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# Comparison of the Functional OutcomeBetween Intra-Articular Corticosteroid Injection versus Platelet-Rich Plasma in Patients with Adhesive Capsulitis

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## ABSTRACT

***Objective:*** To compare mean resting pain relief and passive external rotation improvement by Intra-articular Steroid versus intra-articular Platelet Rich Plasma injection in patients with adhesive capsulitis.

***Study Design:*** Prospective comparative study.

***Place and Duration of Study:*** Armed Forces Institute of Rehabilitation Medicine, Rawalpindi Pakistan, from Jan to Jun 2019.

***Methodology:*** A total of 60 patients were included in the study. Group-A and B received Intra-articular 40mg Triamcinolone Acetonide with 1 ml 1% Lignocaine and platelet-rich plasma injections in affected shoulders, respectively. Pain severity was assessed on the Numeric Rating Scale, and passive external rotation was assessed by goniometry at baseline, i.e., pre-intervention, six weeks and 12 weeks intervals.

***Results:*** In our study, the NRS scale for pain was 3.030.76 at six weeks and 1.230.77 at 12 weeks with PRP versus 5.070.87 at six weeks and 3.200.89 with Corticosteroids at 12 weeks post-intervention, with the *p*-value of <0.001 showing increased efficacy of PRP. While passive external rotation was 70.275.26 at six weeks and 82.304.84 at 12 weeks with PRP versus 61.35.28 at six weeks and 71.806.99 with corticosteroids at 12 weeks post-intervention, with the *p*-value of <0.001 showing increased efficacy of PRP.

***Conclusion:*** There was a significant improvement in mean resting pain relief and passive external rotation after platelet-rich plasma injection in the shoulder joint adhesive capsulitis compared to intra-articular Steroids.

**Keywords:** Adhesive capsulitis, Pain relief, Platelet-rich plasma.

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## INTRODUCTION

One of the most prevalent causes of shoulder discomfort and dysfunction in the upper extremities is adhesive capsulitis.[1,2] It impairs the glenohumeral joint's functioning, reducing active and passive shoulder movements.[3] The clinical diagnosis of adhesive capsulitis relies on the limitation of the passive range of motion of the shoulder, notably external rotation. In the general community, the incidence of adhesive capsulitis in the general population is estimated to be 3-5%, while the prevalence in patients with diabetes is 10-24%.[4]

Corticosteroid injections into the shoulder joint have been demonstrated in studies to give symptomatic relief and to slow the progression of capsular fibrosis.[5] However, corticosteroid injection has been linked to hyperglycemia, articular cartilage damage, an increased risk of tendon rupture, local skin depigmentation, & subcutaneous tissue atrophy.[6] Given the potential negative effects of steroid injections, physicians and patients must understand how to design the best treatment strategy for patients with adhesive capsulitis who are contraindicated to or unwilling to receive corticosteroid injection.[7]

Recently, new evidence on the usefulness of platelet-rich plasma (PRP) injection in treating chronic tendon and muscle injuries, tendinopathies, osteoarthritis, and other conditions has surfaced.[8,9] PRP therapy involves concentrating autologous "platelets" acquired through whole-blood centrifugation and injecting them back into the damaged joint. In addition, platelet-rich plasma can speed up the repair of chronically injured tissues while reducing joint pain and stiffness.[8]. However, there is limited evidence of its usefulness in people with adhesive capsulitis.[10]

Considering the debatable effectiveness of various treatment options, there is a need to compare the role of PRP with steroid injections, as PRP is emerging as a new treatment option in new literature. Therefore, the current study aims to compare the effects of single intra-articular PRP and corticosteroid (CS) injections in patients with shoulder adhesive capsulitis.

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## METHODOLOGY

The prospective comparative study was conducted at the Department of Medical Rehabilitation, Armed Forces Institute of Rehabilitation Medicine Rawalpindi Pakistan, from January to June 2019. Data were collected after obtaining permission from the hospital ethical committee (ERC number 234/2020). The sample size was calculated by the WHO sample size calculator taking population standard deviation 2.2, population variance 4.84, and test value of the population mean as 3.4.[11] The sampling technique was non-probability, consecutive sampling.

**Inclusion Criteria:** Patients of either gender, aged 25 to 75 years, with normal glenohumeral (GH) joint anteroposterior radiograph, shoulder pain at rest, active and passive range of motion for at least three months and restriction of at least thirty per cent in shoulder abduction, flexion and external rotation as measured by goniometer were included in the study.

**Exclusion Criteria:** Patients having a history of shoulder trauma or surgery, traumatic brain injury, stroke or neuropathy, resulting in hemiplegia involving the shoulder under study, uncontrolled diabetes mellitus, coagulopathy or bleeding diathesis and communication or cognition deficit preventing the patient from classifying pain using Numeric Rating Scale (NRS) were excluded from the study.

Triamcinolone Acetonide Plus 1 ml 1% Lignocaine injection in affected shoulders (IA-CS), and Group-B patients received a single intra-articular Platelet Rich Plasma injection in 4ml dose in the affected shoulder (IA-PRP). Following standard operating practice, the PRP was made utilizing a single centrifugation process on a bench-top centrifuge Patients were enrolled according to inclusion criteria. The patient's informed consent for participation and follow-up was taken after explaining the objectives and benefits of the study. Selected patients were then divided into groups of equal numbers, i.e., 30. Patients in Group-A received a single intra-articular 40mg system. During blood sampling, an 18-gauge needle syringe was used to extract 24 millilitres of venous blood from the patient's uninvolved arm with a traumatic puncture to limit tissue damage and platelet activation. The blood sample was divided evenly into two specially constructed disposable bio-kit tubes, each with a 12 ml capacity and 1.5 ml of anticoagulant citrate dextrose-A to prevent the coagulation cascade. The automatic cell counter got a peripheral complete blood count from the left-out blood sample at the initial blood draw. The two PRP kit tubes were made up and down three times to mix the blood with the anticoagulant. The tubes were centrifuged for 14 minutes at 1800 rpm, yielding roughly 5 ml of PRP (2.5 ml in each tube) from the two tubes. Next, 4 ml of PRP was aspirated aseptically from the two tubes by the spinal needle in a class IIA biosafety cabinet for injecting the patient without any buffering or activating agent. The total platelet count in the final PRP product was quantified and compared to the beginning platelet count in the whole-blood sample. All of the procedures were carried out in a sterile environment. PRP injections were given to the patients within 30 minutes of preparation. Under the supervision of a Transfusion Medicine Physician, the entire procedure for preparing PRP was carried out at the Laboratory of the Department of Transfusion Medicine and Blood Bank of the hospital.

The injections were done with ultrasound equipment SonoSite M-Turbo and a 13- to 6-MHz linear array transducer by an experienced physiatrist (lead author). Both intervention groups used the posterior route for IA injection into the GH joint. The patients were seated upright on a chair, with their hands on their thighs. A 23-gauge, 7-cm-long needle was inserted in a semi-oblique plane parallel to the ultrasound probe until the needle tip penetrated the GH joint. While the fluid (PRP or CS) was injected, the articular capsule's enlargement was evaluated. All injections, including IA-PRP and IA-CS, were delivered in an aseptic environment in the operating room. The patients were told to avoid overhead activity and rotating shoulder movements during the first two days. Once the procedure was completed, patients were given picture leaflets and proper instructions about the home exercise programme for increasing ROM. The exercises were to begin two days after the injection and be done twice daily for 20 minutes each time. Nonsteroidal anti-inflammatory medicines were not permitted during the 12-week observation period. However, if needed, patients could use up to 3 g/d of oral acetaminophen (1g) tablets for severe pain or discomfort. Before the follow-up examination, all patients were advised to stop taking their prescriptions for 48 hours. The patients were asked to keep track of their exercise frequency, duration, and difficulties by keeping a record of when they received tablets & an exercise diary. At each follow-up session, the notebooks were examined. Patients were also contacted to encourage them to continue exercising and to remind them not to take additional medicine or physical agents.

Demographic data were recorded, and pain severity was assessed on Numeric Rating Scale. The passive external rotation was assessed by goniometry at baseline, i.e., pre-intervention, 6 weeks and 12 weeks intervals. The mean change in pain scores on NRS and passive external rotation on goniometry was calculated at baseline, 6 weeks and 12 weeks post-intervention.

Statistical Package for Social Sciences (SPSS) version 24.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages Independent sample t-test was applied to explore the inferential statistics. The *p*-value of ≤0.05 was considered statistically significant.

## RESULTS

A total of 60 patients were included in the study. The age range in this study was from 25 to 75 years, with a mean age of 58.03±7.51 years. Mean disease duration was 5.13±1.57-months. Preinjection pain (NRS score) and passive external rotation have shown no significant difference between the two groups. In contrast, post-injection (NRS score), the results have shown that there was significant improvement (*p*-value <0.05) in mean-resting pain relief and passive external rotation in Group-B (intra articular platelet rich plasma) compared to Group-A (intra-articular Steroid). In our study, the NRS scale for pain was 3.03±0.76 at six weeks and 1.23±0.77 at 12 weeks with PRP versus 5.07±0.87 at six weeks and 3.20±0.89 with Corticosteroids at 12 weeks post-intervention with the *p*-value of <.001 showing increased efficacy of PRP (Table-I). In our study, passive external rotation was 70.27±5.26 at six weeks and 82.30±4.84 at 12 weeks with PRP versus 61.30±5.28 at six weeks and 71.80±6.99 with Corticosteroids at 12 weeks post-intervention, with the *p*-value of <0.001 showing increased efficacy of PRP (Table-II).

**Table-I: Baseline Pain and Post- Injection Numeric Rating Scale at 6 and 12-Weeks in Study Groups (n=60)**

| Pain (NRS Score ) | Group-A (n=30) | Group-B (n=30) | *p*-value |
|---|---|---|---|
| | Mean±SD | Mean±SD | |
| Baseline | 7.57±1.07 | 7.83±0.95 | 0.324 |
| At 6 Weeks | 5.07±0.87 | 3.03±0.76 | <0.001 |
| At 12 Weeks | 3.20±0.89 | 1.23±0.77 | <0.001 |

**Table-II: Baseline and Post-Injection Passive External Rotation at 6 and 12 weeks in Study Groups (n=60)**

| Passive External rotation | Group-A (n=30) | Group-B (n=30) | *p*-value |
|---|---|---|---|
| | Mean±Standard Deviation | Mean±Standard Deviation | |
| Baseline | 43.50±4.70 | 41.40±4.66 | 0.088 |
| At 6 Weeks | 61.30±5.28 | 70.27±5.26 | <0.01 |
| At 12 Weeks | 71.80±6.99 | 82.30±4.84 | <0.01 |

## DISCUSSION

The current study revealed that patients who received platelet-rich plasma injections showed significantly better numeric rating pain scale scores at 12 weeks than corticosteroids, i.e. at 12 weeks, the pain scores were 3.200.89 versus 1.230.77 respectively, and the difference in pain scores was statistically significant, i.e., *p*=0.0001. Furthermore, regarding passive external rotation, the mean rotation at 12 weeks in the PRP group was 82.304.84 degrees; in the corticosteroid group, it was 71.806.99 degrees, and this difference was also statistically significant (*p*=0.0001).

In a study conducted at Lahore by Shehzad *et al.*,PRP and steroid injections were compared for a range of motion and severity of pain in patients who had frozen shoulders (adhesive capsulitis). It was revealed that at 12 weeks, external rotation in the PRP versus steroid group was 71.59±7.43 versus 56.27±5.93 degrees (*p*=0.0001), and the mean VAS pain score was 0.85±0.52 versus 2.3±1.6 (*p*=0.004), respectively.[11] In a study conducted in India by Barman *et al.*, it was found that in patients who underwent treatment with PRP injection versus intra-articular steroid injection, the mean VAS pain score at baseline was 74.28±8.89 and at 12 weeks, it was 15.89±8.05 in the PRP group and the steroid group it was 71.48±8.75 and 22.77±11.03 respectively. The mean difference in the VAS pain score at 12 weeks between both groups was 9.7. This difference was statistically significant, i.e. *p*=0.00112. In terms of external rotation, it was found that the mean external rotation in the PRP versus steroid group at 12 weeks was 60.42±10.49 versus 53.59±8.93, respectively.[12] In another study conducted in India, the authors revealed that in patients who received PRP versus steroids for treatment of adhesive capsulitis, the mean VAS pain score at the end of the study was 1.34 versus 14.68, respectively, and this difference was statistically significant (*p*<0.05).[13] The findings of these local and regional studies are consistent with current study findings denoting that PRP intra-articular injections are better compared to intra-articular steroid injections for treating adhesive capsulitis. Kothari *et al.*[14], Le *et al.*[15] and Griesser *et al.*[16] also revealed similar findings that PRP results in better pain scores and improved range of motions as compared to intra-articular steroids and these findings are supported by current study findings.

Adhesive capsulitis commonly occurs in the fifth and sixth decades of life, and if it occurs below 40 years of age, other etiologies should be kept in mind,

and a thorough workup should be done.[17-19] Adhesive capsulitis affects all races equally.[20]

## LIMITATIONS OF STUDY

The concentration of platelets in the processed samples prior to the injection has yet to be attempted to be measured. The results of the current investigation are entirely subjective because neither imaging (magnetic resonance imaging) nor any histological evaluation of the repair was attempted.

## CONCLUSION

There was a significant improvement in mean resting pain relief and passive external rotation after platelet-rich plasma injection in the shoulder joint adhesive capsulitis compared to intra-articular Steroids.

**Conflict of Interest:** None.

**Authors Contribution**

Following authors have made substantial contributions to the manuscript as under:

IA & NA: Data analysis, drafting the manuscript, critical review, approval of the final version to be published.

AWB & ALK: Conception, study design, data acquisition, drafting the manuscript, approval of the final version to be published.

HKS & FM: Data interpretation, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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