significant.

Result Analysis:

In this study, 51 out of 56 patients completed follow-up. Glenohumeral (GH) injection group included 25 patients and subacromial (SA) injection group included 26 patients. Majority of the patients (47 out of total 51 patients) were within the age group of 40 to 60 years (Table 1). In total study population 64.70% were male and 35.30% were female (Fig 6), 60.78% patients had left shoulder and 39.22% had right shoulder involvement (Fig 7), 48.04% patients were having stage 1 and 51.96% were having stage 2 adhesive capsulitis (Fig 8).

Comparison of Parameters between Groups

At visit-1 there was no statistically significant difference between those two groups in any parameters (Table 2).

At 3 weeks post-injection glenohumeral group showed statistically significant improvement in passive flexion, active and passive abduction as compared to subacromial group (Table 3).

At 6 weeks post-injection there was no difference in improvement of abduction between those groups. But improvement in active and passive flexion were better in glenohumeral group (Table 4). There was no difference in improvement of external rotation in any visit.

Drop Out: In this study only 5 patients out of 56 failed to follow-up. In glenohumeral group 3 patients and in Subacromial group 2 patients did not complete the follow-up. So, the total drop out rate was 8.93%.

Discussion:

The effectiveness of intra-articular injection of steroid in adhesive capsulitis has been claimed for long. Injection can be given through different approach²⁷. There are few studies comparing the effectiveness of glenohumeral versus subacromial approach of injection.

This study showed that age is an important risk factor for the occurrence of adhesive capsulitis as the highest number of the patients in this total study population were between the age group of 40 and 60 years. As per several literatures incidence of adhesive capsulitis is highest between 40 and 60 years of age group^{3,11,13}.

Adhesive capsulitis is more common in women^{6,28}. But, in this study 64.70% of the total study population were male and 35.30% were female. This is probably due to relatively small study population.

All the patients in this study were right handed; 60.78% patients of the total study population had left shoulder involvement and 39.22% had right shoulder involvement. This finding is also supported by some literatures as saying that non-dominant shoulder involvement is more common in adhesive capsulitis⁴.

More patients (51.96%) of the total study population were in stage 2 and 48.04% patients were in stage 1 of adhesive capsulitis. Stage 3 and stage 4 adhesive capsulitis were excluded from this study, as these are not inflammatory stage¹⁵.

During comparison between glenohumeral versus subacromial, in glenohumeral group there was statistically significant improvement in passive flexion at visit-2 and in active as well as passive flexion in visit-3. For abduction, though statistically significant improvement was found in active and passive abduction

Table 1: Descriptive Statistics for Age in Years (GH= Glenohumeral, SA = Subacromial)

Group	Minimum	Maximum	Mean	Standard deviation
GH (n = 25)	45	64	51.5	4.48
SA (n = 26)	40	64	53.2	6.39

Table 2: Comparison of Parameters between Groups at Visit-1

Variables	Glenohumeral (Mean±SD)	Subacromial (Mean±SD)	p-value
Active flexion	86.0±17.97	85.0±22.67	0.862
Passive flexion	92.0±16.52	88.5±21.34	0.512
Active abduction	74.4±25.14	71.2±21.74	0.624
Passive abduction	81.0±21.41	73.1±21.59	0.194
Active external rotation	25.6±4.64	26.7±8.83	0.572
Passive external rotation	30.8±6.07	30.0±8.94	0.711

in glenohumeral group at visit-2, no significant difference was found between them at visit-3. For external rotation and internal rotation, there was no significant difference in improvement at visit-2 and visit-3 between those groups.

However the persistence of the improvement over long term could not be determined as the final follow-up was at 6 weeks. So, better designed and better planned studies could be done to find out those in future. Only one patient complained of mild local pain during administration of

Table 3: Comparison of Parameters between Groups at Visit-2 (3 Weeks Post-injection)

Variables	Glenohumeral (Mean±SD)	Subacromial (Mean±SD)	p-value
Active flexion	138.8±18.72	130.0±13.27	0.058
Passive flexion	146.8±19.09	137.7±10.88	0.041
Active abduction	123.2±23.93	109.2±21.85	0.034
Passive abduction	131.2±24.12	116.5±21.90	0.027
Active external rotation	46.8±5.38	47.1±4.73	0.825
Passive external rotation	53.6±6.85	51.9±4.71	0.312

Table 4: Comparison of Parameters between Groups at Visit-3 (6 Weeks Post-injection)

Variables	Glenohumeral (Mean±SD)	Subacromial (Mean±SD)	p-value
Active flexion	165.2±9.41	158.5±8.81	0.011
Passive flexion	173.6±8.10	168.5±8.81	0.035
Active abduction	156.8±11.80	153.7±8.43	0.277
Passive abduction	165.6±10.83	163.1±8.26	0.353
Active external rotation	69.6±5.94	68.1±6.64	0.393
Passive external rotation	78.8±7.11	77.5±6.20	0.489



Fig 4: Glenohumeral Injection - USG Guided



Fig 5: Subacromial Injection - USG Guided

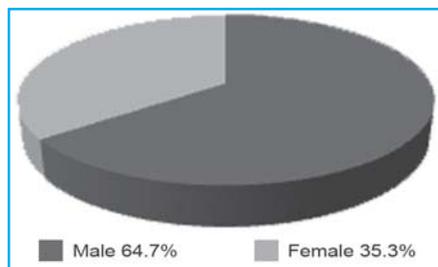


Fig 6- Sex Distribution in Total Study Population

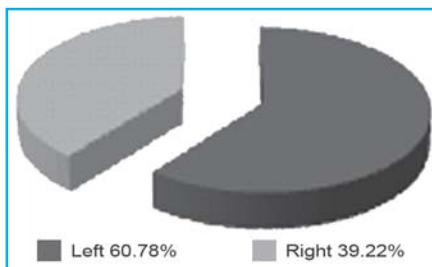


Fig 7- Distribution of Side of Involvement in Total Study Population

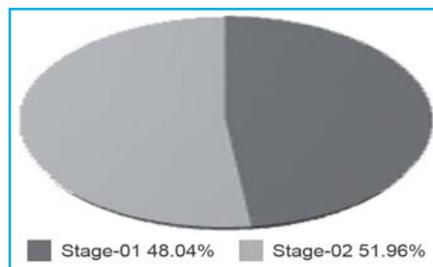


Fig 8- Distribution of Stage of Disease in Total Study Population

steroid in the shoulder joint and that was transient. No other adverse reaction occurred in any group of patients, which suggests that all the treatment options are safe if not otherwise contra-indicated.

Conclusion:

Ultrasound guided injections in adhesive capsulitis by glenohumeral approach is better than subacromial approach in terms of short term improvement and morbidity.

Limitations: There were some limitations of this study. The limitations were :

- 1) No control group was taken.
- 2) Sample size was small in each group.
- 3) It was a short term study as the final follow-up was at 6 weeks, so it was not possible to know the treatment effects after 6 weeks post-injection.

Initial post-injection frequent follow-up and statistical analysis were not done. So this study has a limitation to conclude about the immediate post-injection effect.

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