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A comparative study of intraarticular versus subacromial corticosteroid injection in the treatment of frozen shoulder

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ABSTRACT

Background: Frozen shoulder or adhesive capsulitis, is a condition characterized by pain and restricted movement of the shoulder joint. Corticosteroid injections are commonly used to alleviate symptoms, but the optimal injection site remains debated. This comparative study aims to evaluate the efficacy of intraarticular versus subacromial corticosteroid injections in treating frozen shoulder.
Methods: This prospective, randomized controlled study was conducted over 12 months, from November 2022 to October 2023, at Bangalore Medical College and Research Institute, Bangalore. A total of 60 patients diagnosed with adhesive capsulitis were enrolled and randomized into two groups: 30 patients in the intraarticular (IA) injection group and 30 patients in the subacromial (SA) injection group. Patients were randomly assigned to either the IA group or the SA group. The IA group received a 40 mg injection of Triamcinolone Hexacetonide with 4 ml of 2% lidocaine into the glenohumeral joint. SPSS (Version 25.0) was used for analysis.
Results: Patients in the intraarticular group demonstrated significantly lower pain scores compared to those in the subacromial group at the 4th, 8th and 12th weeks ($p<0.05$). The intraarticular group consistently achieved higher Constant Shoulder Scores at 4, 8 and 12 weeks, suggesting a more effective recovery in shoulder function compared to the subacromial group.
Conclusion: This study demonstrates that intraarticular corticosteroid injections are more effective than subacromial injections in treating patients with frozen shoulders, particularly in terms of pain relief and functional improvement.

Keywords: Adhesive capsulitis, Frozen shoulder, Range of motion, Shoulder pain management, Visual analog scale

INTRODUCTION

Frozen shoulder, or adhesive capsulitis, is a disorder of the shoulder joint that affects 2-5% of the general population, with a predilection for individuals between 40 and 60 years of age, and is more common in women.[1] It is characterized by progressive stiffness and pain, which lead to a restriction in active and passive range of motion.[2] A frozen shoulder develops insidiously and progresses through three distinct phases, the freezing phase (painful), the frozen phase (stiffness), and the thawing phase, where there is gradual restoration of movement.[3] Despite its high prevalence, the etiology of frozen shoulder remains largely idiopathic in most cases, although it is frequently associated with conditions such as diabetes mellitus, thyroid disorders and post-traumatic injuries.

Adhesive capsulitis is primarily a self-limiting condition, but it can last for months to years, severely impacting a patient's quality of life.[4] Corticosteroid injections are widely accepted as the gold standard for managing a primary frozen shoulder. By targeting the inflammatory

process early in the course of the disease, corticosteroids can significantly reduce pain and accelerate functional recovery.[5] However, there remains a debate about the optimal site of injection-whether intraarticular (IA) injections directly into the glenohumeral joint or subacromial (SA) injections into the 5subacromial bursa offer superior outcomes.[6]

The objective of this study is to compare the efficacy of intraarticular and subacromial corticosteroid injections in treating patients with frozen shoulders. The primary outcome is pain reduction, measured using the Visual Analog Scale (VAS), while secondary outcomes include functional improvement assessed by the Constant Shoulder Score and changes in passive range of motion.

METHODS

Study type

This was a prospective, randomized controlled study.

Study place

The study was conducted at Bangalore Medical College and Research Institute, Bangalore, India.

Study duration

The study was conducted over 12 months, from November 2022 to October 2023.

Sample size

A total of 60 patients diagnosed with adhesive capsulitis were enrolled and randomized into two groups: 30 patients in the intraarticular (IA) injection group and 30 patients in the subacromial (SA) injection group.

Inclusion criteria

Patients between 40 and 60 years of age. Patients diagnosed with stage 2 or 3 frozen shoulder based on the classification by Hannafin and Chiaia. Restricted passive range of motion in the glenohumeral joint (>30 degrees in two or more planes).

Diagnosis is confirmed by imaging techniques such as plain X-rays, ultrasound and MRI to exclude other pathologies like rotator cuff tears, osteoarthritis, or calcific tendonitis.

Exclusion criteria

Patients with shoulder trauma or recent surgery within the last 3 months. Secondary frozen shoulder caused by systemic conditions such as infections, fibromyalgia or autoimmune diseases. Prior corticosteroid injection in the affected shoulder within 3 months.

Study protocol

Patients were randomly assigned to either the IA group or the SA group. The IA group received a 40 mg injection of Triamcinolone Hexacetonide with 4 ml of 2% lidocaine into the glenohumeral joint, while the SA group received the same solution injected into the subacromial bursa. Injections were performed under ultrasound guidance by a single trained physician to ensure precision and minimize variability. Patients were instructed to perform a home-based rehabilitation program that included pendulum exercises, wall climbing, and gentle range-of-motion exercises to maintain shoulder mobility.

The study was approved by the Institutional Review Board (IRB) and Institutional Ethics Committee and patient consent was obtained in accordance with ethical standards.

Outcome measures

The primary outcome was pain reduction, measured using the Visual Analog Scale (VAS). Secondary outcomes included shoulder function improvement measured by the Constant Shoulder Score and passive range of motion in forward flexion, abduction, external rotation, and internal rotation. Outcomes were assessed at baseline, 4 weeks, 8 weeks and 12 weeks.

Statistical analysis

Continuous variables were expressed as mean±standard deviation (SD) or median with interquartile range (IQR), and categorical variables as frequencies and percentages. Comparisons between groups were made using the Chi-square test for categorical data and the student's t-test or Mann-Whitney U test for continuous data, as appropriate. Logistic regression analysis was performed to identify independent risk factors associated with poor outcomes in CLI patients. A p-value of <0.05 was considered statistically significant. SPSS (Version 25.0) was used as statistical tool.

RESULTS

The baseline characteristics between the two groups were comparable, ensuring a balanced comparison between intraarticular and subacromial injections. Patients in the intraarticular group demonstrated significantly lower pain scores compared to those in the subacromial group at the 4th, 8th and 12th weeks ($p<0.05$).The intraarticular group exhibited better improvements in external and internal rotation, with significant differences observed compared to the subacromial group.

The intraarticular group consistently achieved higher Constant Shoulder Scores at 4, 8 and 12 weeks, suggesting a more effective recovery in shoulder function compared to the subacromial group. There was a relatively higher proportion of women affected by frozen shoulder, consistent with the known demographic trends for the condition. Approximately 20% of the study population had

diabetes, which aligns with the established association between diabetes and a higher risk of developing adhesive capsulitis.

Table 1: Demographic characteristics of patients (n=60).

Characteristic	IA group (n=30)	SA group (n=30)
Male	12	16
Female	18	14
Dominant side involvement	19	16
Non-dominant side	11	14
Diabetic patients	12	10

Table 2: VAS pain scores at baseline and follow-up intervals.

Time point	IA group (mean±SD)	SA group (mean±SD)	P value
Baseline	7.8±1.1	7.6±1.2	0.605
4 weeks	4.2±1.5	5.1±1.6	0.038*
8 weeks	2.8±1.2	3.7±1.4	0.021*
12 weeks	1.9±1.1	3.1±1.5	0.008*

*Statistically significant.

Table 3: Passive Range of Motion (in degrees).

Motion	IA group (mean±SD)	SA group (mean±SD)	P value
Forward flexion	138.4±20.6	132.8±18.2	0.480
Abduction	130.6±22.3	125.9±21.1	0.298
External rotation	48.7±10.5	41.6±9.9	0.015*
Internal rotation	40.5±12.4	32.9±11.2	0.041*

*Statistically significant.

Table 4: Constant shoulder score (at 4, 8 and 12 weeks).

Time point	IA group (mean±SD)	SA group (mean±SD)	P value
Baseline	52.6±9.2	52.3±10.1	1.000
4 weeks	66.1±8.7	62.2±9.4	0.048*
8 weeks	78.9±7.4	72.5±8.1	0.021*
12 weeks	86.4±6.1	79.8±7.5	0.011*

*Statistically significant.

Table 5: Gender distribution and affected side (n=60).

Parameter	IA group (n=30)	SA group (n=30)
Male	12	16
Female	18	14
Dominant side	19	16
Non-dominant side	11	14

Table 6: Diabetes distribution (n=60).

Diabetic status	IA group (n=30)	SA group (n=30)
Diabetic	12	10
Non-diabetic	18	20

DISCUSSION

This study provides a comprehensive comparison of the effectiveness of intraarticular (IA) and subacromial (SA) corticosteroid injections in the management of frozen shoulder.[7] The findings reveal that IA injections offer superior pain relief and functional improvement compared to SA injections.[8]

These differences became apparent from the 4th week onward, with statistically significant reductions in VAS scores and improved constant shoulder scores in the IA group compared to the SA group.[9] The higher efficacy of IA injections can be attributed to their direct targeting of the glenohumeral joint, where the primary pathology of adhesive capsulitis resides.[10]

Pain reduction

The IA group consistently demonstrated better pain control at each follow-up, as evidenced by the VAS scores. Pain relief was particularly pronounced in the 4th and 8th weeks post-injection. The early and sustained reduction in pain observed in the IA group aligns with previous studies, which have shown that targeting the joint capsule with corticosteroids can effectively reduce inflammation and fibrotic changes, leading to quicker pain relief.[11]

Functional improvement

In terms of functional outcomes, patients in the IA group also exhibited superior improvements in range of motion, particularly in external and internal rotation. Adhesive capsulitis often severely restricts these movements, which are essential for activities of daily living. The Constant Shoulder Scores, which assess pain, strength, and range of motion, were significantly higher in the IA group at 4, 8 and 12 weeks, reflecting better overall functional recovery.[12]

Gender distribution and diabetes

Frozen shoulder disproportionately affects women and individuals with diabetes, both of which were reflected in this study.[13] Although the precise reasons for this gender disparity are not fully understood, hormonal factors, particularly in postmenopausal women, may play a role in the development of adhesive capsulitis.[14] Moreover, diabetes is a well-known risk factor due to its association with systemic inflammation and microvascular changes, which can contribute to the thickening of the shoulder capsule.[15]

Safety and complications

Both injection techniques were well-tolerated by the patients. No major complications such as infections or adverse reactions were reported. Two patients in the IA group experienced mild, transient soreness at the injection site, which resolved within 24 hours without intervention. This confirms the safety profile of corticosteroid injections for frozen shoulder.

This study has few limitations as given follows.

Small sample size

The study involved only 60 patients, which limits the generalizability of the results. A larger sample size would be required to validate the findings and provide more robust statistical power.

Short follow-up duration

The study followed patients for only 12 weeks. Longer follow-up periods would be necessary to assess the long-term efficacy and recurrence rates of intraarticular versus subacromial corticosteroid injections.

Single-center study

Conducted at a single center (Bangalore Medical College and Research Institute, Bangalore), the findings may not be fully generalizable to other populations or healthcare settings.

Lack of blinding

Since patients were aware of the type of injection they received, the possibility of bias in patient-reported outcomes (such as pain scores) cannot be excluded. Double-blinding could have reduced potential bias.

No assessment of adverse effects

The study did not extensively report on potential side effects or complications associated with corticosteroid injections, which are important factors to consider when evaluating treatment options.

Homogeneous population

The study population may not reflect a diverse demographic, limiting the applicability of the results to different age groups, genders or ethnicities.

CONCLUSION

This study demonstrates that intraarticular corticosteroid injections are more effective than subacromial injections in treating patients with frozen shoulders, particularly in terms of pain relief and functional improvement. Intraarticular injections provide faster and more sustained pain reduction, as well as better recovery of shoulder mobility, making them the preferred choice for managing adhesive capsulitis. Given the comparable safety profiles of both injection methods, IA injections should be considered the primary treatment option, particularly for patients seeking early relief and improved joint function.

Further research is warranted to explore the long-term outcomes of IA versus SA injections, including recurrence rates and the potential need for repeat injections.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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