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Dr. S Hari Kumar
Assistant professor, Department
of Orthopaedics, MNR Medical
College, Sangareddy, Telangana,
India

Management of unstable distal radius fractures by ligamentotaxis with external fixation

Dr. S Hari Kumar

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Abstract

Distal radial fractures accounts 16% in upper limb fractures. Not only management and restoration of articular compatibility is also a major task for successful recovery. External fixation, ligamentotaxis provides best functional and anatomical outcome for unstable distal radial fractures. This study was designed to assess the efficacy of ligamentotaxis with external fixation in the management of distal radius fractures. A total 32 cases with a chief complaint of unstable fractures distal radius between age group 3rd to 7th decades were considered. All fractures were fixed with external fixator with ligamentotaxis. Study outcome was evaluated by Modified of Gartland and Werley Demerit point system. 21.8% cases had excellent results, 40.6% cases had good results, 28.1% cases had moderate results and 9.3% cases had poor results when treated with ligamentotaxis with external fixation. Grip strength complication was seen in 2 cases (Table 4). No associated symptom was seen in 20 cases. Ligamentotaxis with external fixation is an effective method for unstable distal radius fractures management. It is minimally-invasive technique which reduces anatomical disabilities of distal radius fractures.

Keywords: distal radial fracture, ligamentotaxis, external fixation, gartland & werley's

Introduction

Distal radial fracture management is controvertible and still challenging task for orthopaedic surgeons. Distal radial fractures accounts 16% of the total upper limb fractures ^[1]. Abraham Colles defined first and stated that fractures occurs 1.5 inches above distal end of radius.

Multiple treatment modalities like external fixation, cast immobilisation, plating technique and K-wire fixation are available in the management of unstable distal radial fractures ^[2]. External fixation provides a rigid fixation fit to achieve radial length, anatomical volar tilt and normal radial angulation ^[3, 4]. All involve distraction across the wrist joint with placement of pins in the radius and the metacarpals. Lipton and Wollstein suggested the placement of two pins into the second metacarpal, both in a plane that is at 45⁰ from the true vertical and from the true lateral. The distal most pin angles slightly in a proximal direction and the proximal most pin angles in a slightly distal direction ^[5]. Fracture site reduction, radial shaft shortening and articular incongruity may lead to permanent abnormality ^[6-8].

This study was designed to assess the efficacy of ligamentotaxis with external fixation in the management of distal radius fractures.

Materials and Methods

The present study was conducted in Department of Orthopaedics, MNR medical college and Hospital, Sangareddy during April 2016 to June 2018. A total 32 cases with a chief complaint of unstable fractures distal radius between age group 3rd to 7th decades were recruited. Cases need treatment based on with external fixator depends on the principle of ligamentotaxis were included, cases with previous history of wrist fractures, stable fractures with dorsal angulation <20⁰, not fulfilling the study criteria and cases not willing to participate were excluded from the study.

Informed consent was obtained from all the cases and study protocol was approved by institutional ethics committee. Lateral and PA view radiographs of fractured and normal side radius were taken to evaluate dorsal angulations,

Correspondence

Dr. S Hari Kumar
Assistant professor, Department
of Orthopaedics, MNR Medical
College, Sangareddy, Telangana,
India

dorsal communication, radial inclination and ulnar variance. Cases were medicated with Inj. tetanus toxoid and temporarily elbow plaster splint was given to the cases for the pain relief. Fractures were classified based on Frykman's classification.

The metacarpal pins were connected to multiaxial ball clamp and radial pins were connected to another multiaxial ball clamp. The ball clamps were connected to distraction rod. Check X rays taken and fine tuning of distraction done. No more than 2 - 3mm distraction was applied over radiocarpal joint. Movement of fingers were started from day 1 after the surgical procedure. Antibiotics were medicated for 2 days with continuation of oral antibiotics for 1 week. Patient follow up was conducted once a week for six weeks to examine finger movements and to check infection status. External fixators were removed at the end of 6th week after confirming the union of fractures and were instructed to start active mobilisation.

Patient follow up was conducted till three months to evaluate functional, infection status of fractures. At the time of every follow up radiological assessment was done on fractured and non-fractured sides. Study outcome was assessed by using Gartland & Werley's system which consist Individual patient evaluation, Functional evaluation, Residual deformity and associated symptoms. Follow up data was extracted in to data sheet and percentages was analysed by using Microsoft excel.

Results

A total 32 cases with complex distal radial fractures between age group 3rd to 7th decades were considered. In males, majority cases were in between 41-50 years (33.3%) and 21-30 years (22.2%), whereas in females, most of the cases were present in between 41-50 years (28.5%) (Table 1).

Table 1: Age and sex wise distribution of cases.

Age	Male (n=18)		Female (n=14)	
	Number	Percentage	Number	Percentage
21-30	04	22.2%	03	21.4%
31-40	02	11.1%	03	21.4%
41-50	06	33.3%	04	28.5%
51-60	03	16.6%	01	7.1%
61-70	03	16.6%	03	21.4%

Table 2: Demographic details of fractures.

Fracture details	Total cases (n=32)	
	Number	Percentage
A. Side of fracture		
Right	22	68.7%
Left	10	31.2%
B. Occurrence of fracture		
Unilateral	32	100%
Bilateral	00	-
C. Mode of injury		
Road traffic accidents	19	59.3%
Falling injury (Out starched hand)	12	37.5%
Others (Lifting weights, Assaults)	01	3.1%
D. Mode of Anaesthesia		
Intravenous	03	9.3%
Axillary block	19	59.3%
Supraclavicular block	10	31.2%
E. Maintenance of length of the bone		
No change in length	26	81.2%
Loss of length <2mm	04	12.5%
Loss of length >2mm	02	6.2%

All fractures occurred were unilateral (100%) and most of the

fractures occurred on right side (68.7%) than left side (31.2%) (Table 2). Mode of injury in many cases due to road traffic injuries followed by falling injuries. In addition to radial fractures, an associated fracture to distal end of ulna was seen in 15.6% cases and to shaft of humerus was seen in 6.2% cases. Along with ligamentotaxis, K wire fixation was performed in 18.7% cases and palmar supportive slab in 9.3% cases.

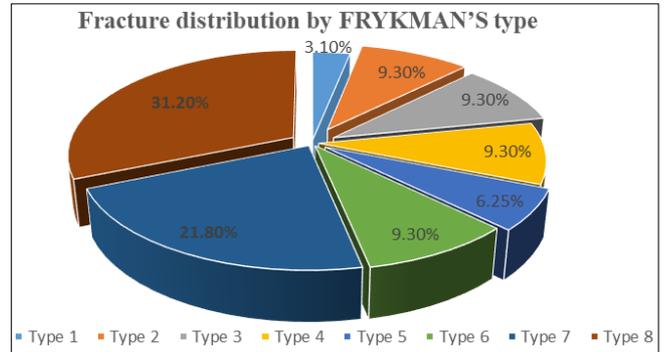


Fig 1: Distribution of fracture based on FRYKMAN'S type.

Table 3: Individual patient evaluation by Gartland & Werley's point system.

Grade	Outcome of Patient evaluation	Number	Percentage
Excellent	No pain and no functional restriction	04	12.5%
Good	Episodic pain and mild functional restriction	09	28.1%
Moderate	Episodic pain and Moderate functional restriction	08	25%
Mild	Notable Pain with functional restriction	11	34.3%

Individual patient evaluation by Gartland & Werley's demerit point system showed excellent results in 12.5% cases, good results in 28.1% cases, moderate results in 25% cases and poor results in 34.35 cases (Table 3). Grip strength complication was seen in 2 cases (Table 4). No associated symptom was seen in 20 cases.

Table 4: Final outcome evaluated by Gartland & Werley's point system.

Outcome	Number
Functional evaluation (complication in movements)	
Supination	03
Pronation	03
Dorsiflexion	05
Palmar flexion	03
Ulnar deviation	04
Radial deviation	02
Inferior radio ulnar joint	03
Grip strength	02
Residual deformity	
prominence of Ulnar styloid	03
Dorsal tilting	01
Radial deviation of hand	04
Associated symptoms	
No associated symptoms	20
Mild	07
Moderate	04
Severe	01

21.8% cases had excellent results, 40.6% cases had good results, 28.1% cases had moderate results and 9.3% cases had

poor results when treated with ligamentotaxis with external fixation (Figure 2).

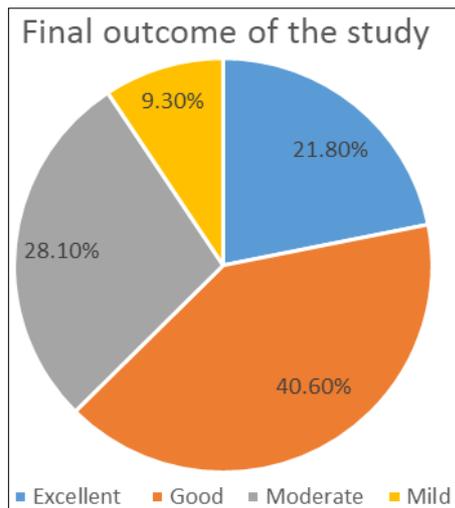


Fig 2: Final outcome of study

Discussion

The Complex distal radius fractures appear simple and its management is a challenge for orthopaedic surgeons. Distal radial fractures accounts 16% of total upper limb fractures^[1,9,10]. Methods like external fixation and ligamentotaxis are commonly preferred to manage unstable distal radius fracture. This study was designed to assess the efficacy of ligamentotaxis with external fixation to manage unstable distal radial fractures. A total 32 cases with complex distal radial fractures between age group 21-70 years were considered. In males, majority cases were in between 41-50 years in both sexes (males 33.3%, females 28.5%) (Table 1). Study by Ashok K Syam *et al.*, included cases between age group 23-79 years with mean age 42.84 and males^[15] were more than female cases (04)^[11]. Study by Vishwanath C *et al.*, on 50 cases found 34% cases were in between age group 20-30 years, 26% in between 41-50 years and 24% in between 31-40 years with mean age 54 years and male predominance (76%)^[12].

In this study, all fractures occurred were unilateral (100%) and most of the fractures occurred on right side (68.7%) than left side (31.2%). Vishwanath C *et al.*, in their study found 70% cases had fracture on right side and 30% had on left side^[12]. In this study, commonest mode of injury was road traffic accidents (RTA) (59.3%), followed by falling injuries on outstretched hand (37.5%) and due to assaults (3.1%) (Table 2). 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^[12]. 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^[13]. Common mode of anaesthesia administered was Axillary block (59.3%) and supraclavicular block (31.2%) (Table 2).

Classification of fractures based on Frykman's classification in a study by Vishwanath C *et al.*, found in no cases in type 1 & 2, 3 cases in type 3, 4 cases in type 4, 3 cases in type 5, 9 cases in type 6, 17 cases in type 7, and 7 cases in type 8^[12]. Where in the present study, 3.1% in type 1, 9.3% cases in type 2, 9.3% cases in type 3, 9.3% cases in type 4, 6.25% cases in type 5, 9.3% cases in type 6, 21.8% cases in type 7, and 31.2% cases in type 8 (Figure 1). Ashok K Syam *et al.*, in

their study found no cases in type 4 & 5, 1 case in type 6, 4 cases in type 7 and 14 cases in type 8^[11].

Individual patient evaluation by Gartland & Werley's demerit point system showed excellent results in 12.5% cases, good results in 28.1% cases, moderate results in 25% cases and poor results in 34.35 cases (Table 3).

In a Study by Vishwanath C *et al.*, the final outcome evaluation by Gartland and Werley's score showed excellent results in 22% cases, good results in 64% cases, fair in 10% cases and poor in 4% cases^[12]. Deepak CD *et al.*, obtained excellent outcome in 15% cases, good results in 60% cases, fair results in 20% cases and 5% cases had poor results^[14]. Study by Supreeth Nekkanti *et al.*, obtained excellent results in 25% cases, good results in 43.4% cases, fair results in 13.1% cases and poor results in 18.4%^[15]. Whereas in the present study, 21.8% cases had excellent results, 40.6% cases had good results, 28.1% cases had moderate results and 9.3% cases had poor results when treated with ligamentotaxis with external fixation. Study outcome reveals that ligamentotaxis has a crucial role in anatomic restoration in unstable fractures (Figure 2). Study by Rakesh K Yalavarthi *et al.*, obtained 88% cases had excellent to good results, 12% cases had fair to poor results^[16].

Conclusion

The results of this study concluding that ligamentotaxis with external fixation is an effective method for unstable distal radius fractures management. It is minimally-invasive technique which reduces anatomical disabilities of distal radius fractures. Outcome and management of fractures always depends on fracture morphology, inclusion of cases, accurate reduction and maintaining by Internal or external fixation. Further studies are required to evaluate long term functions outcome of fractures.

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