



Role of Platelet Rich Plasma in Close Fracture Distal End of Radius Healing-A Comparative Study

KEYWORDS

Distal radius fracture, PRP.

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ABSTRACT

Introduction: Distal radius fractures are most common fractures encountered, specially in elderly, osteoporotic bone.

The decision whether operative or nonoperative treatment taken is based on patient factors, the personality of the fracture, and implant availability.

Recently advent of orthobiologics in treating bone fracture has developed.

Platelet-rich plasma (PRP) is an orthobiologic that has recently gained popularity as an adjuvant treatment for musculoskeletal injuries.

Material and Method: STUDY DESIGN: Hospital based comparative interventional study.

STUDY PARTICIPANTS: Patients with distal end radius fractures who met the inclusion criteria and reported at department of Orthopaedics, RNT Medical college, Udaipur would be participants.

SAMPLE SIZE: 25 patients in each group of with and without PRP

For the study purpose, every eligible case admitted between time period of April 2015 to December 2016 will be included in my study.

Results: The union time for patients treated conservatively with PRP is reduced as compared to patients treated without PRP. The functional outcome as rated by PRWHE and Mayo wrist score in the group treated conservatively with PRP is favourable as compared to group treated without PRP.

Conclusion: Our study shows that the group treated conservatively with PRP had a better functional outcome in terms of PRWHE score and Mayo wrist score in comparison to group treated conservatively without PRP. Also the time taken for radiological union in the group treated conservatively with PRP is significantly less than the non PRP treated group.

Thus the patients treated with PRP are able to gain early range of motion exercises and also the complications related to longer cast immobilization could be avoided.

INTRODUCTION

Fracture of the distal radius continues to be one of the most common skeletal injuries treated by Orthopaedic or trauma surgeons.

Treatment Options

1. Cast and immobilization:
2. Closed Reduction and Percutaneous Pinning
3. Open reduction and internal fixation –
4. External Fixation-

- Recently advent of orthobiologics in treating bone fracture has developed. Orthobiologics is a relatively newer science that involves application of naturally found materials from biological sources (for example, cell-based therapies), and offers exciting new possibilities to promote and accelerate bone and soft tissue healing. Platelet-rich plasma (PRP) is an orthobiologic that has recently gained popularity as an adjuvant treatment for musculoskeletal injuries.²¹ It is a volume of fractionated plasma from the patient's own blood that contains platelet concentrate. The platelets contain alpha granules that are rich in several growth factors, such as platelet-derived growth factor, transforming growth factor- β , insulin-like growth factor, vascular endothelial growth factor and epidermal growth factor, which play key roles in tissue repair mechanisms.^{22,23} Hence it is plausible to assume that PRP injection therapy can have a beneficial effect in the management of bony injury. The postulated effect of PRP is gained due to several different growth factors, which stimulate the healing of soft tissues (such as ligaments), and bones or cartilage.²⁵

Since there are very few studies evaluating the beneficial effect of PRP injection therapy in the treatment of bone fracture, we conducted a novel study in the Department of Orthopedics, MB Government Hospital attached to RNT Medical College, Udaipur to assess its

results and biological effect of PRP augmented DER fracture healing.

AIMS AND OBJECTIVES

- To determine the effect of autologous PRP in augmentation of union in distal end radius fracture managed conservatively.
- To compare the functional and radiological outcome of extra articular distal radius fracture treated by conservative with or without Platelet rich plasma injection.

MATERIALS AND METHODS

STUDY DESIGN: Hospital based comparative interventional study.

STUDY PARTICIPANTS: Patients with distal end radius fractures who met the inclusion criteria and reported at our department of Orthopaedics would be participants.

STUDY AREA: Deptt. Of Orthopaedics, RNT Medical college, Udaipur

SAMPLING PROCEDURE: All study participants would be allocated in intervention who had fracture distal end radius.

SAMPLE SIZE: 25 patients in each group of with and without PRP For the study purpose, every eligible case admitted between time period of April 2015 to December 2016 will be included in my study.

INCLUSION CRITERIA

- Close extra articular fracture DER
- Age 50 to 75 years

EXCLUSION CRITERIA

- Open Fracture
- Fracture with intra-articular extension
- Pathological fracture

1. INITIAL ASSESSMENT AND EVALUATION OF PATIENT

Good qualities of X-ray both AP and LAT view were taken & important points to consider are: 1. Fracture displacement, 2. Intra-articular or partial articular involvement, 3. Associated ulna fracture or disruption of the distal radioulnar joint, 4. An overall assessment of bone quality and comminution.

And radiographs are evaluated for 1. Radial length, 2. Radial inclination, 3. Volar tilt & 4. Intra-articular step or gap.

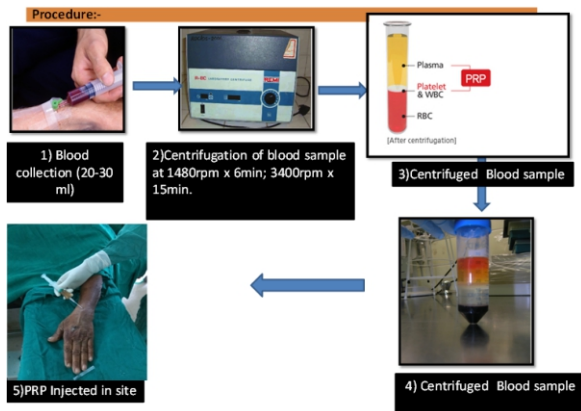
This study involved total 50 patients, 25 cases with PRP and 25 without PRP were managed conservatively. Treatment to be received was decided by the patients themselves after thorough counselling about pros & cons of each modality, according to their financial status, activity level and associated comorbidities.

2. PLANNING OF TREATMENT

Sedation and short anaesthesia given and closed reduction according to pattern of fractures and slab applied. Conservative treatment is continuing, if the reduction is acceptable in check X-ray. After 7-14 days, duration the patient follow-up check X-ray done and continue the conservative treatment if reduction maintained. If initial or follow-up check X-ray the reduction is not maintained then fracture is unstable. Recommended treatment for unstable fracture is operative.

3. TECHNIQUES

(a) Preparation of PRP: Venous blood collection of around 20 ml was done for every patient in the group A and then centrifugation resulted in PRP concentrate of around 5-6 ml which was then injected at the site concerned.



(b) Closed reduction & cast: We after achieving adequate analgesia, applied in-line traction with assistant facilitate relaxation of the forearm musculature. Required manipulation will depend on the presenting fracture, once the fracture fragments are disimpacted, each component of the fracture displacement reduced according to fracture & for plaster immobilization we tried to adapt the position of the hand and wrist to a position that is directly opposite to the displacement that occurred in producing the original deformity and slab applied such as for the typical dorsally angulated fracture with minimal displacement of the volar cortex, the reduction can be obtained by direct pressure on the distal fragment from the dorsal surface to correct the angulation. Check X-ray done & discharged for 1-2 week. The length of immobilization varies from 4 to 6 weeks.

FOLLOWUP

Patients were randomized to 2 groups: Close reduction with PRP and close reduction without PRP. After the closed reduction check X-rays are taken and the radiological parameters were measured and noted Patients were followed up at 6 weeks, 3 month & 6 months.

Radiographic assessment:

Check X-rays were taken at 6 weeks to assess consolidation or

collapse at the fracture site and to note any displacement. The fracture was considered united when clinically there was no tenderness, subjective complaints, and radiologically when the fracture line was not visible. Regular follow up was done at an interval of 6 weeks, 3 months. The results were assessed at 6 weeks and 3 months after the procedures using Patient Rated Hand Wrist Evaluation (PRHWE) Score:

1. PAIN													
Rate the average amount of pain in your wrist over the past week by circling the number that best describes your pain on a scale from 0-10. A zero (0) means that you did not have any pain and a ten (10) means that you had the worst pain you have ever experienced or that you could not do the activity because of pain.													
RATE YOUR PAIN: Sample Scale **	No Pain	0	1	2	3	4	5	6	7	8	9	10	Worst Ever
At rest		0	1	2	3	4	5	6	7	8	9	10	
When doing a task with a repeated wrist movement		0	1	2	3	4	5	6	7	8	9	10	
When lifting a heavy object		0	1	2	3	4	5	6	7	8	9	10	
When it is at its worst		0	1	2	3	4	5	6	7	8	9	10	
How often do you have pain?	Never	0	1	2	3	4	5	6	7	8	9	10	Always

2. FUNCTION													
A. SPECIFIC ACTIVITIES													
Rate the amount of difficulty you experienced performing each of the items listed below - over the past week, by circling the number that describes your difficulty on a scale of 0-10. A zero (0) means you did not experience any difficulty and a ten (10) means it was so difficult you were unable to do it at all.													
Sample scale -->	No Difficulty	0	1	2	3	4	5	6	7	8	9	10	Unable To Do
Turn a door knob using my affected hand		0	1	2	3	4	5	6	7	8	9	10	
Cut meat using a knife in my affected hand		0	1	2	3	4	5	6	7	8	9	10	
Fasten buttons on my shirt		0	1	2	3	4	5	6	7	8	9	10	
Use my affected hand to push up from a chair		0	1	2	3	4	5	6	7	8	9	10	
Carry a 10lb object in my affected hand		0	1	2	3	4	5	6	7	8	9	10	
Use bathroom tissue with my affected hand		0	1	2	3	4	5	6	7	8	9	10	
B. USUAL ACTIVITIES													
Rate the amount of difficulty you experienced performing your usual activities in each of the areas listed below, over the past week, by circling the number that best describes your difficulty on a scale of 0-10. By "usual activities," we mean the activities you performed before you started having a problem with your wrist. A zero (0) means that you did not experience any difficulty and a ten (10) means it was so difficult you were unable to do any of your usual activities.													
Personal care activities (dressing, washing)		0	1	2	3	4	5	6	7	8	9	10	
Household work (cleaning, maintenance)		0	1	2	3	4	5	6	7	8	9	10	
Work (your job or usual everyday work)		0	1	2	3	4	5	6	7	8	9	10	
Recreational activities		0	1	2	3	4	5	6	7	8	9	10	

Functional outcome according to PRHWE Score (TOTAL 10)

Section 1 - Pain Intensity	Section 2 - Functional Status
No pain	Returned to regular employment
Mild Occasional	Restricted employment
Moderate, tolerable	Able to work, but unemployed
Severe to intolerable	Unable to work because of pain

Section 3 (choose either 3a or 3b)

3a - Range of Motion (% of normal side)	3b - If only injured hand examined
100%	Greater than 120 degrees
75-99%	90-120 degrees
50-74%	60-90 degrees
25-49%	30-60 degrees
0-24%	less than 30 degrees

Section 4 - Grip strength % of normal

100%
75-100%
50-75%
25-50%
0-25%

Functional outcome according to Mayo Wrist Score(TOTAL 100)

90-100	Excellent
80-90	Good
60-80	Fair
Below 60	Poor

OBSERVATIONS

Table No.1: Distribution of cases according to type Frykman

TYPE FRYKMAN	GROUP A		GROUP B	
	NO. OF CASES	PERCENTAGE	NO. OF CASES	PERCENTAGE
I	18	72	17	68
II	7	28	8	32
TOTAL	25		25	

Table 2: Distribution of cases according to radiological time of union

TIME OF UNION (RADIOLOGICAL) IN WEEKS	GROUP A		GROUP B	
	NO.OF CASES	PERCENTAGE	NO.OF CASES	PERCENTAGE
8-9	12	48	7	28
9-10	8	32	7	28
10-11	3	12	6	24
11-12	2	8	5	20
TOTAL	25	100	25	100

The union time for patients treated conservatively with PRP is seen mostly 12(48%) in the time interval of 8-9 weeks and in the group treated conservatively without PRP the union appears a week or two later.

Table 3: Distribution of cases according to functional outcome rated by mayo wrist score

MAYO WRIST SCORE	GROUP A		GROUP B	
	NO. OF CASES	PERCENTAGE	NO. OF CASES	PERCENTAGE
<60	1	4	2	8
60-80	6	24	8	32
80-90	8	32	10	40
90-100	10	40	5	20
TOTAL	25	100	25	100

The group treated conservatively with PRP had wrist score of 80-100 in 18(72%) of patients while group treated conservatively without PRP had wrist score of 80-100 in 15(60%) of patients. This indicates a more favorable functional outcome in the group A.

Table 4: Distribution of cases according to functional outcome rated by PRWHE score

PRWHE SCORE	GROUP A		GROUP B	
	NO. OF CASES	PERCENTAGE	NO. OF CASES	PERCENTAGE
0-1	10	40	6	24
2-4	7	28	8	32
5-7	7	28	9	36
8-10	1	4	2	8
TOTAL	25	100	25	100

The group treated conservatively with PRP had PRWHE score of 0-4 in 17(67%) of patients while group treated conservatively without PRP had PRWHE score of 0-4 in 14(56%) of patients. This indicates a more favorable functional outcome in the group A.

Table 5: Distribution of cases according to functional outcome

FUNCTION SCORE	TYPE	POOR	FAIR	GOOD	EXCELLENT
MAYO WRIST SCORE	GROUP A	1	6	8	10
	GROUP B	2	8	10	5
PRWHE SCORE	GROUP A	1	7	7	10
	GROUP B	2	9	8	6

In our study we determine subjective evaluation of functional outcome by using two variables mayo wrist score and PRWHE score the patients treated conservatively with PRP included in group A had excellent results in most of the patients (40%) in both variables while patient treated conservatively without PRP had good results in most of the patients (40%) in mayo wrist score and (32%) in PRWHE score.

Table 6 : Distribution of complication observed at various intervals

Complication	At 3 months		At 6 months	
	GROUP A	GROUP B	GROUP A	GROUP B
Finger stiffness	4 (16%)	6 (24%)	0 (0.00)	2 (8%)
Arthritic changes	0 (0.00)	0 (0.00)	1 (4%)	3 (12%)
Pain DRUJ	2 (8%)	7 (28%)	0 (0.00)	0 (0.00)
Tendon injury	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Nerve injury	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
RSD	0 (0.00)	1 (4%)	0 (0.00)	0 (0.00)

It was observed from the above table that at 3 months follow up, the most common complication encountered was finger stiffness affecting 4(16%) patients and 6 (24%) patients treated conservatively with and without PRP respectively. At 6 month follow up the finger stiffness complication was remained in 2 (8%) patients treated conservatively without PRP. It shows that finger stiffness complication at 6 month follow up was disappeared in patients of group A.

Second most common complication observed was pain DRUJ affecting 2(8%) & 7(28%) patients in PRP group and without PRP group, which again decrease to 0% in both the groups at 6 months. At 6 months the complication taking predominance was arthritic changes at radiocarpal joint affecting 4% & 12% patient re

Table 7 : Functional result according to Gartland and Werley criteria

Outcome	At 3 months		At 6 months	
	GROUP A	GROUP B	GROUP A	GROUP B
Excellent	13 (52%)	10 (40%)	14 (56%)	13 (52%)
Good	11 (44%)	10 (40%)	11 (44%)	11 (44%)
Fair	1 (4%)	4 (16%)	0 (0.00)	2 (8%)
Poor	0 (0.00)	1 (4%)	0 (0.00)	0 (0.00)
Total	25 (100.0)	25 (100.0)	25 (100.0)	27 (100.0)

According to Gartland and Werley criteria result obtained at 3 months in PRP group were 24 patients (96%) in good to excellent while 1 patient (4%) was in fair group. In non PRP group 20 patients (40%) had good to excellent result, 4 patients (16%) had fair, 1 patient (4%) had poor result.

At 6 months all patients (100%) in PRP group had good to excellent result while 96% of non PRP group had good to excellent result, 8% had fair result.

DISCUSSION

Distal radius fractures are commonly encountered in orthopedic practice especially in elderly patients. A number of clinical papers have supported the idea that anatomic restoration of distal end radius is essential to gain superior results 15-17 Direct relationship between the anatomical result and the functional outcomes were also suggested by several studies.

However, most elderly patients who suffer from this kind of fracture with lower functional demands works well in spite of obvious deformity.

So in view of above literature in our study we included those elderly patients in whom the conservative treatment for fracture distal radius is most suitable (i.e. extra articular). Also due to increasing functional demand at an elderly age we want to study the effect of PRP in augmentation of fracture healing and rapid recovery.

The criteria for treatment outcome comparison used in this study were the speed of functional recovery the functional end result and the incidence of complications .The anatomical end result was not used as a criterion.

The uninjured wrist served as the individual standard which proved to be important as a wide range of normal values were found in uninjured wrists.

In displaced fractures close reduction with B/E cast with PRP are only superior to conventional plaster treatment in cases of extra articular fractures by providing a faster functional recovery early in the rehabilitation phase.

In our study the data shows:

Out of 50 patients 25 included in group A and 25 in group B. Of which maximum patients in group A and group B are of age group between 55 to 60 years.

Out of 50 patients in both groups maximum patients (60%) are females. This is attributed to higher incidence of osteoporosis in females.

The above table reveals that fall on out stretched hand was the leading cause of mode of injury in both the groups 39 (78%). This indicates the increase incidence of distal radius fracture in elderly patients is due to trivial trauma i.e. fall.

The union time for patients treated conservatively with PRP is seen mostly 12(48%) in the time interval of 8-9 weeks and in the group treated conservatively without PRP the union appears a week or two later. This implies an earlier union for the patients which are treated conservatively with PRP.

The group treated conservatively with PRP had wrist score of 80-100 in 18(72%) of patients while group treated conservatively without PRP had wrist score of 80-100 in 15(60%) of patients. This indicates a more favorable functional outcome in the group A.

In our study we included only extra-articular fracture distal radius (i.e. Frykman type 1 and type 2) which should be treated conservatively.

The group treated conservatively with PRP had PRWHE score of 0-4 in 17(67%) of patients while group treated conservatively without PRP had PRWHE score of 0-4 in 14(56%) of patients. This indicates a more favorable functional outcome in the group A.

In our study we determine subjective evaluation of functional outcome by using two variables mayo wrist score and PRWHE score. The patients treated conservatively with PRP included in group A had excellent results in most of the patients (40%) in both variables while patient treated conservatively without PRP had good results in most of the patients (40%) in mayo wrist score and (32%) in PRWHE score.

It was observed from the above table that at 3 months follow up, the most common complication encountered was finger stiffness affecting 4(16%) patients and 6 (24%) patients treated conservatively with and without PRP respectively. At 6 month follow up the finger stiffness complication was remained in 2 (8%) patients treated conservatively without PRP. It shows that finger stiffness complication at 6 month follow up was disappeared in patients of group A.

Second most common complication observed was pain DRUJ affecting 2(8%) & 7(28%) patients in PRP group and without PRP group, which again decrease to 0% in both the groups at 6 months. At 6 months the complication taking predominance was arthritic changes at radiocarpal joint affecting 4% & 12% patient respectively.

According to Gartland and Werley criteria result obtained at 3 months in PRP group were 24 patients (96%) in good to excellent while 1 patient (4%) was in fair group. In non PRP group 20 patients (40%) had good to excellent result, 4 patients (16%) had fair, 1 patient (4%) had poor result.

At 6 months all patients (100%) in PRP group had good to excellent result while 96% of non PRP group had good to excellent result, 8% had fair result.

SUMMARY AND CONCLUSION

The present study was undertaken to compare the functional outcome and mean union time of extra-articular distal radius fracture using closed reduction and immobilization supplemented with PRP with closed reduction and immobilization only.

Distal radius fractures are common in elderly individuals with osteoporotic bone and generally occurs due to trivial fall on outstretched hand.

As our clinical trial was undertaken to compare the effectiveness of PRP in the conservative management of distal radius fracture, so we included the cases which required only conservative treatment(i.e. extra-articular and undisplaced or minimally displaced.

Our study shows that the group treated conservatively with PRP had a better functional outcome in terms of PRWHE score and Mayo wrist score in comparison to group treated conservatively without PRP. Also the time taken for radiological union in the group treated conservatively with PRP is significantly less than the non PRP treated group.

Thus the patients treated with PRP are able to gain early range of motion exercises and also the complications related to longer cast immobilization could be avoided.

After 6 months follow up the range of movement and functional outcome as per PRWHE score and Mayo wrist score in both the groups are similar which shows that in due course of time there is no significant difference in PRP treated group and non-PRP treated group.

Due to early functional recovery, better patient satisfaction and hardly any cost disadvantage, use of PRP with conservative treatment in extra-articular fracture distal radius has shown beneficial results.

ILLUSTRATIONS

Patient mangi devi 67yr female managed by close reduction and cast immobilization



At the time of injury

At 6 weeks follow up



Patient devial 55 yr old male managed by CR + PRP+IMMOBILIZATION



At the time of injury

after 6 weeks follow up



Dorsiflexion

Palmar flexion

Radial deviation

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