

Original Research Article

The effect of pronator quadratus repair versus non-repair after distal radius plating

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Abstract

Background: Fracture distal end of radius is the common fractures presenting to orthopaedics. About one-sixth of all fractures presenting to emergency department, constituting upto 15% of skeletal injuries in adults. Various management options available including non-operative and operative procedures. Volar plating is the well-known surgical procedure performed for distal radius fractures. But the need for pronator quadratus repair or non-repair is still debatable. **Aims and objective:** The purpose of this study was to compare and analyze the functional outcome of fracture distal radius treated by volar plating and pronator quadrates repair versus volar plating and pronator quadrates non-repair. **Materials and methods:** This retrospective study of 50 patients with distal radius fracture who were admitted and operated in the department of Orthopaedics, at R.L.Jalappa hospital, Tamaka, Kolar from January 2018- January 2020. Functional outcome was evaluated using VAS score, wrist range of movements and hand grip strength during follow-up after volar plating at 6 weeks, 3 months and 6 months. **Results:** Out of 50 patients, 21 patients underwent repair of pronator quadrates (group A) and 24 patients non-repair of pronator quadrates (group B). 5 patients lost for follow-up. There were 31 male and 14 females with mean age of 39.2 years. All the patients were followed up till 6 months. Mean VAS score at 6 weeks was 4 and at 6 months 1.71 in group A, where as in group B at 6 weeks was 5.8 and at 6 months 1.95. The mean grip strength at 6 weeks was 60% and 92% at 6 months in group A, where as in group B 41% and 88% respectively. **CONCLUSION –** We conclude that repair of pronator quadratus have reduced post-operative pain, good grip strength and good functional range of movements of wrist at early post-operative period when compared to non-repair group. But on long term follow up there was insignificant difference.

Keywords: Fracture distal end of radius, pronator quadrates repair, non-repair.

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Introduction

Fracture distal end radius is the common fractures presenting to orthopaedics. About one-sixth of all fractures presenting to emergency department, [1] constituting upto 15% of skeletal injuries in adults [2]. Elderly females are commonly affected due to fall on outstretched hand [3]. Comminuted fractures of the distal end of the radius are usually caused by high-energy trauma in young patients [4]. Various modalities of treatment available for the management of distal radius fractures - closed reduction and casting, percutaneous k wire fixation, external fixation, open reduction and internal fixation with plate [5]. Restoration of radial height, volar tilt and radial inclination are essential for maintaining the near normal anatomic reduction [6]. Open reduction and volar plating provides stable fixation of these fractures and offers early mobilization of the wrist joint and better functional outcome [7]. Volar plating requires elevation of pronator quadrates muscle from its attachment of distal lateral border of radius to expose the fracture site [8]. Few authors prefer repair of pronator quadrates muscle following implantation [9]. The proposed benefit of pronator quadrates repair include restoration of pronation strength and flexor tendon protection [10]. But excessive tightened repair of pronator quadrates leads to ischemic contracture and

restricted pronation and supination [11]. The purpose of this study was to compare the functional outcome of fracture distal radius treated by volar plating and pronator quadrates repair versus volar plating and pronator quadrates non repair.

Materials and methods

1. Source and type of study – This is a retrospective study of 50 cases that were admitted and operated in the dept. of orthopaedics, at R.L.Jalappa hospital, Tamakakolar from January 2018- January 2020. 21 patients underwent repair of pronator quadrates and 24 patients non repair of pronator quadrates. Our institutional ethics committee approved the study and informed consent was obtained from all patients when called for follow-up.

2. Mode of selection of subjects-Patients were admitted in orthopedics ward from opd/ casualty at R.L. Jalappa hospital and research centre, attached to Sri Devaraj Urs Medical College, meeting the inclusion and exclusion criteria as cited below.

Inclusion criteria

- Patients greater than 18 years of age
- Patients with distal end radius fracture both intra and extraarticular
- Patients presenting with injuries not older than 2 weeks

Exclusion criteria

- Distal radius fracture associated with neurovascular deficit
- Distal end radius fracture associated with carpal bone fractures
- Ipsilateral fractures in the same limb proximal to the wrist
- Open fractures

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Method of collection of data- As mentioned above patients meeting the inclusion and exclusion criteria were included in this study. Patients who underwent pronator quadrates repair were included in group A and patients with non-repair in group B. Patients demographic details such as age, sex, side of injury were recorded and fractures were classified according to AO classification system. Follow up – VAS score, wrist range of movements and grip strength was assessed at 6 weeks, 3 months and 6 months.

Surgical procedure – The surgeries were performed under general anaesthesia or under regional anaesthesia. Tourniquet was used for all cases. The distal radius was exposed using Modified Henry approach. The pronator quadrates was exposed by incising along the longitudinal direction at the lateral radial border and then elevated

using a periosteal elevator. The fracture site exposed, reduction attempted and volar plating was done. In group A, pronator quadrates was repaired using Vicryl 2-0 as shown in figure 1 and 1. In group B, pronator quadrates was not repaired, but it was placed back to its original position to cover the implant as shown in figure 3 and 4.

Post-operative management – Below elbow slab was applied for all cases. Post-operative antibiotics, analgesics and anti – edema measures were taken. Suture removal was done on day 14 post operatively. Radiographs were taken on post op days 1, 6 weeks and 6 months. Finger movements were encouraged from day one of post op. Slab was removed after 1- 2weeks. At 4 weeks wrist and finger strengthening exercises were started.



Fig 1: Suturing of pronator quadratus using vicryl RCN 2-0;



Fig 2: Repaired pronator quadratus (repair, group A)



Fig 3: Incised portion of pronator quadratus

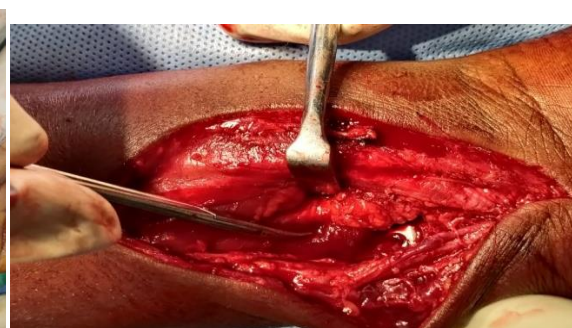


Fig 4: Pronator quadratus being positioned over distal radius plate (non-repair, group B)

Statistical analysis

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square test was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation[19]. Continuous data was represented as mean and standard deviation. **Independent t test** was used as test of significance to identify the mean difference between two quantitative variables and qualitative variables respectively[20].

Graphical representation of data: MS Excel and MS word was used to obtain various types of graphs such as bar diagram, Pie diagram.

p value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Statistical software: MS Excel, SPSS version 22 (IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

Results

Table 1: Comparison of demographic data of patients in each group (n=45)

	Group A (repair done)	Group B (repair not done)	Total	p-value
Mean (SD) age	37.2 (11.1)	40.9 (13.9)	39.2 (12.6)	0.336
Gender				
Male	16 (76.2%)	15 (62.5%)	31 (68.9%)	0.322
Female	5 (23.8%)	9 (37.5%)	14 (31.1%)	
Side				
Left	12 (57.1%)	8 (33.3%)	20 (44.4%)	0.109
Right	9 (42.9%)	16 (66.7%)	25 (55.6%)	

Table 2: Range of motion at different follow-ups (n=45) expressed as Mean (SD)

	6 weeks	3 months	6 months
Flexion			
Group A	49.3 (4.3)	70.5 (4.0)	82.8 (3.3)
Group B	42.4 (3.2)	64.4 (2.9)	77.1 (2.5)
p-value	<0.001	<0.001	<0.001
Extension			
Group A	44.0 (3.7)	68.5 (3.1)	78.2 (2.6)
Group B	38.0 (2.9)	60.3 (2.8)	73.7 (2.1)
p-value	<0.001	<0.001	<0.001
Pronation			
Group A	58.0 (3.8)	71.5 (2.7)	82.4 (2.5)
Group B	49.0 (2.5)	65.8 (3.5)	77.4 (2.0)
p-value	<0.001	<0.001	<0.001
Supination			
Group A	51.3 (3.2)	66.9 (3.1)	79.7 (2.8)
Group B	44.7 (3.5)	61.3 (2.6)	76.7 (1.7)
p-value	<0.001	<0.001	<0.001
Radial deviation			
Group A	8.9 (1.7)	14.5 (2.2)	18.9 (1.4)
Group B	8.6 (1.8)	14.3 (0.8)	18.5 (1.8)
p-value	0.528	0.767	0.317
Ulnar deviation			
Group A	14.5 (2.7)	21.5 (2.9)	27.0 (1.7)
Group B	14.3 (1.8)	21.3 (2.1)	26.9 (2.6)
p-value	0.737	0.755	0.844

Table 3: VAS scores and grip strength at different follow-ups (n=45)

VAS SCORE			
	6 weeks	3 months	6 months
VAS – Mean (SD)			
Group A	4.0 (1.2)	2.7 (0.9)	1.7 (0.9)
Group B	5.8 (0.8)	3.6 (0.7)	1.9 (0.8)
p-value	<0.001	0.0012	0.343
GRIP STRENGTH			
Grip strength – Mean (SD)			
Group A	60.5 (8.0)	79.5 (9.2)	92.1 (6.4)
Group B	41.5 (8.8)	74.2 (10.2)	87.7 (6.8)
p-value	<0.001	0.073	0.0644

50 cases were operated. 5 patients lost for follow up. Group A had 21 patients and group B had 24 patients. Right side was affected in 25 patients and left side in 20 patients. The mean age group was 38.5 years ranging from 23 – 66 years. All the patients were followed up till 6 months

Range of movements

The assessment was done at 3 weeks, 3 months and 6 months. The mean value at final follow up was 82° flexion, 72° extension, 82° pronation, 79° supination, 18° radial deviation, 27° ulnar deviation in group A. 77° flexion, 73° extension, 77° pronation, 76° supination, 18° radial deviation, 26° ulnar deviation in group B.

VAS score

Mean VAS score at 6 weeks was 4 and at 6 months 1.71 in group A. Group B at 6 weeks was 5.8 and at 6 months 1.95. At 6th week there was statistically significant difference in VAS score in group A indicating that patients with pronator quadratus repair had less postoperative pain but at the final follow up there was no difference between those two groups.

Grip strength

Grip strength was assessed using hand held dynamometer at 6 weeks and 6 months. The mean grip strength at 6 weeks was 60% and 92% at 6 months in group A. Where as in group B 41% and 88% respectively. At 6th week there was statistically significant difference in grip strength in group A indicating that patients with pronator

quadratus repair had good grip strength but at the final follow up there was no difference between those two groups.

Discussion

Following volar plating for distal radius is there any necessity to repair pronator quadratus or not is a debatable topic with varying results obtained in various studies. Our study aims at comparing the functional outcome following volar plate for distal radius managed by repair of pronator quadratus versus non repair. We found that there was no statistically significant difference in the VAS score, grip strength but significant difference in flexion, extension, pronation and supination in the two groups at the final follow up i.e., after 6 months of post-op. However patients with repair group had lesser post operative pain as assessed by VAS score and good grip strength as assessed by hand held dynamometer at 6th week follow up. Wrist range of movements were statistically significant in both groups at 6th, 3rd month and 6th month follow up except for radial and ulnar deviation. Whether repair of the Pronator quadratus is necessary after volar plating has been a topic of debate. Our study detected no significant differences between the PQ repair group versus non repair in mean grip strength, VAS scores at the final follow up i.e., 6 months post operatively. There was a statistically significant difference in the wrist range of movement however the difference in the ROM between group was 5 degree which was not significant clinically as all our patients had good functional range of movements of wrist. Hershman et al in their study concluded that there was no

added advantage of repairing pronator quadratus following volar plating for distal radius fractures. Their retrospective study included 606 patients over a period of 5 years, there was no difference in mean pronation ($P = 0.08$) at 1 year, pain ($P = 0.13$) and DASH scores ($P = 0.14$)¹². The radiological outcome between the two groups was similar in a study reported by Cannon and his colleagues in pronator sparing technique for volar plating of distal radius however they failed to mention the clinical outcomes[13]. Trosti and Ilyas in a prospective evaluation of pronator quadratus repair versus no repair following volar plate fixation with a minimum follow-up of 12 months found no significant different results between groups according to ROM at the wrist, DASH scores, grip strength, and VAS scores which was similar to our study[14]. In a retrospective study with a 3-month follow-up, Ahsan et al. found no differences in ROM and grip strength in 108 patients with complete and incomplete PQ repair[15].

Minimally invasive plate osteosynthesis, the pronator quadratus is slightly lifted to create space between distal radius and pronator quadratus muscle so that the volar plate can be inserted. The main aim of this technique is to restore the blood supply to distal radius through pronator quadratus and to enhance fracture healing there by preserving pronator quadratus function and preventing tendon injury[16-18]. A retrospective study by Zenke et al on 66 patients compared conventional volar plate fixation with minimally invasive plate osteosynthesis found that there is no significant difference between two groups in terms of DASH scores, range of motion, grip strength and VAS-scores. But there were also no significant differences in fracture healing between both groups. Hence they suggested that fracture healing process was not obviously augmented by keeping the pronator quadratus muscle and the blood supply intact[17]. Repairing the pronator quadratus muscle believed to protect the flexor tendons against the rough volar plate, screws and serves as a Dynamic stabilizer of distal radio ulnar joint. But the choice of repair or not depends on the surgeon. Comminuted distal end radius fracture, elderly patient will make the repair of pronator quadratus muscle difficult. Excessive tightness leads to ischemic contracture, pronator quadratus space compartment syndrome, restricted pronation and supination[11].

Limitations of the study

unequal sample size, no radiological parameters assessment and short duration follow up.

Conclusion

We conclude that repair of pronator quadratus have reduced post operative pain, good grip strength and good functional range of movements of wrist at early post operative period when compared to non repair group. But there is no significant difference on long term follow up.

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