

**ORIGINAL RESEARCH**

# Comminuted Distal Radius Fractures- Conservative vs External Fixation

Dr. G.V.S. Lakshmi Narayana<sup>1</sup>, Dr. V. Sivani<sup>2</sup>, Dr. Chiranjeevi Varudu<sup>3</sup>, Dr. Rahul Suna<sup>4</sup>, Dr. Siva G. Prasad<sup>5</sup>,  
Dr. Gollakoti Satya Shankar<sup>6</sup>,

<sup>1</sup>Assistant Professor, Department of Orthopaedics, Gayatri Vidya Parishad Institute of Health Care and Medical Technology, Visakhapatnam, Andhra Pradesh

<sup>2</sup>Assistant Professor, Department of Orthopaedics, Gayatri Vidya Parishad Institute of Health Care and Medical Technology, Visakhapatnam, Andhra Pradesh

<sup>3</sup>Associate Professor, Department of Orthopaedics, Gayatri Vidya Parishad Institute of Health Care and Medical Technology, Visakhapatnam, Andhra Pradesh

<sup>4</sup>Assistant Professor, Department of Orthopaedics, Gayatri Vidya Parishad Institute of Health Care and Medical Technology, Visakhapatnam, Andhra Pradesh

<sup>5</sup>Professor and HOD, Department of Orthopaedics, Gayatri Vidya Parishad Institute of Health Care and Medical Technology, Visakhapatnam, Andhra Pradesh

<sup>6</sup>Junior Resident, Department of Orthopaedics, Gayatri Vidya Parishad Institute of Health Care and Medical Technology, Visakhapatnam, Andhra Pradesh

**Corresponding author:**

Dr. Rahul Suna, Assistant Professor, Department of Orthopaedics, Gayatri Vidya Parishad Institute of Health Care and Medical Technology, Visakhapatnam Andhra Pradesh

**Received: 12-02-2023****Accepted: 27-03-2023****Abstract:**

Distal radius fractures (DRF) are one of the most common fractures to be seen in Orthopaedics. The treatment options for them are also multitudinous ranging from closed reduction and percutaneous pinning to open reduction and plating. With the diversity in treatment options, there is also ambiguity about the most effective method of treating these fractures. In this scenario, studies to compare effectiveness of different treatment options is necessary. In this study, closed reduction and percutaneous pinning and ligamentotaxis with external fixation are compared with respect to their outcomes. **Methods and methodology:** About 66 patients of DRF are prospectively followed up in our tertiary care hospital. After recruiting the patients who met the inclusion and exclusion criteria into the study, based on the indications for closed reduction and percutaneous pinning and external fixation, patients were divided into CRPCF group and EF group respectively and were treated accordingly. Patients were evaluated at intervals of 2 weeks till 2 months post-operatively clinically and radiologically. Demerit Point System of Gartland and Werley modified by Sarmiento and Lidstrom and Frykman Criteria are used for evaluation of the patients. **Results:** out of 66 patients, 34 were treated with spanning external fixator (EF) and 32 were treated with closed reduction and percutaneous pinning and cast fixation (CRPCF). When both methods of treatment are compared in the present study, radiologically, loss of radial length was less in EF group. Maintenance of palmar tilt was better in CRPCF group. Over all range of motion was better in those treated with external fixator compared to CRPCF with lesser complication rate. **Conclusion:** External fixation is better treatment over CRPCF with better functional outcome and lesser chances of complications like CRPS. Spanning external fixator is minimally invasive and better option for comminuted distal radius fractures. Casting can be reserved for low demand patients and for with serious co-morbidities which precludes surgery.

**Keywords:** Distal Radius Fracture, Conservative Fixation, External Fixation.

---

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial- Share Alike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

---

**Introduction:**

Distal radius fractures (DRF) are one of the most commonly encountered fractures in day-to day orthopaedic practice. They account for about 20% of all the fractures treated in an emergency department [1]. There is bimodal distribution of distal radius

fractures. It is seen in elderly women following trivial trauma and in young patients following a high energy trauma [2].

There are umpteen number of treatment options for DRF. These include cast immobilization, percutaneous pinning, external fixator, plating

technique. Methods of fixation are also numerous viz, non-spanning external fixator, spanning external fixator, with or without augmentation with k-wires or plates etc... The options of implants are also many ranging from simple buttress plate to volar locking plate.

Loss of reduction is one of the major complications of DRF. In order to prevent it, multifarious treatment options have been in vogue<sup>[3]</sup> Depending on the fracture morphology, the treatment options vary. Despite, the number of treatment options available, there is insufficient evidence from different RCTs (Randomized Controlled Trials) with respect to the most appropriate treatment options for distal radius fractures<sup>[4]</sup>.

The method of moulding the fracture fragments into alignment, by giving traction across a fracture utilizing the surrounding intact soft tissues is called ligamentotaxis<sup>[5]</sup>. This is a method of closed reduction. Once, fracture reduction is achieved, it has to be immobilized to maintain the reduction. Plating techniques involve opening of fracture site. Lack of purchase of screw in comminuted, metaphyseal bone, hardware prominence (dorsal plating) etc are other issues involved in plating. Compared to volar plating, dorsal bridge plating is an effective method of treating comminuted fractures. However, hardware prominence and necessity of plate removal is a detrimental factor to it<sup>[7]</sup>.

Casting with or without percutaneous pinning and external fixators are two other options to maintain reduction without opening the fracture. This study is intended to compare both methods of treatment of distal radius fractures.

### Materials and Methods:

Prospective study of 66 patients is done in a tertiary care hospital over a period of 2 years after obtaining approval from the Institutional Ethics Committee.

#### Inclusion criteria:

1. Intra articular distal end radius fractures with volar/ dorsal comminution
2. Extra articular fractures with significant metaphyseal comminution
3. Patients of age between 18-80 years
4. Hemodynamically stable patients

#### Exclusion criteria:

1. Patients below 18 years and above 80 years of age
2. Pathological fractures
3. Injuries to head, chest and abdomen requiring active management associated haemorrhagic shock
4. Cases with ipsilateral upper limb fractures
5. Patients with neurovascular injuries
6. Patients presenting two weeks after the injury

Patients presenting to the emergency department who met the requisite inclusion and exclusion criteria are included in the study. After obtaining the initial radiographs, patients were stabilized in the below-elbow slab after closed manipulation and reduction under local anaesthesia, till the oedema has subsided. Check x-ray is taken after two days. Then patients are managed definitively by either closed reduction and plaster cast fixation (CRPCF) or external fixation (EF).

#### Indications for CRPCF:

1. Stable fractures
2. Satisfactory radiographic findings on check x-ray
3. Elderly patients with low demand
4. Patients not willing for surgery

Of 66 patients included in the study, 34 are treated by CRPCF and 32 are treated with spanning external fixators. In CRPCF group, under hematoma block, closed reduction was done and below-elbow cast is applied. Patients are treated on out-patient basis.

In EF group, after thorough pre-anaesthetic check-up (PAC), under brachial block, two 3.5mm shanz pins are introduced in the shaft of radius and two 2.5mm shanz pins are introduced into the second metacarpal. Closed manipulation and reduction done and clamps are fastened. The reduction is checked under fluoroscopy. Supplementary K-wires are used occasionally.

Post-operatively, active and passive range of motion (ROM) exercises of shoulder, elbow, and fingers are advised right from first post-operative day (POD). Pin-site dressings were done daily and it is taught to patients at the time of discharge. Patients are discharged in stable condition on POD-5. External fixators are removed between 5-8 weeks after clinical and radiological fracture union on day care basis under sedation.

Patients are followed up at intervals of 2 weeks till 2 months. Clinical and radiological evaluation of the patient is done. Demerit Point System of Gartland and Werley modified by Sarmiento<sup>[7]</sup> and Lidstorm and Frykman Criteria modified by Sarmiento<sup>[8]</sup> are used for evaluation of the patients.

#### Results:

Among the 66 cases of DER fractures, in the present study, majority of the patients are of age group 41-60 years. The mean age of the study is 43.9 years. Out of 66 patients, 40 are male and 26 are females indicating male preponderance of fracture in the present study. Majority of the patients are manual labourers (44%) in the present study followed by students (20%). The most common mechanism of injury in the present study is road traffic accident (50%).

Among 32 patients in EF group, 16(50%) got their external fixator removed between 5-6 weeks

and remaining between 7-8 weeks. About 19 people among casting group got their cast removed within 5-6 weeks while 15 of them got the cast removed within 7-8 weeks.

At the end of 12 months follow up, it is noted that the average loss of radial length is less in EF group compared to that of casting group (P=0.001) which is statistically significant. The palmar tilt is better achieved in casting techniques

compared to external fixator indicating that dorsal angulation is better corrected in casting method. There is no significant difference in radial inclination between the two groups.

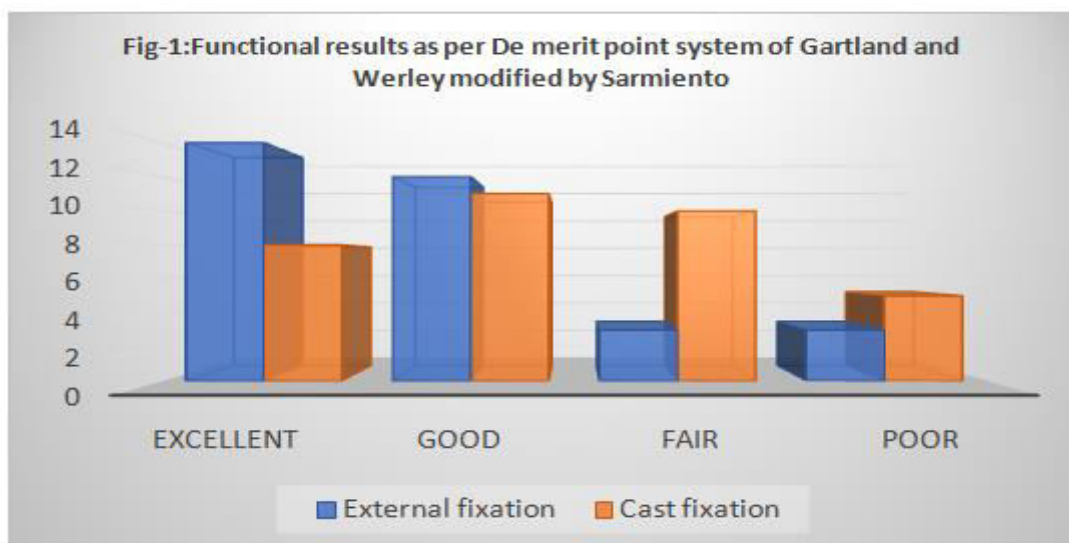
The average range of movements are less in casting group compared to that of EF group. Statistically significant results are observed with respect to movements of dorsiflexion and ulnar deviation [Table-1].

Movements	EF group	CRPCF group	Normal	P value
Dorsiflexion	66.31 <sup>0</sup>	56.76 <sup>0</sup>	80 <sup>0</sup>	0.002
Palmar flexion	56.64 <sup>0</sup>	50.59 <sup>0</sup>	70 <sup>0</sup>	0.05
Radial deviation	21.66 <sup>0</sup>	19.61 <sup>0</sup>	25 <sup>0</sup>	0.022
Ulnar deviation	25.31 <sup>0</sup>	21.91 <sup>0</sup>	30 <sup>0</sup>	0.009
Supination	72.43 <sup>0</sup>	71.51 <sup>0</sup>	85 <sup>0</sup>	0.61
Pronation	63.62 <sup>0</sup>	64.31 <sup>0</sup>	85 <sup>0</sup>	0.768

Table-1: Range of movements in EF group and CRPCF group

Complications following treatment are found to be higher in the casting group than the EF group. Loss of reduction and Sudek’s dystrophy are the complications which are observed exclusively in the casting group. There are 3 cases of pin tract infection in the EF group. Complications like finger stiffness, residual pain, dorsal angulation of fracture, are seen more or less equally in both groups.

Functional results are evaluated by De merit point system of Gartland and Werley (modified by Sarmiento) and Lidstorm criteria modified by Sarmiento are tabulated below [Fig-1 and 2] [Table-2]. Excellent results are observed predominantly in the EF group. Suboptimal results are found to be more in the casting group.



Results	External Fixation	Cast fixation
Excellent	17	7
Good	11	11
Fair	2	10
Poor	2	6

Table-2: Results as per Lidstorm criteria modified by Sarmiento



**Fig-2: Functional outcome of a patient**

#### Discussion:

Hand is one of the finest and most elegant structure in the human body<sup>[9]</sup>. For hand to function to the best possible extent, the wrist joint should be supple and healthy. DER fractures, especially comminuted fractures compromise the function of the hand and wrist. Radial shortening and articular step are associated with poorer outcomes<sup>[10,12]</sup>. Therefore, maintaining radial length and articular congruity are important. It is difficult to maintain reduction in comminuted and unstable fractures of distal radius.

Ligamentotaxis is the process of applying traction to the distal fragment through the surrounding soft tissues<sup>[6]</sup>. Ligamentotaxis, using either POP or external fixator is one of reliable means of treating unstable DER fractures. POP is easily available, low-cost option, which does not involve hospitalization. External fixator is a biomechanically superior modality to maintain the reduction of fracture<sup>[11]</sup>. In this study, outcomes and complications following CRPCF and EF are evaluated.

The mean age of the patients in the present study is 43.9 years which is lesser compared to that of C.Viswanath et al<sup>[9]</sup> and Sharma et al<sup>[13]</sup> which

were 53.4 years and 54 years respectively. Males were predominantly involved in the studies by C.Viswanath et al, Gupta AK et al and Sharma et al<sup>[9,15,13]</sup>, similar to the present study. RTA is predominant mechanism of injury in the present study as well as in the study by C. Vishwanath et al<sup>[9]</sup>. Fall on out stretched hand was the main mechanism of injury in the study done by Sharma et al<sup>[13]</sup> and Gupta PK et al<sup>[15]</sup>.

In the present study, about 50% of the patients had their external fixators removed within 7-8 weeks similar to the study by C.Viswanath et al<sup>[9]</sup> where, 44% got EF removed at 8 weeks. The average ROM achieved in the present study are similar to that of Sharma et al<sup>[13]</sup> with supination slightly better in the present study. But for pronation and supination, results in the present study are better than that of Gupta et al<sup>[15]</sup>. Results in the present study are similar to those in Oner et al<sup>[16]</sup>. The ROM is better in EF group compared to casting group in the present study, dorsiflexion being more statistically significant ( $P=0.002$ ). The results in present study are consistent with that of Oner et al and Gupta AK et al, where dorsiflexion and forearm rotations are significantly better in EF group than casting group<sup>[15,16]</sup>[Table-3].

Table-3 Comparison of Range of motion in different studies	Oner et al		Gupta AK et al		Present study	
	EF group	Casting group	EF group	Casting group	EF group	Casting group
Dorsiflexion	62.79	51.45	60	56	66.31	56.76 <sup>0</sup>
Palmar flexion	68.79	62.1	59	46	56.64 <sup>0</sup>	50.59 <sup>0</sup>
Radial deviation	16.76	17.1	19	14	21.66 <sup>0</sup>	19.61 <sup>0</sup>
Ulnar deviation	20.15	18.23	21	15	25.31 <sup>0</sup>	21.91 <sup>0</sup>
Supination	70.88	57.42	81	72	72.43 <sup>0</sup>	71.51 <sup>0</sup>
Pronation	63.09	56.45	81	69	63.62 <sup>0</sup>	64.31 <sup>0</sup>

Radial inclination and length are better maintained in the EF group in the present study. Dorsa tilt is better corrected in casting group in the present study. The results of the present study are similar to that of Oner K et al <sup>[16]</sup>. However, in study by Gupta PK et al, radial inclination is found to be better in casting group and palmar tilt is better maintained in EF group <sup>[15]</sup>.

About 53% of the patients treated with EF had excellent outcome compared to 20% in the casting group. 32% of the patients had good outcome in both the groups. Only 6% had poor outcome in the EF group as compared to 17.6% in the casting group. The results in the present study are better than that of Viswanth et al <sup>[9]</sup> where 22% had excellent outcome. However, only 4% had poorer outcome in their study.

Complications like complex regional pain syndrome (CRPS) is predominantly seen in casting group compared to the EF group. There is 1 case of CRPS in the present study as compared to 7 patients in the casting group in the study by Oner et al <sup>[16]</sup>. There are 3 cases of pin tract infection in the present study as compared to 5 in study by Gupta AK et al and Oner K et al <sup>[16,15]</sup>.

External fixator can be used conveniently in open fractures. External fixator facilitates dressings in open fractures. Treatment of open fractures is difficult in a cast, where a window has to be cut and sometimes it can compromise the immobilization achieved by a cast. Complication rates are found to be lesser and functional outcome is found to be better in cases treated with external fixator in the present study. Casting is an easily available, cost-effective method which is provided on outpatient basis. There is no need of a major surgical procedure.

### Conclusion:

External fixation and ligamentotaxis provides better functional and anatomic results in the comminuted and unstable fractures of distal radius. It provides early mobilization and reduces oedema and stiffness of joints thus leading to early and better functional recovery. The incidence of complications like loss of reduction and regional pain syndrome are minimised. Key to better functional results is excellent post-operative care and physiotherapy. Casting may be reserved to low demand patients and patients who are not fit for surgery. Serial follow up with radiographs

at 2 weeks interval is needed in casting as chances of fracture displacement are high.

### Limitations of the study:

Only two methods of distal radius fracture management are compared. Other modalities like plating can be included. In the present study there is no comparison between people of different age groups. Age-specific and gender-specific outcomes are to be compared.

### References

- Edward A. Parez, Chapter 57: Fractures of the shoulder, arm and forearm. In: Fredrick M Azar, James H Beaty, Campbell's Operative Orthopaedics, 14<sup>th</sup> edition, Elsevier 2021.
- Brady T. Evans, Carl M. Harper, Tamara D. Rozental, Chapter 42, Fractures of distal radius and ulna. In: Paul Tornetta, William M. Ricci et al, Rockwood and Green's Fractures in Adults, 9<sup>th</sup> edition, Wolter Kluver 2020.
- Mark Cohen, Robert Wysocki. Chapter 44 Fractures of the distal radius, Browner, Jupiter, Krettek, Anderson et al, Skeletal Trauma 5<sup>th</sup> Edition, Elsevier 2015.
- Handoll HH, Madhok R. Surgical interventions for treating distal radial fractures in adults. *Cochrane Database Syst Rev.* 2003;(3):CD003209.
- Agee JM. Distal radius fractures. Multiplanar ligamentotaxis. *Hand Clin.* 1993;9(4):577-585.
- Mittal S, Agrawal AC, Sakale H, Kar BK. Distal radial fractures: Conservative treatment. *J Orthop Dis Traumatol* 2020;3:41-4
- Gartland JJ Jr, Werley CW. Evaluation of healed Colles' fractures. *J Bone Joint Surg Am.* 1951;33-A(4):895-907
- Sarmiento A, Pratt G.A.W., Berry N.C., Sinclair W.F. Colle's fractures: functional bracing in supination. *J Bone Jt Surg.* 1975;57A:311-317.
- Vishwanath C, Harish K, Gunnaiah KG, Ravooof A. Surgical outcome of distal end radius fractures by ligamentotaxis. *J Orthop Allied Sci* 2017;5:68-73.
- Larouche J, Pike J, Slobogean G, et al. Determinants of functional outcome in distal radius fractures in high-functioning patients older than 55 Years. *J Orthop Trauma* 2016; 30: 445-449.
- Raskin KB, Melone CP Jr. Unstable articular fractures of the distal radius. Comparative techniques of ligamentotaxis. *Orthop Clin North Am.* 1993;24(2):275-286.
- Raudasoja L, Vastamäki H, Raatikainen T. The importance of radiological results in distal radius

- fracture operations: Functional outcome after long-term (6.5 years) follow-up. *SAGE Open Medicine*. 2018;6. doi:10.1177/2050312118776578
13. Sharma A, Pathak S, Sandhu H, et al. (February 02, 2020) Prospective Randomized Study Comparing the External Fixator and Volar Locking Plate in Intraarticular Distal Radius Fractures: Which Is Better?. *Cureus*12(2): e6849. DOI 10.7759/cureus.6849
  14. Aktekin CN, Altay M, Gursoy Z, Aktekin LA, Ozturk AM, Tabak AY. Comparison between external fixation and cast treatment in the management of distal radius fractures in patients aged 65 years and older. *J Hand Surg Am*. 2010;35(5):736-742. doi:10.1016/j.jhsa.2010.01.028
  15. Gupta PK, Chaudhary AK. To Compare The Functional Outcome of Intra Articular Distal end of Radius Fracture Treated by Conventional Pop Cast and External Fixatator Fixatation. *BJHS* 2019;4(1)8: 586 - 591.
  16. Oner K, Ayas m. S. Comparison of external fixation and plaster casting results in distal radius metaphysis fractures that are not suitable for open reduction. *Kırıkkale Üni Tıp Derg*. 2021; 23(2): 270-278.