

A Comparative study of steroid injections versus platelet- rich plasma in Rotator cuff Tendinopathies

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ABSTRACT

Background: Rotator cuff tendinopathy (RCT) is a main source of disability work inefficiency and overall inefficiency. Platelet-rich plasma (PRP) has been postulated to be of great advantage in the management of RCT. Steroidal formulations are base of all joint morbidities since long for inflammatory and degenerative conditions in orthopedics.

Aim and Objectives: The aim of the study was to compare the effect of PRP injections versus steroid Injection (triamcinolone) in subacromial space on pain control and improved shoulder functions in patients having chronic RCT.

Materials and Methods: The study was conducted on 40 patients (aged more than 18 years) who presented in emergency and Outpatient Department with symptoms of shoulder pain and decreased mobility at shoulder. The patients were divided into two groups. Every odd number of patient presenting to us was given PRP injection (Study group) and every even number patient was given injection triamcinolone (control group) along with physical therapy in both study and control group. Patient was followed up subsequently after 4-week and 12-week time for resolution of symptoms and improved pain-free activities. Outcome assessment criterion used included VAS system and Oxford Shoulder Scoring System.

Results: Comparison of the patients in the two groups revealed significant difference between the groups in VAS and OSS at 4-week and 12-week follow-ups. Long-term effect was more in case of PRP group as compared to steroid formulation which was almost similarly effective acutely.

Conclusion: Subacromial PRP injection was found to be more effective in long-term in improving overall quality of life, disability, pain, improved work efficiency, and improved shoulder movements in patients with chronic RCT than those treated by subacromial steroidal injection along with exercise program.

KEY WORDS: Platelet-rich Plasma; Rotator Cuff; Tendon; Injection; Randomized Controlled Trial; Oxford Shoulder Score.

INTRODUCTION

The shoulder is one among the most complex and highly mobile joints in the humans which allows a freedom of increased movements of the upper limb. However, this mobility is provided at the stake of stability making the joint stabilizers prone to injuries during extremes of motion at the shoulder. Tendons are defined as compactly arranged connective tissue that connects the muscles to bones. They transfer muscle forces to bones thus enabling joint mobility. Consequently, tendons are subjected to mechanical loads which may cause injuries to the tendons and affect their functionality. Shoulder stabilizers include the following components:

Static Dynamic

1. Joint Capsule
2. Glenoid Labrum
3. Negative intra-articular
4. Glenohumeral ligaments
5. Coracoacromial ligament.

Various movements possible at shoulder joint include:

1. Flexion/Extension
2. Adduction/Abduction
3. Internal rotation/External rotation
4. Circumduction.

Rotator cuff is constituted by a group of muscles and their tendons that stabilizes the shoulder complex, allowing for its enhanced range of motion. Four of scapulohumeral muscles collectively make up the rotator cuff, namely, supraspinatus, infraspinatus, teres minor, and subscapularis muscle. One of the most common causes of the shoulder pain syndromes is rotator cuff tendinopathy (RCT). Tendinopathy is a major musculoskeletal disorder. It is defined by a syndromic tendon pain, decreased mobility that impairs overall performance of

the upper limb.^[1]

RCT is a common and perplexing problem in the current clinical practice. It is one of the most common reasons that patients seek medical attention.^[2] The most common reason for RCT consists of sports injuries as well as in workplace which require repetitive activity causing overuse injuries.^[3,4] Tendons are typically hypo vascular. Whereas, histopathological examination from tendinopathy sites revealed that it consists of disorganized neovascularization and hypervascularity, which thereby effects its mechanical functioning of the tendons, inducing pain. Although originally considered an inflammatory condition, histopathological examination of tendinopathy has revealed evidence of degenerative process characterized by hypercellularity, vascular hyperplasia, and collagen disorganization.

Platelet rich plasma (PRP) is a formulation of concentrated autologous platelets containing growth factors and various bioactive substances essential to musculoskeletal healing.^[5] During degranulation, platelets release various cytokines and growth factor (platelet-derived growth factors, TGF- β , IGF- 1, and other growth factor) which enhances neoangiogenesis promoting tissue remodeling.^[6]

PRP is an excellent autologous source of concentrated bioactive molecules that have potential to enhance healing process in the worn and torn sites of the tendons.

PRP has been considered to play a key role in cellular proliferation, cell differentiation, causes chemotaxis, and promotes angiogenesis.^[7] Various studies have concluded favorable clinical results using PRP in the management of neglected cases of chronic tendinopathies and also partial rotator cuff tendon tears,^[8] Contrary to above mentioned positive response of PRP in research studies, clinical outcomes of some studies reported insignificant or even worse outcome in cases of rotator cuff tendinopathies. If the patient response poor, the more commonly used treatment modalities with degenerative tendon pathologies, that is, corticosteroids are considered for enhancing healing process of the degenerated tendon. Corticosteroids have been considered to be more effective in acute phase of tendinitis, although they are associated with ill-effects such as tendon tear/rupture and even also retard collagen synthesis.^[9,10]

Corticosteroid injections are often used for various tendon lesions.^[10] The efficacy and role of corticosteroid injections have been widely confirmed in alleviating pain and enhancing function,^[11,12] and it is considered as a cheap and effective therapeutic option by many practitioners, but the adverse effects of corticosteroids cause a great concern in its clinical utility.^[13]

MATERIALS AND METHODS

The study was conducted in the Department of Orthopedics in Basaveshwara medical college and Hospital, Chitradurga among 40 patients (aged more than 18 years) who presented in emergency and OPD with symptoms of shoulder pain and decreased mobility at shoulder.

The patients were divided into two groups. Every odd number of patient presenting to us was given PRP injection (Study group) and every even number patient was given injection triamcinolone (control group) along with physical therapy in both study and control group. Patient was followed up subsequently after 4-week and 12-week time for resolution of symptoms and improved pain-free activities. Outcome assessment criterion used included VAS system and Oxford Shoulder Scoring System.

Patients included in the study were having pain and difficulty in movement at shoulder for more than 3 months with following clinical examination:

- Positive painful arc syndrome
- Positive Hawkins Kennedy Test
- Positive Empty can Test/Jobe's Test
- Positive Neers Test
- Positive Lift off Test Normal radiographic visualization of Glenohumeral and AC-joint
- Negative Drop Arm Test
- Magnetic resonance imaging (MRI) scan in complex and doubtful cases.

Selection Criteria

Patient inclusion criteria

The following criteria were included in the study:

- i. Age 18 years and older.
- ii. Patient who agrees to stop analgesic medications such as NSAIDs.
- iii. The patient has not undergone any previous shoulder surgery.
- iv. The patient having no history of steroid injection in shoulder in the past 1 month or systematic steroid therapy within the past 2 weeks.
- v. The patient has given written informed consent.
- vi. Patients having no gross bone loss or deformity.
- vii. X-rays of the shoulders show no organic pathology or gross joint disruption.

Patient exclusion criteria

- I. Count <1 lakh/ $\square$ l.
- II. Active local site infection at the shoulder or septicemic patient.
- III. The patient has been given local steroid injection within last 1 month or systemic steroid therapy within the past 2 weeks.
- IV. The patient has fever or infectious disease within 2 weeks.
- V. The patients on chemotherapy within 1 year.
- VI. Cognitive dysfunction.
- VII. Currently pregnant or a lactating women.

Preparation procedure

PRP: Brief preparation method of PRP is as described: 30CC of whole blood will be drawn from patient with 18 Gauge syringe and collected in citrate anticoagulant under all aseptic precautions. The anti-coagulated blood will then be transferred to a specially designed tubes, which are then placed in centrifugation machine for a soft spin followed by hard spin serially and the ultimate concentrate collected will be filled into the sterile syringe.

Corticosteroid formulation: This formulation consists of injection triamcinolone (40 mg) with 1 cc of injection lignocaine 1%.

Intervention Procedure

Every odd number patient will be subjected to PRP injection under aseptic conditions in the sub-acromial space of the shoulder by one of the investigators of the study and will be

instructed for any side effect and complications occurring thereafter and to report back immediately in case of any complication occurring in general or at the local site of injection (redness swelling blister or pus formation). Patient will be instructed not to consume any analgesic medication post-injection. Patient will be advised to follow-up at 4-week and 12-week time after injection instillation for pain assessment and improvement in general.

Every even number of the patient presenting to us was given injection triamcinolone (40 mg) with 1cc of injection lignocaine 1% in the sub-acromial space. Physical therapy and rehabilitation exercises were done in both groups.

Sub-acromial injections are given by two methods, lateral and posterior approaches. Both of which are given keeping acromion process as a bony landmark for reference. However, we employed lateral injection technique in our study.

Assessment Method

Patients were assessed on basis of two methods

VAS scoring

Pain scale was graded as per the following numbering 0–10 as per subjective criteria of the patient before and after the treatment at 4–12 weeks from time of therapy. Zero will be the lowest grading with least pain and 10 will be the most severe pain [Figure 5].

Oxford shoulder score

Patients were assessed as per the following questionnaire and grading will be done at 4–12 weeks of therapy where the least scoring will indicate better scoring and highest grade will indicate the worst scoring. Scoring will be done as per OSS questionnaire.

RESULTS

Data of the patients and their particulars are shown in Table 1 showing VAS in the study group, Table 2 showing statistical analysis of VAS score in the study group, and Tables 3-8 shows the statistical analysis for value of significance.

Table 1: VAS in study group (paired *t*-test)

Variables	n	Mean	SD	SEM
Pre-intervention	20	7.20	1.24	0.28
Post 4 weeks	20	4.80	1.06	0.24
Post 12 weeks	20	2.10	1.48	0.33

Table 2: Statistical analysis of VAS scoring in study group (paired *t*-test)

Variables	Mean difference	<i>t</i> -value	<i>P</i> -value	95% Confidence interval of the difference	
				Lower	Upper
Pre and post 4 weeks	2.40±1.60	6.697	0.001	1.65	3.15
Pre and post 12 weeks	5.10±2.07	10.992	0.001	4.13	6.07
Post 4 weeks and post 12 weeks	2.70±1.26	9.577	0.001	2.11	3.29

Table 3: OSS in study group (paired *t*-test)

Variables	<i>n</i>	Mean	SD	SE M
Pre-intervention	2	46.00	5.5	1.23
	0		2	
Post 4 weeks	2	28.00	7.2	1.61
	0		1	
Post 12 Weeks	2	21.05	2.9	0.65
	0		1	

Table 6: Statistical analysis of VAS in control group
(paired *t*-test)

Variables	Mean difference	<i>t</i> -value	<i>P</i> -value	95% Confidence interval of the difference	
				Lower	Upper
Pre and post 4 weeks	2.45±1.70	6.443	0.001	1.65	3.25
Pre and post 12 weeks	1.10±1.37	3.584	0.002	0.46	1.74
Post 4 weeks and post 12 weeks	1.35±1.18	5.107	0.001	-1.90	-0.80

Table 4: Statistical analysis of OSS in study group (paired *t*-test)

Variables	Mean difference	<i>t</i> -value	<i>P</i> -value	95% Confidence interval of the difference	
				Lower	Upper
Pre and post 4 weeks	18.00±7.75	10.392	0.001	14.37	21.63
Pre and post 12 weeks	24.95±7.75	14.399	0.001	21.32	28.58
Post 4 weeks and post 12 weeks	6.95±8.95	3.472	0.003	2.76	11.14

Table 5: VAS in control group (paired *t*-test)

Variables	<i>n</i>	Mean	SD	SEM
Pre-intervention	20	7.00	1.17	0.26
Post 4 weeks	20	4.55	1.36	0.30
Post 12 weeks	20	5.90	1.21	0.27

Table 7: OSS values in control group (paired *t*-test)

Variables	<i>n</i>	Mean	SD	SEM
Pre-intervention	20	42.00	9.21	2.06
Post 4 weeks	20	37.90	5.46	1.22
Post 12 weeks	20	35.55	8.24	1.84

Table 8: Statistical analysis of OSS in control group shows statistically significant values at pre and post 12 weeks interval

Variables	Mean difference	<i>t</i> -value	<i>P</i> -value	95% Confidence interval of the difference	
				Lower	Upper
Pre and post 4 weeks	4.10±9.11	2.013	0.058	-0.16	8.36
Pre and post 12 weeks	6.45±6.57	4.388	0.001	3.37	9.53
Post 4 weeks and post 12 weeks	2.35±9.09	1.157	0.262	-1.90	6.60

DISCUSSION

Similar to our study, Ibrahim *et al.*^[14] found that according to the ultrasonic assessment before and 2 months after the treatment in both groups, the percentage of improvement of tendinitis and bursitis in Group II was more than in Group I the frequency of partial tears improved in Group I more than in Group II. These results agreed with Scarpone *et al.*^[15] who found that a single injection of PRP under ultrasound guidance resulted in a safe, significant, sustained improvement in pain, and function outcomes for participants with refractory RCT. Because PRP is safe, easy to prepare, and apply and effectively improves the patient's condition, it can be used to treat partial thickness rotator cuff tears. PRP enhanced the energy

to failure of RCT repair in an experimental model. PRP was a significantly effective adjunct to rotator cuff repair by improving tendon-bone healing and potentially reducing the incidence of subsequent tendon retears. PRP supplements arthroscopic repair of rotator cuff tear by reducing pain, thus allowing for a more rapid recovery of mobilization and improvement in functionality.

Kesikburn *et al.*^[16] in 2013 conducted a randomized controlled trial level 1 study on PRP versus placebo on 20 patients in each group with diagnosis of Rotator cuff tendinosis diagnosed by MRI with mean symptom duration of 8.5/10.5 and with mean age 45.5/51.4 years in both groups, respectively. They concluded that PRP is no better formulate than corticosteroids for symptoms relief and functionality improvement assessment s as per VAS, SPADI, and WORC assessment scales. Sham *et al.*, in 2016^[17] conducted a randomized controlled trial on group of painful partial rotator cuff tear patients diagnosed by MRI for PRP and corticosteroid (40 mg triamcinolone) injection into subacromial space by landmark guidance of shoulder, as we have used this shoulder bony landmarks for injection technique into the subacromial space. They used 20 patients in their study with average age of 52/50 and duration symptoms more than 3 months. This study concluded that PRP is a better formulation than corticosteroids on the basis of VAS, constant scores, and ASES scoring at 6-, 12-, and 24-week follow-ups. Jo *et al.*^[18] in 2020 conducted a randomized controlled study assessor blinded on two groups of 30 patients each where they used 4 ml PRP and 4 ml mixture of 1 ml of 40 mg/ml triamcinolone acetone with 3 ml of 2% lidocaine by ultrasonographic method and found that constant score did not differ significantly between two groups but at 6-month follow-up, DASH scores, overall function, and external rotation were significantly better in PRP group. Strength of our study is that both VAS score and Oxford Shoulder Scoring System for analysis of pain in patients that gives us more correct results rather than using only VAS score. One major limitation of our study was the sample size.

CONCLUSIONS

At 4-week follow-ups, as per VAS scoring, corticosteroid group showed better results in pain improvement and general betterment of the condition of the patient. However, as per OSS Scoring far better improvement was seen in PRP group than corticosteroid group at the same

time. However, at 12-week follow-up, PRP group showed far superior results and significant improvement as per both VAS and OSS scores in the pain and improving overall condition of the patient and return to pain free movement at the shoulder significantly. Hence, it can be concluded that, however, corticosteroids may be helpful acutely in pain relief, PRP is a better therapy than corticosteroids in significant fractions and a superior formulation to corticosteroids. Furthermore, PRP is a cheap, autogenous, cost-effective, and long-term effective therapy without any hypersensitivity or side effects for RCT cases. Hence, it is preferable to use PRP over corticosteroids in RCT.

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