# Role of Intra-Articular Corticosteroid Injection in Treatment of Adhesive Capsulitis of Shoulder Joint

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Abstract: <u>Introduction</u>: Adhesive Capsulitis, also known as frozen shoulder, is an inflammation of the articular capsule, leading to significant pain and restricted range of motion (ROM), commonly affecting the shoulder. Diagnosis is primarily clinical, involving the assessment of active and passive mobility in the glenohumeral joint. <u>Methodology</u>: Participants received intra-articular steroid injections followed by self-practice mobilization exercises. Inclusion criteria included patients aged 30-60 with a painful, stiff shoulder for at least four weeks. Exclusions were recent trauma, uncontrolled diabetes, and other conditions. Assessments were done using VAS for pain, and SPADI for pain and disability. Statistical analysis was performed using SPSS software. <u>Results</u>: The study found that intra-articular corticosteroid injections significantly reduced pain severity and night pain over 26 weeks. Night pain incidence reduced, improving sleep quality. Significant improvements in shoulder mobility and function were evidenced by reduced SPADI scores. A higher prevalence of adhesive capsulitis in patients aged 51-55 years, with slight female predominance and right-side dominance was observed. <u>Conclusion</u>: Intra-articular corticosteroid injections, combined with self-directed ROM exercises, significantly alleviate pain and improve function in patients with adhesive capsulitis. Early intervention and comprehensive management are crucial for optimizing outcomes.

Keywords: Adhesive Capsulitis, Intra-Articular Corticosteroid Injections, Pain Relief, Shoulder Mobility, Nonoperative Management

## 1. Introduction

Adhesive Capsulitis, or "frozen shoulder," is an inflammation of articular capsule which is usually aseptic. It is mainly characterized by spontaneous chronic shoulder pain and gradual loss of shoulder motion including all active and passive movements. <sup>1</sup> The pathogenesis of primary adhesive capsulitis remains unclear.<sup>2</sup> Patients with adhesive capsulitis first encounter a phase of "freezing" when increasing pain and stiffness last for several months, followed by a steady-state stage of "frozen" when shoulder motion is lost, then progressing into a "thawing" phase which presents less pain and return of the restricted motion. <sup>3,4</sup> Although adhesive capsulitis is thought to be self-limited, complete resolution of the pain and disability does not always occur. Only 59% of the patients regain normal function after 4 years. <sup>5</sup> The main treatment for adhesive capsulitis is a trial of conservative therapies, including analgesia, exercise, physiotherapy, oral nonsteroidal anti-inflammation drugs (NSAIDs), and intraarticular corticosteroid injections.<sup>6</sup>

It was previously reported that intra-articular corticosteroids lead to fast pain relief and improvement of range of motion (ROM). <sup>7-11</sup> Griesser et al. <sup>12</sup> performed a systematic review of randomized-controlled trials (RCTs) and concluded that intra-articular corticosteroid injections lead to greater improvements in pain relief and ROM both in the short and the long terms, but compared to other treatments, the effects were similar in the long term.

Many physiotherapy and home exercises has been used as a first-line treatment for adhesive capsulitis. Physiotherapy has been shown to bring about pain relief and return of functional motion. <sup>13</sup> Manipulation under anaesthesia with an intraarticular steroid injection is also used as a treatment modality for frozen shoulder. The affected shoulder is manipulated to stretch and tear the tight capsule and to improve range of movement. Surgeons used an intra-articular injection of corticosteroid to the glenohumeral joint whilst the patient is under the same anaesthetic unless it is contraindicated. Postoperative analgesia, including nerve blocks, provided as per usual care in the treating hospital. <sup>14</sup>

There is no current consensus in favour of one form of treatment, and several different therapeutic regimens are used. This suggests there is no major advantage with any single treatment. In view of the prevalence of such shoulder problems it is important to determine the most effective remedy. In the present series, we will study the role of intraarticular steroid injection in the treatment of the adhesive capsulitis and evaluate its efficacy.

# 2. Material & Method

This prospective study was conducted at the Mayo Institute of Medical Sciences in Barabanki, focusing on patients presenting with shoulder pain specifically diagnosed as adhesive capsulitis through clinical examination. The treatment protocol included administering an intra-articular steroid injection, followed by a regimen of self-directed mobilization exercises.

Inclusion criteria for the study were based on the guidelines by Bulgen et al. Patients aged 30 to 60 years with a history of a painful and stiff shoulder for at least four weeks, restricted arm movement, and sleep disturbance due to pain were eligible for inclusion. Exclusion criteria ruled out patients with conditions such as stroke, recent trauma, and uncontrolled diabetes.

Baseline assessments were conducted at the start of the study, followed by evaluations at 4, 6, 12, and 26 weeks. These assessments included X-rays, blood tests, and random blood sugar levels. The primary outcomes were measured using the Visual Analogue Scale (VAS) for pain and the Shoulder Pain and Disability Index (SPADI) for both pain and disability. The SPADI scores were derived from patient responses to a set of 13 questions, assessing the impact of the condition on their daily lives. Data analysis was performed using SPSS software, version 26.0 (SPSS Inc., Chicago, IL, USA) for Windows, ensuring a robust statistical evaluation of the study outcomes.

# 3. Results

In the present study, the mean age of the patients was approximately 47.57 years, with a standard deviation of 5.63 years, indicating a moderate variation around the mean. The largest proportion of patients fell within the 51–55-year age group, comprising 30.26% of the study population, followed by the 56–60-year age group, representing 19.74% of the patients. The smallest age groups were those aged 30-35 and 36-40 years, each accounting for 10.53% of the total [Table-1].

The gender distribution was nearly balanced, with females representing 51.32% of the patients and males accounting for 48.68%. The occupation of the patients varied, with nearly half (48.68%) being professionals or white-collar workers, followed by 32.89% in skilled trades or blue-collar jobs, and 14.47% being laborers. A small portion (3.95%) were students. Regarding clinical symptoms, 73.68% of the patients experienced night pain, while 26.32% did not. The affected side was predominantly the right shoulder, affecting 54.79% of the patients, compared to 45.21% with left shoulder involvement. Additionally, 24.66% of the patients had a family history of the condition, and personal medical history revealed that 16.44% of the patients were diabetic, while 7.89% tested positive for rheumatoid factor.

On clinical examination, pain on manipulation was the most common symptom, affecting 59.21% of patients, followed by tenderness in 43.42%. The range of motion (ROM) was initially limited, with an average flexion of 90.12 degrees, extension of 31.89 degrees, abduction of 90.34 degrees, internal rotation of 31.56 degrees, and external rotation of 42.78 degrees. Over the course of the study, significant improvements in ROM were observed, particularly after 26 weeks, where flexion improved to 141.34 degrees, extension to 83.56 degrees, abduction to 151.67 degrees, internal rotation to 73.23 degrees, and external rotation to 91.67 degrees. These changes were statistically significant, with pvalues less than 0.0001, indicating strong evidence of improvement [Figure-1]. The Shoulder Pain and Disability Index (SPADI) scores reflected significant reductions in pain and disability over time. Initially, the mean SPADI score was 65.34, which decreased to 45.78 after 6 weeks, 26.89 after 12 weeks, and 12.45 after 26 weeks. Correspondingly, clinical improvement increased dramatically, from 0% on Day 1 to 87.56% after 26 weeks, with statistical analysis confirming these changes as highly significant [Figure-2].

Pain severity also decreased notably over time. On Day 1, 25 patients reported severe pain, but this number dropped to 2 by the end of the 26-week period. Similarly, moderate and mild pain levels decreased, while the number of patients reporting no pain increased significantly, from 6 on Day 1 to 67 after 26 weeks. Statistical analysis revealed a highly significant reduction in pain, with a p-value of less than 0.0001 [Figure-3] Night pain showed a similar trend, with the number of patients experiencing night pain decreasing from 65 at the start to just 7 after 26 weeks. The reduction in night pain was also highly significant, further supporting the effectiveness of intra-articular corticosteroid injections in managing adhesive capsulitis of the shoulder joint [Figure-4].

# 4. Discussion

Adhesive capsulitis, commonly known as frozen shoulder, is a condition characterized by stiffness and pain in the shoulder joint. <sup>15</sup> Intra-articular corticosteroid injections are a common treatment option for this condition, aimed at reducing inflammation and pain, and improving range of motion. <sup>16</sup> This procedure involves injecting corticosteroids directly into the shoulder joint to reduce inflammation and pain, which can help improve mobility. The anti-inflammatory properties of corticosteroids can provide significant symptomatic relief, particularly in the early stages of adhesive capsulitis, facilitating a quicker return to normal function. When combined with physical therapy, corticosteroid injections can enhance overall outcomes, though their efficacy may diminish in the later stages of the condition.

Adhesive capsulitis often affects middle-aged individuals, with the highest prevalence typically noted in those between 40 and 60 years old. This demographic data reflects the common age distribution observed in clinical settings. In this study of 76 patients with adhesive capsulitis, we found the mean age 47.57 years (SD  $\pm$  5.63), indicating a moderate spread around the mean, consistent with the typical age range for this condition. The largest age group in this study was 51-55 years, comprising 30.26% of the population (23 patients). This is in line with other studies that identify the peak incidence of adhesive capsulitis in individuals over 50 years old, possibly due to age-related degenerative changes and increased prevalence of conditions like diabetes and thyroid disorders, which are risk factors for adhesive capsulitis. <sup>17</sup>

The next largest group, patients aged 56-60 years, accounted for 19.74% (15 patients). The slightly lower percentage in this older age group compared to the 51-55 years bracket could be due to the resolution of the condition or decreased diagnosis in older patients who might attribute shoulder stiffness to aging and not seek medical intervention. Younger age groups, specifically 30-35 years and 36-40 years, each represented 10.53% of the sample (8 patients each). While adhesive

capsulitis is less common in these age ranges, it can still occur, particularly in individuals with predisposing factors like trauma, surgery, or systemic diseases. <sup>18</sup> The remaining groups, 41-45 years and 46-50 years, included 13.16% (10 patients) and 15.79% (12 patients) of the sample, respectively. These percentages are indicative of the progressive increase in the incidence of adhesive capsulitis with advancing age, reaching a peak in the early 50s. <sup>19</sup> This demographic distribution highlights the importance of considering age as a significant factor in the diagnosis and management of adhesive capsulitis, with a clear predominance in middle-aged individuals.

The patient characteristics of a cohort with adhesive capsulitis reveal insightful demographics and clinical profiles essential for understanding the condition's impact and potential risk factors. This study involves 76 patients, with a nearly balanced gender distribution: 52.05% females (38 patients) and 47.95% males (35 patients). This gender distribution is consistent with existing literature suggesting a slight female predominance in adhesive capsulitis cases.

The occupation data show that nearly half of the patients are professionals or white-collar workers, accounting for 48.68% (37 patients). This could be due to the nature of their work, which might involve repetitive shoulder movements or prolonged sedentary positions contributing to shoulder stiffness. Skilled trades or blue-collar workers form 32.89% (25 patients), reflecting significant physical labor as a contributing factor. Laborers constitute 14.47% (11 patients), and students represent the smallest group at 3.95% (3 patients), suggesting that physical activity levels and occupational stress might influence the incidence of adhesive capsulitis.

A significant majority of the patients, 73.68% (56 patients), report night pain, a common symptom of adhesive capsulitis. Night pain is often indicative of inflammation and capsular tightness, contributing to disturbed sleep and increased discomfort. <sup>20</sup> Regarding the affected side, 54.79% (43 patients) have right-sided adhesive capsulitis, while 45.21% (33 patients) have left-sided involvement. This slight dominance of right-side involvement could be related to the predominance of right-handedness in the general population, leading to more frequent use and subsequent overuse injuries. <sup>21</sup> Family history reveals that 24.66% (18 patients) have a family history of the condition, while 75.34% (58 patients) do not, suggesting a possible genetic predisposition in a subset of patients. From a personal medical history perspective, 16.44% (12 patients) are diabetic, and 8.22% (6 patients) tested positive for rheumatoid factor. Diabetes is a wellestablished risk factor for adhesive capsulitis, likely due to the glycosylation of collagen and resultant stiffness.<sup>22</sup> Rheumatoid factor positivity also suggests an association with autoimmune conditions, which may contribute to inflammatory changes in the shoulder joint capsule.<sup>23</sup>

Clinical examination findings provide crucial insights into the physical manifestations of adhesive capsulitis, aiding in diagnosis and treatment planning. Deformity and attitude are the most prevalent symptoms observed during inspection, affecting 47.37% (36 patients). Adhesive capsulitis can lead to a characteristic posture with limited shoulder movement

and altered alignment, resulting in apparent deformities or changes in posture. Skin abnormalities, noted in 30.26% (23 patients), may include erythema, scarring, or discoloration, possibly due to inflammation or previous trauma. Swelling, observed in 22.37% (17 patients), may indicate underlying inflammation or synovial effusion, contributing to the patient's discomfort and restricted range of motion.

Palpation findings provide additional diagnostic information. Pain on manipulation is the most common symptom, affecting 59.21% (45 patients). Palpation-induced pain, particularly at the glenohumeral joint and surrounding structures, is characteristic of adhesive capsulitis and reflects the inflammatory process within the joint capsule. <sup>24</sup> Tenderness, noted in 43.42% (33 patients), further supports the presence of inflammation and capsular involvement. Palpable swelling, observed in 26.32% (20 patients), may correlate with synovial thickening or effusion, contributing to joint stiffness and functional impairment. <sup>25</sup> Local bony irregularities and deformities, although less common, may suggest secondary changes such as osteophyte formation or joint erosion in chronic cases. 26 These findings help differentiate adhesive capsulitis from other shoulder pathologies and guide appropriate interventions, including physiotherapy, corticosteroid injections, and, in refractory cases, surgical intervention. 27

The ROM in patients with adhesive capsulitis significantly improves over time with appropriate treatment, as evidenced by the data provided. Initially, patients presented with restricted ROM, as indicated by mean values for flexion. extension, abduction, internal rotation, and external rotation. However, over the course of the study, substantial improvements were observed in all ROM measurements. Flexion, extension, abduction, internal rotation, and external rotation all showed statistically significant increases from baseline to subsequent follow-up time points. These improvements were particularly pronounced after 26 weeks of treatment, indicating a progressive recovery of shoulder function. These findings align with the natural course of adhesive capsulitis, which typically follows a prolonged and gradual resolution trajectory, often lasting from months to years. <sup>28</sup> The improvements in ROM are essential indicators of treatment efficacy and patient progress. Increased flexion, extension, abduction, internal rotation, and external rotation signify enhanced shoulder mobility, reduced pain, and improved overall function.

These outcomes are crucial for restoring patients' quality of life and enabling them to perform daily activities and tasks without limitations. The statistically significant p-values and F-statistics reinforce the robustness of the observed changes in ROM. These values suggest strong evidence of improvement and lend credibility to the study findings. Such statistical analyses are vital for establishing the validity and reliability of research results. Clinically, these findings underscore the importance of implementing comprehensive treatment strategies for adhesive capsulitis, including a combination of interventions such as corticosteroid injections, physical therapy, and home exercises. Early intervention and consistent management are key to optimizing patient outcomes and facilitating timely recovery. The data presented demonstrate substantial improvements in

ROM among patients with adhesive capsulitis over a 26-week period.

The SPADI is a widely used tool for assessing pain and disability associated with shoulder conditions, including adhesive capsulitis. It consists of a self-administered questionnaire that evaluates both pain and functional limitations in daily activities related to the shoulder joint. In this study, the SPADI scores, along with clinical improvement percentages, were tracked over a period of 26 weeks to assess the efficacy of treatment for adhesive capsulitis. The findings reveal a clear trend of improvement in both SPADI scores and clinical outcomes over time.

On Day 1, patients presented with a high average SPADI score of  $65.34 \pm 10.56$ , indicating significant pain and disability. However, no clinical improvement was reported at this early stage. This reflects the typical presentation of patients with adhesive capsulitis, characterized by severe pain and restricted shoulder mobility.

Subsequent follow-up assessments demonstrated remarkable progress. At 6 weeks, the SPADI score decreased to  $45.78 \pm 8.23$ , accompanied by a clinical improvement of  $31.45 \pm 3.67\%$ .<sup>29</sup> By 12 weeks, the SPADI score further decreased to  $26.89 \pm 5.67$ , with a corresponding clinical improvement of  $64.23 \pm 5.74\%$ . Finally, at 26 weeks, the SPADI score significantly dropped to  $12.45 \pm 1.78$ , while the clinical improvement soared to  $87.56 \pm 7.52\%$ . These findings highlight the effectiveness of the treatment protocol, likely involving a combination of intra-articular corticosteroid injections, physical therapy, and analgesics. The statistical analysis further validates these findings, with highly significant p-values (<0.0001) indicating substantial improvements in both SPADI scores and clinical outcomes over the follow-up period.<sup>30</sup>

The graphical representation of the SPADI scores and clinical improvement over a 26-week period for patients with adhesive capsulitis provides valuable insights into the effectiveness of treatment and the natural progression of the condition. The data shows a significant reduction in pain severity over time, with a clear trend towards improvement. Initially, a substantial number of patients experienced severe, moderate, or mild pain, which progressively decreased with each follow-up period. Remarkably, the number of patients reporting no pain increased dramatically from the baseline assessment to the 26-week follow-up. This decline in pain severity is consistent with the expected course of adhesive capsulitis, as conservative management and interventions such as corticosteroid injections aim to alleviate pain and restore shoulder function. <sup>31</sup> Similarly, the incidence of night pain, a common complaint in adhesive capsulitis, also showed a notable reduction over the 26-week period. The decrease in night pain is indicative of improved shoulder mobility and reduced inflammation within the joint capsule. The significant decrease in night pain further supports the efficacy of the treatment approach employed in this study.

The statistical analysis confirms the clinical observations, revealing highly significant reductions in both pain severity and night pain over time, as indicated by the low P-values (<0.0001) and high X-values (119.5 for pain severity and

145.7 for night pain). These findings underscore the effectiveness of the chosen treatment modality in managing symptoms and improving patient outcomes in adhesive capsulitis. Overall, the graphical representation of SPADI scores and clinical improvement provides compelling evidence of the positive impact of treatment on pain relief and functional recovery in patients with adhesive capsulitis. These findings support the use of conservative management strategies, including corticosteroid injections, in the management of this debilitating condition.

The analysis of pain severity and night pain in patients with adhesive capsulitis over a 26-week period provides valuable insights into the effectiveness of treatment and the natural progression of the condition. Initially, a substantial number of patients reported severe, moderate, and mild pain, indicative of the characteristic symptomatology of adhesive capsulitis. However, as the study progressed, there was a notable reduction in pain severity across all categories. By the end of the 26-week period, the majority of patients reported no pain, indicating a significant improvement in symptomatology. These findings align with existing literature, which suggests that adhesive capsulitis tends to resolve spontaneously over time, with or without intervention. <sup>32</sup> Nevertheless, comprehensive treatment strategies, including intra-articular corticosteroid injections and physical therapy, have been shown to accelerate the recovery process and improve patient outcomes. 33

Similarly, there was a significant reduction in the incidence of nocturnal discomfort among patients with adhesive capsulitis. At the onset of the study, a majority of patients reported experiencing night pain, a common symptom associated with adhesive capsulitis. However, over the 26week period, there was a drastic decrease in the number of patients reporting night pain, with only a small fraction experiencing it at the end of the study. These findings highlight the effectiveness of treatment in alleviating nighttime discomfort and improving patient well-being.

The observed improvements in pain severity and night pain are consistent with previous research demonstrating the efficacy of various treatment modalities for adhesive capsulitis, including corticosteroid injections, physical therapy, and manipulative techniques. <sup>[34, 35]</sup> These interventions aim to reduce inflammation, restore shoulder mobility, and alleviate pain, thereby facilitating the natural healing process. Moreover, the significant reduction in pain and night pain over the study period underscores the importance of early intervention and proactive management in minimizing the impact of adhesive capsulitis on patient function and quality of life. <sup>36, 37</sup> These findings emphasize the importance of adopting a comprehensive approach to the management of adhesive capsulitis, incorporating both conservative and interventional strategies to optimize patient care and facilitate recovery.

# 5. Conclusion

The study conclusively demonstrates that intra-articular corticosteroid injections, particularly when combined with self-directed range of motion exercises, significantly alleviate pain severity and night pain in patients with adhesive

capsulitis over a 26-week period. This treatment approach not only markedly reduces severe pain and enhances sleep quality but also significantly improves shoulder mobility and function, as reflected by decreased SPADI scores. The highest prevalence of adhesive capsulitis is observed in individuals aged 51-55 years, with a slight female predominance and right-side dominance, highlighting typical demographic patterns. The findings underscore the importance of early intervention and comprehensive management, particularly for patients with associated conditions like diabetes and rheumatoid factor positivity, ultimately leading to substantial enhancements in the quality of life for those affected by this condition.

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#### **Tables and Figures**

Table I: Pati	ent Characteristi	CS
Patient Characteristics	Number	Percentage
	[N=76]	(%)
GENDER		
Female	39	51.32%
Male	37	48.68%
OCCUPATION		
Professional/White Collar	37	48.68%
Skilled Trades/Blue Collar	25	32.89%
Laborers	11	14.47%
Student	3	3.95%
HISTORY OF PRESENTING ILLNESS		
Night Pain	56	73.68%
No Night Pain	20	26.32%
AFFE	CTED SIDE	
Right	43	54.79%
Left	33	45.21%
FAMILY HISTORY		
Present	18	24.66%
Absent	58	75.34%
PERSON	IAL HISTORY	
Diabetic	6	7.89%
Rheumatoid Factor Positive	12	16.44%





Figure 1: Range of motion at different follow-up showed significant differences [ANOVA, p<0.0001\*].



Figure 2: SPADI Score and Clinical Improvement follow-up showed significant differences [ANOVA, p<0.0001\*]

## International Journal of Science and Research (IJSR) ISSN: 2319-7064 SJIF (2022): 7.942



Figure 3: Severity of pain at various follow-up showed significant differences [Chi-Square, p<0.0001\*]



Figure 4: Severity of Night pain at various follow-up showed significant differences [Chi-Square, p<0.0001\*