



MANAGEMENT OF FRACTURE OF DISTAL RADIUS BY EXTERNAL FIXATOR USING THE PRINCIPLE OF LIGAMENTOTAXIS

Orthopaedics

**Dr. Sameer
Mohammad
Zargar***

PG Scholar Orthopaedics, GMC Srinagar *Corresponding Author

**Dr. Rajkumar
Prasad**

Assistant Professor, Department of Orthopaedics, JNUIMSRC, Jaipur

**Dr. Uroosa Fayaz
Mir**

PG Scholar, Department of Anatomy

ABSTRACT

Introduction: Fractures of the distal radius continue to be the most common skeletal injuries treated by the orthopedic surgeon. Numerous techniques have been described and developed to treat the fracture in an effort to improve the outcome. The main aim of this study is to evaluate the results obtained by treatment of distal end radius fractures by external fixation using the principle of ligamentotaxis. **Materials and Methods:** In this study a total of 24 patients radiologically confirmed with distal radius fractures were enrolled. All patients were managed by external fixation using the principle of ligamentotaxis. The functional outcomes were assessed by using Gartland & Werley's system. **Results:** In this study 7 (29.17 %) patients had full range of movements with no pain. 2 (8.33 %) patients had full range of movements with mild pain not affecting the function of wrist. The results were assessed by Gartland & Werley's system as excellent in 9 (37.5 %) patients, good in 11 (45.83 %) patients, fair in 3 (12.5 %) patients and poor in 1 (4.17 %) patient. **Conclusion:** The external fixator with ligamentotaxis is a good method of treatment for fracture of distal end of radius.

KEYWORDS

Distal end radius, ligamentotaxis, External fixation, closed reduction

INTRODUCTION

Fractures of the distal radius continue to be the most common skeletal injuries treated by the orthopedic surgeon. In fact these injuries are the most common fractures of the upper extremity and account for approximately 1/6th (16%) of all fractures seen and treated in emergency rooms [1-3]. It occurs in middle aged and elderly women commonly. It also occurs in young men with high velocity injury though less in number. With increase in longevity and activity in middle aged to elderly population, there is increase in number of these fractures [4].

Various surgical interventions are available presently, like percutaneous pinning, intra focal pinning, external fixator and plate fixation [5]. External fixator may be performed in a bridging technique and a non-bridging technique. Bridging external fixator allows distraction across the radio carpal joint [6]. The moulding of fracture fragments into alignment by traction force applied across the fracture through the surrounding soft tissue is known as ligamentotaxis. Multiple studies have documented the efficacy of this technique [7-9]. This study was designed to evaluate the results obtained by treatment of distal end radius fractures by external fixation using the principle of ligamentotaxis.

MATERIALS AND METHODS

This study was carried out from 2016 to 2023. A total of 24 patients radiologically confirmed with distal radius fractures, managed by external fixation using the principle of ligamentotaxis were enrolled in this study.

Inclusion criteria

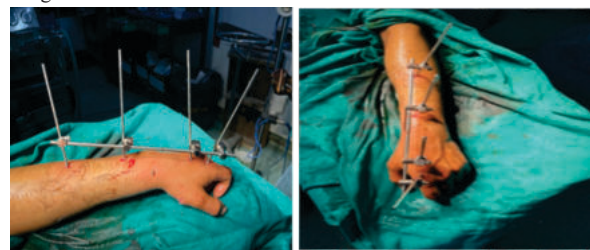
- Age group between 18-60 years
- Both closed and open fractures
- Fractures less than 2 weeks old
- Comminuted fracture

Exclusion criteria

- Patients with pathological fractures
- Fracture more than 2 weeks old
- Non-union
- Fracture with neurovascular complications
- Fracture associated with other bone fracture in the wrist hand or forearm
- Complex fractures with depression of articular surface

Surgical Technique

All patients were placed supine on the operating table. Under regional block anaesthesia or general anaesthesia closed reduction was done under C-arm. 5mm incision for 4 shanz pins, 2 in the middle third of the radius on the dorso lateral aspect about 10-12cm from distal end of radius and 2-3cm apart. By the use of haemostat soft tissue dissection was done, care taken to avoid injury to radial nerve. Another 2 incision over the base of the second metacarpal on dorso lateral aspect about 1-2cm apart were done, 3mm shanz pin were inserted in the radius, and 2.5mm Shanz pins were introduced in second metacarpal, then with fixator pins securely in place, clamps and external fixator rod were mounted to shanz pin. The clamps were loosened and longitudinal traction was given with manual moulding of. The fracture fragments back into a more normal alignment and gentle flexion and ulnar deviation was maintained. The reduction was confirmed through image intensifier and then external fixation device was locked into place. The tension across the wrist generated by the external fixator device which provides enough ligamentotaxis was confirmed by image intensifier.



A

B



C

D

Figure 1: A, B (Intra-operative pictures) and C (Post-operative x-ray) and D (X-ray after removal of ex fix at 4 weeks)



Figure 2: A (Distal radius with lunate dislocation) and B (Post-operative x-ray of lunate dislocation with fracture distal end of radius)

All patients were regularly followed up after 2 weeks, 4 wks, 6wks, 8 wks and 12 wks. During the follow ups, all the patients were observed for any possible complications. The external fixators were removed after radiological union and physiotherapy of the wrist was commenced. A removable splint for forearm was applied during night time and was removed during day time for physiotherapy for another 2 weeks and wrist and finger exercises were taught to continue at home. At the end of the 3 months follow-up each patient was evaluated for functional recovery by clinical and radiological examination.

The functional outcomes were assessed by using Gartland & Werley's system which consist Individual patient evaluation, Functional evaluation, Residual deformity and associated symptoms.

Table 1: Demographic characteristics of patients

Characteristics	No. of patients	Percentage
Gender	Male	19
	Female	5
Age group	18-30 years	14
	31-40 years	6
	41-50 years	3
	51-60 years	1
Mechanism of injury	Road accidents	16
	Fall	8
Side	Right	13
	Left	11
Fracture type	Closed fracture	20
	Open fracture	4

RESULTS

The average age of the study population was 39 (range 23-59) years. There were 19 (79.17 %) males and 5 (20.83 %) females. In our study 14 (58.33 %) patients sustained distal radius fractures were in the age group of 18-30 years, 6 (25 %) were in the age groups of 31-40 years, 3 (12.5 %) patients were in the age group of 41-50 years and 1 (4.17 %) patient belong in the age group of 51-60 years. 16 (66.67 %) patients sustained injury with road traffic accident, whereas 8 (33.33 %) patients were injured in falls on outstretched hand. 13 (54.17 %) patients were with right sided injury and 11 (45.83 %) patients were with left sided injury. Majority of the cases 20 (83.33 %) were closed fractures and 4 (16.67 %) were open fractures (Table 1). The average follow up was 8 (Range 3-18) months.

In this study 7 (29.17 %) patients had full range of movements with no pain. 2 (8.33 %) patients had full range of movements with mild pain not affecting the function of wrist. 11 (45.83 %) patients had limitation of movements of wrist and forearm by 20% and decreased hand strength by 15-20% as compared to that of normal side, but without any pain. 3 (12.5 %) patients had limitation of movements of wrist and forearms more than 20 %, with mild pain, unable to lift heavy weights and their hand grip strength was also decreased by more than 20 % as compared to that of normal side. 1 (4.17 %) patient was with moderate pain, unable to do heavy manual work, restriction of wrist movements by 50% as compared to that of normal side.

The results were assessed by Gartland & Werley's system as excellent in 9 (37.5 %) patients, good in 11 (45.83 %) patients, fair in 3 (12.5 %) patients and poor in 1 (4.17 %) patient (Table 2).

Table 2: Results assessed by Gartland & Werley's system

Grading	No. of patients	Percentage
Excellent	9	37.50
Good	11	45.83
Fair	3	12.50
Poor	1	4.17

DISCUSSION

Fracture of the distal end of radius is one of the most common fractures. It occurs in middle aged and elderly women commonly. It also occurs in young men with high velocity injury though less in number. With increase in longevity and activity in middle aged to elderly population, there is increase in number of these fractures [4]. Patients with fracture distal end of radius have serious complications more frequently than generally appreciated [10] and failure in management may cause permanent disability [11]. Distal radius fractures crush the mechanical foundation of the man's most elegant tool, the hand. Fit middle aged patients do not expect their wrist to be deformed and do expect a strong mobile hand. Previous policies of benign neglect, is no longer acceptable. Therefore treatment methods are continually improving and best suitable method of management has to be followed in each case [4].

Management of fracture distal end of radius is still a challenge for orthopaedic surgeons and pose therapeutic problem in term of reduction of fracture, maintenance of reduction till the fracture unites mobility of the joint after fracture union. Failure in the management may cause permanent disability [12]. We agree with Green [13] that a good functional result usually accompanies a good anatomical reduction. Failure to identify the unstable fracture by the degree of displacement, severity of the comminution, the involvement of radio carpal or radioulnar joint. The aims of treatment in fractures of distal end of the radius are to allow early functional recovery of the limb, to improve long term function of the wrist and to prevent cosmes deformity and external fixator effectively maintains the reduced position whereas treatment by plaster does not. Bridging external fixator with ligamentotaxis for treatment of fracture distal end of radius has given promising results. Good functional result usually accompanies a good anatomical reduction. External fixation uses the concept of ligamentotaxis and is very useful in maintaining reduction and radial length.

In this study the average age of the study population was 39 years near about equivalent to the study by Ashok K Syam et al. [14]. In this study, there were 19 (79.17 %) males and 5 (20.83 %) females. In our study 14 (58.33 %) patients sustained distal radius fractures were in the age group of 18-30 years, 6 (25 %) were in the age groups of 31-40 years, 3 (12.5 %) patients were in the age group of 41-50 years and 1 (4.17 %) patient belong in the age group of 51-60 years. The increase in number of male patients is because of increase in number of road traffic accident and high energy trauma which was noticed in young adults. We restricted our study group from 20-60yrs, because management and rate of union differ in younger and older age groups.

In this study 16 (66.67 %) patients sustained injury with road traffic accident, whereas 8 (33.33 %) patients were injured in falls on outstretched hand. About the mode of injury in study by Vishwanath C et al., stated that 645 cases had injury due to road traffic accidents and 365 cases had injuries due to falling injuries [15]. Boparai R et al., in their study found commonest cause of injury road traffic accidents in 56.6% cases, by fall of heavy objects in 205 cases, by assault in 13.35 cases and by machine injury in 10% cases [12]. 13 (54.17 %) patients were with right sided injury and 11 (45.83 %) patients were with left sided injury. Vishwanath C et al., in their study found 70% cases had fracture on right side and 305 had on left side [15].

In this study the functional outcomes were excellent in 9 (37.5 %) patients, good in 11 (45.83 %) patients, fair in 3 (12.5 %) patients and poor in 1 (4.17 %) patient, as compared to 40.6% excellent 53% good 3% fair and 3% poor results of Jenkins et al study [16].

CONCLUSION

The external fixator with ligamentotaxis is a good method of treatment for fracture of distal of radius. This technique is simpler than other techniques. The procedure is performed during a short hospital stay. The external fixator is reliable in terms of maintaining reduction of axes as well as of radial length. Simple intra-articular fractures with dorso ulnar fragments can be reduced with ligamentotaxis.

REFERENCES

1. Ark J, Jupiter JB. The rationale for precise management of distal radius fractures. *Orthop Clin North Am.* 1993 April; 24(2): 205-210.
2. Nagi ON, Dhillon MS, Aggarwal S, Deogaonkar KJ. External fixators for intra-articular distal radius fractures. *Indian Journal of Orthopaedics.* 2004;38: 19-22.
3. Jupiter JB. Current concepts review-Fractures of the distal end of the radius. *J Bone Joint Surg (Am).* 1991; 73-A: 461-469.
4. Christopher Bulstrode, Josjob Buck walter. *Oxford text book of orthopaedics and*

- trauma. First edition, vol.3: 1942-1956.
5. Terry Canale S. Campbell's operative orthopaedics 10th edition. vol 3 ; 3058-3069.
 6. Robert W Bochohz James D Hackman. Rockwood and Greens fracture in adults 5th edition. Vol, 1: 829-880.
 7. Edward GS. Intra articular fracture of the distal part of the radius treated with small AO external fixator. JBJS (Am), 1991; 7: 1242-1250.
 8. Fernandez DL Geinler WB. Treatment of displaced articular fracture of the radius. J Hand Surgery. Am, 1991; 16:375-384.
 9. Anderson. Roger and O'Neil. Gordon: Comminuted fractures of the distal end of the radius; Surg. Gynec and Obstet, 1944; 78: 434-440.
 10. William.P. Cooney, James, H. Complication of colle's fracture. JBJS 1980; Vol 62-A: No4: 613-619.
 11. Thomas. G. Wadsworth Colles fracture: failure in management may cause permanent disability. British medical journal; 1990 vol, 301; no. 6745: 192-194.
 12. Boparai RPS, Boparai RS, Kapilar, Pandher DS. Role of ligamentotaxis in management of comminuted intra/juxta articular fractures. IJO, 2006; 40, (3):185-7.
 13. Green D P. Pins and plaster treatment of comminuted fracture of the distal end of the radius. JBJS, 1975; 57-A: 304-310.
 14. Ashok Shyam K, Chetan Pradhan, Rajiv Arora, Gaurav Pardesi, Parag Sancheti, Atul Patil et al. A Comparative Study of the Functional outcome of k-wire Fixation with Cast Cersus Ligamentotaxis in Management of Distal End Comminuted Fracture Radius. J Orthopaedics, 2010; 7(3):3.
 15. 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.
 16. Jenkins NH, Jones DG, Johnson SR, et al. External fixation of colles fracture: An Anatomical study. JBJS 69-B; 1987: 207.