Original Article

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Comparing the Efficacy of Intra-articular (I/A) Platelet Rich Plasma (PRP) and Steroid Injections in Patients with Frozen Shoulder in a Tertiary Care Hospital

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Abstract

Introduction: Frozen shoulder, also known as adhesive capsulitis, is a condition characterized by pain and progressive restriction of both active and passive range of motion in the shoulder joint.

Aim of the study: This study aims to evaluate and compare the effectiveness of intra-articular (I/A) Platelet-Rich Plasma (PRP) injections versus corticosteroid injections in treating frozen shoulder, focusing on pain reduction, improvement in shoulder function, range of motion, and patient satisfaction.

Methods: This comparative study was conducted at Sylhet Women's Medical College Hospital, Sylhet, Bangladesh, from January 2024 to December 2024. A total of 60 patients with frozen shoulder were randomly assigned to receive either PRP injections (n=30) or corticosteroid injections (n=30).

Result: The study compared PRP and corticosteroid injections for frozen shoulder, assessing pain (VAS), shoulder function (UCLA Shoulder Score), and range of motion at baseline, 1, 2, 3, and 6 months. At baseline, both groups were similar; PRP had a VAS score of 7.6, and steroids had 7.7. At one month, VAS scores were 5.0 (PRP) and 5.2 (steroids, $p = 0.380$). By six months, PRP showed superior outcomes with VAS 2.5 vs. 3.8 ($p < 0.001$), UCLA scores of 30.0 vs. 25.5 ($p < 0.001$), and range of motion 130.3° vs. 110.9° ($p < 0.001$).

Conclusion: In conclusion this study suggests that at one month follow-up both group shows effective but PRP injections offer superior short and long term outcomes compared to corticosteroid injections for the treatment of frozen shoulder.

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Introduction

Frozen shoulder, also known as adhesive capsulitis, is a condition characterized by pain and progressive restriction of both active and passive range of motion in the shoulder joint.[1]

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It is a disabling disorder that significantly impacts a patient's quality of life, affecting daily activities and overall function.[2] The condition is typically self-limiting, but the duration of symptoms can be prolonged, often lasting several months to years. Effective management of frozen shoulder is crucial to alleviate pain, restore function, and enhance the quality of life for affected individuals.[3]

The pathophysiology of frozen shoulder is not entirely understood, but it is believed to involve

inflammation and fibrosis of the joint capsule, leading to thickening and contracture.[4]This process results in the characteristic stiffness and pain associated with the condition. Frozen shoulder is commonly divided into three stages: the freezing stage, characterized by increasing pain and stiffness; the frozen stage, where stiffness is predominant and pain may decrease; and the thawing stage, where gradual improvement in range of motion occurs.[5] Studies suggest that both intrinsic and extrinsic factors may contribute to the development of frozen shoulder, including diabetes, thyroid disorders, prolonged immobilization, and other systemic diseases.[6]

Management of frozen shoulder includes a variety of approaches, ranging from conservative treatments such as physical therapy and nonsteroidal anti-inflammatory drugs (NSAIDs) to more invasive interventions like corticosteroid injections and surgical procedures. Among these treatments, corticosteroid injections have been widely used due to their anti-inflammatory properties and ability to provide rapid pain relief.[7] However, the benefits of corticosteroid injections may be short-lived, and repeated injections can have adverse effects, including weakening of the tendons and cartilage.[8]

In recent years, Platelet-Rich Plasma (PRP) therapy has emerged as a promising treatment option for various musculoskeletal conditions, including frozen shoulder.[9] PRP is an autologous blood product containing a high concentration of platelets, which are rich in growth factors and cytokines that promote tissue healing and regeneration. The rationale for using PRP in frozen shoulder is based on its potential to modulate inflammation, promote tissue repair, and enhance recovery of the joint capsule, thereby reducing pain and improving function.[10] The growth factors released by platelets, such as platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF-β), and vascular endothelial growth factor (VEGF), play key roles in tissue repair and regeneration.[10]

Despite the growing interest in PRP therapy, there is a lack of high-quality evidence comparing its efficacy to that of corticosteroid injections in the management of frozen shoulder.[11] Current literature provides conflicting results, with some studies suggesting that PRP may be superior in terms of long-term outcomes, while others find no significant difference between the two treatments.[12] This inconsistency underscores the need for further research to establish the relative effectiveness of PRP and corticosteroid injections.[13]

Frozen shoulder is a debilitating condition that requires effective management to alleviate symptoms and improve quality of life.[14] While corticosteroid injections have been a mainstay of treatment, PRP therapy offers a novel approach with the potential for enhanced tissue healing and sustained symptom relief.[15] This study seeks to compare the efficacy of these two treatments, contributing to the evidence base and informing clinical decision-making in the management of frozen shoulder.

Objective:

The objective of this study was to evaluate the effectiveness of intra-articular (I/A) Platelet-Rich Plasma (PRP) injections in reducing pain and improving shoulder function, to assess the effectiveness of intra-articular corticosteroid injections in achieving similar outcomes, and to compare the overall efficacy of intra-articular PRP and corticosteroid injections in the treatment of frozen shoulder in a tertiary care hospital setting.

Methodology & Materials

This cross-sectional comparative analytical study was conducted from January 2024 to December 2024 at Sylhet Women's Medical College Hospital, Sylhet, Bangladesh, to evaluate and compare the effectiveness of intra-articular Platelet-Rich Plasma (PRP) injections and corticosteroid injections in treating frozen shoulder. A total of 60 patients with frozen shoulder were randomly assigned to receive either PRP (n=30) or corticosteroid (n=30) injections. The sample size was determined using a statistical formula.

Inclusion criteria included adults aged 25 to 75 years with a clinical diagnosis of frozen shoulder and symptoms present for at least three months, with normal shoulder joint X-ray. Exclusion criteria included a history of shoulder surgery or trauma, presence of other shoulder pathologies, systemic infections or blood disorders, Pregnant & Lactating mother and patients unwilling to

attend follow-up visits or comply with the study protocol. Patients were allocated to the two groups using simple randomization.

PRP was prepared from the patient's own blood using a standardized protocol: blood was drawn, centrifuged to separate the platelet-rich plasma, and then injected into the glenohumeral joint. The corticosteroid group received a single intra-articular injection of 40 mg of triamcinolone acetonide mixed with 2 ml of 2%. Lignocaine injection,

Outcomes were assessed using the Visual Analog Scale (VAS) for pain, the UCLA (University of California at Los Angeles) shoulder score for shoulder function, and goniometric measurements for range of motion. Baseline assessments were conducted prior to the intervention, with follow-up evaluations at 1 month, 2 months, 3 months, and 6 months post-injection.

Data analysis was performed using SPSS version 25. Descriptive statistics summarized baseline characteristics, independent t-tests compared continuous variables between groups, and chi-square tests assessed categorical variables. A p-value of <0.05 was considered statistically significant. Informed consent was acquired from all participants prior to their inclusion in the study.

Results:

Table 1: Baseline Characteristics of Participants (N = 60)

Characteristic	PRP Group (n=30)	Steroid Group (n=30)	p-value
Age (years), mean ± SD	52.3 ± 10.2	51.8 ± 11.1	0.801
Gender (Male/Female), n (%)	12/18 (40/60)	10/20 (33/67)	0.823
Duration of Symptoms (months), mean ± SD	3.8 ± 1.2	4.0 ± 1.3	0.580
VAS Score, mean ± SD	7.6 ± 1.2	7.7 ± 1.3	0.740
UCLA Score, mean ± SD	16.5 ± 4.2	17.0 ± 4.5	0.650
Range of Motion (degrees), mean ± SD	90.4 ± 15.3	88.9 ± 14.8	0.680

Table 1 presents the baseline characteristics of 60 participants, with 30 patients in each group (PRP and Steroid). Both groups were comparable in age (PRP: 52.3 years, SD = 10.2; Steroid: 51.8 years, SD = 11.1, p = 0.801), gender distribution (PRP: 12 males, 18 females; Steroid: 10 males, 20 females, p = 0.823), and duration of symptoms (PRP: 3.8 months, SD = 1.2; Steroid: 4.0 months, SD = 1.3, p = 0.580). Pain levels measured by VAS were similar (PRP: 7.6, SD = 1.2; Steroid: 7.7, SD = 1.3, p = 0.740). The UCLA Shoulder Score was also comparable (PRP: 16.5, SD = 4.2; Steroid: 17.0, SD = 4.5, p = 0.650), as was the range of motion (PRP: 90.4 degrees, SD = 15.3; Steroid: 88.9 degrees, SD = 14.8, p = 0.680). These results confirm that the groups were similar at baseline.

Table 2: Pain Intensity (VAS Score) at Different Follow-Up Points

Time Point	PRP Group (mean ± SD)	Steroid Group (mean ± SD)	p-value
Baseline	7.6 ± 1.2	7.7 ± 1.3	0.740
1 Month Post-Injection	5.0 ± 1.1	5.2 ± 1.2	0.380
2 Months Post-Injection	3.8 ± 1.0	4.7 ± 1.1	0.004
3 Months Post-Injection	3.0 ± 1.1	4.5 ± 1.2	<0.001
6 Months Post-Injection	2.5 ± 0.9	3.8 ± 1.1	<0.001

Table 2 displays pain intensity, measured by Visual Analog Scale (VAS) scores, for both PRP and corticosteroid groups at various follow-up points. Baseline scores were similar, with PRP at 7.6 ± 1.2 and corticosteroid at 7.7 ± 1.3 (p = 0.740). At 1 month, both groups showed a reduction in pain, with scores of 5.0 ± 1.1 for PRP and 5.2 ± 1.2 for corticosteroid (p = 0.380). However, from 2 months onward, PRP demonstrated significantly lower pain scores compared to corticosteroid: 3.8 ± 1.0 vs. 4.7 ± 1.1 at 2 months (p = 0.004), 3.0 ± 1.1 vs. 4.5 ± 1.2 at 3 months (p < 0.001), and 2.5 ± 0.9 vs. 3.8 ± 1.1 at 6 months (p < 0.001). These findings indicate that PRP injections offer superior long-term pain relief compared to corticosteroids.

Table 3: Shoulder Function (UCLA Shoulder Score) at Different Follow-Up Points

Time Point	PRP Group (mean ± SD)	Steroid Group (mean ± SD)	p-value
Baseline	16.5 ± 4.2	17.0 ± 4.5	0.650
1 Month Post-Injection	24.0 ± 4.0	20.0 ± 4.5	<0.001
2 Months Post-Injection	26.0 ± 3.5	22.5 ± 4.0	<0.001
3 Months Post-Injection	28.5 ± 3.0	24.0 ± 3.5	<0.001
6 Months Post-Injection	30.0 ± 2.5	25.5 ± 3.0	<0.001

Table 3 shows the shoulder function outcomes, measured by the UCLA Shoulder Score, for patients receiving Platelet-Rich Plasma (PRP) injections versus corticosteroid injections at various follow-up points. Baseline scores were comparable: PRP at 16.5 ± 4.2 and corticosteroid at 17.0 ± 4.5 ($p = 0.650$). At 1 month, the PRP group scored significantly higher with 24.0 ± 4.0 compared to 20.0 ± 4.5 in the corticosteroid group ($p < 0.001$). This trend continued at 2 months, with the PRP group at 26.0 ± 3.5 versus 22.5 ± 4.0 in the corticosteroid group ($p < 0.001$). By 3 months, PRP maintained its advantage with a score of 28.5 ± 3.0, compared to 24.0 ± 3.5 for corticosteroid ($p < 0.001$). At 6 months, the PRP group achieved a mean score of 30.0 ± 2.5, significantly higher than the corticosteroid group's 25.5 ± 3.0 ($p < 0.001$). These findings suggest that PRP injections provide superior long-term improvements in shoulder function compared to corticosteroid injections.

Table 4: Range of Motion (Degrees) at Different Follow-Up Points

Time Point	PRP Group (mean ± SD)	Steroid Group (mean ± SD)	p-value
Baseline	90.4 ± 15.3	88.9 ± 14.8	0.680
1 Month Post-Injection	110.5 ± 12.7	95.3 ± 14.5	<0.001
2 Months Post-Injection	115.2 ± 13.0	100.7 ± 13.3	<0.001
3 Months Post-Injection	120.8 ± 11.2	105.4 ± 12.8	<0.001
6 Months Post-Injection	130.3 ± 10.5	110.9 ± 11.7	<0.001

Table 4 highlights the range of motion (in degrees) for patients treated with Platelet-Rich Plasma (PRP) versus corticosteroid injections at different follow-up intervals. Initially, both groups had comparable range of motion, with the PRP group at 90.4 ± 15.3 degrees and the steroid group at 88.9 ± 14.8 degrees ($p = 0.68$). At 1 month, the PRP group showed significantly greater improvement, achieving 110.5 ± 12.7 degrees compared to 95.3 ± 14.5 degrees in the steroid group ($p < 0.001$). By 2 months, the PRP group continued to outperform with a range of motion of 115.2 ± 13.0 degrees versus 100.7 ± 13.3 degrees for the steroid group ($p < 0.001$). This positive trend persisted at 3 months, where the PRP group reached 120.8 ± 11.2 degrees compared to 105.4 ± 12.8 degrees in the steroid group ($p < 0.001$). At the 6-month follow-up, the PRP group demonstrated a significant and sustained improvement with 130.3 ± 10.5 degrees, while the steroid group measured 110.9 ± 11.7 degrees ($p < 0.001$). These results emphasize the superior and lasting benefits of PRP injections in enhancing shoulder range of motion compared to corticosteroid injections.

Discussion:

This study demonstrates that while both PRP and corticosteroid injections are effective in the initial phase, PRP injections provide superior long-term outcomes for frozen shoulder. The findings are consistent with recent literature, which has shown varying degrees of efficacy for PRP in musculoskeletal conditions, including adhesive capsulitis.

At the one-month follow-up, both the PRP and corticosteroid groups showed significant improvements in pain and function, with VAS scores decreasing to 5.0 ± 1.1 and 5.2 ± 1.2, respectively. This aligns with the study by Lin et al., where both treatments provided similar pain relief within the first month, reporting VAS scores of 5.3 ± 1.3 for PRP and 5.4 ± 1.2 for corticosteroids, indicating comparable short-term efficacy.[16] Similarly, the meta-analysis by Chen et al., found that corticosteroids reduced pain more rapidly within the first four weeks, but PRP offered similar early benefits.[17]

However, by the two-month follow-up, the PRP group showed significantly greater improvements than the corticosteroid group. In

our study, the PRP group's VAS score was 3.8 ± 1.0 compared to 4.7 ± 1.1 in the steroid group ($p = 0.004$), demonstrating a statistically significant difference favoring PRP. This trend continued through the three-month and six-month follow-ups, with the PRP group achieving VAS scores of 3.0 ± 1.1 and 2.5 ± 0.9, respectively, versus 4.5 ± 1.2 and 3.8 ± 1.1 in the corticosteroid group ($p < 0.001$ at both time points). Lin et al., similarly reported sustained pain reduction with PRP, showing a decrease in VAS scores from 6.8 ± 1.4 at baseline to 3.0 ± 1.1 at six months, compared to a decrease from 7.0 ± 1.5 to 4.1 ± 1.3 with corticosteroids.[18]These findings suggest that PRP not only matches but exceeds corticosteroid efficacy in the medium to long term.

In terms of shoulder function, measured by the UCLA Shoulder Score, our results showed that PRP injections significantly improved function over time compared to corticosteroids. At six months, the PRP group scored 30.0 ± 2.5 versus 25.5 ± 3.0 in the steroid group ($p < 0.001$). This is in agreement with the study by Koltzan et al. (2023), which found that PRP injections led to significantly better functional outcomes, with UCLA Shoulder Scores improving from 17.5 ± 3.2 at baseline to 29.1 ± 2.8 at six months, compared to an improvement from 16.8 ± 3.5 to 25.7 ± 3.1 in the corticosteroid group.[19] These findings underscore PRP's potential to enhance tissue regeneration and functional recovery beyond the anti-inflammatory effects provided by corticosteroids.

Furthermore, range of motion improvements were more pronounced in the PRP group, which showed a mean increase from 90.4 ± 15.3 degrees at baseline to 130.3 ± 10.5 degrees at six months. In contrast, the corticosteroid group improved from 88.9 ± 14.8 degrees to 110.9 ± 11.7 degrees over the same period ($p < 0.001$). A study by Karasawa et al. (2021) reported similar findings, with PRP-treated patients showing an increase in shoulder abduction from 95.0 ± 14.5 degrees to 135.0 ± 12.5 degrees at six months, compared to an increase from 90.0 ± 13.8 degrees to 115.0 ± 13.0 degrees in the corticosteroid group.[20] These results reflect PRP's potential to address the underlying pathophysiology of frozen shoulder more effectively by promoting collagen synthesis and tissue damage, and reducing fibrosis.

The biological basis for PRP's superior long-term efficacy lies in its rich content of growth factors, including platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF-β), and vascular endothelial growth factor (VEGF), which collectively stimulate cellular proliferation, angiogenesis, and tissue repair.[21] Corticosteroids, on the other hand, primarily exert their effects through anti-inflammatory pathways, offering rapid pain relief but without the regenerative benefits observed with PRP.[22] This difference in mechanism likely accounts for the observed divergence in treatment outcomes beyond the initial one-month period.

Overall, our findings are consistent with a growing body of evidence that supports the use of PRP as a superior treatment option for frozen shoulder in the long term. While both PRP and corticosteroids are effective in the short term, the sustained pain relief, improved shoulder function, and greater range of motion observed with PRP suggest it offers a more comprehensive solution for this condition.

Limitations of the study:

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community. Future research should continue to explore in more diverse populations to validate and expand upon these findings.

Conclusion:

In conclusion, while both I/A PRP and corticosteroid injections are effective in the short term, particularly within the first month of treatment, PRP injections offer superior long-term outcomes for patients with frozen shoulder. The PRP group demonstrated more significant and sustained improvements in pain reduction, shoulder function, and range of motion at two months and beyond, highlighting PRP as a more effective treatment option in the long run. This study suggests that PRP injections should be considered a preferred treatment strategy for achieving lasting relief and functional recovery in patients with frozen shoulder, offering a promising alternative to corticosteroid injections. Further research with larger sample

sizes and longer follow-up periods is warranted to confirm these findings and refine PRP treatment protocols for optimal patient outcomes.

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

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