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Original Research Article

Comparison of the efficacy of single intra-articular platelet-rich plasma (PRP) vs. corticosteroid injection in periarthritis shoulder patients in a tertiary care hospital, Chennai – A comparative RCT study

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Abstract

Introductions: Periarthritis shoulder is a common degenerative condition causing pain and progressive stiffness in the shoulder joint. While the treatment ranges from Physical therapy and oral medications to invasive interventions such as Injections or Surgery, this randomized controlled trial compares the clinical outcomes of platelet-rich plasma (PRP) with corticosteroid injections for managing periarthritis shoulder in a government hospital setting.
Materials and Methods: About sixty patients diagnosed with periarthritis shoulder were randomized equally into two groups. Group 1 received a single intra-articular PRP injection prepared by a Indigenous double differential centrifugation method method, while Group 2 was administered a single intra-articular corticosteroid injection (Triamcinolone 40mg/ml). Both groups underwent concomitant physiotherapy. Patients were followed up for 52 weeks to assess outcomes using the Visual Analog Scale (VAS) for pain and Quick Disabilities of the Arm, Shoulder, and Hand (Quick-DASH) scores for functional improvement at seven specified intervals during the study period (2, 4, 6, 8, 12, 24 and 52 weeks).
Results: Both groups demonstrated significant improvement in pain and function throughout the study. The PRP group showed more sustained symptom relief with maximum improvement at 8 weeks (mean Q-DASH score: 51.24, mean VAS score: 4.77), while the steroid group showed faster initial improvement with maximum effect at 4 weeks (mean Q-DASH score: 52.99, mean VAS score: 4.97). No significant differences in efficacy were observed between the two treatments at the end of 52 weeks.
Conclusions: A statistically significant association was noted between disease severity and comorbidities such as hypertension, supraspinatus tear, and cervical disc disease ($p = 0.005$). With no adverse effects and significant pain relief and functional improvement in both the groups, PRP offers more sustained effects while corticosteroids provide faster relief. Hence, PRP is an effective alternative for long-term management, particularly among patients seeking prolonged symptom relief.

Keywords: Periarthritis shoulder, Frozen shoulder, Platelet-Rich Plasma, Corticosteroid injection, Intra-articular injection, Pain relief.

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1. Introduction

Periarthritis shoulder, also called adhesive capsulitis or frozen shoulder, represents a significant and often debilitating degenerative condition characterized by pain and progressive stiffness in the shoulder joint.[1] Almost everyone above the age of 40 years starts experiencing shoulder pain, and it is more common among women than men.[2] The condition is most associated with diabetes, thyroid disorders, dyslipidemia, and cervical disc disease, and it leads to substantial limitations in performing everyday activities, ranging from personal hygiene to professional occupational task.[3-6]

Although it is a self-resolving condition with a protracted natural course, most patients seek medical attention due to the resultant impact on their daily activities. The treatment landscape is varied, ranging from physical therapy and oral medications to invasive interventions such as injections or surgery, especially where immediate resolution of symptoms is expected by the patients.[7,8]

Corticosteroid injections have long been the mainstay of treatment in the management of periarthritis due to their potent anti-inflammatory properties. They are known to provide rapid pain relief with improved joint mobility,[9] albeit with potential side effects such as cartilage damage with

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prolonged use.[10] Conversely, the newly emerging orthobiologic therapy – PRP (Platelet Rich Plasma), harnesses the healing properties of concentrated platelets derived from the patient's own blood. PRP is shown to promote tissue regeneration and modulate inflammation in alleviating pain,[11-13] offering a potentially safer alternative to corticosteroids.

The choice between PRP and corticosteroid injections is particularly relevant in a government medical college setting, which serves a diverse population including economically disadvantageous patients who have limited access to long-term follow-up. Resource constraints and patient demographics can influence treatment outcomes, and hence it is crucial to determine which treatment provides more sustainable and cost-effective relief for periarthritis of the shoulder.[14,15]

With disparity and conflicting evidence in the existing literature between the superior long-term benefits of PRP with fewer side effects and immediate efficacy of corticosteroids in alleviating pain and improving function, this study was undertaken to compare the efficacy of PRP and corticosteroid injections for periarthritis shoulder.[7,9]

This study aims to compare PRP and corticosteroid injections to provide evidence-based recommendations for periarthritis shoulder treatment in a resource-limited setting.

2. Materials and Methods

2.1. Study design and population

This comparative randomized controlled trial was conducted over a period of 1 year (August 2023 to August 2024) at Government Royapettah Hospital & Government Kilpauk Medical College, Chennai. IEC Protocol No: 986/2023; Reg. No: ECR/1385/Inst/TN/2020 dated 03/08/2023 at Government Kilpauk Medical College, Chennai-10. The study included 60 patients diagnosed with periarthritis shoulder who satisfied the inclusion criteria who were randomized into two groups.

2.2. Inclusion criteria

1. Adults aged between 35 to 75 years
2. Shoulder pain for at least three months associated with more than one-third loss of active shoulder flexion, abduction, and external rotation
3. Normal anteroposterior radiograph of glenohumeral joint in neutral rotation
4. Willingness to refrain from other treatment modalities during the study period

2.3. Exclusion criteria

1. Unwillingness to participate
2. Previous treatment with local injections for periarthritis shoulder
3. History of shoulder trauma/surgery or clinical evidence of Complex Regional Pain Syndrome
4. Previous intraarticular steroid or PRP injection within six months
5. Haematological disorders or antiplatelet/anticoagulant therapy
6. Acute infections or active systemic skin diseases/lesions around the shoulder joint
7. Established neoplastic or rheumatological disorders

2.4. Randomization and interventions

Patients were randomized on an "odd or even" basis upon first presentation. The study comprised two groups:

1. Group 1 (n=30): Single intra-articular PRP injection (2ml) with physiotherapy as standard care
2. Group 2 (n=30): Single intra-articular corticosteroid injection (Triamcinolone 40mg/ml, 2ml) with physiotherapy as standard care

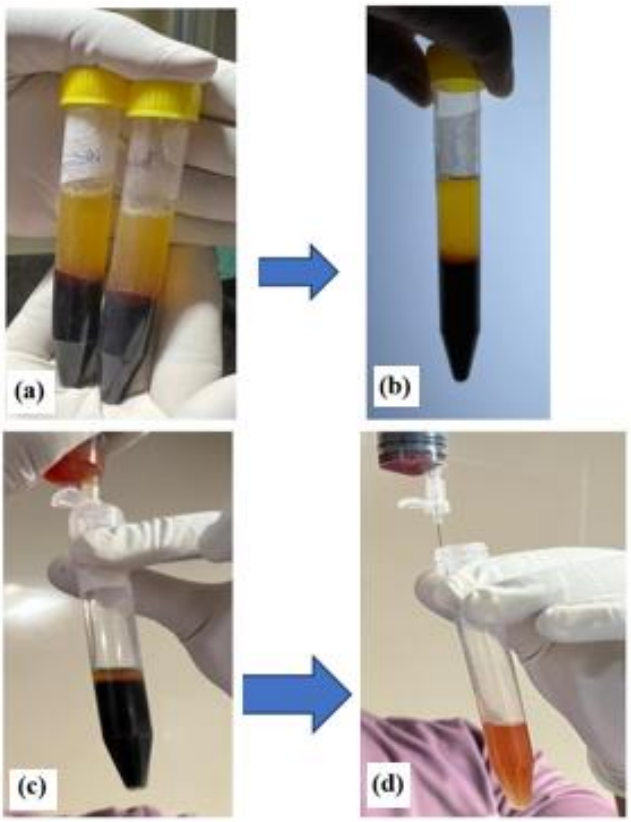

Figure 1: a: Resultant centrifuged and RBC's after the first spin **b** & **c:** Supernatant plasma layer with buffy coat extracted using syringe and transferred to a new ACD-A devoid test tube **d.**

2.5. Platelet rich plasma (PRP) preparation

PRP was prepared using differential centrifugation method for each patient.(**Figure 1,2**)

1. 20ml of autologous blood was collected and mixed with ACD-A anticoagulant (1:10 ratio)

2. First centrifugation (soft spin) was done at 2000 rpm for 10 minutes to separate RBCs from plasma layer with buffy coat.
3. The resultant supernatant plasma layer with buffy coat was transferred to a plain test tube and second centrifugation (hard spin) at 4000 rpm was done for 10 minutes separating the platelet rich plasma from the platelet poor plasma and platelet pellet.
4. After discarding the supernatant platelet-poor plasma (PPP), the required plasma was mixed with the platelet plug and the resultant PRP sample (approximately 2ml) was injected within 30 minutes after the second spin. 0.1 to 0.2 ml of the harvested sample was sent for analysis for platelet count

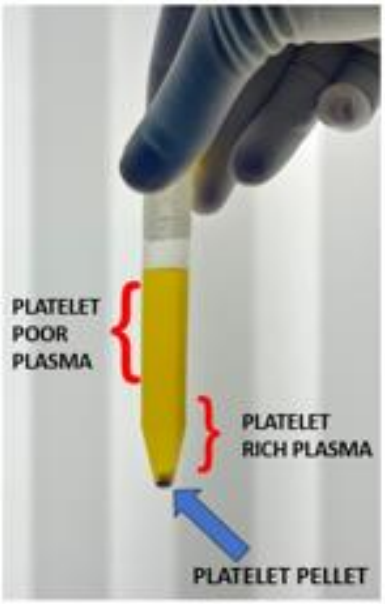

Figure 2: Final product after double centrifugation showing PPP, PRP (Required plasma) and platelet

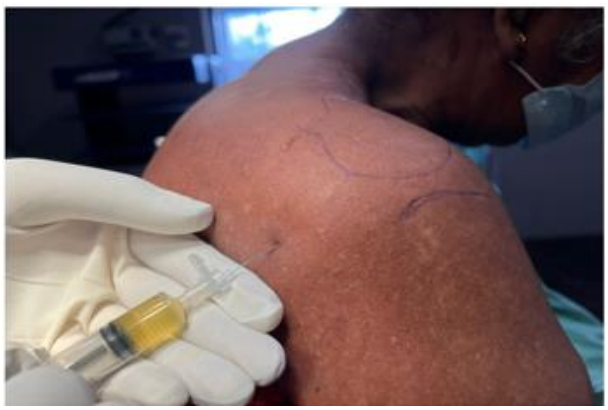

Figure 3: Sample under study being injected through the posterior landmark into the shoulder joint space blindly

2.6. Injection technique

Both injections were administered through the posterior approach to the shoulder under sterile aseptic conditions. The landmark was located approximately 2.5cm below and 2cm medial to the posterolateral corner of the acromion process which also corresponds to the Posterior Arthroscopic Portal landmark. Using an 18G venflon needle directed towards the joint in the direction of the coracoid process, the drug was injected after confirmation through negative aspiration along with the loss of resistance.(**Figure 3**)

2.7. Data collection procedure

After getting IEC clearance from the institute and informed written consent from the patients enrolled in our study, the patients were clinically examined and their details, comorbidities associated and relevant X-ray findings were noted and pretested Questionnaire in Tamil / English versions was administered to collect data and entered in excel sheet for data analysis**.** Patients were taken up for PRP or steroid injections after randomization and were followed up at seven specified intervals (2, 4, 6, 8, 12, 24 and 52 weeks) and patients' VAS and Quick DASH scores were determined and entered in the excel sheet for analysis. In the event of any adverse reactions, patient were planned to be discontinued from the study with the event being reported.

2.8. Outcome measures

The primary outcome measures measured at the intervals were:

1. Visual Analog Scale (VAS) for pain assessment (0-10)
2. Quick Disabilities of Arm, Shoulder, and Hand (Q-DASH) score for functional assessment

The values were noted during enrolment and at the intervals mentioned as follow-up in Excel spreadsheet and used for analysis.

VAS scores were categorized as: 0-3 (mild), 4-7 (moderate), and 8-10 (severe). Q-DASH scores were categorized as: 0-25 (mild), 26-75 (moderate), and 76-100(severe).

2.9. Statistical analysis

Data was analyzed after entry into excel using SPSS version 16. Paired t-tests were used to compare variables within groups, and independent t-tests were used to compare between groups. Fisher's exact test was used to analyze associations between categorical variables. P-values <0.05 were considered statistically significant.

3. Results

3.1. Demographics and clinical characteristics

The total of 60 patients who were included in the study had a mean age of 52.6 years (range: 35–73 years) with the majority of participants (36.7%) in the 52–62 years age group. The next largest groups are 41–51 years (25.0%) and 63–73 years (20.0%). Younger participants aged 30–40 years form about 16.7% of the total, while only a small proportion (1.7%) are aged 73–75 years.

With respect to gender distribution, there was a slight female predominance, with 53.3% females (n=32) and 46.7% males (n=28)

The affected side showed that 55% of cases involved the right side, while 45% were on the left.

Nearly half of the study population (48.3%) were diabetic, whereas 51.7% were non-diabetic. When stratified by the intervention groups, the PRP group consisted of 14 diabetics (46.7%) and 16 non-diabetics (53.3%), while the steroid group had 15 diabetics (50%) and 15 non-diabetics (50%) (**Figure 4**). Apart from this about 12%(11) were hypertensive and 40% (24) had no comorbidities. About 23.3% (14) of the population had Cervical degenerative disc disease and 11.7% (7) had a history of supraspinatous tear.

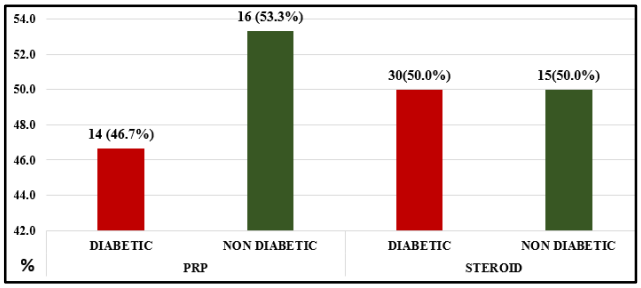

Figure 4: Diabetic status distribution among the steroid and PRP groups

3.2. Quick disabilities of arm, shoulder, and hand (Q-DASH) score for functional assessment

3.2.1 Comparison of Q-DASH scores among the PRP and Steroid groups of study participants

Both the PRP and steroid groups demonstrated an improvement in pain levels over the course of 52 weeks, as evidenced by declining mean values of Q-DASH scores relative to its baseline values, as evidenced by declining mean values relative to baseline (**Table 1**).

The steroid group began with a slightly higher mean score (62.2 ± 22.9) than the PRP group (60.3 ± 23.7), but by week 52, the PRP group ended with a lower mean score (54.6 ± 22.11) than the steroid group (57.9 ± 22.2), indicating better long-term outcomes.

The PRP group showed a steady decrease in scores until week 8 (lowest mean: 51.2), followed by a modest increase, while the steroid group experienced its lowest mean at week 4 (53.0), then gradually increased.

The Standard deviations remained relatively high for both groups throughout, reflecting substantial individual variation.

To evaluate the differences between the two interventional groups, an independent t-test was performed following these trends. The Independent sample t-test comparing the Q-DASH scores between the steroid and PRP groups at all assessed time points revealed no statistically significant differences (all p-values > 0.05) (**Table 2**). The smallest p-value observed was 0.376 at 12 weeks. Mean differences in scores ranged from -4.93 to 1.71, with negative values indicating lower scores in the PRP group. These findings suggest that both treatments had comparable or similar effects on functional outcomes over the 52-week study period in the study groups.

3.2.2. To test the efficacy of PRP in the interventional group 2 of study population

A paired sample t-test was done to assess the efficacy of PRP comparing Q-DASH scores at Day 0 and 52 weeks of the PRP group which revealed a statistically significant reduction in scores (Mean difference : 5.69 points, 95% CI: 3.56 – 7.82; t = 5.469, p < 0.001). This indicates a post PRP significant improvement in arm, shoulder, and hand function over the 52-week follow-up period (**Table 3**).

Table 1: Mean Q-DASH scores among the Steroid and PRP groups during the study period

Steroid / PRP Mean Q-Dash scores:									
Steroid/prp		**Q-dash score day 0**	**2 weeks**	**4 weeks**	**6 weeks**	**8 weeks**	**12 weeks**	**24 weeks**	**52 weeks**
PRP	Mean	60.2750	57.8720	54.2857	51.7673	51.2450	52.4673	53.3850	54.5813
	N	30	30	30	30	30	30	30	30
	Std. Deviation	23.70545	22.63714	21.80774	20.4243	20.66371	21.20975	21.2513	22.119
Steroid	Mean	62.2103	56.1627	52.9950	53.5433	54.7213	57.4003	56.9257	57.9040
	N	30	30	30	30	30	30	30	30
	Std. Deviation	22.93964	20.42996	20.89014	21.2324	21.68765	21.63034	21.5734	22.21163
Total	Mean	61.2427	57.0173	53.6403	52.6553	52.9832	54.9338	55.1553	56.2427
	N	60	60	60	60	60	60	60	60
	Std. Deviation	23.14774	21.39567	21.18213	20.6743	21.07461	21.38392	21.306	22.04032

Table 2: Independent sample T test to compare the Q-DASH scores among the 2 groups (steroid/PRP)

Steroid / PRP - t test results :									
Steroid / prp		**Dash score day 0**	**2 weeks**	**4 weeks**	**6 weeks**	**8 weeks**	**12 weeks**	**24 weeks**	**52 weeks**
Independent t test	P value	.749	.760	.816	.742	.528	.376	.524	.564
	Mean difference	-1.93533	1.70933	1.29067	-1.77600	-3.47633	-4.93300	-3.54067	-3.32267

Table 3: PRP efficacy: paired sample t test done using baseline and 52nd week Q-DASH scores

Paired samples statistics						
PRP group - DASH scores	**Mean**	**N**	**Std. Deviation**	**Std. Error mean**	**T value**	**P value**
DASH score day 0	60.2750	30	23.70545	4.32800	**5.469**	**< 0.001**
52 weeks	54.5813	30	22.11867	4.03830		

Table 4: Test for association between Diabetic status and Q-DASH score categories (52nd week) among the study population – using Fisher Exact test

Diabetic staus * Q-Dash score - Crosstabulation							P Value (Fisher Exact)
			Dash score categories			Total	
			Mild	**Moderate**	**Severe**		**0.136**
Diabetic	**Yes**	Count	1	17	11	29	
		% within Diabetic	3.4%	58.6%	37.9%	100.0%	
	No	Count	2	22	7	31	
		% within Diabetic	6.5%	71.0%	22.6%	100.0%	
Total		Count	3	39	18	60	
		% within Diabetic	5.0%	65.0%	30.0%	100.0%	

Table 5: Test for association between other comorbidities and Q-DASH score categories (52nd week) among the study population – using Fisher Exact test

Other comorbids * Q-Dash score - Crosstabulation							
			Q-Dash score categories			Total	P Value (Fisher Exact)
			Mild	**Moderate**	**Severe**		
Other Comorbids	**No Comorbs**	**Count**	1	22	1	24	**0.005**
		% within Other Comorbids	4.2%	91.7%	4.2%	100.0%	
	Supraspinatus tear	**Count**	0	4	3	7	
		% within other comorbids	0.0%	57.1%	42.9%	100.0%	
	Hypertension	**Count**	1	5	5	11	
		% within other comorbids	9.1%	45.5%	45.5%	100.0%	
	Cervical degenerative disc disease	**Count**	1	7	6	14	
		% within other comorbids	7.1%	50.0%	42.9%	100.0%	
	Others	Count	0	1	3	4	
		% within Other comorbids	0.0%	25.0%	75.0%	100.0%	
Total		Count	3	39	18	60	
		% within Other comorbids	5.0%	65.0%	30.0%	100.0%	

Table 6: Comparison of VAS scores among the PRP and steroid groups of study participants

Steroid/PRP mean VAS scores									
Steroid/PRP		**Vas score day 0**	**2 weeks**	**4 weeks**	**6 weeks**	**8 weeks**	**12 weeks**	**24 weeks**	**52 weeks**
PRP	Mean	5.9333	5.7333	5.3333	4.8667	4.7667	5.0667	5.1000	5.3667
	N	30	30	30	30	30	30	30	30
	Std. Deviation	2.11617	1.94641	2.00574	1.87052	1.90613	1.98152	1.98876	1.99107
Steroid	Mean	6.1333	5.3333	4.9667	5.0000	5.1667	5.4000	5.4667	5.5333
	N	30	30	30	30	30	30	30	30
	Std. Deviation	2.06336	1.88155	1.97368	2.10090	2.06920	2.01032	1.97804	2.06336
Total	Mean	6.0333	5.5333	5.1500	4.9333	4.9667	5.2333	5.2833	5.4500
	N	60	60	60	60	60	60	60	60
	Std. Deviation	2.07460	1.90865	1.98148	1.97327	1.98269	1.98611	1.97520	2.01204

Table 7: Independent sample T test to compare the VAS scores among the 2 groups (steroid/PRP)

Steroid / PRP - T Test results									
Steroid / PRP		**Vas score day 0**	**2 weeks**	**4 weeks**	**6 weeks**	**8 weeks**	**12 weeks**	**24 weeks**	**52 weeks**
Independent t test	P value	.712	.422	.478	.796	.439	.520	.477	.751
	Mean difference	-.20000	.40000	.36667	-.13333	-.40000	-.33333	-.36667	-.16667

Table 8: PRP efficacy: paired sample t test done using baseline and 52nd week VAS scores

Paired Samples Statistics						
	Mean	**N**	**Std. Deviation**	**Std. Error Mean**	**T value**	**P value**
VAS Score day 0	2.3000	30	.59596	.10881	**-3.525**	**0.001**
52 Weeks	2.0000	30	.64327	.11744		

3.2.3. Association between DASH score categories and Diabetic status

On analysis there was no statistically significant association between diabetic status and DASH score categories (p = 0.136) (**Table 4**)

3.2.4. Association between Q-DASH score categories and other comorbidities

A statistically significant association was determined between comorbidities (hypertension, Cervical Disc disease and Supraspinatus tear) and Q-DASH score categories (p = 0.005) (**Table 5**)

3.3. Visual analog scale (VAS) score for pain assessment

3.3.1. Comparison of VAS scores among the PRP and Steroid groups of study participants

Both the PRP and steroid groups exhibited a general decrease in mean VAS scores over the initial weeks, indicating an improvement in pain levels (**Table 6**). The PRP group's mean VAS score decreased from 5.93 at baseline to a low of 4.77 at 8 weeks, followed by a slight increase to 5.37 at 52 weeks showing a trend of lower scores in the later weeks of study.

Similarly, the steroid group showed a reduction from 6.13 at baseline to 4.97 at 4 weeks, with a gradual increase to 5.53 by week 52. Standard deviations remained consistent throughout for both the groups, ranging from about 1.87 to 2.11, reflecting moderate variability in pain responses among patients. Overall, both treatments demonstrated comparable trajectories of pain reduction over the study period.

Independent t-tests comparing VAS scores between the steroid and PRP groups at all-time points showed no statistically significant differences (all p-values > 0.05) (**Table 7**). Mean differences ranged from -0.40 to 0.40, indicating minimal variation in pain scores between the two treatment groups throughout the 52-week follow-up period. These results suggest comparable or moderately similar pain relief effects for both interventions across all measured intervals in both the groups.

3.3.2. To test the efficacy of PRP in the interventional group 2 of study population

A paired sample t-test comparing VAS scores at Day 0 and 52 weeks demonstrated a statistically significant reduction in pain scores (Mean Difference: 0.3 points; t = -3.525, p = 0.001) (**Table 8**), indicating a significant improvement in

pain levels over the study period in the group receiving PRP treatment.

3.4. Adverse effects / complications among the study population

Among the 60 patients (2 groups), no adverse events (fever, swelling, localized warmth, discharging sinus, urticarial reactions, breathlessness, or neurological deficits) were reported during follow-up.

A few showed transient increases in VAS and Q-DASH scores within 2–4 weeks, and only one PRP patient did not respond to treatment.

All patients showed improvement in VAS and Q-DASH scores by at least one level of the conventional classification described previously and were overall satisfied after the complete course of the trial.

4. Discussion

Posing as a significant debilitating yet common condition, periarthritis of shoulder should be attended to, as per the individual's severity and expectations for the best satisfactory outcome. With Physiotherapy being the main stay of treatment, moderate to severe cases must be picked up by the treating surgeon and the other interventional modes of therapy should be offered as a choice for the patients. Foundational research by Reeves et al. (1975)[2] and the comprehensive review by Ewald A et al. (2011) [16] have advocated a multimodal management approach, emphasizing patient education on the natural history of frozen shoulder and informed timing of interventions.

In this study, both platelet-rich plasma (PRP) and corticosteroid injections effectively reduced pain and functional disability over 52 weeks. Although statistically significant improvements in VAS and Quick-DASH scores were observed within both groups, no significant intergroup differences were found. This aligns with findings from Gupta et al. (2022)[9] and Somisetty T et al. (2022),[13] reporting similar initial benefits but noted PRP's more sustained effects on pain relief and function compared to corticosteroids.

Standardization of PRP preparation is crucial to optimize outcomes. In reviews by Dhurat R and Sukesh M (2014), Alsousou J et al. (2009), and Ziltener JL et al. (2012),[17-19] it is highlighted that the consistent preparation and administration methods enhances the clinical efficacy of PRP administration. This study utilized a standardized manual Differential Double Centrifugation technique to prepare Platelet Rich Plasma (PCP), suited for orthopaedic applications.

Despite diabetes being a known risk factor for periarthritis, our data showed no statistically significant association between diabetic status and disease severity or treatment/functional outcomes, suggesting no preference or contraindication for PRP or steroid use in diabetic patients. However the recommendation by Cole A et al. (2009)[4] was for a holistic integration of diabetes and musculoskeletal care which was on line with Waterbrook AL et al. (2017),[10] who stressed glucose monitoring during steroid use in diabetics. This is very crucial in patient selection as uncontrolled diabetics can have an inconsistent and a varied threshold for musculoskeletal interventional procedures involving steroids and future studies which are more generalised to the diabetic population are needed to obtain more validated results.

Conversely, comorbidities such as supraspinatus tear, cervical degenerative disc disease, and hypertension were significantly associated with higher disability scores, highlighting a need for further risk stratification and tailored individual management strategies for these patients.

In conclusion, both PRP and steroid injections are safe and effective options for managing periarthritis of the shoulder. The choice of therapy can be individualized, considering steroids for their rapid symptomatic relief and PRP for longer-lasting sustained functional improvement. These results corroborate observations by Barman et al. (2019),[12] who reported superior midterm outcomes with PRP, compared to steroids which offered faster but less durable relief.

5. Strengths

All patients were examined, treated, and assessed by the same physician using a standardized preparation of PRP and Triamcinolone, thereby minimizing interobserver variability in treatment administration and outcome reporting.

As a randomized controlled trial, this study provides a robust level of evidence for the findings and establishes a foundation for future well-designed research tailored to address the specific questions raised.

6. Limitations

The frequency and dosing of the treatments could not be ascertained, necessitating further research to establish optimal protocols.

Additionally, a crossover randomized controlled trial with a shorter follow-up period may provide more precise comparisons by evaluating both treatments within the same patient, thereby reducing variability caused by individual differences.

Moreover, reliance on self-reported measures of pain and functional improvement introduces subjective bias, as factors such as other underlying causes of symptoms and psychological influences were not accounted for in the outcome assessment.

7. Conclusion

In conclusion, both PRP and steroid injections were effective in significantly reducing pain (VAS scores) and disability (DASH scores), with no statistically significant differences observed between the two treatment groups. The regenerative and lasting effects of indigenous PRP, position it as a viable alternative for periarthritis of the shoulder, particularly for patients seeking long-term relief.

8. Ethical No.

986/2023.

9. Conflicts of Interest

None.

10. Source of Funding

None.

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