

## Clinico-Radiological Assessment of Distal End Radius Fractures: A Prospective Study in Moradabad City

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### Abstract

**Background:**Fractures of distal radius account for 20% of all fractures treated in emergency department. These fractures result from low energy injuries in elderly population and high energy injuries in young adults. Most of these fractures are relatively uncomplicated and are effectively treated by closed reduction and casting. However, fractures that are unstable intra-articular can jeopardize the integrity of the articular congruence and kinematics of articulations resulting in high prevalence of complications. So to overcome these above complications, trend is shifting towards surgical management. **Aim:** To assess clinico-radiological outcome of distal end of radius fractures managed in our institution (conservative and surgical). **Methods:**A comparative interventional study was done in our institution in which all the patients of distal end of radius fractures were included as per inclusion and exclusion criteria. Bilateral X-ray wrist with forearm was taken (Day-0). Fractures were classified using Frykman classification Mayo and Lidstrom score to assess the patient clinico-radiologically on the day of intervention both pre and post reduction and then followed up on day 7-10<sup>th</sup>, 6<sup>th</sup> week, 3<sup>rd</sup> month, and 6<sup>th</sup> month. **Results:**30 patients were included in this study and followed upto 6 months. The comparison of final Lidstrom score was, Surgically: Excellent 46.7%, Good 40%, Fair 6.7%, Poor 6.7%. and Conservatively: Excellent 13.3%, Good 26.7%, Fair 53.3%, Poor 6.7% (p-value=0.03) and of the final Mayo-score was, Surgically: Excellent 53.3%, Good 26.7%, Fair 13.3%, Poor 6.7% and Conservatively: Excellent 13.3%, Good 20%, Fair 60%, Poor 6.7% (p-value=0.04). **Conclusion:**It can be concluded that surgical intervention for fracture distal end radius reduces chances of wrist joint stiffness and loss of reduction and gave good results as compared to conservative intervention. Hence, in our opinion surgical intervention for treatment of fracture distal end radius is a good method with excellent outcome.

**Keywords:**Fracture, Unstable, Radius, Surgical, Outcome

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### Introduction

Distal end radius fracture (DERF) is one of the most frequent fractures that orthopaedic surgeons have to deal in casualty. The severity of the bone fractures extent from mere extra-articular to highly comminuted intra-articular fractures. Approximately, 20% of all bone fractures that are treated in casualty entails DERF. It probably accounts 75% of all forearm fractures[1]. In younger population these fractures typically results from high intensity injuries and in a veteran group of patients it results from low intensity injuries. Most DERFs are treated in plaster cast with closed reductions and immobilization. But despite that, the fractures which involve the articular surface or unstable fractures can jeopardize the kinematics of the articulation as well as integrity of the articular congruence[2]. It is difficult to treat such injuries and most of these fractures are

unstable, tough to reduce in previous anatomical position, and therefore easily land-up in complications like post-traumatic osteoarthritis[3]. It is found that extra-articular malalignment affects grip strength, endurance,[4] reduce the mobility and make carpal unstable[5,6].

The main target of treatment of unstable DERF is restoration of the wrist functions[3,7]. The outcome of management of plaster application, percutaneous pin mounting, internal or external fixation vary widely and are mainly determined by the fracture patterns[8].

DERF are managed by wide range of technique such as like cast reduction, percutaneous pins mounting, pin and cast application, closed manipulation, external and internal fixation, ligamentotaxis etc. Moreover, internal fixation for the management of Metapygseal bending fracture are more favored because of-

- To maintain and control the palmar tilt,
- Prevention of collapse by using external fixation,
- Elude radiocarpal joint bridging. And the size of distal fragment is good enough to provide ample purchase[7].

For unstable DERF and those with articular incongruity whose anatomical reduction cannot be maintained through external manipulation like ligament axis ORIF is indicated, adequate amount

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of bone stock is necessary for early mobility[9].The main goal of the treatment is that method of immobilization which sustain reduction to the normal anatomical position that leads to least amount of surgical morbidity. The outcome of the present available published data are tough to compare because of most of the available data that is present are retrospective in nature. And they use different numbers of classifications and have conflicting outcomes, especially in relation to comminuted fractures with high end results of joint congruity. To overcome these above complications, trend is shifting towards surgical management. The present study was conducted with the following aim and objectives:

**Aim:**To assess clinico-radiologically assessment of distal end radius fractures that will be managed in our institution.

**Objective:** To asses and follow the functional and radiological outcome of results of Distal Radius fractures.

**Methods**

**Study Site:**Department of Orthopaedics,Teerthanker Mahaveer Medical College and Research Centre (TMMC&RC),TMU, Moradabad.

**Study Population:**Patients of age 18 years and above with unilateral fractures of distal end of Radius.

**Study Design:**Comparative interventional

**Sample size:** 30

To calculate the sample size based on the prevalence with an approximate 95% confidence level, following formula will be used, Sample Size (n) = Z<sup>2</sup> x P (100 – P)

r<sup>2</sup>

- Z = 1.96 at 95% confidence interval
- P = Prevalence
- Q = (100-P)
- r = Absolute error = 10%

**Study Duration:**The study was conducted over a period of 1.5 years i.e. from April 2019 to October 2020.

**Inclusion criteria**

Patients of age 18 years and above with unilateral DERF.

- No previous history of DERF or distal end of Radius operation.
- All displaced fractures of distal end of radius.

**Exclusion criteria**

- Bilateral fractures of DERF.
- Non osteoporotic pathological fracture.
- Fractures involving shafts of both Bones of forearm.
- Previous History of DERF on either side.
- Pregnancy.

**Ethical Considerations**

- Informed consent was obtained from all the participants. Ethical approval for the study was obtained from the Institutional Ethical Committee.

**Methods**

- 30 patients were included in the study and followed upto 6 months. They were distributed equally into two groups i.e. 15 patients were treated surgically and the rest 15 conservatively. As all the patients were having similar characteristics, therefore no difference was noted among the groups w.r.t. demographic information.
- Patients would be followed up at:
  - 0-day pre-reduction
  - 0 day post –reduction
  - 7-10th day after intervention.
  - 6<sup>th</sup> weeks after intervention.
  - 3<sup>rd</sup> month after intervention.
  - Then 6<sup>th</sup> months.
  - Bilateral X-rays of Wrist with forearm was done at day zero only.
  - Pre-reduction at the time presentation, post-intervention and short-term follow-up (at 7-10<sup>th</sup> days after intervention) and after 6th weeks of intervention radiographs were taken for each patient. Repeat radiographs of the injured side were done at 3rd month, and 6th month.
  - In follow-up, radial inclination, Radial height and volar tilt were calculated on a radiograph with the help of a goniometer.
  - Radiographic alignment was designated as per Lidstrom scoring (1959).
  - Functional assessment of Distal radius fracture was done according to the Mayo score.

**Statistical Analysis**

The results are presented in frequencies, percentages and mean± SD. Chi-square test was used for comparisons.The p-value<0.05 was considered significant. All the analysis was carried out on SPSS 24.0 version (Chicago, Inc., USA).

**Results**

30 patients were included in this study and followed upto 6 months. Out of 30 subjects, 17 were males and 13 were females. More than half of patients had left side fracture (53.3%). 15 patients were treated surgically and the rest 15 were conservatively (table 1).

**Table 1:Characteristics of the study population**

	Number	Percentage
<b>Gender</b>		
Male	17	56.7
Female	13	43.3
<b>Injured side</b>		
Left	16	53.3
Right	14	46.7
<b>Type of management</b>		
Surgical	15	50
Conservative	15	50

Table 2 shows that final excellent LIDSTROM score was highest in age 41-50 years (60%). Final good LIDSTROM score was highest in age 41-50 years (40%). However, there was no significant (p>0.05) association of final LIDSTROM score with age in years. Table 2 also shows that final excellent, good and fair LIDSTROM score was higher among females than males. However, there was no significant (p>0.05) association of final LIDSTROM score with gender.

**Table 2:Comparison of final Lidstrom Score with age and gender**

Age in years	N	Final LIDSTROM score								p-value
		Excellent		Good		Fair		Poor		
		No.	%	No.	%	No.	%	No.	%	
20-30	8	1	12.5	3	37.5	3	37.5	1	12.5	0.71
31-40	8	2	25.0	3	37.5	3	37.5	0	0.0	
41-50	5	3	60.0	2	40.0	0	0.0	0	0.0	

>50	9	3	33.3	2	22.2	3	33.3	1	11.1	
<b>Gender</b>										
Male	17	5	29.4	5	29.4	5	29.4	2	11.8	0.63
Female	13	4	30.8	5	38.5	4	30.8	0	0.0	

Table 3 shows that final excellent Mayo score was highest in age 41-50 years. Final good LIDSTROM score was also highest in age 41-50 years. However, there was no significant (p>0.05) association of final Mayo score with age in years. There was no significant association of final MAYO score with age (in years) and gender (p>0.05).

**Table 3: Comparison of final Mayo Score with age and gender**

Age in years	N	Final MAYO score								p-value
		Excellent		Good		Fair		Poor		
		No.	%	No.	%	No.	%	No.	%	
20-30	8	1	12.5	3	37.5	3	37.5	1	12.5	0.50
31-40	8	3	37.5	1	12.5	4	50.0	0	0.0	
41-50	5	3	60.0	2	40.0	0	0.0	0	0.0	
>50	9	3	33.3	1	11.1	4	44.4	1	11.1	
<b>Gender</b>										
Male	17	6	35.3	3	17.6	6	35.3	2	11.8	0.54
Female	13	4	30.8	4	30.8	5	38.5	0	0.0	NS

Table 4 shows final excellent and good LIDSTROM score was higher among whom surgical management was done than conservatively. There was significant association found in final LIDSTROM score with type of management (p=0.03). Final excellent MAYO score was higher whom surgical management was done than conservatively. There was significant (p=0.04) association of final MAYO score with type of management.

**Table 4: Comparison of final Lidstrom and Mayo Score with type of management**

Type of management	N	Final LIDSTROM score								P value
		Excellent		Good		Fair		Poor		
		No.	%	No.	%	No.	%	No.	%	
Conservatively	15	2	13.3	4	26.7	8	53.3	1	6.7	0.03
Surgically	15	7	46.7	6	40.0	1	6.7	1	6.7	
Type of management	N	Final MAYO score								P value
		Excellent		Good		Fair		Poor		
		No.	%	No.	%	No.	%	No.	%	
Conservatively	15	2	13.3	3	20.0	9	60.0	1	6.7	0.04
Surgically	15	8	53.3	4	26.7	2	13.3	1	6.7	

Table 5 shows there was no significant (p>0.05) association of fracture grade with type of management.

**Table 5: Comparison of fracture classification with management**

Fracture classification	Conservatively(n=15)	Surgically(n=15)	p-value
III	4	2	13.3
IV	3	2	13.3
V	1	0	0.0
VI	6	6	40.0
VII	0	1	6.7
VIII	1	4	26.7

**Discussion**

The present study was conducted in TMMC&RC, TMU, Moradabad with the objective to assess clinico-radiologically outcome of DERF that were managed in our research center. In this study, 30 patients were included. Over the last decade, several studies have been directed towards clarifying which modalities would be the better for fracture of the distal extremity of radius with fewer complications. Lutz et al[10] conducted study over complications associated with operative versus non-surgical treatment of distal radius fractures in age group 65 yrs. above and found more complications in elderly patients who went surgical interventions compare to non-surgical. Jordan et al 2016[11] in their study concluded that there was improvement in the radiological outcome but not in the clinical outcome in the wire fixation group compared to the cast group at the mean followup of 2 years. Toon et al 2016[12] conducted a comparative study over outcomes and financial implications of I/A DERF and compared the treatment with ORIF with volar plates versus non operative management functional and radiological assessment done and at the end of 12 months they did not found any difference either fixed with volar plate or cast immobilization. Zengin et al 2018<sup>13</sup> done study over cast immobilization versus volar locking

plates fixation of AO type C DERF in patients aged 60 and above and suggest that LCP fixation for intra-articular DERF gives better result for the grip strength and radiological parameters compare to cast immobilization. So the debate and controversy remain the concerning the best management for distal end of radius fracture.

In this study, about one third of patients were >50 years of age (30%). The mean age of patients were 42.20±15.20 years ranging from 20 to 72 years. More than half of patients were males (56.7%) in the present study.

In the study by Prashant et al,[14] out of 50 patients the average age of the patients at the time of fracture was 38.46 (ranges: 20-65years) with same dominance of male patients. This study found that more than half of patients had left side fracture (53.3%). Chavhanet al[15] found that left side 19 (54.30%) was involved more as compare to right 16 (45.70%). This study showed that conservatively and surgically management has equal number of patients in both the groups. Lutz et al[10] were also having same division half in each group with higher number of sample size 129 in each group. Jordan et al[11](159 patients) were taken more than 50 years patients for study with 20 male patients (6 fixed with cast and 12 fixed with wire). Toon et al[12] took 60 patients; divide into 32 in operative

fixation female dominant (18) male (14) with mean age 52.1(23-77 years) and 28 in non-operative female (17) male (11) with mean age 57.4 years (26-79). Zengin et al 2018[13] 49 patients included in this study more than 60 years of patients they also divide into 25 in operative fixation female dominant (18) male (7) with average age 66.6±7.4 years and 24 in non-operative female (17) male (7) with average age 68.9±8.7 years. Again, contrast to our study with female dominant in their study.

This study found that more than half of patients had left side fracture (53.3%). Prashant et al.[14] showed 30 (60%) left side and 20(40%) right side same as our study with left side predominance. Toon et al[12] found operative right in 14 and left among 18 in non-operative right (24) left (4), contrast to our study with dominance of right side hand injury. Chavhan et al[15] found that left side 19 (54.30%) was involved more as compare to right 16 (45.70%).

This study showed that conservatively and surgically management has equal number of patients in both the groups. Lutz et al[10] were also having same division half in each group with higher number of sample size 129 in each group. Jordan et al[11] had 85 numbers of patients in non-operative and 74 in operative group unequal division contrast to our study. Toon et al[12] having total 60 patients 32 received operative treatment and 28 non operative treatment contrasts to our study unequal distribution of patients. Zengin et al[13] a total number of 49 patients taken for study with nearly equal distribution of patients 25 in operative and 24 in non-operative same as our study.

In this study, half of patients had fair LIDSTROM score at Day 0 (50%) followed by good (43.3%) and poor (6.7%). The current study showed that all the patients had poor MAYO score at Day 0. In the present study, more than half of patients had good LIDSTROM score post reduction (60%) followed by excellent (33.3%) and fair (6.7%). All the patients had poor MAYO score post reduction in this study. The current study found that final LIDSTROM and MAYO score was better for surgical group compare to conservative. LIDSTROM score was good in more than one third of patients at 3 months (40%) followed by fair & excellent (30%). MAYO score was fair in more than one third of patients at 3 months (40%) followed by good (36.7%) and excellent (23.3%).

Jordan et al 2016[11] found patients achieved either an excellent or good results with wire fixation group (79.8%) compare to cast immobilization group (50.6%). In this study, final Mayo score was higher among males than females. However, there was no significant association found in final Mayo score with gender ( $p>0.05$ ). In a study by Karthikeyan et al 2016,[16] total 60 patients were taken, 60% of them were found in the age group of 30-50 years 56% of males and 75% of females and found that males had a better recovery 85% compared to females (75%) as per Mayo score in their study. In this study, fracture grade VI and Grade III was most common fracture grade, however, there was no significant association found in fracture grade with type of management ( $p>0.05$ ). Karthikeyan et al 2016[16], showed that majority of the study population (70% of males and 50% of females) had type III or type IV fracture which is similar to our study.

**Table 6: Comparison of fracture classification with management**

	Total patient		Age	Study Design	Followed up	Result (operative/non-operative/no difference)	
	N	Surgical					Operative
Lutz et al 2014[10]	258	129	129	>65	A case control study	16 yrs	Non operative.
Hung et al 2015[17]	57	26	31	61-80	Historical cohort study	9-12 months	Operative better.
Jordan et al 2016[11]	159	74	85	>50	A retrospective study	24 months	Non operative
Toon et al 2017[12]	60	32	28	23-77	A prospective study	12 months	No difference
Zengin et al 2018[13]	49	25	24	>60	A retrospective study	24 months	Operative better
Present study	30	15	15	20-72	A prospective study	6 months	Operative better

## Discussion

**Complications:** Post traumatic arthritis found in 1 patient that managed surgically. Malunion with restriction of wrist joint found in 1 patient that managed conservatively.

### Limitations of the Study

- (1) Short sample size.
- (2) Single center study.
- (3) Short duration of follow up.

### Conclusion

DERFs are the most common injuries orthopaedics surgeon deals with in casualty and controversy remain concerning the best management (operative vs non operative). Since the introduction of locking plate fixation, there has been a tendency to manage DERFs with plates over cast fixation. In the beginning of our study we hypothesized that surgical intervention would improve fracture alignment with fewer complications compare to conservative. The result we obtained at the end of the study (30 patients) that followed upto 6 months, the comparison of final Lidstrom score and Mayo score for operative method is better with  $p$ -value =0.03 and  $p$ -value=0.04 respectively compare to non-operative method. At the end of the study, we concluded that surgical intervention for fracture distal end radius reduces chances of wrist joint stiffness and loss of reduction and gave good results as compared to conservative intervention. Hence, in our opinion surgical intervention for treatment of fracture distal end radius is a good method of choice with excellent outcome. DERFs are the most common injuries orthopaedics surgeon deals with in casualty and controversy remain concerning the best management (operative vs non operative). Since

the introduction of locking plate fixation, there has been a tendency to manage distal end of radius fractures with plates over cast fixation. In the beginning of our study we hypothesized that surgical intervention would improve fracture alignment with fewer complications compare to conservative. The result we obtained at the end of the study (30 patients) that followed up to 6 months the comparison of final Lidstrom score was, surgically: Excellent 46.7%, Good 40%, Fair 6.7%, Poor 6.7%. and Conservatively: Excellent 13.3%, Good 26.7%, Fair 53.3%, Poor 6.7% ( $p$ -value=0.03), and of the final Mayo-score was, Surgically: Excellent 53.3%, Good 26.7%, Fair 13.3%, Poor 6.7% and Conservatively: Excellent 13.3%, Good 20%, Fair 60%, Poor 6.7% ( $p$ -value=0.04). At the end of the study, we concluded that surgical intervention for fracture distal end radius reduces chances of wrist joint stiffness and loss of reduction and gave good results as compared to conservative intervention. Hence, in our opinion surgical intervention for treatment of fracture distal end radius is a good method with excellent outcome.

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