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Platelet-rich plasma for the improvement in shoulder function in rotator cuff disorders

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ABSTRACT

Background: Among causes of shoulder pain, rotator cuff disorders are very common. The exact pathogenesis of rotator cuff tears is not clearly understood. To improve outcomes, the relatively new technique of injection of PRP is under investigation. Purpose of this study is to clinically evaluate the efficacy of new treatment of PRP injection in shoulder pain due to rotator cuff pathology.
Methods: A prospective, observational study, on patients with shoulder pain diagnosed as rotator cuff disorders admitted in Department of Orthopaedics, RIMS, Ranchi during one year time interval (from 10th October 2016 to 09th October 2017) in the age ranging from 41 to 80 years with a mean age of 57.90 years was conducted. 20 Patients were selected for the study. Initial pre-injection score of patient taken on constant shoulder score and noted. Patient underwent intra-articular injection of PRP in shoulder joint through posterior approach under local anaesthesia. Patients were followed up at 1st post-injection day, 1 month, 3 months and 6 months after the injection.
Results: Results were analysed according to constant shoulder score. In partial tear 5 (41.67%) have excellent, 6 (50%) have good and 1 (8.33%) has fair outcome on 6 months follow up and in full tear all 8 (100%) patients have poor outcome and none of the patients developed any complication.
Conclusions: A single injection of PRP resulted in a safe, significant, sustained improvement in pain and functional outcomes for patients with refractory partial rotator cuff tear (RCT).

Keywords: Platelet-rich plasma, Rotator cuff tear

INTRODUCTION

It is important to investigate shoulder pain in the community to understand the full impact such complaints have on general population. Among causes of shoulder pain, rotator cuff disorders viz tendinitis, tears, impingement are very common. Tendons of supraspinatus, infraspinatus, teres minor and subscapularis forms the rotator cuff, which is the basis of stability of shoulder joint. The exact pathogenesis of rotator cuff tears is not clearly understood.[1] It is thought to be a combination of intrinsic and extrinsic factors that cause joint injury.[1] Extrinsic factors include repetitive microtrauma and impingement. Intrinsic factors include hypovascularity of tendons, as well as age related changes including decreased cellular activity and changes in the composition of the matrix of the tendon. Once injured, it is likely that there is difficulty healing due to poor blood supply at the humeral insertion point. Diagnosis is made based on clinical suspicion with supporting radiographic evidence. The preferred imaging method is magnetic resonance imaging (MRI), which can show partial or small rotator cuff tears. Initial work-up includes a radiograph, and if patients are unable to have

an MRI performed, ultrasound may be used as an alternative.[2] To improve outcomes, the relatively new technique of injection of PRP is under investigation. This technique uses platelet-rich plasma, which is a whole blood fraction containing high platelet concentration. This provides the addition of various growth factors, including transforming growth factor beta (TGF-!), fibroblast growth factor (FGF), platelet derived growth factor (PDGF), vascular endothelial growth factor (VEGF), connective tissue growth factors and epidermal growth factor (EGF).[3] The proposed benefit of including PRP in rotator cuff disorders is that it allows platelet derived factors to be locally available to the tissue throughout the healing process.[4] Our aim is to study the improvement in shoulder function in rotator cuff disorders by giving platelet rich plasma.

METHODS

A prospective, observational study, on patients with shoulder pain diagnosed as rotator cuff disorders admitted in Department of Orthopaedics, RIMS, Ranchi during one year time interval (from 10th October 2016 to 09th October 2017)in the age ranging from 41 to 80 years with a mean age of 57.90 years was conducted. 20 Patients were selected for the study from those presenting to our hospital.

Inclusion criteria

Inclusion criteria were age group : >18 years; gender: male and female patients; patients with shoulder pain due to rotator cuff disorders; patients who are willing to participate in the study; skeletally mature patient.

Exclusion criteria

Exclusion criteria were children and adolescent patients <18 yrs; patients with any previous history of fracture of shoulder; patients not willing to participate; patients with history of shoulder dislocation; patients with infections; patients with haematological disorders(Coagulopathy); patients with severe cardiovascular diseases; patients with immunodeficiency; patients who are using anticoagulants or antiaggregants; patients with platelet value less than 150,000 mm^3.

Radiograph of shoulder i.e, anteroposterior view were taken to rule out any fractures around shoulder. Next the rotator cuff pathology viztear(complete or partial), tendinitis etc. were confirmed by doing either ultrasonography or MRI of shoulder joint. After that, initial pre-injection score of patient taken on constant shoulder score and noted. All routine and screening investigations done. The patient was then sent to hospital blood bank for blood withdrawal and preparation of autologous PRP (platelet rich plasma). The consent for injection was taken from the patients and their attendants after explaining the procedure and the possible complications. Patient underwent intra-articular injection of PRP in shoulder joint through posterior approach under local anaesthesia. Post-injection physiotherapy was followed according to the protocol to evaluate the functional outcome. Patients were followed up at 1st post-injection day, 1 month, 3 months and 6 months after the injection. The outcome was assessed based on Constant Shoulder Score and complications in our study

Injection technique

Local anaesthesia was used in all of the patients. A posterior sub-acromial approach was used. Painting and draping of the part was done. The sulcus between the head of the humerus and acromion is identified. The needle is inserted 2-3cm inferior and medial to the posterolateral corner of the acromion and directed anteriorly towards the coracoid process. The needle should sink completely into the joint and the plunger should push with great ease and no resistance if needle is in the glenohumeral joint. Now we inject the PRP in joint and take out the needle and do sterile dressing and perform mild passive movements of joint. We keep the patient in the operation theatre to be monitored for 30 minutes after the injection, and explain the patient to avoid strenuous activity involving the injected region for at least 48 hours.

Patients were instructed not to use NSAIDs for a period of 3-4 weeks as they may hamper functions of PRP. They were prescribed opioid analgesic on SOS basis. They were explained to do active range of motion exercises. Patient discharged next day. After discharge, patients were advised to report for follow up at 1 month, 3months and at 6 months. The final results were assessed 6 months after the procedure. At each follow up a detailed clinical examination was done and patients were assessed subjectively for the symptoms like pain, range of motion and constant shoulder score recorded. Patients were instructed to carry out physiotherapy in the form of active range of motion exercises.

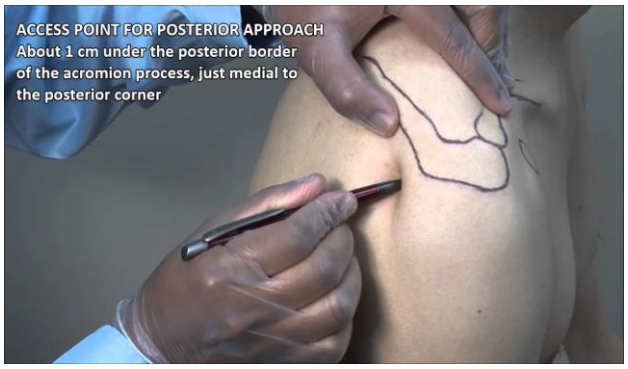

Figure 1: Injection technique.

RESULTS

The study included 20 patients with age ranging from 41 to 80 years with a mean age of 57.90 years. Mean age of

male patients was 58.73 years and mean age of female patients was 56.89 years. There were 11 male and 09 female patients.

Table 1: Age and sex distribution.

Gender	Mean	Standard deviation
Male (n=11) 55%	58.73	11.77
Female (n=9) 45%	56.89	9.70

10 (50%) patients having right shoulder pain and 10 (50%) patients having left shoulder suggesting equal incidence of shoulder pain in both shoulder. 12 patients have partial supraspinatous tear and 08 patients have complete supraspinatous tear confirmed with either USG or MRI. In partial tear initially 6 patients have strength in range 1-3 pounds and 4 patients have strength in 4-6 range and on final follow up 5 patients improved to range 7-9 pounds and 3 have >10 pounds strength of abduction. In full tear there is not much significant improvement in strength of abduction.

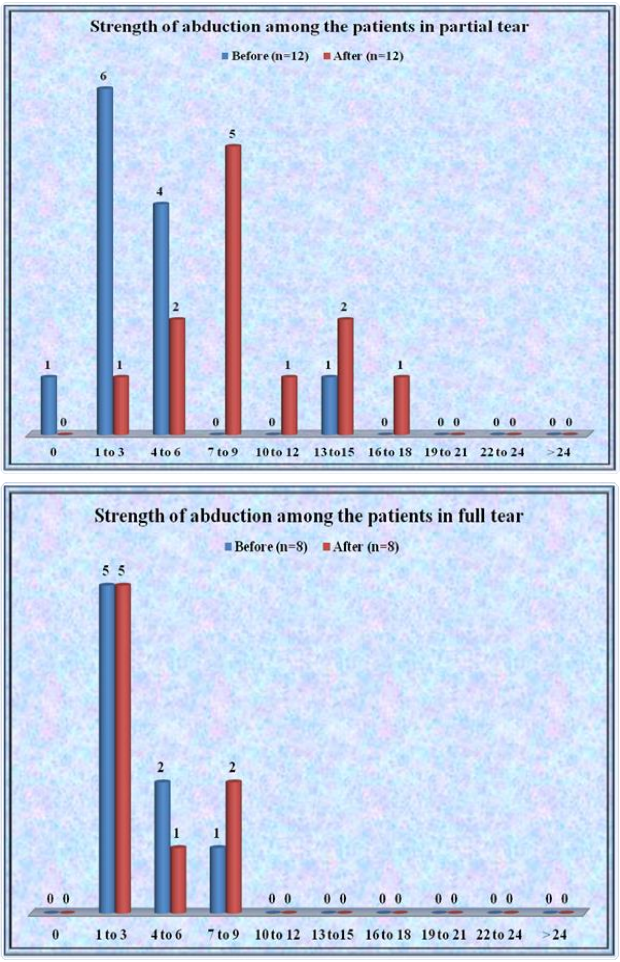

Figure 2: Strength of abduction in partial tear and full tear.

In full tear 4 have severe and 4 have moderate pain and on follow up pain decreased to mild grade in 5 patients. Patients showed significant improvements in pain relief.

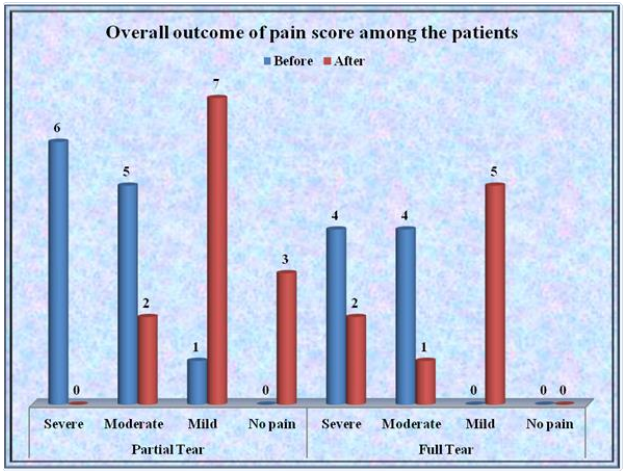

Figure 3: Pain score among patients.

In partial tear initially, 5 have forward flexion in 31-60 degrees range and 4 have 61-90 degrees flexion and on final follow up, no patient is in 31-60 degrees range, 3 have 91-120 degrees, 3 have 121-150 degrees range and 3 improved to 151-180 degrees of flexion. In full tear only 1 improved to 121-150 and 2 improved to 91-120, rest have <90 degrees of flexion.

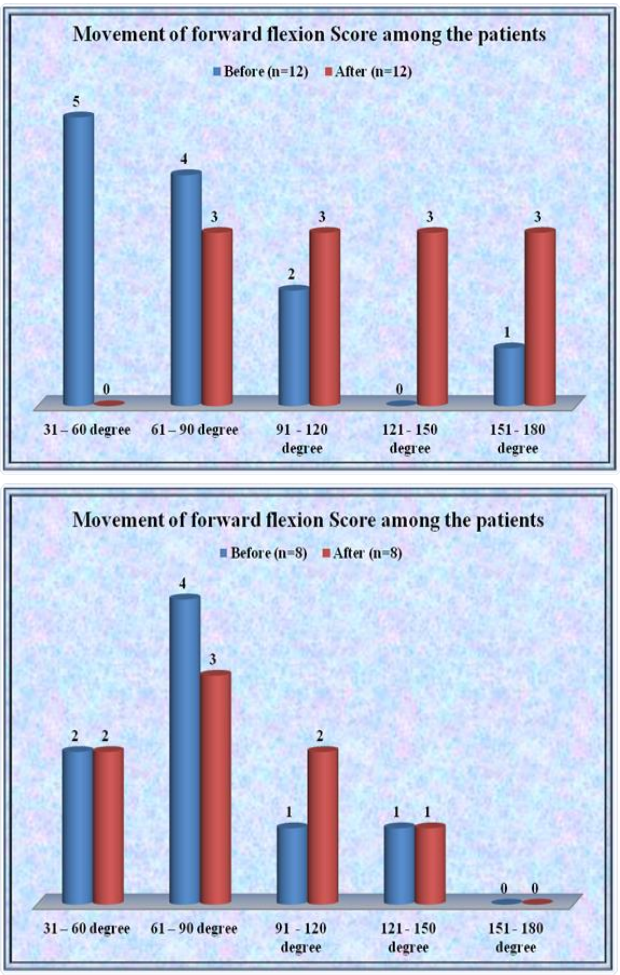

Figure 4: Forward flexion score among patients.

In partial tear initially 3 have lateral elevation 31-60 degrees, 6 have 61-90 degrees 2 have 121-150 degrees and on follow up, 5 patients improved to 151-180 degrees and 5 patients have lateral elevations >90 degrees and only 2 in 31-60 degrees, no patient have <60 lateral elevation. Full tear patient do not shows much significant difference on follow up.

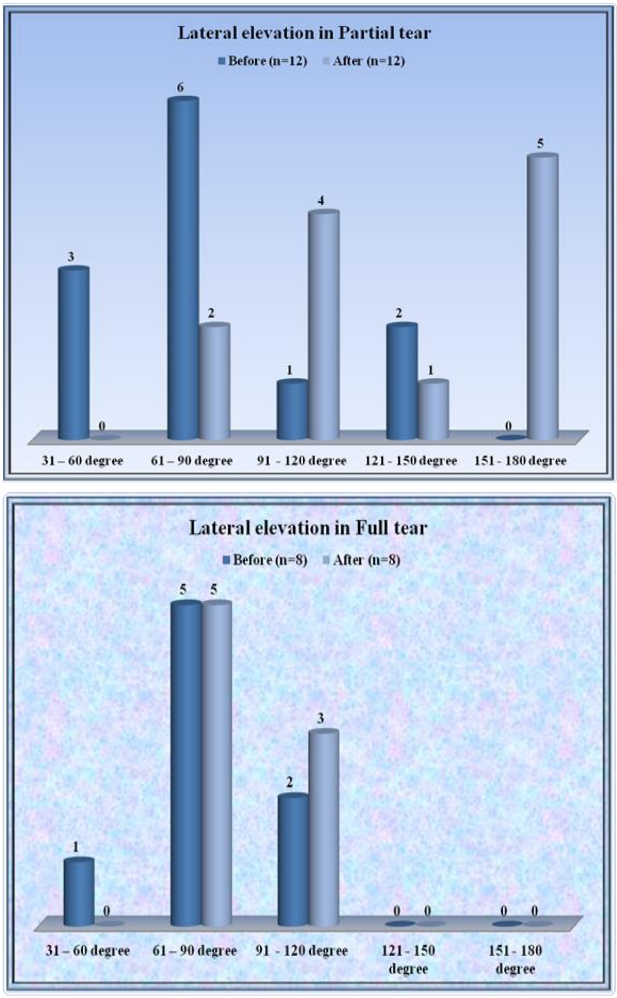

Figure 5: Lateral elevation among patients.

In partial tear initially 8 patients have external rotation only up to hand behind head, elbow forward and on final follow up 2 patients do full external rotation, 3 have rotation with hand above head and elbow back, 5 have rotation with hand above head and elbow forward. In full tear external rotation improved to mild degrees in few patients, not much significant.

In partial tear initially 2 patients have internal rotation up to lateral thigh, 7 have up to buttock, 3 have up to lumbosacral region and after 6 months follow up 6 patient have rotation up to lumbosacral junction, 3 improved to rotation up to waist and 1 patient improved to internal rotation up to T12 and 1 patient improved to full internal rotation up to T7 vertebra. In full tear no significant improvement seen on follow up.

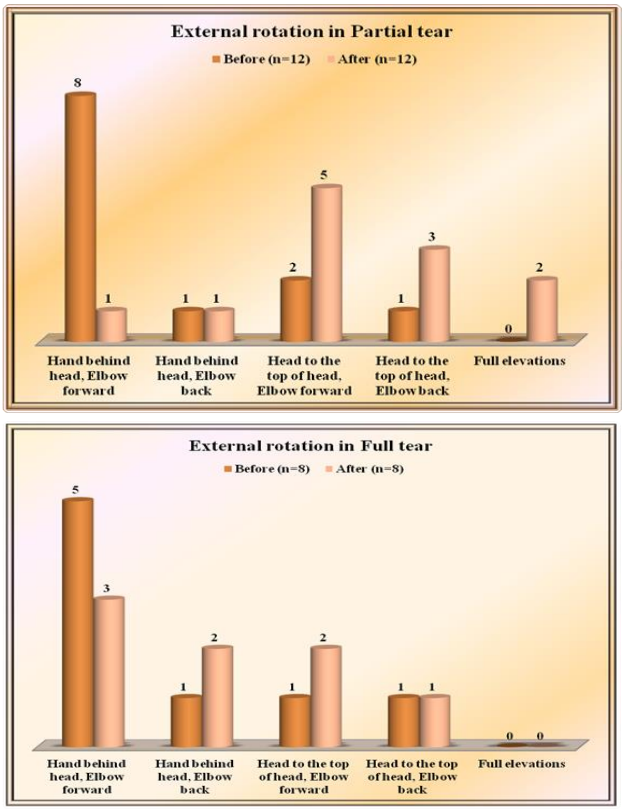

Figure 6: External rotation among patients.

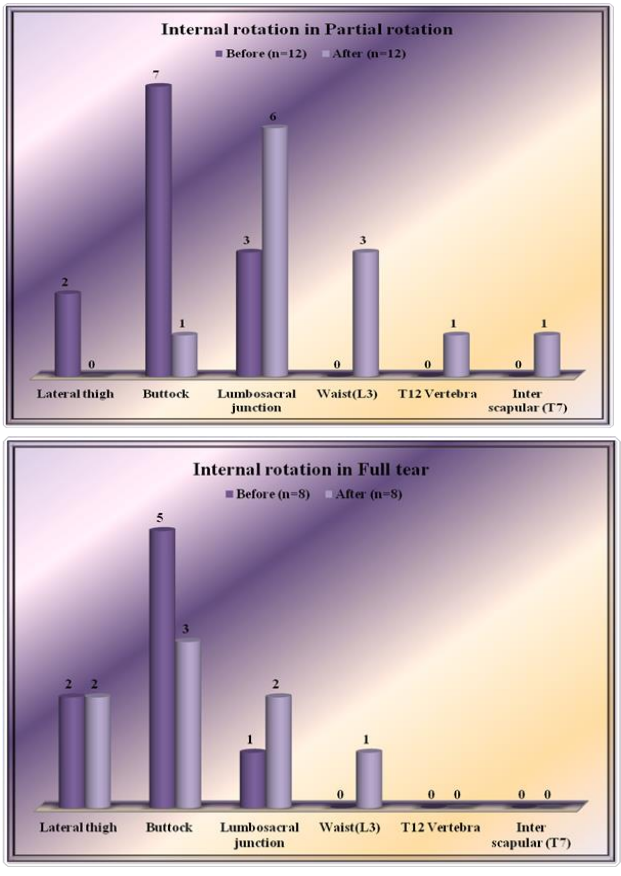

Figure 7: Internal Rotation among patients.

In partial tear all 12 patients have unaffected sleep after follow up, 4 patients can do full sports activity without any discomfort and 4 can do full daily activity and 5 patients use their hand to do over head activity without any problem. In full tear patients out of 8 patients 6 have unaffected sleep, rest activity scores do not show significant improvements. Constant score improvement seen in both the groups but it is more in partial tear patients compared to full tear patients. In partial tear 5(41.67%) have excellent, 6(50%) have good and 1(8.33%) has fair outcome on 6 months follow up and in full tear all 8(100%) patients have poor outcome. None of the patients developed any complication in our study.

Table 2: Overall outcome of constant score among patients.

Parameter	Partial tear (n=12) (%)	Full tear (n=8) (%)
Poor (>30)	0 (0)	8 (100)
Fair (21-30)	1 (8.33)	0
Good (11-20)	6 (50)	0
Excellent (<11)	5 (41.67)	0

DISCUSSION

Our study showed a significant change in the preinjection and postinjection constant scores at 3 months and 6 months while the study was able to demonstrate that the injected product influenced the pain score, the overall decrease in pain from baseline for group demonstrates that PRP injection can be effective in pain control in partial tears. Most of the people were satisfied because of the adequate pain control by 6 month. The secondary objectives which designate the shoulder function exhibit unique progressive pattern. The shoulder score increases from baseline to 6 month with good patient satisfaction. The 3 month review also shows a unanimous increase in the score with a definite difference in shoulder abduction. The Constant score shows improvement in 3 month and 6 month compared to baseline showing improved range of motion in the shoulder in partial RC tear. Though results were not so good in complete RC tear. The most common adverse effect was post-injection pain which was mainly treated with ice packing. Pain is nonspecific to study event, or it could be technically related. There were no other specific adverse effects regarding PRP. These overall findings are consistent with the mounting literature examining the use of PRP in partial RC injuries.

Currently, there are few published studies that specifically investigate the safety and efficacy of PRP injections to the shoulder as a non-operative treatment option for Partial Tear RCTs. Even fewer studies seek to compare pre- and post-injection imaging to radiographically assess healing of the partially torn tendon and, at the same time, to determine a correlation between objective (i.e. image reporting) and subjective (i.e. patient report) outcome data.

There are little studies suggesting the effect of ultrasound-guided PRP injection in partial RC tears. However, there are studies in augmentation of arthroscopic RC repair using PRP intraoperatively.

Saltzman et al concluded that there is improvement in pain and reduction in rehabilitatory period in cases where PRP augmentation was done in patients with RC tear. When PRP is used to augment rotatorcuff repair, it resulted in decreased retear rates, early going back to day-to-day activity and improvement in pain.[5]

Randelli et al study revealed that when PRP is used for the augmentation of arthroscopically conducted cuff repair, all the fourteen patients had reduction in pain and functional improvement and had no adverse effect as shown by improvement in constant score at 12 weeks following the repair.[6]

Scarpone et al concluded a single ultrasound-guided, intralesional injection of PRP resulted in safe, significant, sustained improvement of pain, function, and MRI outcomes in participants with refractory RCT.[7]

Ilhani et al concluded PRP to be a well-tolerated application which showed promising results in patients with chronic partial supraspinatus tears.[8]

Sengodan et al concluded Ultrasound guided platelet rich plasma injection for partial rotator cuff tears is an effective procedure that leads to significant decrease in pain, improvement in shoulder functions, much cost-effective and less problematic compared to a surgical treatment.[9]

Thus PRP seems to be a well-tolerated therapeutic application which has shown encouraging clinical results in patients with chronic partial rotator cuff tears. This suggests that PRP may have the potential to heal the muscle-tendon unit of the rotator cuff at the level of degenerative tissue and may be a primary nonsurgical treatment for refractory partial RCT.

CONCLUSION

PRP injection is an effective modality of treatment in patients having shoulder pain due to partial rotator cuff tear. In full rotator cuff tear patients this modality of treatment seems to be not effective. In shoulder joint posterior approach is safe and effective method for intra-articular injections. No patient in our study developed any type of complication during and after injection on follow up. We come to conclusion that, a single injection of PRP resulted in a safe, significant, sustained improvement in pain and functional outcomes for patients with refractory partial Rotator Cuff Tear (RCT).

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Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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