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ORIGINAL RESEARCH

Study to Evaluate the Correlation Between the Functional and Radiological Outcome in Intraarticular Fracture of Distal end Radius Treated by ORIF with Volar Plating

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ABSTRACT

Background: Many techniques have been described for the treatment of patients with intraarticular distal radius fractures; however the main objective of all these techniques is to restore upper-limb function. The purpose of this prospective study is to evaluate the correlation between the functional and radiological outcome in intra articular fracture of distal end radius treated by ORIF with volar plating. Moreover, we have also evaluated the duration of fracture healing and associated complications. **Methodology:** This study was conducted on 30 patients who underwent surgery for intra articular fracture of distal end of radius. The patients of age 18 years of age and above, either sex with closed/open Gustilo Anderson grade 1 intra-articular fracture of distal end of radius were included in study. All patients were briefed about purpose of study and their written, valid, informed consent for surgery were taken. **Results:** In our study, the mean values for Radiological Findings were as follows: Radial length - 11.65 ± 1.83 mm, Radial Inclination - 20.60 ± 1.59 degrees, Volar tilt - 10.63 ± 1.19 degrees and Intra-articular step off - 0.12 ± 0.32 mm. In our study, the mean value for Functional Outcome were as follows:Dorsiflexion was 63.33 ± 9.13 degrees, Palmar flexion was 60.00 ± 8.09 degrees, Supination was 66.00 ± 7.24 degrees, Pronation was 65.33 ± 8.40 degrees, Radial deviation was 17.33 ± 3.88 degrees and Ulnar deviation 18.50 ± 2.67 degrees as compared with contralateral normal side. Mean duration of fracture union was noted as 9.2 weeks ranging from 8 to 12 weeks. **Conclusion:** In our study no significant correlation was observed between the radiological and functional outcome.

Keywords: Distal radius fracture, open reduction, volarplating.

INTRODUCTION

Fracture of the distal radius continues to be one of the most common skeletal injuries treated by Orthopedic surgeons. In fact these injuries account for approximately one sixth of all fractures seen and treated.[1]Distal Radius fracture have a Bimodal age distribution[2], among these one with younger age group who sustained injury due to high- energy trauma and another group of elderly patients with relatively low energy trauma.Intra-articular component in distal radius fractures generally denotes high-energy trauma occurring in young adults. High-energy injuries regularly cause shear and impacted fractures of the articular surface of the distal end of the radius with displacement of the fracture fragments. The fracture pattern most commonly seen in geriatric age group is extra-articular type while the high-energy intra-articular type is most commonly seen in young adult age group.

Patients who have a displaced, comminuted intraarticular fracture of the distal end of the radius that has been treated by a closed method, such as pins and plaster or external fixation, have frequently had an unsatisfactory result. Main problem with this method is prolonged immobilization of the wrist and forearm for at least 6 weeks and the further time is

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required to regain the functions of forearm, wrist and hand by physiotherapy. During this entire time duration, patient's ability to carry out day to day activities is hampered.

Despite the frequency of intraarticular distal radius fractures, a consensus has not been reached on the optimal approach to treatment. Volar plating systems have greatly increased the ease by which fractures can be treated compared to traditional methods such as fracture specific fixation, pinning, and external fixation.[4] By directly restoring the anatomy, volar plating provides secure internal fixation which results inearly return of wrist function. The anti-glide effect of buttress plates help reduce and stabilize intra articular fractures. This also reduces the period of immobilization and time required to regain the functions of wrist, forearm and hand.[4]

Restoration of radial length, radial tilt angle and congruity of articular surfaces is important for good functional results.[5]Failure to achieve and maintain near anatomic restoration can lead to various disabilities and deformities.[5]Yet there is no consensus on what constitutes an 'acceptable' radiological position before or after treatment. This should be defined as the position that will predict good functional outcome inmajority of cases[6].Fracture union is no longer the only goal, as the restoration of normal anatomy with early functional recovery, as well as resultant full and painless motion of the wrist takes over as the ultimate goal of treatment[6].

The purpose of the study is to evaluate the correlation between the functional and radiological outcome in intra articular fracture of distal end radius treated by open reduction and internal fixation with volar plating. Moreover, we have also evaluated the duration of fracture healing and associated complications.

MATERIALS AND METHODS

The study is clinical, observational, prospective type of study conducted at Madhubani Medical College and Hospital, Madhubani Bihar. The study included 30 cases, all managed with ORIF with volar plating for intraarticular fracture of distal end of radius after obtaining informed consent, clinical and radiological assessment was done for a period of two years. This study was reviewed and approved by the Institutional Ethics Committee of the Madhubani Medical College and Hospital, Madhubani Bihar.

Inclusion Criteria

- Patients with intra articular fracture of distal end radius aged 18 years and above
- All patients giving consent for thestudy
- All Closed fractures and open fractures with Gustilo Anderson grade 1.

Exclusion Criteria:

- Patients aged less than 18ys
- Patients with associated injury affecting the wrist functions.
- Pathological fractures excluding osteoporosis
- Compound fractures with Gustilo Anderson grade II & above

All the patients underwent a detailed history taking, all relevant investigations andPre-anesthetic checkup. An informed consent was taken from patients prior to inclusion in our study. Patients weretreated with ORIF with volar plating. Platingwas be done using the modified henry's approach.Effort was made to put two/three proximal and two/three distal screws in all cases. K-wire fixation for radial styloid fixation was also done in some cases as per fracture configuration.

Post-operative radiological evaluation was done using the standard AP and Lateral views.

Follow-up was doneat 2weeks,1 month,2 month, 4 month, 8 month ,1 year and at 2 years time from surgery.

Functional assessment of the wrist was done using theDemerit point system of Gartland and Werley's with Sarmiento *et al*. modificationand Radiological assessment was done by using the Sarmiento's modification of Lindstrom criteria.

RESULT

There were 09 (33.33%) patients in the age group of 21-30 years, 07 (23.33 %) in the age group 31-40 years, 06 (20.00 %) in the age group 41-50 years, 05 (16.66%) in the age group 51-60 years and 03(10.00%) between 61-70 years andpatient's age ranged from 21 to 68 years with average of 42.8 yrs. In our study, 24 (80.00%) patients were injured due to Road Traffic Accidents, while 06 (20.00%) were injured due to fall on outstretched hand , also 24 (80.00%) of patients were male and 6 (20.00%) were female. Out of 30 patients enrolled in the study, distribution as per AO Classification of fracture was 1 (3.33%) for B1, 1 (3.33%) for B2, 11 (36.67%) for B3, 13 (43.33%) for C1, 04 (13.33%) for C2 and 0 (00.00%) for C3. In the present study, following injuries were associated with distal radius fracture: 03(10.00%) ulnar styloid fracture,02 (6.66%) DRUJ instability , 01(3.33%) bimalleolar fracture and 01(3.33%) proximal humerus fracture of the contralateral side.

In our study, the mean values for Radiological Findings were as follows: Radial length - 11.65 ± 1.83 mm, Radial Inclination - 20.60 ± 1.59 degrees, Volar tilt - 10.63 ± 1.19 degrees and Intra-articular step off - 0.12 ± 0.32 mm.

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Table: 1

Radiological Findings	Mean	Standard Deviation
Volar Tilt(degrees)	10.63	1.189
Radial Shortening (mm)	00.37	0.765
Radial Inclination(degrees)	20.60	1.589
Intra-Articular step off (mm)	00.12	0.32

In our study 24 cases (80%) had excellent and 06 cases (20%) had good radiological outcome. None of the cases had fair or poor radiological outcome.
In our study, the mean value for Functional Outcome were as follows :Dorsiflexion was 63.33 ± 9.13 degrees, Palmar flexion was 60.00 ± 8.09 degrees , Supination was 66.00 ± 7.24 degrees, Pronation was 65.33 ± 8.40 degrees, Radial deviation was 17.33 ± 3.88 degrees and Ulnar deviation 18.50 ± 2.67 degrees as compared with contralateral normal side.

Table: 2

Functional Assessment	Mean	Standard Deviation
Palmar Flexion(degrees)	60.00	8.09
Dorsiflexion(degrees)	63.33	9.13
Radial Deviation(degrees)	17.33	3.88
Ulnar Deviation(degrees)	18.50	2.67
Pronation(degrees)	65.33	8.40
Supination(degrees)	66.00	7.24

In our study 21 cases (70%) had excellent, 8 cases (26.67%) had good and 1 case (3.33%) had fair functional outcome. None of the cases had poor functional outcome in our study. Mean duration of fracture union was noted as 9.2 weeks ranging from 8 to 12 weeks.

Correlation Between Radiological And Functional Outcome

Table 3: Correlation between radiological and functional outcome

Correlations							
		Palmar Flexion	**Dorsiflexion**	**Radial Deviation**	**Ulnar deviation**	**Supination**	**Pronation**
Volar tilt	Pearson Correlation	-.014	.010	.151	-.008	.002	-.021
	Sig. (2-tailed)	.940	.958	.425	.967	.992	.910
Radial Shortening	Pearson Correlation	-.153	-.107	-.172	-.202	-.213	-.208
	Sig. (2-tailed)	.421	.573	.362	.284	.258	.269
Radial Inclination	Pearson Correlation	.253	.278	.274	.311	.196	.305
	Sig. (2-tailed)	.177	.137	.143	.095	.300	.101
Correlation coefficient calculated using Pearson's correlation coefficient Value of <0.25 is considered weak correlation 0.25-0.75 is considered moderate correlation >0.75 is considered good correlation							

No significant correlation was observed between the radiological and functional outcome. Volar tilt shows the negative poor correlation with Palmar Flexion, Pronation and Ulnar deviation. Radial Shortening shows the negative poor not significant correlation with all functional outcome while poor positive correlation of Radial Inclination with all functional outcome except with ulnar deviation shows the fair correlation (r=0.311)

Table 4: Radiological Evaluation after Fracture Union

Studies	RL in mm	RI in degrees	VA in degrees
Jupiter *et al.*[9]	10	21	7
F.Fitoussi*et al.*[11]	9	20	3
R E Anakwe*et al.*[10]	11	20	10
Orbay J *et al.*[12]	10	21	13
Our study	10	21	11

The average range of functional outcome of various studies was comparable with our study, as tabulated below.

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Table 5: Functional Outcome

Studies	PF in degrees	DF in degrees	Pr in degrees	Sup in degrees	RD in degrees	UD in degrees	GS in degrees
Jupiter *et al.*[9]	66	58	72	78	22	42	71%
F. Fitoussi[11]	52	52	68	88	14	26	76%
R E Anakwe[10]	64	62	62	78	20	34	80%
Orbay J[12]	47	44	77	76	22	32	65%
Our study	60	63	65	66	17	19	70%

Good functional results have been reported with any modality of treatment in low energy fractures in elderly but the ideal treatment for high energy injuries with associated distal ulna fractures is still being debated. The goals of the treatment are anatomical reduction of the distal radius articular surface and achieving distal radio ulnar congruity and early mobilization.

In our study we had 70% of excellent results based on Demerit system and are comparable to other studies as tabulated below.

Table 6: Functional Score

	Excellent	Good	Fair	Poor
John K Bradway *et al.*[13]	44	12	44	-
Jupiter *et al.*[9]	63	20	17	-
Dennison *et al.*[14]	80	20	-	-
Anakwe RE *et al.*[10]	24	60	16	-
Our study	70	27	3	-

DISCUSSION

The incidence of intra articular distal radius fractures and its complex nature is in increasing trend due to rising road traffic accidents. In our series around 80% of patients are due to RTA and presents with polytrauma, the exact incidence has not been reviewed in the literature[7,8]. In our study 18 of 30 cases (60%) are type C distal radius fractures, which explains the more and more complex presentation of these fracture patterns.

The average age of 41 years in our study is comparable to Jupiter *et al.*[9] and RE Anakwe[10] who had an average age of 43 & 48 years respectively. Our study had a male preponderance with 24 cases of 30 (80%) cases and is comparable to F Fitoussi & SP Chow *et al.*[11] and Orbay J *et al.*[12] which were 92%and 89% respectively. The higher incidence among the males would be due to higher involvement in road traffic accidents.

In our study Road traffic accidents dominated with 80% and is comparable to F Fitoussi & SP Chow *et al.*[11]and Jupiter *et al.*[9] which were 79%and 67% respectively. This increased nature of RTA violence and involvement of younger age group in our study is a new trend. This could be explained by fall on outstretched hand in older age causes extra articular fractures with minimal displacement and without involvement of the ulnar side, which were not included in our study.

The average range of radiological evaluation of various studies was comparable with our study, as tabulated below. Complications were minimal and are comparable with standard studies. Residual pain in distal radioulnar joint was the most common complication which is comparable to studies of Solgaard *et al.*[15] and Baruah r *et al.*[16].

We had one patient with median nerve neuropraxia which got resolved spontaneously within 2 months. In our study two had distal radio-ulnar instability identified after stable fixation of distal radius which necessitates additional K wire fixation and immobilization in above elbow slab for 4 weeks. Later it was removed and vigorous wrist mobilization started. The results of these subgroup patients were comparable to studies like Dennison *et al.*[14]. All the cases had union within 3 months, ranging from 8 weeks to 12 weeks with mean of 9.2 weeks which was comparable with studies of Melon CP *et al.*[6], (8.8weeks), John K Bradway *et al.*[13] (9.6) and Fitoussi F *et al.*[11].

In our study no significant correlation was observed between the radiological and functional outcome which was comparable to studies like Neeraj ranjeet and Emmanuel P.E.[17], Perugia Dario *et al.*[18] and Plant and Parson.s[19]

CONCLUSION

In our study no significant correlation was observed between the radiological and functional outcome at two years of follow up. However further research with larger sample size and longer follow up period is needed to confirm these results.

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