Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v30i19.4029

COMPARISION OF FUNCTIONAL OUTCOMES OF VOLAR PLATING VERSUS CONSERVATIVE TREATMENT IN DISTAL RADIUS FRACTURES- A RANDOMIZED CONTROL TRIAL

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ABSTRACT:
Objective: To compare the functional and radiological outcomes of volar plating versus conservative treatment for distal radius fractures.
Methodology: This randomized controlled trial was conducted in department of Orthopedics and Trauma, National Institute of Rehabilitation Medicine, Islamabad and Zimri Orthopedic Hospital, Islamabad. 74 cases of closed intraarticular distal radius fracture, were divided in two groups, cast immobilization for 6 weeks (group A) and open reduction internal fixation with volar locking plating (group B) and were followed over a period of one and a half year from February 2021 to August 2022.
Results: Total of 74 patients were observed, which were divided in two equal groups. Overall Male to female ratio was 1.74:1. The overall average age of the patients was 45.33years+ 15.6SD. Dash score was a little bit low in group A as compared to Group B although insignificant with p- value 0.418. Average volar tilt score in group A was 6.68+1.28SD as compared to 3.31+0.59SD in Group B which was significant.
Conclusion: Operative treatment using open reduction and locking plate fixation volarly is more effective as compared to conservative treatment with closed reduction and cast immobilization of distal radius AO type B and C fractures keeping in view the commonly used radiological and functional parameters.

Keywords: Distal radius fractures, cast immobilization and volar locking plating.

INTRODUCTION

Distal radius fracture (DRF) is the most frequent fracture caused by fall and the most common upper extremity fracture. Distal radius fractures comprise approximately 16% of all fractures treated in the emergency department and 74.5% of forearm fractures. DRF has an overall incidence of 100 to 300 per 100,000 person-years. The incidence is growing in elderly persons due to osteoporosis and an increased risk of falling.[1,2,3]

There are several treatment options for distal radius fractures, including close reduction and plaster immobilization, volar or dorsal plating of the fracture, external fixation and percutaneous pinning. Treatment options may differ depending on specific parameters, such as patient age, fracture fragments, lifestyle, soft tissue condition, and fracture position. Close reduction and casting can be done in an emergency setting at a lower cost and without hospitalisation; nevertheless, it is associated with poorer anatomical repair. Reconstruction is required in displaced fractures for anatomic restitution of bone pieces. However surgical treatment is associated with increased radiation exposure and expensive outlay.[4,5] The primary objective of management of these fractures is to restore normal bone alignment and articular congruity, which is required for a satisfactory functional result.[6]

According to National Clinical Guidelines (NCG) all DRF with significant comminution, incongruity of distal radioulnar joint, more than 10° dorsal tilt, more than 3 mm ulnar variance and more than 2 mm articular step-off should be operatively fixed. Any one or more of the above criteria points towards operative management of these fractures. However, the NCG claims that the scientific evidence for this prescription is "extremely weak" when compared to conservative management.[7]

Closed reduction and cast immobilization is a safe and cost-effective therapy that does not need hospitalisation; yet, this time-honored approach may result in the inability to manage misplaced or depressed fracture pieces.[8] Open lowering Internal fixation using volar plating has yielded encouraging results in terms of anatomical alignment and secure fixation, allowing for early weight bearing and wrist mobility. Cost increases, infections, extensor tendinitis, intra-articular screw penetration, and flexor pollicis longus attritional rupture are all disadvantages. The most recent AAOS recommendations failed to uncover compelling evidence for or against any specific treatment approach.[6,8]

This randomized controlled trial (RCT) compared the functional and radiological outcomes of intra-articular distal radius fractures AO type B and C treated with plaster cast immobilization for 6 weeks with open reduction internal fixation utilizing a volar locking plate.

MATERIAL AND METHODS:

This randomized controlled trial comprised of 74 patients with distal radius fractures lasting for one and a half year, conducted from February 2021 to August 2022 at Department of Orthopedic & Trauma Surgery, National Institute of Rehabilitation Medicine Islamabad, and Zimri Orthopedic Hospital, Islamabad - Pakistan. Ethical approval of the study was obtained from ethical review committee of the hospitals.

Inclusion Criteria:

- Closed distal radius fractures of B and C types according to AO classification
- Both genders
- Age 16 to 65 years
- ASA class I, II and III
- BMI between 19-30 Kgs/m2

Exclusion Criteria:

- Open fractures
- ASA class IV and V
- Bilateral fractures
- Associated vascular injury
- Pathological fractures
- Associated fractures of ipsilateral shoulder, elbow or wrist

After obtaining written consent the participants were randomly divided into two equal groups A & B by lottery method. In Group A, open reduction and volar plating of the fracture was done, while in Group B, (conservative treatment group) complete plaster of Paris cast below elbow were applied.

Procedure for volar plating

The procedure was done under general anaesthesia. Fracture site was approached through volar forearm incision (Henry approach) on distal radius. Fracture was reduced and a Depuy Synthes 2.4-mm LCP with variable-angle was applied on volar aspect using mage intensifier guidance to prevent screw penetration in the wrist joint. Cast was applied which remained there for 6 weeks. Broad-spectrum prophylactic antibiotic were given for 7 days. Sutures removal was done at 10th postoperative day and active wrist movements were started.

Plaster of Paris cast immobilization (conservative) technique

The fracture was reduced under hematoma block. A below elbow plaster of Paris cast was applied immediately which remained there for 6 weeks.

In both groups pre-reduction and post-reduction x rays were obtained to ensure acceptable post reduction parameters. Acceptable radiological parameters were; Radial height of 11–12 mm, Radial inclination of 16°–28°, and Volar tilt of between 0° and 22°.[9] X-rays of the normal side were used as a template. Functional outcomes and radiological outcome of each patients was determined at 3 months interval by comparing both fractured and normal wrists through the disabilities of the arm, shoulder, and hand (DASH) score and x-rays of normal and fractured wrists in both groups.

Statistical Analysis: SPSS version 23 was used to analyze the data obtained. Mean and standard deviation were calculated for quantitative variables while percentages and frequencies were calculated for qualitative variables. Data were stratified by age and gender. Independent sample T test was applied to compare DASH score, volar tilt, radial height and radial inclination between the two groups. P-value ≤0.05 were taken as significant.

RESULTS:

Predominant of participants of our study were male i.e. 47 (63.5%) and 27 (36.5%) were female with male to female ratio of 1.74:1. Group A contains 21(56.8%) male and 16 (43.2%) female while Group B contains 26(70.3%) male and 11 (29.7%) female patients with p-value of 0.167 which is not significant. (Fig. 1).

Figure No. 1

Average age was 45.33years±15.6SD with range of 16-65 years. The average age in group A was 44.13years±16.1SD and contained 12(32.4%) patients in less than 30 years, 5(13.5%) patients 31-50 years and 20(54.1%) patients between the ages of more than 50 years. While average age in group B was 46.51years±15.1SD and contained 9(24.3%) patients in less than or equal to 30 years, 6(16.2%) in 31-50 years and 22(59.5%) patients with age more than 50 years. (Table 1).

Age (in years)	Groups		
	Group A	Group B	Total
≤ 30	12 32.4%	9 24.3%	21 28.4%
30-50	5 13.5%	6 16.2%	11 14.9%
51+	20 54.1%	22 59.5%	42 56.8%
Total	37 100%	37 100%	74 100%
Standard deviation	44.13±16.1	46.51±15.1	45.33±15.6

Table. 1: Age-wise distribution of patients

Out of all 74 patients 39 patients were having left sided fracture while 35 patients were having right sided fracture. Of these 18(24.32%) patients belonged to group A while 21(28.38%) belonged to Group B. (Fig. 2)

Figure No. 2

Dash score was a little bit low in group A as compared to Group B although insignificant with p-value 0.418. Average volar tilt score in group A was 6.68±1.28SD as compared to 3.31±0.59SD in Group B which was significant with p- value 0.000. Similar result was observed in radial height which was also significant with p- value 0.003. Radial inclination was insignificant in both the groups. (Table 2)

Parameter	Groups	Number	Mean	SD	p- value
Dash score	Group A	37	14.1622	5.08371	
	Group B	37	15.2138	5.97779	0.418
Volar Tilt (°)	Group A	37	6.6822	1.27915	
	Group B	37	3.3118	0.59027	0.000
Radial height (mm)	Group A	37	9.2939	3.33618	
	Group B	37	7.0636	2.77540	0.003
Radial inclination (mm)	Group A	37	17.3486	6.22754	
	Group B	37	15.8389	6.96418	0.329

Table. 2: Functional and radiological outcomes (n=74)

Age wise distribution of functional and radiological outcomes in both the groups shows that average functional and radiological outcome were insignificant except volar tilt, which were highly significant in both the groups in all ages. (Table 3).

Age (in years)	Parameter	Group	Mean	SD	P-Value
≤ 30	Volar Tilt (°)	Group A	6.77	1.27	0.000
		Group B	3.02	0.25	
	Radial height (mm)	Group A	10.28	3.93	0.1301
		Group B	6.67	2.27	
	Radial inclination (°)	Group A	19.19	7.34	0.9890
		Group B	14.90	7.22	
	Dash score	Group A	15.67	5.99	0.5808
		Group B	14.37	4.90	
30-50	Volar Tilt (°)	Group A	6.52	1.82	0.01854
		Group B	3.32	0.53	
	Radial height (mm)	Group A	9.14	3.74	0.9026
		Group B	7.04	4.05	
	Radial inclination (°)	Group A	17.05	6.98	0.8825
		Group B	14.11	6.60	
	Dash score	Group A	13.92	5.70	0.4291
		Group B	15.16	8.73	
51+	Volar Tilt (°)	Group A	6.67	1.21	0.01021
		Group B	3.43	0.67	
	Radial height (mm)	Group A	8.74	2.87	0.8948
		Group B	7.23	2.69	
	Radial inclination (°)	Group A	16.32	5.36	0.8474
		Group B	16.70	7.14	
	Dash score	Group A	13.32	4.38	0.2262
		Group B	15.57	5.79	

Table. 3: Age-wise distribution of functional and radiological outcomes

When stratified over gender it showed the same result that volar tilt was significant in male and female in both the groups. (Table 4).

Age (in years)	Parameter	Group	Number	Mean	SD	P-Value
Male	Volar Tilt (°)	Group A	21	6.96	1.16	0.000
		Group B	26	3.21	0.61	
	Radial height (mm)	Group A	21	8.87	2.98	0.8355
		Group B	26	6.76	2.86	
	Radial inclination (^{o})	Group A	21	16.57	5.56	0.1934
		Group B	26	15.33	7.41	
	Dash score	Group A	21	13.52	4.54	0.1696
		Group B	26	14.56	6.15	
Female	Volar Tilt (°)	Group A	16	6.32	1.37	0.0019
		Group B	11	3.56	0.48	
	Radial height (mm)	Group A	16	9.84	3.78	0.2161
		Group B	11	7.78	2.56	
	Radial inclination (^{o})	Group A	16	18.38	7.06	0.5819
		Group B	11	17.05	5.92	
	Dash score	Group A	16	15.00	5.77	0.9068
		Group B	11	16.75	5.51	

Table. 4: Gender-wise distribution of functional and radiological outcomes

DISCUSSION:

The treatment of distal radius fractures has long been a contentious and difficult subject for orthopedic surgeons. The ultimate aim is to restore grip strength and mobility, allowing for a rapid return to function while reducing the risk of future degenerative changes in the wrist joint. Distal radial fractures are treated using a variety of techniques, including closed reduction with cast immobilization, percutaneous pinning, external fixation, and ORIF with traditional plating.[10]

In our study we have included 74 patients of both sexes. Male predominance in our study was 63.5%while females' frequency was 36.5% with male to female frequency of 2.90: 1. Male dominance is also reported in various international studies.[11,12] The reason of male dominance in our study may be because of females' late referral, lack of awareness, poverty and above all low literacy rate in females of this part of the country. The other reason could be that females in this part of the country are restricted to home and they are not allowed to seek treatment from male doctors due to some social and regional customs. 3rd male are more to RTA as that female in our society.

In our study the age range of the patient was from 16 to 65 years with a mean age of 45.33years±15.6SD. These results are comparable with some national and international studies. In one local study out of 160 patients, age was between 35-65 years. Mean age was 47.1 years.[13] In a prospective consecutive international case series study, among the 8 patients with distal radius fracture, median age of the patients was 49 years (range, 43-56 years).[14] In a study mean age less than of 40 years has been reported. In that study the 30 cases were all fresh fractures, including patients with a mean age of 37 years (range from 26 to 47).[15]

In our study operative treatment was more effective than conservative one for distal radius fracture. Another similar randomised controlled trial also found a higher likelihood of excellent function with ORIF than with conservative treatment.[16]

CONCLUSION:

Operative treatment using open reduction and locking plate fixation volarly is more effective as compared to closed reduction and cast immobilization of distal radius AO type B and C fractures keeping in view the commonly used radiological and functional parameters.

Declaration of conflicting interest: None**.**

Funding: None

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