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Evaluation of Clinical Outcomes Following Single Injection of Platelet Rich Plasma in Chronic Shoulder Impingement Syndrome

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Abstract
Chronic shoulder impingement syndrome (CSIS) is a prevalent and debilitating condition characterized by pain and restricted shoulder movement. Conventional treatments, including physical therapy, NSAIDs, corticosteroid injections and surgical intervention, often fail to provide satisfactory or long-term relief. Recently, regenerative medicine techniques such as platelet-rich plasma (PRP) therapy have gained interest for treating musculoskeletal disorders. This study aimed to assess the effect of subacromial injection of PRP, steroids and normal saline on pain in shoulder impingement syndrome. The study included 150 patients with suspected chronic shoulder impingement syndrome attending a tertiary care hospital. Patients were divided into three groups of 50 each: PRP group, steroid group and normal saline group. Patients were observed for 30 minutes in a lying down position following injections. Follow-up examinations were conducted at 4, 12 and 24 weeks. The main outcome measure was pain with overhead activities, assessed using a visual analog scale (VAS). Changes in VAS scores were compared among the three groups. The groups were comparable in terms of demographic data, comorbidities and symptom duration ($p>0.05$). There was a dominance of right-side involvement (64%, 60% and 68% respectively) compared to the left side (36%, 40% and 32%respectively), which was not statistically significant ($p>0.05$). VAS scores improved significantly in both the PRP and steroid groups compared to the normal saline group at 4th, 12th and 24th weeks post-injection ($p<0.05$). PRP injection was more effective than corticosteroid and normal saline injections for long-term pain relief in shoulder impingement syndrome. PRP can be considered an effective and less invasive treatment option compared to surgical interventions, improving pain and shoulder function.

INTRODUCTION

Shoulder impingement is a common diagnosis for patients with pain and dysfunction of shoulder joint. Rotator cuff disorders are considered to be among the most common causes of shoulder pain and disability encountered in both primary and secondary care, with subacromial impingement syndrome in particular being the most common disorder, resulting in functional loss and disability, of the shoulder[1]. However, shoulder impingement syndrome is most commonly seen in individuals who participate in sports and activities that require repetitive overhead activities, including but not limited to handball, volleyball, swimming, carpenters, painters and hairdressers[2]. Other extrinsic risk factors that may predispose to the development of impingement syndrome include bearing heavy loads, infection, smoking and fluoroquinolone antibiotics[3]. The incidence of shoulder impingement syndrome rises with age, with peak incidence occurring in the sixth decade of life[4].

Diagnosis of this condition remains a clinical one and an initial careful assessment is crucial in identifying shoulder impingement as the particular cause of shoulder pain from the list of differentials. Early recognition and subsequent management are important also as this can help reduce the risk of impingement progressing and causing increased further morbidity to patients in the form of pain, reduced activity or subsequent partial or even complete rotator cuff tears[5].

Moreover, CSIS can significantly impair daily activities and quality of life, necessitating effective management strategies. Conventional treatments for CSIS include physical therapy, nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroid injections and in severe cases, surgical intervention. However, these approaches may not always provide satisfactory or long-term relief[6,7].

In recent years, there has been growing interest in the use of regenerative medicine techniques, such as platelet-rich plasma (PRP) therapy, for musculoskeletal disorders. PRP is an autologous concentration of platelets in plasma, containing various growth factors and cytokines that promote tissue healing and regeneration. The application of PRP in treating CSIS aims to harness these biological properties to reduce inflammation, enhance tendon repair and improve overall shoulder function[8,9]. Hence the present study was done at our tertiary care centre to assess the effect of subacromial injection of platelet rich plasma, steroid and normal saline on pain in shoulder impingement syndrome and compare the change in analogue visual score for pain in shoulder impingement syndrome.

MATERIALS AND METHODS

A hospital based descriptive, epidemiological study was conducted in the Department of Orthopedics at tertiary care centreduring the study period of 12 months from Aug 2020 to July 2021 after due permission from the Institutional Ethics Committee and Review Board and after taking Written Informed Consent from the patients. A total 150 patients of age more than 40 years with chronic shoulder pain for more than 3 months and patient's having positive clinical test for shoulder impingement syndrome who attending OPD/IPD of tertiary care hospital were included in the study. Patients with pain following history of trauma were excluded from the study. Selected patients were divided in to three groups of 50 patients each: Platelet Rich Plasma (PRP) Group: 50 patients received platelet rich plasma injection, Steroid Group: 50 patients received steroid injection; Normal Saline Group: 50 patients received normal saline injection.

A thorough history and physical examination were done as per proforma. The diagnosis of SIS was made based on a history of shoulder pain with overhead activities and clinical signs of impingement (either in internal rotation or external rotation).Injections were performed with the patient in the same upright sitting position. A posterior approach was used, and the needle was inserted 1 cm medially and inferiorly to the posterolateral corner of the acromion and directed cephalad, anteriorly and medially toward the subacromial bursa. The first consecutive 50 patients received a cortisone injection. The injection fluid contained 1 mL of 40mg/mL methyl prednisolone acetate and 5 mL of 1% lidocaine hydrochloride.

The PRP was prepared manually using single spin rotation. A total of 30 cc peripheral blood was drawn from the antecubital region into tubes containing 3.2% sodium citrate. The tubes were centrifuged at 1800 rpm for 8 min at room temperature. From the 3.5 ml PRP, 1 ml was sent to the laboratory for bacteriological testing and platelet count, the platelet count was four times greater than the thrombocyte count in the peripheral blood. The 2.5 ml PRP was activated by 5.5% calcium chloride(50 µl in 1 ml PRP), calcium chloride was added to the PRP concentrate to activate the platelets for inducing the rapid formation of the fibrin clot. The patients were kept in observation in lying down position for 30 min following injections.

After 4th weeks, 12th weeks, and 24th weeks, patients were examined in the outpatient clinic. The main outcome measure was pain with overhead activities using a visual analog scale (VAS).Changes in pain VAS was compare among 3 groups.

Statistical Analysis: Quantitative data was presented with the help of Mean and Standard deviation.

Comparison among the study groups was done with the help of unpaired t test as perresults of normality test. Qualitative data was presented with the help of frequency and percentage table. Association among the study groups was assessed with the help of Fisher test, Student 't' test and Chi Square test. p<0.05 was taken as significant.

RESULTS AND DISCUSSIONS

Majority of the patients (36%) in PRP Group were from the age group of 61-70 years with the mean age of patients was 61.92±11.03 years. In the steroid group, most patients (28%) were aged 71-80 years, with a mean age of 61.12±10.47 years. However, the majority of the patients (30%) in normal saline group were from the age group of 61-70 years with the mean age of patients was 60.44±10.78 years. Most of the patients in all groups were male (54%, 52% and 56% respectively). There was no significant difference between the groups in terms of age, sex, BMI and comorbidities, (p>0.05) as shown in table 1.

There was dominance of right side (64%, 60% and 68% respectively) as compared to left side (36%, 40% and 32% respectively) in all groups. There was no significant difference between the groups as per Chi Square test (p>0.05), (Fig 1).

The mean duration of symptoms in PRP group, steroid group and normal saline group was 5.85±1.63 months, 5.74±1.23 months and 5.52±0.96 months, respectively. There was no significant difference between the groups as per Student test (p>0.05), (Fig. 2).

The intragroup comparison shows that there was significant improvement in VAS score in all three groups at follow up period as per ANOVA test (p<0.05) whereas inter group comparison show that the VAS score improved significantly in PRP group and steroid group as compared to normal saline group at post-injection 4 weeks, post-injection 12 weeks period and post-injection 24 weeks follow-up period as per ANOVA test (p<0.05), (Table 2).

Platelet-rich plasma (PRP) triggers the release of several growth factors, such as platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF) and transforming growth factor (TGF). PDGF stimulates cell mitosis, VEGF promotes endothelial cell proliferation and TGF enhances collagen synthesis[10]. Recent studies have shown that PRP biologically enhances the healing process by delivering high concentrations of growth factors and collagen, potentially increasing the number of stem cells. PRP has been proven effective and safe, and it can be used as a non-operative treatment or applied intra-operatively[11,12].

In the present study all three groups were comparable and found no significant difference with respect to demographic data of patients (age, sex and BMI).The age and sex distribution of patients in current study is consistent with previous studies conducted by Pasin[13], Mahajan[14] El Gharbawy, NH[15] and Wang[16].

In the present study, there was a higher prevalence of right-side involvement in all three groups, with 64%, 60% and 68% of patients affected on the right side compared to 36%, 40% and 32% on the left side. The Chi-Square test revealed no significant difference between the groups (p>0.05), indicating that the distribution of affected sides was similar across the PRP, steroid and normal saline groups. This finding aligns with the study by Mahajan A[14], which also observed a majority of patients (90%) being right-hand dominant. The higher incidence of right-side shoulder impingement can be attributed to the predominance of right-handedness in the general population, leading to greater use and potential overuse of the right arm in daily activities and occupational tasks.

The mean duration of symptoms in the PRP group, steroid group and normal saline group was 5.85±1.63 months, 5.74±1.23 months, and 5.52±0.96 months, respectively. Statistical analysis using the student t-test indicated no significant difference between the groups (p>0.05).These findings are consistent with those of previous studies by Pasin[13], Mahajan[14] and El Gharbawy[15].

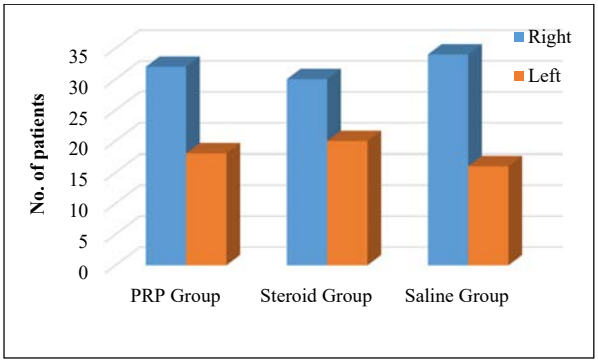

Fig. 1: Distribution of patients according to Laterality

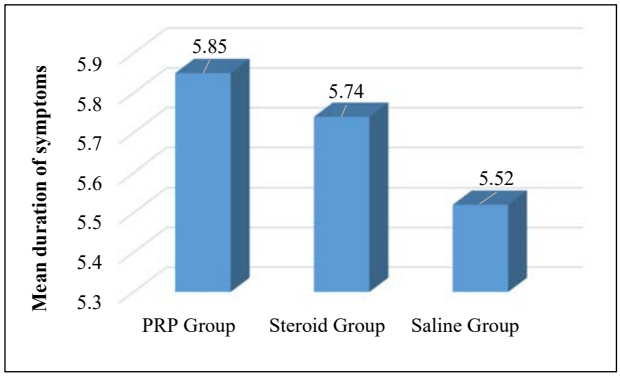

Fig. 2: Distribution of patients according to mean duration of symptoms

Table 1: Demographic profile of the patients and associated comorbidities

	Demographic data	PRP Group	Steroid Group	Saline Group	p-value
Age (years)	41 to 50	07 (14%)	11 (22%)	11 (22%)	>0.05
	51 to 60	14 (28%)	13 (26%)	13 (26%)	
	61 to 70	18 (36%)	12 (24%)	15 (30%)	
	71 to 80	11 (22%)	14 (28%)	11 (22%)	
	Mean±SD	61.92±11.03	61.12±10.47	60.44±10.78	
Sex	Male	27 (54%)	26 (52%)	28 (56%)	>0.05
	Female	23 (46%)	24 (48%)	22 (44%)	
BMI					
(kg/m2)	Normal (18.5-24.9)	22 (44%)	11 (22%)	12 (24%)	>0.05
	Overweight (25-29.9)	11 (22%)	25 (50%)	32 (64%)	
	Obese (=30)	17 (34%)	14 (28%)	06 (12%)	
	Mean ± SD	27.21±5.26	27.49±4.10	26.63±3.65	
Comorbidities	Diabetes Mellitus	13 (26%)	09 (18%)	09 (18%)	>0.05
	Hypertension	07 (14%)	03 (6%)	08 (16%)	

Table 2: Comparison of VAS score between groups during follow-up period

VAS Score	PRP Group	Steroid Group	Saline Group	p-value
Pre Injection 0 week	7.30±0.48	7.40±0.73	7.39±0.80	>0.05
Post injection 4 weeks	5.56±0.61	5.90±0.69	6.26±0.60	<0.05
Post injection 12 weeks	4.23±0.96	4.62±1.02	5.54±0.50	<0.05
Post injection 24 weeks	2.51±0.67	2.91±1.02	4.42±0.50	<0.05
P value	<0.05	<0.05	<0.05	

The present study found that the Visual Analog Scale (VAS) scores improved significantly in both the PRP group and the steroid group compared to the normal saline group at 4th, 12th and 24th weeks post-injection. This improvement was statistically significant as determined by the ANOVA test ($p<0.05$). These findings indicate that PRP and corticosteroid injections are more effective in reducing pain associated with chronic shoulder impingement syndrome compared to normal saline injections. These results are consistent with several previous studies done by Pasin[13], Mahajan[14], El Gharbawy, NH[15], Wang[16], Say[17], Shams[18], Smid[19],Hamid[20].

The significant improvement in VAS scores in the PRP and Steroid Groups suggests that these treatments may be more effective in promoting healing and reducing inflammation compared to normal saline. PRP, with its concentration of growth factors and regenerative properties, likely plays a crucial role in enhancing tissue repair and reducing pain. Similarly, corticosteroids are known for their anti-inflammatory effects, which contribute to pain relief and improved shoulder function. The lack of significant improvement in the normal saline group highlights the limited effectiveness of saline as a control treatment, underscoring the necessity of active therapeutic interventions for managing chronic shoulder impingement syndrome.

CONCLUSIONS

In conclusion, PRP injection proved to be more effective than corticosteroid injection and normal saline injection for the long-term treatment of shoulder impingement syndrome. PRP can be considered a viable and effective method for alleviating pain in chronic shoulder impingement syndrome, offering a less invasive alternative to surgical treatment. It not only improves pain but also enhances shoulder function, making it a valuable option for patients seeking non-surgical intervention.

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