

Evaluation of Clinical Outcome of Intra-Articular Distal Radius Fractures Treated with Distractor: Prospective Randomized Study

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Abstract: *Background and purpose:* Distractor allowing movement during fracture healing are commonly used for treatment of intraarticular or unstable extraarticular distal radius fractures. Distractor has recently been introduced as an alternative to volar locking plate for the fixation of unstable intra-articular distal radial fractures. *Patients and Methods:* All adult patients at our institution who underwent treatment of a unilateral distal radius fracture using a Distractor from 2014 to 2017 were identified retrospectively. This study comprised 75 patients with displaced intra-articular (Frykman type IV-VIII) distal end radius fractures treated with distractor fixation. The patients were followed up at 2nd week, 6th week, 12 week, 6 months and 1 year after surgery. The assessment of pain, range of motion, grip strength and activity were assessed at each follow-up visit and scored according to the Green and O'Brien scoring system. *Results:* we observed excellent result was achieved in 30 patients (40%), good in 35 patients (46.66%), fair in 10 patients (13.33%). *Conclusions:* Irrespective of the direction and amount of initial displacement, a great majority of intra articular fractures of the distal radius can be managed with a Distractor through a percutaneous approach. Distraction fixation for distal radius fractures is safe with minimal complications.

Keywords: distal radius fracture, volar plate, internal fixation, intra-articular fractures

1. Introduction

Fractures of the distal radius account for approximately 20% of all fractures treated in emergency rooms.⁽¹⁾ There are numerous surgical techniques to treat these fractures, including percutaneous pinning, Distractor, and plate fixation⁽²⁾The goals of surgical treatment are anatomic reduction of the distal radius, placement of a stable construct to enable fracture healing, and restoration of normal wrist kinematics.⁽³⁾

Distractor has been described as an effective treatment option for unstable comminuted distal radius fractures⁽⁴⁾, Distractor is temporarily fixed to the second or third metacarpal under the extensor tendons after fracture healing is confirmed radiologically at approximately 8-12 weeks⁽⁵⁾, the Distractor is removed and physiotherapy is initiated for wrist motion and strengthening.⁽⁶⁾

2. Material and Methods

This study was done prospectively in the Department of Orthopaedics and Trauma Centre in J. A. Group of Hospitals, Gwalior (M.P.) from July 2014 to July 2017 for the period of 3 years. Total of 75 intra articular distal radius fractures, treated with Distractor.

Fractures were classified using Frykman classification and Randomization was done to allocate the patients to one of the Distractor groups.⁽⁷⁾

Functional outcome was assessed according to the Green and O'Brien scoring system.⁽⁸⁾Pain, grip strength, wrist range of motion (ROM) and activity were noted at each visit. All the patients were followed up till the radiological union achieved.

The general Distractor technique used two 2.5-mm Schanz pins in the second metacarpal and two 3.5-mm pins in the radius proximal to the fracture. The pins were interconnected and tightened with solid connecting rod and link joints. After application of a frame, reduction was checked in the C-arm in antero-posterior and lateral views. Reduction was achieved via manual traction and closed reduction method in all cases. Sterile betadine dressing of the pin tract site was performed. A below elbow plaster of Paris slab was applied in all patients. The Distractor was removed in all patients after 8 weeks. K-wire was used in any patient since we were able to achieve reduction in fracture by use of pins only.

Follow-Up: Patients were regularly followed after 2, 6 and 12 weeks, and every 4 weeks thereafter until radiographic healing and function are established.

3. Results

This study was conducted in the Department of Orthopedics, Jaya Arogya Hospital, Gwalior over a period of 36 months to assess Irrespective of the direction and amount of initial displacement, a great majority of intra articular fractures of the distal radius can be managed with a Distractor through a percutaneous approach. Distraction fixation for distal radius fractures is safe with minimal complications.

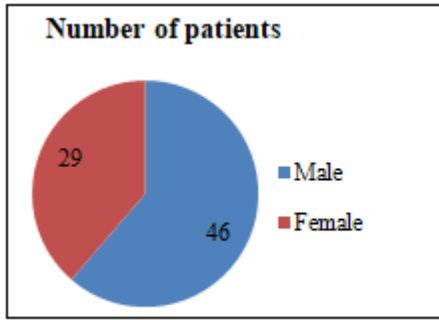


Figure 1: Gender Distribution

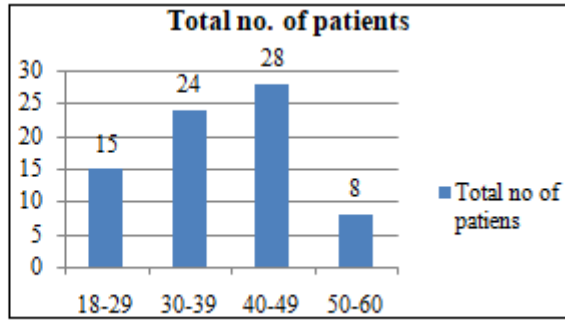


Figure 2: Age Wise Distribution

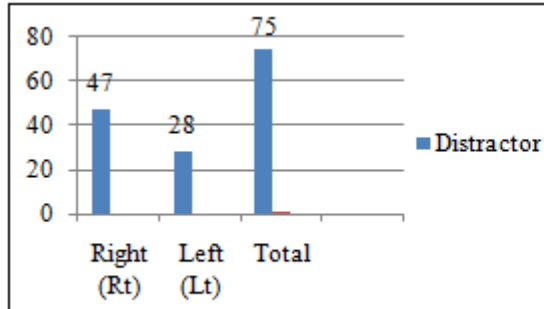


Figure 3: Side Affected

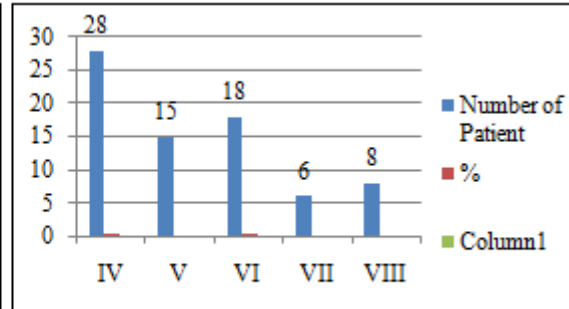


Figure 4: Frykman Type

Table 1: Frykman Type (Distractor Group)

Type	Number of Patient	%
IV	28	37%
V	15	20%
VI	18	24%
VII	6	8%
VIII	8	11%

Table 6: Comparison of Green and O'Brien Score in two Techniques at 6 Months and 1 Year Follow-Up

	Distractor fixator(n=75)		P value
	6 month	1 years	
Pain	18.36 ± 2.86	20.33 ± 3.5	0.000
ROM	18.92 ± 2.77	20.09 ± 2.05	0.004
Grip strength	18.91 ± 5.4	20.89 ± 4.4	0.015
Activity	20.09 ± 2.52	21.24 ± 2.28	0.004
Final score	76.28 ± 13.55	82.55 ± 12.23	0.003

Table 2: Trauma Surgery Interval DISTRACTOR GROUP

Interval	Number of patients	%
< 24 hour	28	37%
1-3 days	32	43%
3-7 days	15	20%
Total	75	100%

Table 3: Intra OP Time

Total Patient	AVG Time for Distractor
75	40 minute

In our study average operative time for Distractor fixation 40 minute

Table 4: Hospital Stay after Surgery

Total Patient	Distractor
75	2 days

In our study average stay time in hospital for Distractor fixation 2 days.

Table 5: Duration of Union

Time of Union	Distractor	
	No.	%
8-12 Weeks	62	82.66%
12-18 Weeks	13	17.33%
>18 Weeks	00	0

Mean value obtained by Green and O'Brien score all measure viz. Pain, ROM, Grip strength, Activity, Final score of all 75 patients had shown gradual improvement from 6 month to final followup at 1 years postoperatively. In all wrist movements final score of distractor group p values had <0.05 suggesting statistically significant, in Pain , ROM, Grip strength, Activity.

Table 7: Clinical Outcome

	Distractor fixator(n=75)		P value
	6 month	1 year	
Flexion (°)	50°	54°	0.274
Extension(°)	49°	56°	0.081
Pronation (°)	88°	89°	0.829
Supination (°)	79°	85°	0.026
Radial deviation (°)	20°	21°	0.604
Ulnar deviation (°)	35°	37°	0.373

Clinical Outcome-The means and ranges for distractor group show that p value(<0.05) more Significant in Extension and Supination group.

Table 8: Result

	Distractor
Excellent	30
Good	35
Fair	10
Total	75

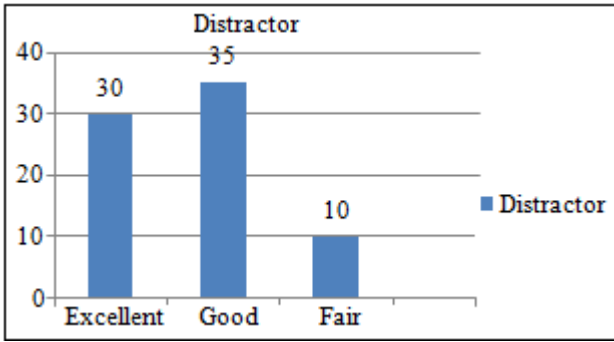
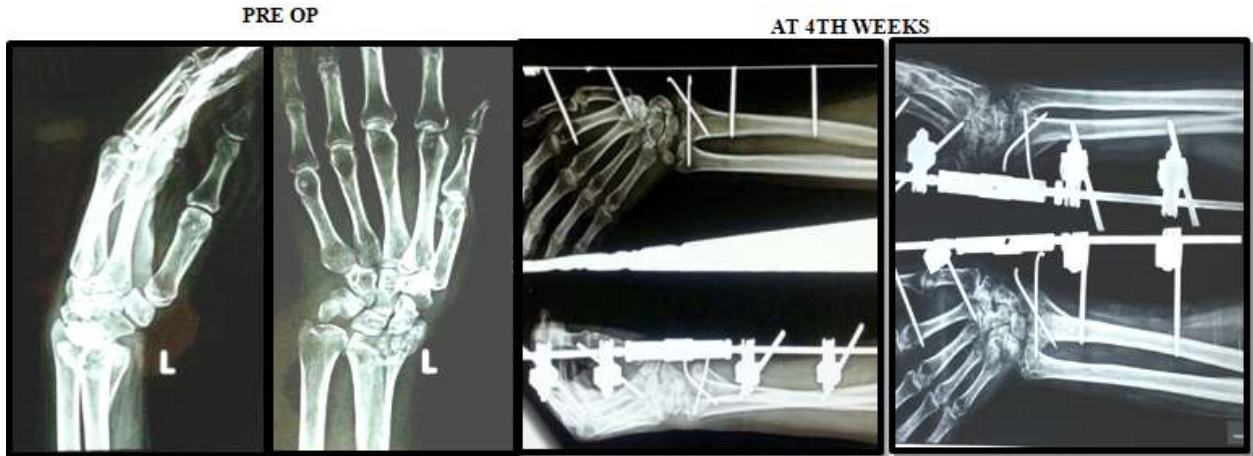


Figure 1: Result

Table 9: Complication

Complication	DF(n =75)
Complex regional pain syndrome	4 (5.33%)
Fixation failure	4(5.33%)
Incomplete reduction	3(4%)
Pin infection	7(9.33%)
Ulnar styloid pain	5(6.66%)
Finger stiffness	14(18.66%)

Case 1

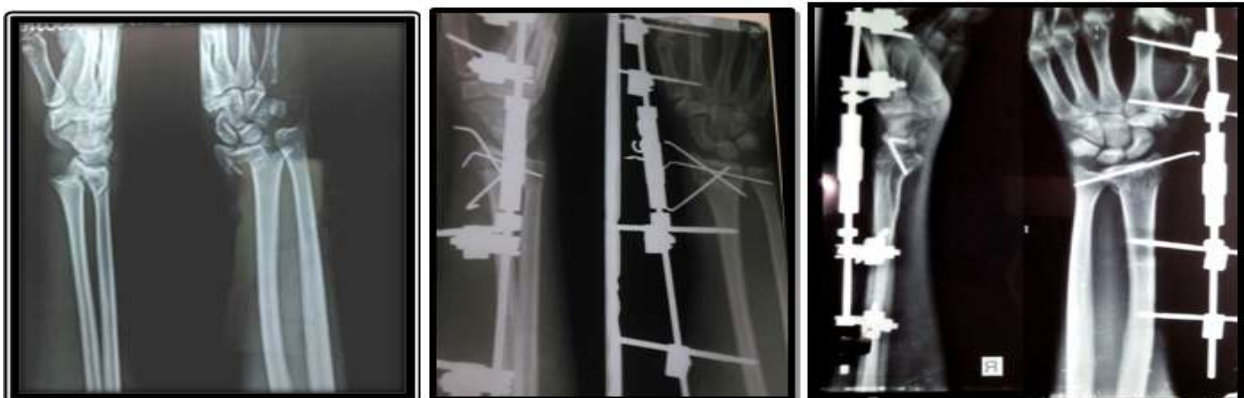


At 24 Weeks



Figure 2: AT 4TH WEEKS

Case 2





Dorsiflexion



Palmar Flexion



Pronation



Supination

4. Discussion

Distractor fixation is a commonly used technique for unstable distal radius fractures, its main benefit being its less invasive nature⁽⁹⁾ The Distractor fixator cannot ensure perfect anatomical reduction in all cases because it has no direct control over the bone fragments and has to rely on indirect reduction through ligamentotaxis.⁽⁵⁾ Other notable limitations of the Distractor are pin tract infections, pin loosening, radial shortening, inadequate correction of dorsal displacements, stiffness of the wrist and deconditioning of the muscles controlling wrist movements. Of these pin loosening has been reported as a very common complication in several studies⁽⁹⁾⁽¹⁰⁾ The holding strength of these Schanz pins in the osteoporotic bone (osteoporosis is highly prevalent among people with distal radius fractures) is another cause for concern⁽⁹⁾

Gelberman et al⁽¹¹⁾ demonstrated that excessive distraction during Distractor could cause elevated pressures in the carpal tunnel.

1. Distal End Radius

i. Age/Sex

Pattanashetty OB et al⁽¹²⁾ This clinical study done on 32 patients with displaced, comminuted, intra-articular fractures of distal end of radius of whom 15(46.9%) were female and 17(53.1%) were males. .

In our study of 75 patients with comminuted distal end radius fractures frykman type(iv-viii), the mean age of the patients was 38 years in which 35 male(47%) and 40 female(53%) in distractor fixation groups.

ii. Fracture pattern

Tamara D. Rozental⁽¹³⁾ The study group consisted of 15 men and 26 women with a mean age of 53 years (17–80years). According to the AO classification scheme, there were 18 type A fractures (3A2, 15 A3), 4 type B fractures (all B2), and 19 type C fractures (14 C2, 5 C3).

In our study of 75 patients of distal radius fractures frykman type(IV-VIII), In Distractor fixation group we had type IV-28(37%), type V-15(20%), type VI-18(24%), type-VII-06(8%) type –VIII-08(11%). Frykman type IV most common fracture pattern involved.

iii. Time of Union

Joideep Phadnis et al⁽⁵⁾ 133 patients (74%) had post-operative radiographs available for analysis. Overall mean time to fracture union was 8.4 weeks (6-28 weeks) shows time to union by fracture type. **Tamara D. Rozental et al⁽¹³⁾** In the EF group, average time to union was 8 weeks (range, 7–10 wk).

In our study In our group 62 (82.66%) had union time is(10.2 week) 8-12weeks and 13 (17.33%) had union time is (12.4 weeks)12-18 weeks. Radiological union of the fracture i.e. characterized by cortex to cortex healing and bridging

callus of the fracture in both AP and lateral views of follow up x-rays, was considered as satisfactory union.

iv. Intra op time

John H. Williksen et al⁽¹⁴⁾, The operative time was 77 minutes in the EF group. **Rajeev Shukla et al**⁽¹⁵⁾, Mean surgery time was 35.1 ± 2.5 in the Distractor group. In our study average operative time for Distractor fixation 40 minutes.

v. Complications

In our study complication are Complex regional pain syndrome 4 (5.33%), in Fixation failure 4(5.33%), Incomplete reduction 3(4%), Ulnar styloid pain 4 (5.33%), Pin infection 7(9.33%) Finger stiffness 14(18.66%) in distractor fixator group.

a. Pin infection:

Dr. S.Sasibhushan Rao et al⁽⁹⁾, There were four cases of pin tract infection in the bridging Distractor group which resulted in loosening of at least one pin in the construct. None of the pins were removed prematurely.

In our study, Pin infection 7(9.33%). Infection was successfully eradicated with parenteral antibiotics.

b. CRPS (Complex regional pain syndrome): .

Tamara D. Rozental et al⁽¹³⁾ Three CRPS complications also occurred in the EF group; all of them resolved with physiotherapy.

In our study distractor group Complex regional pain syndrome 4 (5.33%), developed CRPS in all of them resolved with physiotherapy

c. Ulnar styloid pain

John H. Williksen et al⁽¹⁴⁾ More EF patients had pain over the ulnar styloid at 52 weeks.

In our study Ulnar styloid pain 4 (5.33%), in Distractor fixation .

5. Outcome and Result

Kapoor et al⁽¹⁶⁾ reported 80 % with good or excellent results in Distractor, while **Gratl et al**⁽¹⁷⁾ reported 100 and 97.5 % with good or excellent results in these Distractor..

Rajeev Shukla et al⁽¹⁵⁾ 110 patients (61 females and 49 males) with Cooney's type IV distal radius fractures were recruited into the study.

Although there was no significant difference in pain, ROM, grip strength, activity and final outcome in patients at 6 months after surgery using either of using this technique, at 1 year, they observed a significant increase in only ROM, grip strength and final outcome in patients treated with Distractor.

In our group we observed excellent result was achieved in 30 patients (40%), good in 35 patients (46.66%), fair in 10 patients (13.33%) .

Mean value obtained by Green and o'Brien score all measure viz. Pain, ROM, Grip strength, Activity, Final score of all 75 patients had shown gradual improvement from 6 month to final follow up at 1 years postoperatively.

6. Conclusion

The distinct advantage of Distractor are its superior mechanical efficiency, its capacity for fracture adjustment during healing period. Distractor is a simple device and easy and safe to use even under regional anesthesia. The shorter period of surgery, minimal exposure, no need for tourniquet are its distinct advantage over plate fixation. It Can be performed in emergency with minimum instrumentation and expertise.

Distractor for distal radius is an easy, cost effective, reliable and most suitable treatment in treating intraarticular distal end radial fractures by the "Principle of ligamentotaxis", but it requires physiotherapy after its removal for normal functioning of wrist joint.

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