



ORIGINAL RESEARCH PAPER

Orthopaedics

COMPLEX FRACTURE DISTAL END RADIUS MANAGED BY DYNAMIC EXTERNAL FIXATOR.

KEY WORDS: Fracture distal end of radius, Ligamentotaxis, External fixator

Dr Rajendra Wamanrao Baitule

Associate Professor, Department of Orthopaedics, Dr PDMMC hospital

Dr Sanjeev V Jaiswal*

Assistant Professor Department of Orthopaedics, Dr PDMMC Hospital
*Corresponding Author

Dr Ankur Chawla

Junior Resident Department of Orthopaedics, Dr PDMMC Hospital

ABSTRACT

BACKGROUND:- Distal radius fractures represents most common fractures of all fracture. Distal radius fractures in the elderly may represent an insufficiency fracture associated with all of the risk factors for osteoporosis. The external fixator are mechanical efficient in complex intraarticular fracture management, its capacity for fracture adjustment during healing period.

MATERIAL AND METHOD:- All fractures were classified according to AO classification b and c. Baseline demographics and injury characteristics were recorded. In this study of 30 patients, 19 sustained type 23 b fracture, 11 had type 23 c fracture. All patients were managed by external fixator.

RESULT:- This study achieved excellent results in 20 patients, good in 6 patients, fair in 2 patients, poor in 2 patients evaluated as per the criteria suggested by Green and O'Brien Score (Cooney modification). (fig 1) In this study, 8 pt had wrist pain and stiffness and 6 pt had finger stiffness as their post operative complication. Pain and stiffness in wrist and finger stiffness significantly improved after physiotherapy.

Our case series attributes to 88% of excellent to good results and 12% of fair to poor results. Thus, it suggests that ligamentotaxis plays a good role in anatomic restoration in unstable fractures as well as intra articular fractures.

CONCLUSION:-

- 1) The external fixator are mechanical efficient in complex intraarticular fracture management, its capacity for fracture adjustment during healing period.
- 2) External fixator is easy and safe to use even under regional anesthesia.
- 3) External fixator is simple device for fracture fixation with preservation of fracture haematoma.
- 4) Shorter period of surgery with minimal exposure no need of tourniquet
- 5) Minimum instrumentation and less expertise required
- 6) Use of dynamic external fixator in complex intraarticular fracture of distal end radius effective method of treatment. Of fracture using principle of ligamentotaxis.

INTRODUCTION

Distal radius fractures represents most common fractures of all fractures¹. There is an increase in incidence of fracture of distal radius in postmenopausal females which has been linked to estrogen withdrawal. Distal radius fractures in the elderly may represent an insufficiency fracture associated with all of the risk factors for osteoporosis². Distal radius fractures were historically thought of as dislocations of the wrist, from Hippocrates' time until the 18th century, when Petit first posed the possibility that they may be fractures³. In 1977, external fixator method gained popularity among orthopaedicians with Vidal Jacques described original method of treatment of these fractures with ligamentotaxis⁴. Using principle of ligamentotaxis a prospective study a prospective study of complex fracture distal end radius was managed by dynamic external fixator and clinical and functional outcome was evaluated.

MATERIAL AND METHODS

A total number of 30 cases of complex intraarticular distal end radius fracture treated by ligamentotaxis were studied.

INCLUSION CRITERIA WERE:

- 1) Skeletally mature individuals.
- 2) Patient who gave consent for this procedure.
- 3) Communitied fractures Intra articular fractures
- 4) AO classification b and c

EXCLUSION CRITERIA:

- 1) Pathological fracture
- 2) Fracture of the scaphoid or scapho-lunate dissociation of the same wrist
- 3) Pre existing inflammatory or degenerative arthritis of the injured wrist, ipsilateral elbow, or shoulder (which would affect the functional outcome).

OPERATIVE PROCEDURE

The patient is positioned supine on the operating room table. Anesthesia can be either regional or general. Complete muscle relaxation of the patient is achieved. Dose of prophylactic antibiotic. The external fixator generally can be placed without the need for a tourniquet, diminishing reactive postoperative edema, and allowing more time later if a complicated open reduction and grafting is required. Before incision a preliminary reduction done to align the grossly displaced fracture fragments. A 2.5-cm longitudinal incision is made at the level of the mid Radial shaft about 10 cm proximal to the radial styloid and a minimum of 3 cm from the most proximal fracture line. We preferred this mini-incision approach over percutaneous placement of the external fixator pins because of the unpredictable proximity of the superficial branch of the radial nerve (SBRN) and the lateral antebrachial cutaneous nerve. The preferred interval is between the extensor common radialis brevis and longus muscles, such that the fixator lies in an oblique plane midway between the coronal and sagittal planes of the forearm. A deep muscular interval between the brachioradialis and extensor radialis longus also is acceptable, although there is an increased risk of neuroparaxic injury or irritation of the radial sensory nerve. Soft tissue is reflected sharply off the bone without stripping periosteum to allow for secure positioning of the pin guide. Two 4-mm-diameter pins are drilled across two cortices of the shaft. Although various pin sizes are available, 4-mm pins have been shown to have the best pullout strength and resistance to bending without increasing risk of pin site fracture. Pin Placement is confirmed with fluoroscopy. A 2-cm longitudinal incision is made in the oblique plane over the index metacarpal distal to the flare of the metacarpal base. The extensor tendon and first dorsal interosseous muscle are sharply reflected to allow exposure to the bone, metacarpophalangeal joint flexed to tension the intrinsics. Properly, two 3-mm pins are drilled across two cortices in

a similar fashion as was done for the radius. Bicortical purchase is again confirmed with fluoroscopy. In few cases we used K-wires as adjuvant fixation for stabilization. The fixator was removed after 6 wks followed by hot paraffin wax bath treatment and active physiotherapy. The follow up period averaged 9 months the highest being 18 months and the least being 3 months.

Patients were followed up every 15 days up to 6 weeks to see radiographic joint space if there is collapse were managed by dynamization rod

FIG-1 Green and O'Brien Score (Cooney modification)⁵

Pain (25 points)	
25	None
20	Mild, occasional
15	Moderate, tolerable
0	Severe or intolerable
Range of motion (25 points) Flexion+ extension , percentage of normal	
25	100
15	75-99
10	50-74
5	25-49
0	0-24
Grip strength(25 points)	
25	100
15	75-99
10	50-74
0	25-49
Activities (25 points)	
25	Returned to regular employment
20	Restricted employment
15	Able to work but unemployed
0	Unable to work because of pain
Final result	
90-100	Excellent
80-89	Good
65-79	Fair
<65	Poor



RESULTS

All fractures were classified according to AO classification b and c. Baseline demographics and injury characteristics were recorded. In this study of 30 patients, 19 sustained type 23 b fracture, 11 had type 23 c fracture. In the present study, 30 cases were followed up for average of 10 months. 53% i.e. 16 were male and 47 % i.e 14 were females. The right wrist was involved in 66% i.e. 20 of our cases and left 10 33% of our cases. The dominant hand in 16 ie 53% of cases. The patients in young working age group 20-40yrs were 20 cases representing 66% of our cases. The number of cases in complex intraarticular fractures i.e. Type23 b 63.33% of our cases and 27 % of type 23c .. Number of cases due to road traffic accident constituted 60% and fall on outstretched hand constituted 40% ..

This study achieved excellent results in 20 patients, good in 6 patients, fair in 2 patients, poor in 2 patients evaluated as per the criteria suggested by Green and O'Brien Score (Cooney modification). (fig1)In this study, 8 pt had wrist pain and stiffness and 6 pt had finger stiffness as their post operative complication. Pain and stiffness in wrist and finger stiffness significantly improved after physiotherapy.

Our case series attributes to 88% of excellent to good results and 12% of fair to poor results. Thus, it suggests that ligamentotaxis plays a good role in anatomic restoration in unstable fractures as

well as intra articular fractures.

DISCUSSION

Distal end of radius fractures are one of the common fractures managed by an orthopaedic surgeon⁶. Treatment outcomes are not uniformly good irrespective of the treatment modality. Number of studies have proved that there is a strong relationship between the quality of anatomical reconstruction and long term functional outcome⁷⁻¹³. The efficacy of ligamentotaxis in neutralizing detrimental compression forces, which are likely to cause displacement of unstable fracture with radial shortening, is a significant and increasingly appealing advance in the management of distal radius fracture.¹⁴ Dowling and Sawyer IN 1961 evaluated results of percutaneous pinning fixation in 51 patients with 84% excellent to good results¹⁵. Cooney et al IN 1979 published results of 60 patients treated with R.A Frame with 87% excellent to good results¹⁶. D'Anca et al IN 1984 evaluated results of Hoffman fixation in 54 patients with 94% excellent to good results¹⁷. Schuind et al IN 1984 evaluated results of Hoffman fixation in 63 patients with 94% excellent to good results¹⁸. Vaughan et al IN 1985 published results of 52 patients treated with R.A Frame with 94% excellent to good results¹⁹. Jenkins et al IN 1987 published results of 72 patients treated with A O Fixator with 93% excellent to good results²⁰. In 1989, Howard evaluated results of Hoffman fixation in 50 patients with 96% excellent to good results. Jakim et al IN 1991 evaluated results of Hoffman ---fixation in 132 patients with 83% excellent to good results²¹. Edwards IN 1991 published results of A O fixation in 30 patients with 96% excellent to good results²². Kapoor H Aggarwal IN 2000 concluded from their studies in 90 cases of unstable distal radius fractures that results were good or excellent in 80% of external fixator. Markowitz AD IN 2000 published a paper on five pin external fixator and early mobilization. They emphasized to use on dorsal pin (additional) incorporated in external fixator to correct dorsal tilt found in many fractures of distal end radius. Additional pins would help to reduce those fragments that would not improve with traction alone, thus unnecessary excessive traction is avoided²³. Aktekin et al. IN 2010 found that wrist extension, ulnar deviation, palmar tilt and radial height were better in those treated with external fixation²⁴. Wei et al. IN 2012 reported good results with external fixation when satisfactory reduction is obtained²⁵. Rajeesh shukla et al IN 2013 concluded from their studies in 72 cases of intraarticular distal radius fractures that Joshi s External Stabilizing System is a cost effective technique and a good option in displaced distal end radial fractures²⁶. Deepak CD, Gopalakrishna G, Ravooof A et. Al. IN 2014 assessed the results of 20 patients of unstable distal radius fractures with / without intra-articular extension and concluded that external fixation and ligamentotaxis provides better functional and anatomical results in comminuted intra-articular and unstable extra-articular wrist injuries²⁷. YALAVARTHI K R, VISHAL A et al in 2015 to 88% of excellent to good results and 12% of fair to poor results. By using ligamentotaxis²⁸

CONCLUSION

- 1) The external fixator are mechanical efficient in complex intraarticular fracture management, its capacity for fracture adjustment during healing period.
- 2) External fixator is easy and safe to use even under regional anesthesia.
- 3) External fixator is simple device for fracture fixation with preservation of fracture haematoma.
- 4) Shorter period of surgery with minimal exposure no need of tourniquet
- 5) Minimum instrumentation and less expertise required
- 6) Use of dynamic external fixator in complex intraarticular fracture of distal end radius effective method of treatment. Of fracture using principle of ligamentotaxis

REFERENCES

- 1 Nellans KW, Kowalski E Chung KC . The epidemiology of distal radius fractures. Hand clin.2012;.28(2):113-25
2. Nguyen TV, Center JR, Sambrook PN, et al. Risk factors for proximal humerus, forearm, and wrist fractures in elderly men and women: the Dubbo Osteoporosis Epidemiology Study. Am J Epidemiology 2001;153(6):587-595.
- 3 Petit JL: L'Art de guerir les maladies des os. Paris: L. d'Houry, 1705.
4. Vidal, Fischbach, Brahin Act Orthop Belgium 43: 781-789,1977
- 5 kwok I, Leung F Assessing Results After Distal radius Fracture Treatment Geriatric

- Orthopaedic Surgery & Rehabilitation 2011 ; 2(4): 155-160.
- 6 Nijs S, Broos PL. Fractures of the Distal Radius: a Contemporary Approach. *Acta Chir Belg.* 2004;104(4):401-12.
 - 7 mcqueen MM, Hajducka C, Court-Brown CM. Redisplaced unstable fractures of the distal radius: a randomized, prospective study of bridging versus non-bridging external fixation. *J Bone Joint Surg Br.* 1996;78(3):404-09.
 - 8 Batra S, Gupta A. The effect of fracture-related factors on the functional outcome at 1 year in distal radius fractures. *Injury.* 2002;33(6):499-502.
 - 9 Kopylov P, Johnell O, Redlund-Johnell I, et al. Fractures of the distal end of the radius in young adults: a 30-year follow-up. *J Hand Surg Br.* 1993;18(1):45-49.
 - 10 mcqueen M, Caspers J. Colles fracture: does the anatomical result affect the final function? *J Bone Joint Surg Br.* 1988;70(4):649-51.
 - 11 Short WH, Palmer AK, Werner FW, et al. A biomechanical study of distal radial fractures. *J Hand Surg Am.* 1987;12(4):529-34.
 - 12 Jenkins NH, Mintowt-Czyz WJ. Mal-union and dysfunction in Colles fracture. *J Hand Surg Br.* 1988;13(3):291-93.
 - 13 Van der LW, Ericson R. Colles' fracture. How should its displacement be measured and how should it be immobilized? *J Bone Joint Surg Am.* 1981;63(8):1285-88.
 - 14 Robert W Bocholez James D Hackman. Rockwood and Greens fracture in adults 5th edition. Vol.1: 829-880.
 - 15 Dowling JJ & Sawyer Blackwell : Comminuted Colles fractures evaluation of method of treatment JBJS 43-A 657-668 July 1961.
 - 16 Cooney, W.P., Agee, J.M., Hastings, H.I., Melone, C.P.J., and Rayhack, J.M.: Management of Intraarticular Fractures of the Distal Radius. *Contemp Ortho* 21:71-104, 1990.
 - 17 D Anca AF, Byron TW, Feinstein PA. External fixator management of unstable Colles fractures *Orthopedics* 1984; 7:853-9.
 - 18 Schuind F, M, Burny F. External fixator for wrist fractures *Orthopaedics* 1984;7:841-4.
 19. Vaughan PA etal: Treatment of unstable fractures of distal radius by external fixator, *JBJS* 67(B) 385, 1985.
 20. Jenkins N.H Jones D.G Johnson S.R and Mintocout WJ: External fixation for Colles fracture: An anatomical study *JBJS* 69 B2:207-211, 1988.
 - 21 Jakim I, Pieters HS Smeets MBE: External fixation for intraarticular fractures of distal radius *JBJS* 1991, March: 73(2): 302-306.
 - 22 G S Edwards *JBJS Am* 1991; 73:1241-1250
 - 23 Markiewicz AD: Five pin external fixator and early range of motion for distal radius fracture, *Orth, Clinics of North America* 2000 APRIL.
 - 24 Aktekin CN, Altay M, Gursoy C, et al: Comparison between external fixation and cast treatment in the management of distal radius fractures in patients aged 65 years and older, *J Hand Surg* 35:86, 2010.
 - 25 Wei DH, Poolman RW, Bhandari M, et al: External fixation versus internal fixation for unstable distal radius fractures: a systematic review and meta-analysis of comparative clinical trials, *J Orthop Trauma* 26:386, 2012.
 - 26 Shukla R. A multifactorial study of application of Joshi's External Stabilizing System in displaced Distal End Radius Fractures. *Indian Journal of Basic and Applied Medical Research* 2013;3(1):165-171
 - 27 Deepak CD, Gopalakrishna G, Ravoo A et. Al. Surgical management of distal end radius fractures by ligamentotaxis. *Int J Health Sci Res.* 2014; (4):106-110.
 - 28 Yalavarthi RK, Vishal A. Outcome of Management of Distal Radius Fractures By Ligamentotaxis. *IOSR Journal of Dental and Medical* 14(7): 33-37