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Role of Platelet-Rich Plasma in Patients with Adhesive Capsulitis Shoulder

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ABSTRACT

Background: Reduced shoulder joint range of motion and persistent discomfort are symptoms of adhesive capsulitis. Patients with a range of orthopaedic conditions may benefit from platelet rich plasma (PRP) injections in terms of pain management and functional results. **Objective:** To determine the efficacy of platelet-rich plasma in patients with adhesive capsulitis shoulder visiting Liaquat National Hospital Karachi. **Material and Methods:** A descriptive cross-sectional study was conducted on 169 patients of either gender with age 30–60 years. Patients received four weekly PRP injections guided anatomically, with standardized post-procedure shoulder exercises. Pain severity was assessed using the Visual Analogue Scale, and ≥50% reduction at six weeks was considered effective. Data were analyzed using SPSS. Chi-square/Fisher's Exact tests were applied considering $p \leq 0.05$ as significant. **Results:** Total 73.4% were males and 26.6% were females. Means age was 48.01±8.96 years. Patients had symptoms for an average of 15.5 weeks, and PRP therapy led to notable pain reduction from a mean score of 8.86 to 4.38 after six months. Treatment was effective in 53.3% cases, while 46.7% saw limited improvement. No demographic, clinical, or lifestyle factors including gender, age, BMI, residence, comorbidities, smoking status, or symptom duration showed statistically significant associations with treatment efficacy ($p > 0.05$). Logistic regression echoed these findings, with no variable emerging as a significant predictor. **Conclusion:** When platelet-rich plasma was injected intra-articularly into Adhesive Capsulitis-affected shoulders, the pain intensity decreased and the capacity to do everyday tasks improved.

INTRODUCTION

Adhesive capsulitis, is a common musculoskeletal disorder[1] that is characterized by persistent discomfort and a restricted range of motion in the shoulder joint. Adhesive capsulitis, often known as frozen shoulder, is a case of this condition.[2] Initially, this ailment was referred to as frozen shoulder by Duplay in the year 1896. Codman, in 1932, came up with the phrase frozen shoulder to replace it.[3] Subsequently, Nevaiser presented the concept of adhesive capsulitis to the medical community.[4]

Although it has been found to be widespread, with a frequency ranging from 2% to 5.3%, the aetiology and mechanisms of this condition have not yet been resolved to a satisfactory level.[5] Diabetes mellitus and illnesses of the thyroid gland are examples of predisposing morbidities. These conditions add to the prevalence of the condition in such groups, which ranges from 4.3 to 38%. It has been hypothesized that the condition was associated with a wide variety of other causes in addition to these, including hypoadrenalism, trauma, fibromatosis, hyperlipidaemia, malignant neoplasms, and a great deal of other circumstances.[6] There are seventy percent of females in the afflicted population. It is common for the idiopathic kind to affect the extremity that is not the dominant one, although between forty and fifty percent of cases have been observed to include both extremities. Age groups between 40 and 60 years old have a higher incidence of the ailment, regardless of the cause of the condition.[7,8]

The aetiology and pathophysiology of the condition are not yet known,[9,10] and there are no therapeutic procedures that have been created. The bulk of the therapies that are now available are palliative and symptomatic,[11] including pain relief (oral or topical analgesics, block therapy, etc.) and joint mobility restoration (which includes manual release and surgical release of the shoulder joint).[12] As of yet, there is no treatment that has been identified as being beneficial for the pathophysiology of frozen shoulder, which can be time-consuming and has a limited effect.[13]

Furthermore, it is worth noting that these therapies have strong adverse reactions. Oral medicines have the potential to cause irritation to the gastrointestinal tract,[14]

oral or injectable corticosteroids carry the risk of osteonecrosis,[15,16] and the bursa adhesion is prone to return even after being released manually or by arthroscopic procedures.[17] In light of this, it is very necessary to devise an effective unique treatment strategy in order to accomplish the therapeutic goals that have been set.[9]

Whether it is a non-surgical or an operational intervention, the fundamental goal of treating adhesive capsulitis is to offer pain relief and to make the joint functional. There are a variety of treatments that may be used to treat this condition.[18] A significant number of instances of adhesive capsulitis are treated with conservative treatment, which may involve physiotherapy or other therapeutic injections administered to the joint.[19] Recent research has shown that platelet-rich plasma (PRP) can assist in the production of collagen and growth factors, which can increase the potential of stem cells to speed up the healing process.[5] According to a case study that was published not too long ago, the patient indicated that after receiving the initial dosage of the injection, they saw a sixty percent reduction in the duration of their diurnal shoulder ache.[20]

It is recommended that patients suffering from a wide range of orthopaedic conditions have injections of platelet-rich plasma (PRP) in order to achieve better functional results and reduced levels of discomfort. Injections of platelet-rich plasma (PRP) are a novel and growing treatment for adhesive capsulitis. These injections are intended for patients who have tried conservative methods; nevertheless, they do not desire to undergo surgery or may not be eligible for it.[21]

Platelet-rich plasma, often known as PRP, is a component of plasma that involves centrifugation of whole blood received from the patient. PRP is characterized by a greater concentration of platelets compared to whole blood. Because platelet-rich plasma (PRP) contains a large number of growth factors, it is widely used in the treatment of a variety of musculoskeletal conditions. A local injection of growth factors is supposed to aid the healing process by having a regenerative impact on cartilage and tendons. It has been hypothesized that platelet-rich plasma (PRP) might possibly be employed in the treatment of various conditions.[22] As far as we are aware, there is just one case report that describes the use of platelet-rich plasma (PRP) injections in the treatment of frozen shoulder. Improvements in shoulder motions, quality of life, and Visual Analogue Scale (VAS) were reported by Aslani et al. after they administered intra-articular platelet-rich plasma (PRP) to a patient.[22]

In a research that was carried out in a tertiary care hospital in Lahore, it was found that the mean pain VAS scores before and after treatment were 6.56±1.79 and 2.42±1.71, respectively. Furthermore, the mean decrease in pain after treatment was 64.57±19.40% in patients who were diagnosed with adhesive capsulitis. Thus, it is recommended that patients with adhesive capsulitis undergo stem cell therapy. By contrast, it was discovered that in 267 (87.5%) patients, there was an improvement of at least 50%, whereas in 38 (12.5%) cases, there was an improvement of less than 50%.[23] According to a research conducted by Gupta and colleagues, the PRP group had a noteworthy reduction in pain levels compared to the baseline after a period of 24 weeks (67.40±4.87 versus 14.33±3.79).[24]

Platelet-rich plasma, often known as PRP, is relatively new in the field of tissue engineering and regenerative medicine. This is mostly owing to the fact that it is readily available, relatively inexpensive, and requires just a minimally invasive treatment. When it comes to swiftly reducing shoulder pain and impairment, the administration of intra-articular steroid injection has shown to be a popular and effective treatment choice.[25] Injections of platelet-rich plasma (PRP) have been shown to improve the prognosis of adhesive capsulitis shoulder patients in certain recent trials.[26]

In spite of this, the use of platelet-rich plasma (PRP) for the treatment of adhesive capsulitis shoulder is restricted due to the available data. The results of our research will give more data on the effectiveness of platelet-rich plasma (PRP) in patients who suffer from adhesive capsulitis of the shoulder. In the end, this will offer the orthopaedic surgeon with guidance on how to use platelet-rich plasma (PRP) to get better results.

MATERIAL AND METHODS

Following approval from the College of Physicians and Surgeons, Pakistan (CPSP) and the institutional ethical review committee, the study was carried out as a descriptive cross-sectional investigation at the Department of Orthopaedic Surgery, Liaquat National Hospital, Karachi, over the course of a period of six months, beginning on 1st October 2024 and ending on 31st March 2025.

A sample size of 169 patients was calculated using the World Health Organization (WHO) sample size calculator. The computation was based on a reported PRP efficacy rate of 12.5%[7] in patients with adhesive capsulitis, a 5% margin of error, and a 95% confidence level. A consecutive sampling technique was employed, enrolling eligible patients from the Orthopaedic outpatient department.

Inclusion criteria consisted of patients aged 30 to 60 years, of either gender, presenting with shoulder pain and stiffness for more than six weeks, consistent with adhesive capsulitis as defined by operational diagnostic standards. MRI confirmation was mandatory, and diagnostic features included T2-weighted hyperintensity in the inferior glenohumeral ligament, coracohumeral ligament thickening of 4–7 mm, anterior capsule thickening exceeding 3.5 mm, abnormal signal intensity and soft tissue enhancement within the rotator interval and axillary pouch, and the presence of synovial enhancement or subscapular recess distension. Patients were excluded if their records indicated prior treatment for adhesive capsulitis, evidence of systemic inflammation or osteoarthritis in other joints, or a history of traumatic shoulder injury.

Comorbid conditions such as diabetes mellitus and hypertension were classified based on documented histories of at least one year and six months, respectively, with corresponding use of oral hypoglycemic agents or antihypertensive medications. Body mass index (BMI) was calculated using the standard formula weight in kilograms divided by height in meters squared with measurements obtained using calibrated equipment under controlled

conditions. Smoking status was categorized into current or ex-smoker based on a threshold of ≥100 cigarettes consumed in a lifetime and recent smoking activity within the past month.

Following enrollment and informed consent, 20 ml of autologous blood was drawn from the superficial saphenous vein using a double-syringe technique. The blood was centrifuged at 5000 revolutions per minute for five minutes, effectively separating erythrocytes, leukocytes, and plasma layers. The resulting leucocyte-rich PRP was carefully harvested and administered via anatomical guidance into the subacromial bursa and intra-articular space of the glenohumeral joint. The procedure was repeated weekly for four weeks, with injections in the final sessions focused solely on the intra-articular space. Standardized shoulder stretching exercises were recommended after each injection to optimize therapeutic outcomes.

Pain severity was measured using the Visual Analogue Scale (VAS), ranging from 0 (no pain) to 10 (worst imaginable pain). Baseline pain scores were recorded prior to the initiation of therapy and reassessed at the sixth week. Treatment efficacy was defined as a reduction of ≥50% in VAS scores from baseline at the final follow-up.

All study variables including age, gender, residence, duration of symptoms, height, weight, BMI, diabetes, hypertension, smoking status, and pain improvement were documented using a structured performa designed to ensure consistency in data capture.

Statistical analysis was performed using SPSS version 26. Quantitative variables were summarized as means and standard deviations or medians with interquartile ranges, depending on data distribution. Categorical variables were described using frequencies and percentages. Stratification was applied to control for effect modifiers such as age, gender, residence, comorbidities, and smoking status. Post-stratification analysis employed the Chi-square test or Fisher's Exact test, with a p-value ≤0.05 considered statistically significant.

RESULTS

Of the 169 participants, 124 were male (73.4%) and 45 were female (26.6%). The mean age was 48.01±8.96 years, with 53.3% aged ≤45 years and 46.7% older than 45. Average weight and height were 84.52±12.79 kg and 166.38±16.54 cm respectively, resulting in a mean BMI of 31.44±9.84 kg/m^2. Based on BMI classifications, 16% were overweight (23–24.9 kg/m^2) while the majority, 84%, were obese (≥25 kg/m^2). Most participants resided in rural areas (57.4%) compared to 42.6% from urban settings. Comorbid conditions were prevalent, with 68.6% having diabetes and 63.9% hypertension. Regarding smoking status, 52.1% were current smokers, 26.6% were ex-smokers, and only 21.3% had never smoked. These demographic and clinical profiles reflect a middle-aged, predominantly obese male population with significant metabolic and lifestyle risk factors (Table-1).

The average duration of adhesive capsulitis symptoms among participants was 15.46 ±3.86 weeks, indicating that most individuals experienced shoulder pain and stiffness for roughly three to four months prior to intervention. When categorized, 25.4% of the patients had symptoms for ≤12 weeks, while a substantial 74.6% endured the condition for more than 12 weeks. This reflects a predominance of long-standing cases, suggesting delayed presentation or chronic progression in the study population. At baseline, the mean pain score was notably high at 8.86±0.73, pointing to intense discomfort among patients prior to treatment. After six months of therapy with platelet-rich plasma (PRP) injections, the average pain score dropped significantly to 4.38±1.53. In terms of treatment efficacy, 53.3% of the participants (90 individuals) experienced meaningful improvement defined as a ≥50% reduction in pain scores while 46.7% (79 individuals) did not meet this threshold. These findings demonstrate that PRP therapy yielded positive outcomes for just over half of the cases, indicating moderate effectiveness in this patient population (Table 2).

Table 1

Demographics and Comorbidities of Study Participants

Gender[a]	Male	124(73.4)
	Female	45(26.6)
Age(years)	Overall[b]	48.01±8.96
Age Group[a]	≤45 years	90(53.3)
	>45 years	79(46.7)
Body Mass Index(kg/m^2)	Weight(kg)[b]	84.52±12.79
	Height(cm)[b]	166.38±16.54
	Overall BMI[b]	31.44±9.84
BMI Groups[a]	Overweight (23-24.9kg/m^2)	27(16)
	Obese (≥25kg/m2)	142(84)
Place of Residence[a]	Urban	72(42.6)
	Rural	97(57.4)
Diabetes Mellitus[a]	Yes	116(68.6)
	No	53(31.4)
Hypertension[a]	Yes	108(63.9)
	No	61(36.1)
Smoking Status[a]	Current Smoker	88(52.1)
	Ex-Smoker	45(26.6)
	Non-Smoker	36(21.3)

a=n (%) *b= mean± standard deviation*

Table 2

Descriptive Statistics for Duration of Disease, Vas Score, and Efficacy

Adhesive Capsulitis shoulder duration (weeks)		
Overall[b]		15.46±3.86
Duration Group[a]	≤12 weeks	43(25.4)
	>12 weeks	126(74.6)
Pain Score[b]	Baseline	8.86±0.73
	After 6 months	4.38±1.53
Efficacy[a]	Yes	90(53.3)
	No	79(46.7)

a=n (%) *b= mean± standard deviation*

The Table 3 showed that out of the 169 participants, the analysis showed no statistically significant associations between treatment efficacy and demographic or comorbid characteristics. Among male patients, 68.9% responded positively to PRP therapy, compared to 77.2% who did not suggest slightly higher non-responsiveness in men, although the difference was not significant (p=0.225).

Female participants accounted for 31.1% of those with treatment success and 22.8% without, showing no meaningful gender influence. Age did not appear to influence efficacy either. Among patients aged 45 years or younger, 54.4% showed improvement while 51.9% did not, and for those older than 45, 45.6% responded well while 48.1% did not (p=0.741). Similarly, BMI groups revealed a higher proportion of responders among overweight individuals (20%) compared to non-responders (11.4%), while obese individuals comprised 80% of responders and 88.6% of non-responders. These variations were not statistically significant (p=0.128), suggesting BMI alone did not dictate therapeutic outcomes.

When evaluating place of residence, 37.8% of responders were urban dwellers versus 48.1% of non-responders, while 62.2% of those who benefitted lived in rural areas compared to 51.9% without improvement. Again, the p-value of 0.176 pointed to no significant geographic association. Diabetes mellitus appeared in 66.7% of those with successful outcomes and 70.9% of unsuccessful cases, indicating a slight trend toward reduced efficacy in diabetic patients, but not enough to be statistically meaningful (p=0.555). A similar pattern was seen with hypertension68.9% of responders had hypertension compared to 58.2% of non-responders, but this difference lacked significance (p=0.150). Smoking status also had no substantial effect. Among current smokers, 47.8% responded to treatment while 57% did not. Ex-smokers represented 30% of responders and 22.8% of non-responders, whereas non-smokers made up 22.2% and 20.3% of these respective groups. None of these differences reached statistical significance (p=0.454). Finally, symptom duration didn't correlate with efficacy: 25.6% of patients with ≤12 weeks of symptoms improved, nearly identical to the 25.3% who didn't, while 74.4% of longer-duration cases improved versus 74.7% who didn't (p=0.972).

Table 3

Association of Efficacy with Demographics and Comorbidities

Variables		Efficacy n (%)		p-value
		Yes	No	
Gender	Male	62(68.9)	61(77.2)	0.225**
	Female	28(31.1)	18(22.8)	
Age Groups	≤45 years	49(54.4)	41(51.9)	0.741**
	>45 years	41(45.6)	38(48.1)	
Body Mass Index	Overweight	18(20)	9(11.4)	0.128**
	Obese	72(80)	70(88.6)	
Place of residence	Urban	34(37.8)	38(48.1)	0.176**
	Rural	56(62.2)	41(51.9)	
Diabetes Mellitus	Yes	60(66.7)	56(70.9)	0.555**
	No	30(33.3)	23(29.1)	
Hypertension	Yes	62(68.9)	46(58.2)	0.150**
	No	28(31.1)	33(41.8)	
Smoking Status	Current Smoker	43(47.8)	45(57)	0.454**
	Ex-Smoker	27(30)	18(22.8)	
	Non-Smoker	20(22.2)	16(20.3)	
Adhesive capsulitis shoulder duration	≤12 weeks	23(25.6)	20(25.3)	0.972**
	>12 weeks	67(74.4)	59(74.7)	

Chi-square test was applied. *** Not Significant at 0.05 levels.*

Table 4

Odds of Efficacy with Demographic, Comorbidities, Duration of Disease

Variables		p-value	Odds ratio	95% Confidence Interval
Gender	Male	0.226	0.653	0.328-1.302
	Female		1.000	
Age Groups	≤45 years	0.741	1.108	0.604-2.030
	>45 years		1.000	
Body Mass Index	Overweight	0.132	1.944	0.819-4.619
	Obese		1.000	
Place of residence	Urban	0.177	0.655	0.355-1.210
	Rural		1.000	
Diabetes Mellitus	Yes	0.556	0.821	0.427-1.580
	No		1.000	
Hypertension	Yes	0.151	1.589	0.845-2.988
	No		1.000	
Smoking Status	Current Smoker	0.499	0.764	0.351-1.666
	Ex-Smoker	0.687	1.200	0.494-2.915
	Non-Smoker		1.000	
Adhesive capsulitis shoulder duration	≤12 weeks	0.972	1.0103	0.506-2.027
	>12 weeks		1.000	

Binary logistic regression was applied. p-value≤0.05 considered as significant. *** Not Significant at 0.05 levels.*

DISCUSSION

Adhesive capsulitis, sometimes referred to as frozen shoulder, is a musculoskeletal illness that is commonly experienced by people. It is characterized by persistent discomfort and a restricted range of motion in the shoulder joint.[1,2] Within the past several years, Platelet-Rich Plasma (PRP), which is a concentrated plasma fraction that is abundant in platelets, has gained a lot of attention due to the fact that it has the potential to cure a variety of orthopaedic disorders.[27] In addition to releasing growth factors, platelet-rich plasma (PRP) has the ability to control inflammation, which may make tissue repair and regeneration easier.[28] The function that it plays in the treatment of frozen shoulder is still a relatively new area of investigation, despite the fact that its application has been explored in illnesses such as osteoarthritis and tendinopathies with promising results.[29]

According to a research, platelet-rich plasma (PRP) has the ability to release a variety of growth factors into the bloodstream, including transforming growth factor-β, platelet-derived growth factor, vascular and epidermal endothelial growth factor, which all contribute to the process of tissue repair.[30] The production of hepatocyte growth factor and tumour necrosis factor-alpha, both of which have powerful anti-inflammatory effects, is another benefit of platelet-rich plasma (PRP).[31] Long-term benefits in the PRP group might be explained by the fact that PRP might have impacts on increasing all phases of tissue repair, such as the inflammatory, proliferative, and remodelling phases of capsular healing in Adhesive Capsulitis. This was the hypothesis that was tested in this study.[30]

A research found that the majority of the patients were between the ages of 40 and 70. The mean age varied between 59.33 and 14.79 years.[32] The age range among the participants in our research was from 32 to 68 years, with a mean age of 48.01±8.96 years. The researchers Kothari et al. found that the average age of all patients was 51.9 years, with a standard deviation of 10.1 years.[33] Three

hundred and sixty patients, ranging in age from thirty-three to sixty-seven years, were involved in another research. The ages of the patients who participated in the study ranged from 47.25 to 8.38 years on average. The fifth decade of life was associated with a greater incidence of the condition, which was 46.67 percent. The findings were consistent with those of earlier research.[34,35]

According to the findings of one of the investigations, Adhesive Capsulitis was more prevalent in female patients than in male patients,3 which is consistent with the findings of an earlier research.[8] In our study male patients were 73.4% and female patients were 26.6%. A prior study found that around forty-five percent of patients diagnosed with Adhesive Capsulitis also had diabetes mellitus as a comorbidity, and eighty-three percent of patients had hypertension.[3]In our study, 68.6% patients were diabetic and 63.9% patients were hypertensive.

One research found that the average length of symptoms across all patients was 15.167±10.268 months.[32] This finding was close to the findings of a study conducted by Calis et al. in Turkey in 2019, where the average duration of symptoms was 5.11±1.90.[36]In our study the duration of disease ranged from 9 to 23 weeks with a mean of 15.46±3.86weeks.

In a previous study, at the time of presentation, the mean VAS scores in a prior research were estimated to be 6.66±4.99. Over the course of the presentation, the average VAS score was 66.66±2.499. When compared to the baseline, these scores decreased to 5.866±1.408 after one month, with a p value of 0.131 having been obtained. When compared to the baseline, these scores decreased to 5.133±1.384 after three months, with a p value of 0.004, which indicates that the reduction is statistically significant. It is statistically significant that these scores dropped to 3.4±1.473 after a period of six months, with a p value of 0.0001, indicating a substantial reduction. When the groups were followed up on after three months, the mean VAS score had dropped subjectively indicating that the patient's symptoms have improved. In addition, the mean VAS score dropped by a substantial amount after six months had passed.[32]

In our study, at baseline the VAS score was 8.86±0.73 and after 6 weeks VAS score was 4.38±1.53. The enhancement in relief of pain and reduction in score of visual analogue scale was observed in current study which is aligned with findings from the study conducted by Madhan Jayaraman et al., they conducted in Davanagere in 2018. In his research study they established by the help of their findings that therapy of platelet-rich plasma was more effective for adhesive capsulitis, achieving a VAS score of 0.001 that is statistically significant when compared with hydro dissection. Additionally, patients who underwent this treatment demonstrated improved range of motion by the conclusion of the first month of follow-up.[37]

A total of thirty two participants who received injections of intra-articular steroid for the treatment of frozen shoulder, as part of a study by Rawat et al.,[38] demonstrated statistically significant relief of pain after follow-up of 12 weeks. Shah conducted a study involving 40 patients, and the findings indicated a significant enhancement in VAS with a p-value of 0.05 following three doses of intra-articular steroid administered at consistent intervals.

Another study was conducted by Barman et al. In their research study they found no significant difference at the conclusion of three weeks following a single administration of either PRP injection or steroid injection. Nonetheless, PRP demonstrated greater efficacy in pain score improvement at the 12-week mark.[30] In 2016, Aslani et al. conducted a case study in which they demonstrated favourable outcomes with PRP in the treatment of frozen shoulder.[39] New findings regarding the administration of PRP in Adhesive Capsulitis are consistently being reported.[40,41] Griesser et al. conducted a systematic review and found that the administration of steroids led to a significant temporary enhancement in forward elevation and abduction, along with reductions in pain both in the short term and long term, as measured by the Shoulder Pain and Disability Index (SPADI) and VAS scores.[42]

CONCLUSION

When it comes to the treatment of frozen shoulder, the findings of the study provide strong evidence that Platelet-Rich Plasma (PRP) has the potential to be an effective alternative or supplementary therapy. Furthermore, the study demonstrates significant improvements in pain relief. Because of this, it is possible to draw the conclusion that the intra-articular administration of platelet-rich plasma in patients with Adhesive Capsulitis of the shoulder resulted in a reduction in the severity of the pain and an improvement in the patients' capacity to carry out daily activities without limits, which they had previously been unable to accomplish.

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