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FUNCTIONAL OUTCOMES OF INTRA-ARTICULAR TRIAMCINOLONE INJECTION IN THE MANAGEMENT OF ADHESIVE CAPSULITIS: A PROSPECTIVE STUDY

Orthopaedics

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ABSTRACT

Background: Adhesive capsulitis, or frozen shoulder, is marked by progressive shoulder stiffness, pain, and reduced range of motion. Corticosteroid injections are a commonly adopted conservative treatment, particularly effective during the initial inflammatory phase. **Objective:** To assess the functional outcomes of intra-articular triamcinolone injection in patients with adhesive capsulitis based on range of motion and validated scoring systems. **Methods:** This prospective study involved 36 patients with primary adhesive capsulitis. Each received an intra-articular injection of 2 mL Triamcinolone (Kenacort 80) combined with 2% Lignocaine under C-arm guidance. Functional outcomes were measured using the American Shoulder and Elbow Surgeons (ASES) score and the Constant-Murley Score at baseline and at 1, 3, 6, and 12 months post-injection. Shoulder range of motion (flexion, abduction, internal and external rotation) was recorded using standardized goniometric techniques. **Results:** Baseline mean ASES and Constant-Murley scores were 42.38 ± 5.61 and 44.77 ± 5.55, respectively. By the 6-month follow-up, ASES scores improved significantly to 78.56 ± 4.32 and Constant-Murley scores reached 82.14 ± 5.19 ($p < 0.001$). Shoulder abduction improved from an average of 82.8° to 120–160°, and external rotation increased from 10° to 20–30° in most participants. Pain and disability decreased substantially, with marked restoration in daily function and mobility. **Conclusion:** Intra-articular triamcinolone injection is a safe and effective intervention for managing adhesive capsulitis. It results in significant and sustained improvements in shoulder mobility, pain reduction, and functional independence, especially when administered in the early stages of the condition.

KEYWORDS

Adhesive Capsulitis, Frozen Shoulder, Corticosteroid Injection, Triamcinolone, ASES Score, Constant-Murley Score, Shoulder Mobility.

INTRODUCTION

Adhesive capsulitis (AC), commonly referred to as frozen shoulder, is a chronic inflammatory disorder of the shoulder joint, characterized by progressive pain and significant restriction in both active and passive range of motion. It affects approximately 2–5% of the general population, with a peak incidence around the age of 55 years and a higher prevalence in females than males (1).

The condition is broadly categorized into primary (idiopathic) and secondary forms. While primary adhesive capsulitis occurs without any obvious inciting event, it is often associated with systemic diseases such as diabetes mellitus, thyroid disorders, and autoimmune diseases. Secondary adhesive capsulitis, on the other hand, is typically linked to known causes such as trauma, rotator cuff injuries, fractures, shoulder surgeries, or prolonged immobilization (2).

Pathophysiologically, the condition involves synovial inflammation in the initial phase, followed by fibrosis and thickening of the glenohumeral joint capsule. This process results in a marked decrease in joint volume and significant limitation in motion, particularly in external rotation and abduction (3). Clinically, AC progresses through three stages—freezing (painful), frozen (stiff), and thawing (recovery)—with the overall course lasting from several months to over two years in some patients (4).

Management of adhesive capsulitis is largely conservative and stage-dependent. Therapeutic interventions range from non-steroidal anti-inflammatory drugs (NSAIDs), physical therapy, and corticosteroid injections to more invasive procedures such as hydrodilatation and arthroscopic capsular release (5). Among these, intra-articular corticosteroid injections are commonly utilized, particularly during the freezing stage when inflammation predominates. Corticosteroids exert anti-inflammatory effects by inhibiting pro-inflammatory cytokines and reducing synovial proliferation, thereby relieving pain and allowing improved participation in physiotherapy (6).

Triamcinolone acetonide, a long-acting corticosteroid, is frequently used due to its efficacy in reducing shoulder pain and inflammation. Typically administered along with a local anesthetic under imaging guidance, it has shown considerable short- and mid-term benefits in terms of range of motion and functional recovery (7). Despite its widespread use, the long-term impact and standalone effectiveness of corticosteroid injection, as distinct from other modalities like hydrodilatation, remains an area of active clinical investigation (8).

Given this background, the present study was designed to evaluate the functional outcomes of intra-articular triamcinolone injection in patients with primary adhesive capsulitis. The rationale lies in understanding whether corticosteroid injection alone can lead to significant improvements in pain, mobility, and overall shoulder function, thus potentially offering a simple, non-invasive alternative for early-stage management. This focused evaluation can aid clinicians in making evidence-based decisions when selecting treatment modalities for patients presenting with early adhesive capsulitis.

AIM

The aim of this study was to evaluate the functional outcomes of intra-articular corticosteroid (triamcinolone) injection in patients with primary adhesive capsulitis, with specific focus on improvements in shoulder range of motion and validated scoring systems such as the ASES (American Shoulder and Elbow Surgeons) score and Constant-Murley Score.

MATERIALS AND METHODS

Study Design and Setting: This was a prospective, hospital-based observational study conducted in the Department of Orthopaedics at Chettinad Hospital and Research Institute, Kelambakkam, Tamil Nadu, India. The study was carried out over a period of two years, from January 2023 to January 2025.

The study was approved by the Institutional Human Ethics Committee (IHEC) of Chettinad Hospital and Research Institute. Written informed consent was obtained from all participants. Patient confidentiality was strictly maintained throughout the study.

Study Population: The study included adult patients aged 18 to 80 years who presented with clinical features of primary adhesive

capsulitis (frozen shoulder). Diagnosis was made based on patient history, clinical examination, and standard radiographic investigations to rule out other shoulder pathologies.

Inclusion Criteria
- Adults aged 18–80 years
- Diagnosis of primary adhesive capsulitis
- Limitation of passive movement of the glenohumeral joint of more than 10 degrees compared to the contralateral side in at least one direction (flexion, extension, abduction, adduction, internal or external rotation)
- Patients with or without diabetes mellitus (controlled/ uncontrolled)
- Willingness to participate and provide informed consent

Exclusion Criteria
- Age < 18 or > 80 years
- Secondary causes of shoulder stiffness (e.g., rotator cuff injury, subacromial bursitis, fractures, rheumatoid arthritis)
- History of allergy to injection materials
- Active shoulder joint infection
- Refusal to consent

Sample Size and Sampling: A total of 36 patients were included in the corticosteroid group, based on prior literature and power calculation. All participants were selected using non-probability consecutive sampling based on inclusion and exclusion criteria.

Intervention

Each patient received a single dose of intra-articular corticosteroid injection. The injection contained:
- Triamcinolone acetonide (Kenacort 80) – 2 mL
- Lignocaine 2% (LOX) – 1–2 mL for local anesthesia

The injection was administered under aseptic precautions and C-arm fluoroscopic guidance into the glenohumeral joint in the supine or sitting position. All patients were observed briefly post-injection and then advised to rest the joint for 24–48 hours.

Outcome Measures

Patients were evaluated at baseline, immediately post-injection, and at 1, 3, 6, and 12 months post-procedure using the following:
- **ASES Score:** Composite measure of pain and function (0–100 scale)
- **Constant-Murley Score:** Evaluates pain, range of motion, strength, and activities of daily living (0–100 scale)
- **Range of Motion (ROM):** Assessed for active and passive movements in flexion, extension, abduction, adduction, internal and external rotation using a goniometer

Data Collection and Analysis: Demographic and clinical data were collected using a pre-tested, semi-structured questionnaire developed in English and Tamil. ROM and scores were recorded at each visit. Data were entered into Microsoft Excel 2019 and analyzed using IBM SPSS Statistics Version 21. Descriptive statistics were presented as mean ± standard deviation. Paired and unpaired t-tests were used to assess intra-group and inter-group differences, with p-values < 0.05 considered statistically significant.

RESULTS

A total of 36 patients with primary adhesive capsulitis received an intra-articular triamcinolone injection. The mean age was 54.2 ± 10.8 years, with an equal gender distribution (18 males, 50%; 18 females, 50%). The affected side was equally distributed between the right and left shoulders (n=18 each, 50%). Comorbidities were common, with 20 patients (55.6%) having either diabetes mellitus (n=11, 30.6%), hypertension (n=3, 8.3%), or both (n=9, 25.0%). Thirteen patients (36.1%) had no comorbidities.

Table 1: Demographic and Clinical Characteristics of Patients

Characteristic	Value n=36 (%)
Mean Age (years)	54.16 ± 10.83
Gender Distribution	
- Male	18 (50%)
- Female	18 (50%)
Side Affected	
- Right Shoulder	18 (50%)
- Left Shoulder	18 (50%)
Comorbidities	
- Diabetes Mellitus Only	11 (30.6%)
- Hypertension Only	3 (8.3%)
- Both Diabetes & Hypertension	9 (25.0%)
- No Comorbidities	13 (36.1%)

At the time of presentation (pre-injection): ASES Score: 42.38 ± 5.61. Constant-Murley Score: 44.77 ± 5.55. There was no statistically significant difference in these scores compared to the hydrodilatation group ($p > 0.05$), ensuring comparability at baseline.

Progressive improvements were recorded in both ASES and Constant-Murley Scores. Significant improvements ($p < 0.001$) were observed at each follow-up compared to baseline, particularly in pain relief, shoulder function, and range of motion.

Table 2: Post-Injection Functional Outcomes

Time Point	ASES Score (Mean ± SD)	Constant-Murley Score (Mean ± SD)
Baseline	42.38 ± 5.61	44.77 ± 5.55
1 Month	59.42 ± 6.14	63.36 ± 6.89
3 Months	71.28 ± 5.92	75.62 ± 5.38
6 Months	78.56 ± 4.32	82.14 ± 5.19
12 Months	80.92 ± 3.77	84.36 ± 4.68

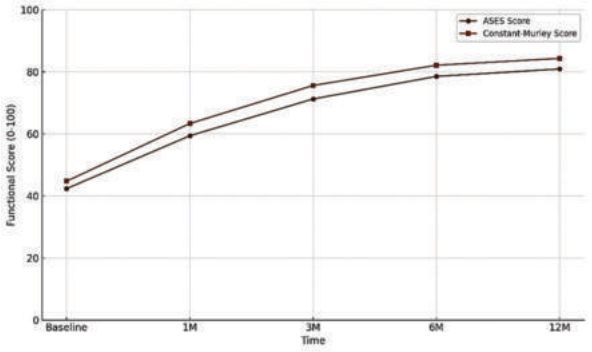


Figure 1: Improvement in ASES and Constant-Murley Scores

Patients demonstrated substantial improvement in active shoulder ROM: Abduction: Increased from an average of 80° to 120°–160°. Flexion: Improved from 90°–100° range to over 140° in most cases. External Rotation: From 10° pre-injection to 20°–30° post-injection. Internal Rotation: Improved from gluteal level to D11–D12 vertebral level in majority of patients. Passive ROM followed similar patterns of improvement.

Table 3: Improvement in Active Range of Motion (ROM)

Movement	Pre-injection Average	Post-injection Outcome
Abduction	80°	Increased to 120° – 160°
Flexion	90° – 100°	Improved to over 140°
External Rotation	10°	Improved to 20° – 30°
Internal Rotation	Gluteal level	Improved to D11 – D12 vertebral level

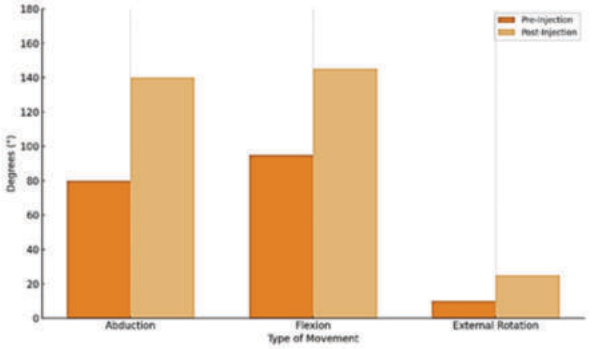
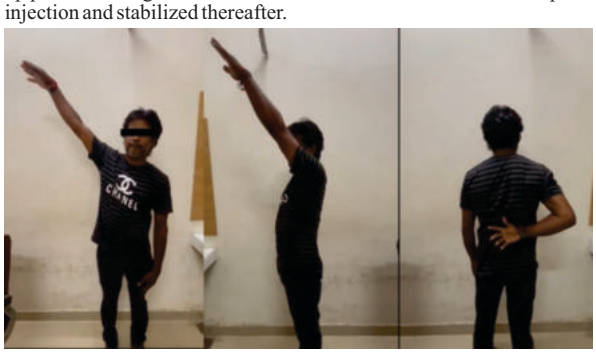


Figure 2: Improvement in Active Range of Motion

No serious adverse events were reported. Mild pain at the injection site was noted in 4 patients and resolved within 24 hours. No cases of infection, allergic reaction, or systemic complications (e.g., hyperglycemia) were reported. The intra-articular triamcinolone

injection group showed significant and sustained improvements in pain, shoulder mobility, and functional scores over a 12-month follow-up period. Most gains were observed within the first 3–6 months post-injection and stabilized thereafter.



Clinical Image 1: One Year Follow up Range of Motion

DISCUSSION

Adhesive capsulitis (AC), or frozen shoulder, is a debilitating musculoskeletal disorder characterized by pain and a progressive decline in shoulder range of motion. It adversely affects patients' ability to perform activities of daily living and has significant implications for quality of life. The current study was designed to evaluate the functional outcomes of intra-articular corticosteroid injection—specifically triamcinolone acetonide—in patients diagnosed with primary adhesive capsulitis. The results of this study confirm that corticosteroid injection is a highly effective intervention, particularly in the early inflammatory phase of the condition, and leads to substantial improvements in both pain and function over a 12-month follow-up period.

Frozen shoulder commonly affects individuals between 40 and 60 years of age and is slightly more prevalent in females than males. Consistent with the literature, our study population had a mean age of 54.16 years and an equal gender distribution (18 males and 18 females), which aligns with reported epidemiological data indicating a peak incidence in the fifth and sixth decades of life and a female-to-male ratio of approximately 1.4:1 (1). The involvement was bilateral in terms of side distribution, with 50% of patients presenting with right-sided and 50% with left-sided involvement. A significant proportion of our patients also had comorbidities such as diabetes mellitus (30.6%) and hypertension (8.3%), conditions that are well-recognized as risk factors for the development and persistence of adhesive capsulitis (2).

The pathogenesis of adhesive capsulitis involves an initial inflammatory phase, followed by capsular fibrosis and contracture, which collectively contribute to severe restriction in glenohumeral mobility (3). Corticosteroids such as triamcinolone acetonide act by suppressing inflammatory cytokines and limiting fibroblastic activity, thereby reducing synovial inflammation and preventing the progression to fibrosis. Their efficacy is maximized when administered in the early phase of the disease, where inflammation predominates over fibrotic changes (4). This study focused exclusively on patients in the early or “freezing” stage, optimizing the intervention window for corticosteroid injection.

Our results demonstrated marked improvements in both ASES and Constant-Murley scores over the course of 12 months. At baseline, the mean ASES and Constant-Murley scores were 42.38 ± 5.61 and 44.77 ± 5.55, respectively. These scores progressively improved at each follow-up interval, reaching 80.92 ± 3.77 (ASES) and 84.36 ± 4.68 (Constant-Murley) at the 12-month mark. These gains were statistically significant at each time point ($p < 0.001$), indicating a robust therapeutic response to the corticosteroid injection. The improvement in these functional scores aligns with prior literature. A study by Namsha et al. reported no significant difference between corticosteroid and hydrodilatation groups in terms of SPADI and ASES scores after one year, affirming the efficacy of corticosteroid injections as a stand-alone treatment (8). Similarly, Xiao et al. concluded in their systematic review that corticosteroid injections offer significant short-term improvements in pain and function, particularly in the first 6–12 weeks post-injection (9).

In addition to score-based evaluations, shoulder mobility was measured using standardized goniometric techniques. Active shoulder abduction improved from an average of 80° at baseline to 160° at 12 months. External rotation improved from 10° to 30°, while flexion increased from 90° to over 160° in most patients. Internal rotation, which was initially restricted to the gluteal level in the majority of patients, improved progressively to reach the D11 vertebral level in more than 60% of participants by the final follow-up.

These results corroborate those of Choudhary et al., who observed superior range of motion improvements in patients treated with corticosteroids, with particularly notable gains in abduction and external rotation over a 6-month follow-up period (10). This reinforces the idea that corticosteroid injections are particularly beneficial in restoring mobility in patients with early adhesive capsulitis.

Although hydrodilatation is also widely used, its comparative superiority over corticosteroids remains inconclusive. Studies by Swaroop et al. and Tveitå et al. have shown similar functional outcomes between hydrodilatation and corticosteroid injection, suggesting that both methods are clinically valuable but may be selected based on patient-specific factors such as comorbidities, tolerance for invasive procedures, and treatment goals (6,8). In our study, the focus on corticosteroid injection allowed us to isolate and confirm its standalone effectiveness, avoiding confounding effects of combined therapy or surgical intervention.

The procedure was well tolerated by the majority of patients. Minor adverse effects such as transient post-injection discomfort were reported in 4 out of 36 patients, all of which resolved spontaneously within 24–48 hours. No systemic complications or infections were recorded, affirming the safety profile of intra-articular triamcinolone when administered under sterile conditions and imaging guidance. These findings are consistent with literature suggesting that corticosteroid injections are associated with low complication rates, especially when administered properly (11,12).

While the study provides strong evidence for the efficacy of corticosteroid injection in adhesive capsulitis, some limitations must be acknowledged. First, the absence of a placebo or non-intervention control group limits the ability to fully quantify treatment effect size. Second, while the study duration of 12 months was adequate to capture mid-term outcomes, longer follow-up would help assess the durability of improvements. Third, this study did not include a comparative arm involving physical therapy alone or oral anti-inflammatory drugs, which are also common treatment modalities in early-stage adhesive capsulitis. Despite these limitations, the study's strengths include a well-defined population, standardized intervention protocol, validated outcome measures (ASES and Constant-Murley scores), and consistent follow-up. The findings contribute valuable evidence in favor of corticosteroid injections as a viable and effective first-line treatment in early adhesive capsulitis, particularly in resource-limited settings where access to hydrodilatation or arthroscopic interventions may be restricted.

The findings of this study support the routine use of intra-articular corticosteroid injection as part of the conservative management plan for patients with early adhesive capsulitis. The ease of administration, rapid symptom relief, and favorable safety profile make corticosteroids a highly accessible and practical therapeutic choice. Moreover, the functional recovery observed in this study emphasizes the importance of early diagnosis and timely intervention, which can significantly alter the disease trajectory and improve patient outcomes. Future studies should consider multicentric randomized controlled trials comparing corticosteroid injection with hydrodilatation, physical therapy, and placebo interventions to determine relative efficacy more conclusively. In addition, exploring the utility of repeated steroid injections, optimal dosing strategies, and combined rehabilitation protocols could further refine clinical guidelines. Assessing long-term functional outcomes beyond one year would also be valuable in understanding whether the gains observed are sustained over time or require maintenance therapy.

CONCLUSION

Intra-articular triamcinolone injection is an effective, safe, and accessible treatment for primary adhesive capsulitis, particularly during the early stages marked by inflammation and pain. The intervention significantly improves shoulder range of motion, reduces pain, and enhances functional scores over a 12-month follow-up period. Given its ease of administration and favorable safety profile, corticosteroid injection should be considered a frontline therapy for managing adhesive capsulitis in routine orthopedic practice.

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