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A Retrospective Comparative Study of Clinical Outcomes of PRP vs Corticosteroid Injection in Frozen Shoulder

Dr. Pardeep Duhan[1]; Dr. Dhruv Lashkare[2*]; Dr. Apoorv Jha[3]

[1]PG Resident 3rd Year, Department of Orthopaedics, RKDF Medical College, SRK University, Bhopal, India.
[2]Associate Professor, Department of Orthopaedics, RKDF Medical College, SRK University, Bhopal, India.
[3]PG Resident 2nd Year, Department of Orthopaedics, RKDF Medical College, SRK University, Bhopal, India.

Corresponding Author: Dr. Dhruv Lashkare[2*]

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Abstract:

- ***Background:***

Adhesive capsulitis (frozen shoulder) is a painful and disabling condition characterized by progressive restriction of active and passive shoulder movements due to capsular inflammation and fibrosis [1-3]. Intra-articular corticosteroid injections are widely used for rapid pain relief, while platelet-rich plasma (PRP) has emerged as a biological treatment aimed at promoting tissue healing and long-term functional recovery [4-8].

- ***Aim:***

To retrospectively compare the clinical outcomes of platelet-rich plasma injection versus corticosteroid injection in the treatment of adhesive capsulitis.

- ***Methods:***

This retrospective comparative observational study was conducted at RKDF Medical College Hospital & Research Center. Medical records of 150 patients diagnosed with adhesive capsulitis and treated with either intra-articular PRP injection or corticosteroid injection were reviewed using purposive sampling. Patients aged 30-70 years with complete clinical and follow-up data were included and divided into two groups of 75 each. Outcome measures included pain assessment using the Visual Analogue Scale (VAS), shoulder range of motion, and functional scores (SPADI/Constant-Murley). Follow-up data were analyzed at 2 weeks, 6 weeks, 3 months, and 6 months. Statistical analysis was performed using independent t-test, paired t-test, and chi-square test, with $p < 0.05$ considered statistically significant.

- ***Results:***

Both treatment modalities resulted in significant improvement in pain, range of motion, and functional outcomes. Corticosteroid injections provided faster short-term pain relief, particularly during early follow-up, whereas PRP injections demonstrated more sustained improvement in shoulder mobility and functional scores at later follow-ups, especially at 3 and 6 months [7-12].

- ***Conclusion:***

PRP injection appears to provide superior long-term clinical outcomes compared with corticosteroid injection, although corticosteroids remain effective for rapid short-term symptom relief. PRP may be considered a promising alternative treatment for adhesive capsulitis, particularly in patients requiring sustained functional improvement [10-16].

Keywords: *Adhesive Capsulitis, Frozen Shoulder, Platelet-Rich Plasma, Corticosteroid Injection, PRP, SPADI.*

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I. INTRODUCTION

Adhesive capsulitis, commonly known as frozen shoulder, is a chronic painful condition characterized by progressive restriction of both active and passive range of motion of the shoulder joint. It most commonly affects adults between 40 and 60 years of age, has a higher prevalence in women, and is strongly associated with diabetes mellitus and other systemic disorders [1-4]. Histopathologically, the disease involves synovial inflammation followed by capsular fibrosis and contracture, particularly in the rotator interval and coracohumeral ligament, which explains the typical limitation of external rotation and overall shoulder stiffness [1,3,6].

Conservative treatment remains the first-line approach for most patients and includes analgesics, physiotherapy, intra-articular injections, hydrodilatation, and, in selected cases, manipulation under anesthesia [2-6]. Intra-articular corticosteroid injection is widely used because it provides rapid pain relief and short-term functional improvement, particularly during the early inflammatory phase of the disease [2,5,6]. However, the durability of steroid benefit remains uncertain, and repeated use may be associated with adverse effects such as transient hyperglycemia, facial flushing, tendon weakening, or cartilage toxicity [2,5,6].

Platelet-rich plasma has emerged as a biological treatment option for adhesive capsulitis. PRP contains concentrated platelets and multiple growth factors that may modulate inflammation, promote tissue healing, and improve capsular remodeling [7-10]. Clinical studies and systematic reviews have suggested that PRP can improve pain, range of motion, and disability scores, with some reports indicating greater mid-term and long-term benefit than corticosteroid injection [7-16]. Recent meta-analyses have further supported the potential role of PRP in improving SPADI scores and shoulder motion, although heterogeneity in PRP preparation and treatment protocols remains a limitation [11-16].

Because clinicians often need to balance immediate symptom relief against durable functional recovery, comparative studies between PRP and corticosteroid injection are clinically relevant. The present retrospective comparative study was therefore undertaken to compare pain relief, range of motion, functional outcome, complications, and patient satisfaction after intra-articular PRP versus corticosteroid injection in patients with adhesive capsulitis of the shoulder [17-22].

II. MATERIALS & METHODS

➢ *Study Setting*

This retrospective comparative observational study was conducted at a tertiary care teaching hospital, RKDF Medical College Hospital & Research Center. The institution caters to a large population from urban and rural areas and has a dedicated Orthopaedics Department with facilities for interventional procedures, physiotherapy, and rehabilitation. Hospital medical records, procedure registers, and follow-up outpatient records were used as the primary data sources. The study duration was 6 months, during which eligible patient records were reviewed and analyzed.

➢ *Study Population and Eligibility Criteria*

The study population consisted of patients diagnosed with adhesive capsulitis (frozen shoulder) who attended the Orthopaedics outpatient department and received either intra-articular platelet-rich plasma (PRP) injection or corticosteroid injection as part of their treatment. Diagnosis was based on clinical findings of shoulder pain with restriction of both active and passive range of motion, supported by radiological evaluation to exclude other pathologies.

- *Patients were Divided into Two Groups Based on the Treatment Received:*

✓ Group A: PRP injection group
✓ Group B: Corticosteroid injection group

Only patients with complete baseline and follow-up records were included to ensure reliable outcome assessment.

➢ *Inclusion Criteria*

- Patients aged between 30 and 70 years
- Clinically and radiologically diagnosed adhesive capsulitis
- Shoulder pain with restriction of both active and passive movements for at least 1 month
- Patients treated with either intra-articular PRP or corticosteroid injection
- Availability of complete medical records and follow-up data

➢ *Exclusion Criteria*

- History of significant shoulder trauma, fracture, or dislocation
- Rotator cuff tear, osteoarthritis, or other shoulder pathologies
- Previous shoulder surgery or manipulation under anesthesia
- Systemic inflammatory disorders (e.g., rheumatoid arthritis)
- Local infection around the shoulder joint
- Incomplete medical records or inadequate follow-up

➢ *Sample Size*

A total of 150 patients were included in the study, with approximately 75 patients in each treatment group. The sample size was calculated for comparison of two independent groups using the formula:

$$n = 2(Z_{\alpha/2} + Z_{\beta})^2 \times \sigma^2 / d^2$$

At 95% confidence level and 80% power, the minimum required sample size was approximately 144 patients. Considering possible data loss in retrospective analysis, the sample size was rounded to 150 to ensure adequate statistical power.

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➢ *Data Collection Procedure*

Data were collected from hospital records including outpatient registers, inpatient files, procedure notes, and follow-up charts using a structured proforma.

- *Collected Variables Included:*

✓ Demographic details (age, sex, affected side)
✓ Duration of symptoms
✓ Comorbidities (e.g., diabetes mellitus)
✓ Baseline pain score (VAS)
✓ Shoulder range of motion (ROM)
✓ Functional scores (SPADI / Constant-Murley)
✓ Type of injection administered
✓ Physiotherapy details
✓ Complications

➢ *PRP Preparation and Injection Procedure*

Approximately 15–20 ml of venous blood was collected and centrifuged to obtain PRP. The PRP was injected intra-articularly into the glenohumeral joint via the posterior approach under aseptic precautions.

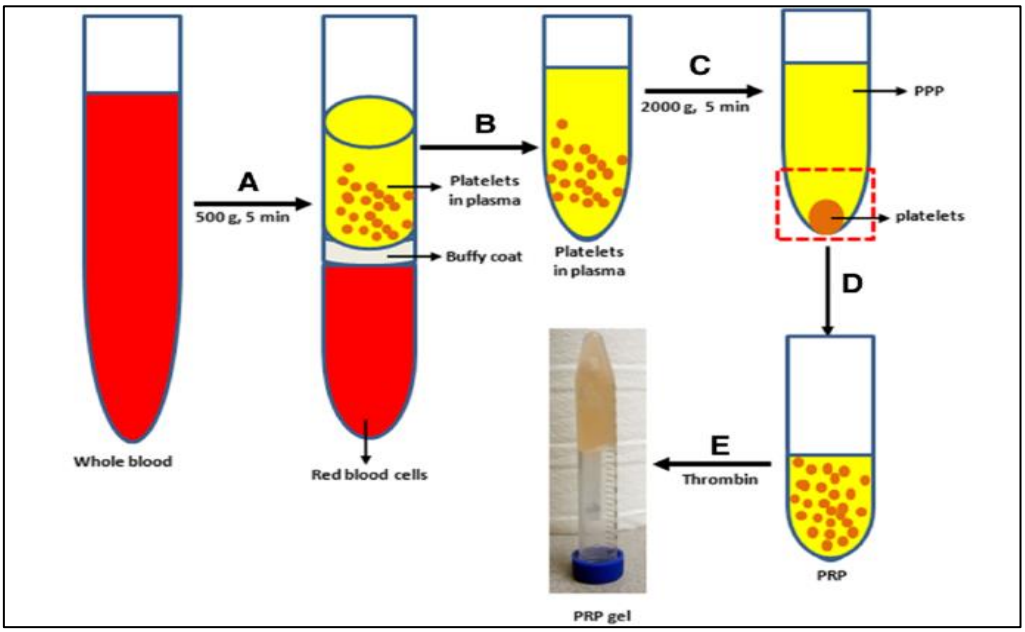

Fig 1 PRP Preparation and Injection Procedure

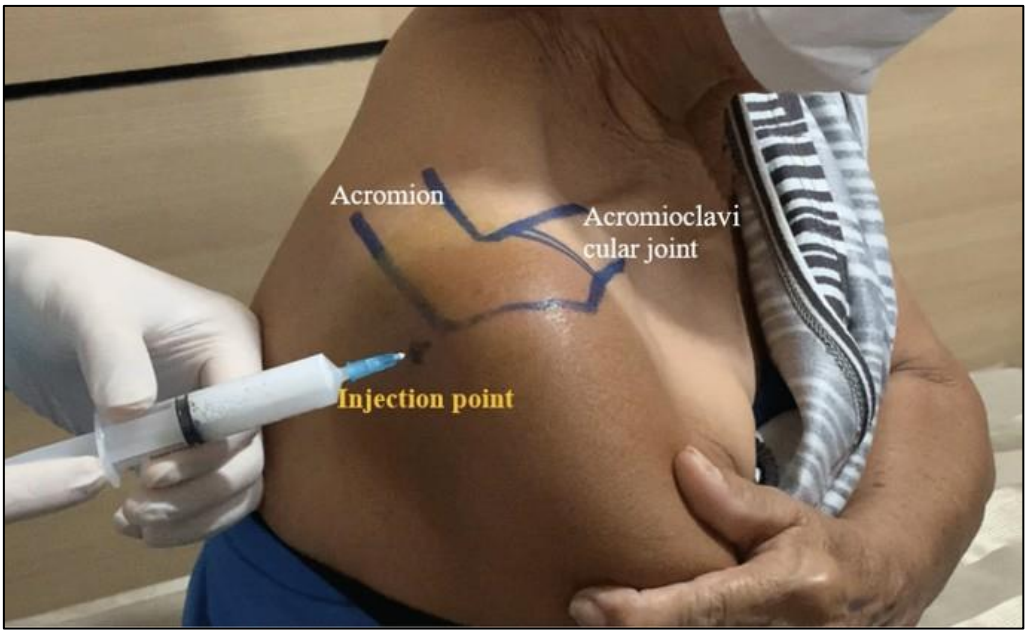

Fig 2 Corticosteroid Injection Procedure

➢ *Corticosteroid Injection Procedure*

Patients received intra-articular corticosteroid (e.g., triamcinolone) mixed with local anesthetic using the posterior approach under sterile conditions. Instrumentation included sterile syringes, 22-gauge needles, antiseptic solutions, centrifuge machine, goniometer for ROM measurement, and standardized scoring tools.

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➢ *Follow-Up Assessment*

Patients were followed for 6 months after injection. Data were recorded at:

- 2 weeks
- 6 weeks
- 3 months
- 6 months

- *Outcome Measures Included:*

✓ Pain assessment using Visual Analogue Scale (VAS)
✓ Range of motion (abduction, flexion, internal and external rotation)
✓ Functional outcome scores (SPADI / Constant-Murley)
✓ Complications

➢ *Data Management and Quality Control*

- Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages.
- Double-entry verification was performed to minimize errors.
- Records with incomplete data were excluded.
- Standardized definitions and measurement techniques were used to maintain uniformity.
- For comparison between the two independent groups, independent t-test was used for continuous variables. Paired t-test was applied to assess within-group changes over time. Categorical variables such as sex distribution, diabetes status, complications, and satisfaction categories were analyzed using chi-square test.
- A p-value of less than 0.05 was considered statistically significant. All statistical tests were two-tailed.

Confidentiality of patient information was maintained throughout the study. Institutional Ethics Committee approval was obtained prior to data collection.

III. RESULTS

A total of 150 patients with clinically diagnosed adhesive capsulitis were included in the study, with 75 patients each in the PRP group (Group A) and the corticosteroid group (Group B). All patients completed the minimum follow-up period of 6 months and were included in the final analysis.

➢ *Baseline Demographic and Clinical Characteristics*

Table 1 summarizes the baseline demographic and clinical characteristics of the two treatment groups. The PRP and steroid groups were comparable with respect to age, sex distribution, affected side, diabetes status, baseline pain score, baseline abduction, and baseline SPADI score, with no statistically significant difference between groups (all $p > 0.05$).

Table 1 Baseline Demographic and Clinical Characteristics of the Study Groups

Parameter	PRP Group (n=75)	Steroid Group (n=75)	p-value
Age (years)	52.1 ± 8.4	52.7 ± 8.9	>0.05
Female (%)	61%	63%	>0.05
Right shoulder (%)	57%	59%	>0.05
Diabetes mellitus (%)	35%	33%	>0.05
Baseline VAS	8.0 ± 0.8	8.1 ± 0.7	>0.05
Baseline abduction	60° ± 10°	62° ± 11°	>0.05
Baseline SPADI	72 ± 9	71 ± 8	>0.05

Independent T-Test Used for Continuous Variables; Chi-Square Test used for Categorical Variables.

➢ *Pain Relief (VAS Score)*

Table 2 presents the mean Visual Analogue Scale (VAS) scores at baseline and during follow-up. Both groups showed progressive reduction in pain over time. The corticosteroid group showed faster pain relief at 2 weeks (4.5 vs 5.8) and 6 weeks (3.9 vs 4.2), whereas the PRP group showed better sustained pain relief at 3 months (2.6 vs 3.2) and 6 months (1.8 vs 2.9). The intergroup difference at 6 months was statistically significant ($p < 0.05$).

Table 2 Comparison of Mean VAS Scores between PRP and Steroid Groups during Follow-up

Follow-up	PRP Group	Steroid Group
Baseline	8.0	8.1
2 weeks	5.8	4.5
6 weeks	4.2	3.9
3 months	2.6	3.2
6 months	1.8	2.9

Intergroup difference at 6 months was statistically significant ($p < 0.05$). Paired t-test used for within-group comparison; Independent t-test used for intergroup comparison.

➢ *Range of Motion Improvement*

Table 3 shows the mean shoulder abduction in both groups at each follow-up visit. Abduction improved progressively in both groups. The steroid group showed

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greater early improvement at 2 weeks (95° vs 85°) and 6 weeks (115° vs 110°), while the PRP group demonstrated better long-term recovery at 3 months (135° vs 125°) and 6 months (155° vs 135°). The difference at 6 months was statistically significant ($p < 0.01$). Similar trends were noted for forward flexion, internal rotation, and external rotation.

Table 3 Comparison of Mean Shoulder Abduction between PRP and Steroid Groups during Follow-Up

Follow-up	PRP Group	Steroid Group
Baseline	60°	62°
2 weeks	85°	95°
6 weeks	110°	115°
3 months	135°	125°
6 months	155°	135°

Intergroup difference at 6 months was statistically significant ($p < 0.05$). Paired t-test used for within-group comparison; Independent t-test used for intergroup comparison.

➢ *Functional Outcome (SPADI Score)*

Table 4 depicts the mean Shoulder Pain and Disability Index (SPADI) scores in both groups. Lower SPADI scores indicate better function. Both groups showed functional improvement over time. Early improvement was comparable, with the steroid group showing slightly lower scores at 2 weeks (50 vs 55). Thereafter, the PRP group demonstrated superior functional recovery at 3 months (28 vs 35) and 6 months (18 vs 30). The difference at final follow-up was statistically significant ($p < 0.01$).

Table 4 Comparison of Mean SPADI Scores between PRP and Steroid Groups During Follow-Up

Follow-up	PRP Group	Steroid Group
Baseline	72	71
2 weeks	55	50
6 weeks	40	42
3 months	28	35
6 months	18	30

Lower SPADI scores indicate better function. The difference at final follow-up was statistically significant ($p < 0.01$). Paired t-test for within-group changes; Independent t-test for intergroup comparison.

➢ *Complications and Patient Satisfaction*

No major complications such as infection, joint damage, or neurovascular injury were observed in either group. Minor adverse effects included transient post-injection pain in 12% of patients in the PRP group and mild facial flushing or hyperglycemia in 9% of patients in the steroid group; all adverse effects were self-limiting. At 6 months, patient satisfaction was higher in the PRP group, with excellent satisfaction reported by 68% of patients compared with 46% in the steroid group. Moderate satisfaction was reported by 24% and 38%, respectively, and poor satisfaction by 8% and 16%, respectively.

➢ *Overall Comparative Outcome*

Overall, the results indicate that corticosteroid injections provide faster short-term pain relief, whereas PRP injections offer superior long-term improvement in pain, shoulder abduction, functional outcome, and patient satisfaction. Both treatment modalities were safe during the period of follow-up.

IV. DISCUSSION

Adhesive capsulitis is a common cause of shoulder pain and stiffness and often leads to prolonged restriction of daily activities. In the present study, both PRP and corticosteroid injections were associated with significant clinical improvement. The steroid group achieved faster short-term pain relief, whereas the PRP group showed better pain, range-of-motion, and functional outcomes at later follow-up. This pattern is broadly consistent with previous randomized studies and systematic reviews evaluating injection-based management for frozen shoulder [2,4-6,17-20].

The early superiority of corticosteroid injection seen in our series is biologically plausible and aligns with prior literature showing that corticosteroids quickly suppress synovial inflammation and improve early pain scores [2,5,6]. In contrast, the better 3- and 6-month outcomes observed with PRP are in agreement with reports suggesting that PRP may provide a more durable effect by modulating inflammation and supporting tissue healing rather than only suppressing symptoms [7-12,14-18,21].

Improvement in range of motion and SPADI score in the PRP group at final follow-up also mirrors findings from prospective studies, cohort studies, and meta-analyses that demonstrated better medium-term functional recovery after PRP injection, even when early results were similar to steroid treatment [7-12,15-18,20-22]. These findings suggest that PRP may be especially relevant when sustained recovery of shoulder function is the primary treatment goal.

Both interventions were safe in the present study, with only minor self-limiting adverse effects. This is comparable to previous reports in which major complications were uncommon after either steroid or PRP injection, although

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steroid-related systemic effects remain a practical concern in susceptible patients, particularly those with diabetes [2,5,6,17,19]. Higher patient satisfaction in the PRP group at final follow-up in our study is likely related to the sustained reduction in pain and better functional recovery over time [18-22].

The results of the present study should be interpreted in light of its retrospective design, single-center setting, and lack of randomization. Nevertheless, the overall findings support the growing body of evidence that PRP is a reasonable alternative to corticosteroid injection for adhesive capsulitis and may provide superior longer-term outcomes, while corticosteroid injection remains useful when rapid short-term symptom relief is desired [10-16,18-22]. Larger prospective randomized studies with standardized PRP protocols are still needed to define the optimal role of PRP in routine clinical practice.

V. CONCLUSION

The present retrospective comparative study demonstrates that both platelet-rich plasma (PRP) injection and intra-articular corticosteroid injection are effective treatment modalities for adhesive capsulitis of the shoulder, resulting in significant improvement in pain, range of motion, and functional outcomes. Corticosteroid injections provided rapid short-term pain relief and early improvement in shoulder mobility, making them particularly useful during the initial inflammatory phase of the disease. However, PRP injections showed superior long-term benefits, with sustained reduction in pain, greater improvement in range of motion, and better functional recovery at later follow-up [17-22].

In conclusion, while corticosteroid injections remain an effective option for rapid symptomatic relief, PRP injections may provide more durable clinical outcomes in the management of frozen shoulder. Further prospective randomized studies with longer follow-up are recommended to establish standardized treatment guidelines and confirm the long-term efficacy of PRP therapy [10-16,18-22].

➢ *Declaration by Authors*

- Ethical Approval: Approved
- Acknowledgement: None
- Source of Funding: None
- Conflict of Interest: The authors declare no conflict of interest.

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