

Fragment Specific Fracture Fixation in the Management of Communitated Intra Articular Distal Radius Fractures: An Assessment of Functional Outcome

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Received: 17-08-2022/ Revised: 12-09-2022/ Accepted: 21-10-2022

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Conflict of interest: Nil

Abstract

Introduction: Distal radius fractures are typical high energy trauma injuries, and their treatment is impacted by parameters such as fracture stability, displacement, and patient characteristics. Fragment-specific fixation can be an effective treatment option for distal radius fractures. The purpose of this study was to assess the therapy of communitated intra articular distal radius fractures using a fragment specific fracture fixation approach.

Material and Methods: Thirty-one cases with communitated distal radius fractures above 21 years of age were recruited. Based on Medoff fracture classification, all the fractures were treated with fragment specific fracture fixation. Postoperative follow up was conducted on the end of 3rd week, 6th week, 3rd month, 6th month and end of 12th month and then until the complete closure of fractures. The functional outcome of fracture was assessed by Gartland and Werley scoring system.

Results: Majority cases had fracture union duration 8 weeks (54.84%) followed by 10 weeks (32.26%). According to Gartland and Werley score, 70.96% had score 0, 9.68% had score 2, 6.45% had core 3 and score 4. The excellent (0-2) functional outcome was observed in 90.32%, good (3-8) in 6.45% and fair (9-20) in 3.23% of cases.

Conclusion: Fragment specific fracture fixation was an efficient treatment modality for Communitated intraarticular distal radius fractures.

Keywords: Distal radius fractures, Gartland and Werley score, fragment specific fracture fixation, Range of motion.

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Introduction

Distal Radius fracture are common adult bone injuries accounts for 8-15% [1]. Distal radius fractures with an intra-articular component typically indicate high-energy trauma in adolescents and young adults. High-energy injuries

frequently result in shear and impacting fractures of the distal aspect of the radius with displacement of the fracture fragments [2]. The restoration of normal anatomy and function is the aim of treatment for distal radius fractures. But

there is still debate on the best way to get the desired result [3]. The typical conservative way of treating intra-articular fractures of the distal end of the radius can occasionally be challenging. To stop the loss of reduction in an unstable fracture of the distal end of the radius, a variety of therapeutic approaches are available [4]. Regazzoni et al. first developed the fragment specific fixation approach in 1996, and it has gained popularity over the past 20 years [5, 6]. A fragment-specific technique employs metal pins and plates that are precisely formed to meet the distal radius's normal contour [7]. Despite their small size, the fragment-specific implants are designed to withstand the rigours of instant wrist motion and are intended to be used as part of post-surgery early wrist movements [8]. With reference to the above literature the present study was designed to evaluate the management of Communitied intra articular distal radius fractures by fragment specific fracture fixation method and evaluation of its functional outcome.

Materials and Methods

The present prospective interventional study was conducted in the Department of Orthopedics, Maheshwara Medical College and Hospital, Isnapur, Telangana from February 2021 to April 2023. A total of 31 cases with distal radius fractures above 21 years of age attending Department of Orthopedics were recruited. Cases aged between 21-55 years, intraarticular distal radius fractures with >2mm articular step off, loss of $\geq 5^\circ$ radial inclination, and willing to participate were included. Cases with skeletal deformations, extraarticular radial fractures, open fractures, combined with neovascular structure involvement, and not willing to participate were excluded. Written informed consent was obtained from all the study participants and the study protocol was approved by the institutional ethics committee.

All participants were undergone routine laboratory investigations, renal function examination, and ECG. Radiological examination including CT and X-ray was taken to examine the fracture grade, and morphological aspects to design management procedures.

The distal radius fractures were categorized according to Medoff fracture classification. Based on the fracture type, fracture morphology and management modality different implants were considered such as for volar factures 2.4mm volar locking compression plate, for radial column fracture 2.4mm straight locking compression plate & K-wire fixation and for distal fragment 2.4mm dorsal T-LCP & K-wire fixation was used. Before surgical procedure all the patients were undergone regional anesthesia. During procedure, patients lied in supine position with the arm in a radiolucent forearm. Postoperatively, antibiotic medication was continued for 48 hours and advised to start finger and wrist mobilization after surgery and wrist mobilization after one week. Dressing was changed on 2nd and 5th day and suture were removed on 13th postoperative day. Postoperative follow up was conducted on the end of 3rd week, 6th week, 3rd month, 6th month and end of 12th month and then until the complete closure of fractures. During each visit participants were undergone detailed clinical and radiological examination to assess the status of the fracture union and functional outcome. The functional outcome of fracture was assessed by Gartland and Werley scoring system [9]. Collected data was analyzed by using SPSS23.0. Categorical variables were represented in frequency and percentages. Comparative analysis was conducted by using chi-square test and fisher's exact test. The $p < 0.05$ was considered as statistically significant outcome.

Results

Table 1: Demographic and clinical profile of study participants

Parameters	No of cases (n=31)	
	Frequency	Percentage
Age (In years)		
21-30	03	9.68%
31-40	12	38.71%
41-50	11	35.48%
>50	05	16.12%
Gender		
Male	19	61.30%
Female	12	38.70%
Side of the fracture		
Unilateral right	20	64.52%
Unilateral left	11	35.48%
Cause of fracture		
Road traffic accidents	26	83.87%
Fall from height	04	12.90%
Assault	01	3.22%
Classification of fractures (Medoff classification)		
Radial column	08	25.80%
Dorsal wall	10	32.26%
Intra-articular	-	-
Volar rim	13	41.94%
Ulnar corner	-	-
Time period of surgery (In days)		
≤2	07	22.58%
3-5	24	77.42%

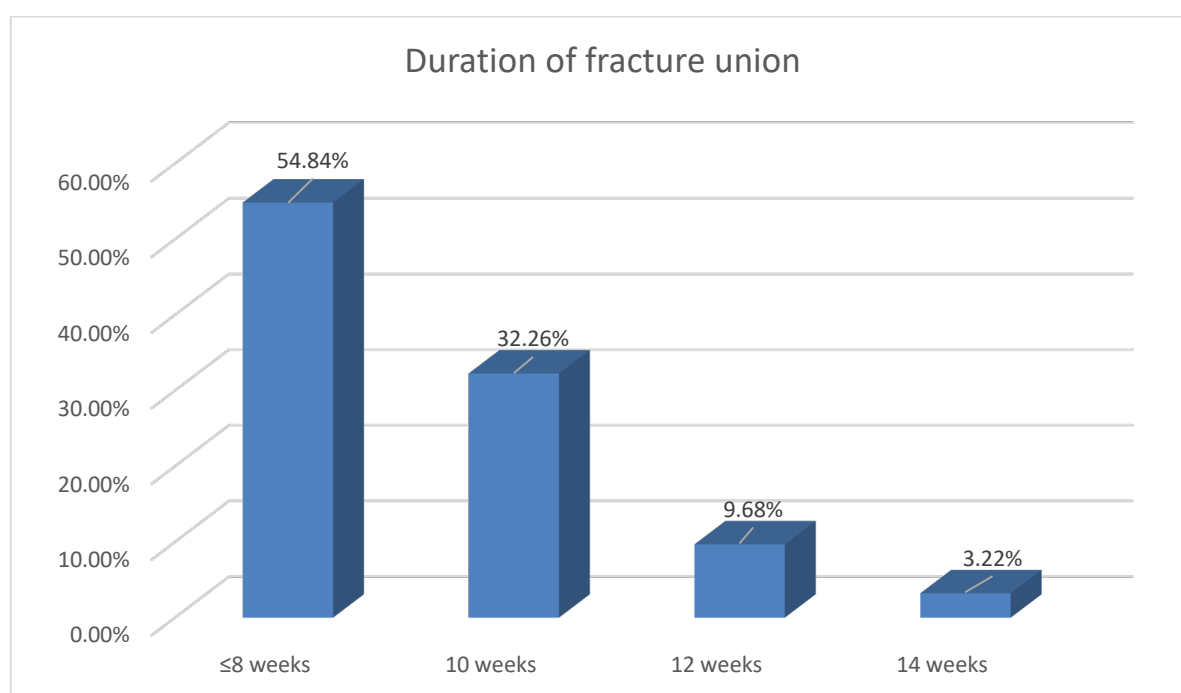


Figure 1: Duration of fracture union

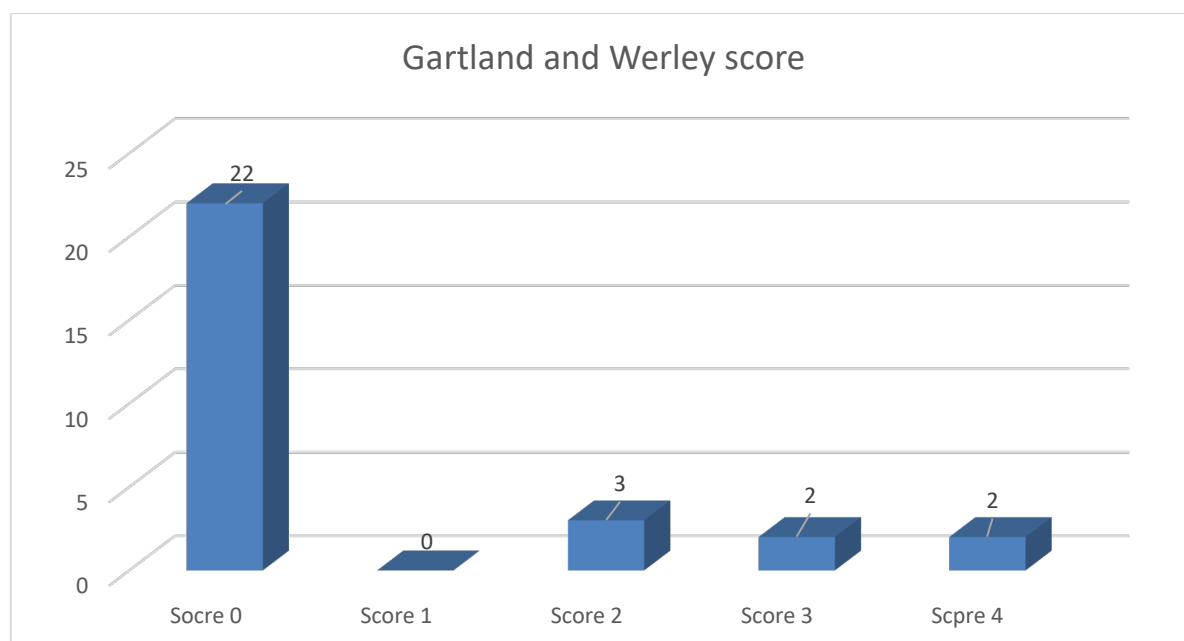


Figure 2: Outcome analysis by Gartland and Werley score

Table 2: Assessment of functional outcome by Gartland and Werley score

Parameter	Total no of cases (n=31)	
	Frequency	Percentage
Residual deformity		
Prominent ulnar styloid	03	9.68%
Residual dorsal tilt	-	-
Radial deviation of hand	-	-
Subjective evaluation		
Score 0	23	74.19%
Score 2	07	22.58%
Score 4	01	3.23%
Score 6	00	0
Objective evaluation		
Loss of dorsiflexion	-	-
Loss of ulnar deviation	-	-
Loss of supination	01	3.23%
Loss of palmar flexion	-	-
Loss of radial deviation	03	9.68%
Loss of circumduction	-	-
Pain distal radio ulnar joint	02	6.45%
Range of motion		
Palmar flexion	57.8±2.4	
Dorsi flexion	62.5±2.9	
Radial deviation	18.31±2.5	
Ulnar deviation	24.3±3.4	
Outcome score		
Excellent (0-2)	28	90.32%
Good (3-8)	02	6.45%
Fair (9-20)	01	3.23%
Poor (>20)	-	-

Discussion

Majority participants were aged between 31-50 years (74.19%) with more male participants (61.30%) than females (38.70%). Unilateral right-side fractures were common (64.52%) than left side fractures (35.48%). Road traffic accidents were the common cause of fractures in 83.87%, followed by fall from height in 12.90% and assault in 3.22%. According to the Medoff classification, fractures to volar rim were observed in 41.94%, to dorsal wall in 32.26% and to radial column in 25.80%. Duration between fracture incident and surgery was between 3-5 days in 77.42% and within 2 days on 22.58% of subjects (Table 1). Shukla et al., included cases with intraarticular distal radius fractures managed under external fixation (n=68) and volar locking plate (n=42) with mean age of 38.95 years and 39.33 years respectively [10].

The duration of fracture union was up to 8 weeks in 54.84%, up to 10 weeks in 32.26%, up to 12 weeks in 9.68% and up to 14 weeks in 3.22% of the subjects (Graph 1). The outcome analysis according to Gartland and Werley score, 70.96% of subjects has score 0, 9.68% had score 2, 6.45% had score 3 and score 4 (graph 2). The assessment of functional outcome by Gartland and Werley score showed excellent (0-2) outcome in 90.32%, good (3-8) outcome in 6.45% and fair (9-20) outcome in 3.23%. None of the cases showed poor (>20) function outcome (Table 2). According to Shukla et al., the range of motion was extended in both cases of external fixation and volar plating, from 17.36 to 22.0 in the case of external fixation and 19.67 to 19.89 in the case of volar plating, at the 6-month and 1-year follow-up. External fixator and volar plating received final scores of 75.54, 80.33, and 87.36, 81.55 at 6 months and 1 year, respectively [10]. In a study by Patel Shivam et al., 30 patients (18 males and 12 females) of intraarticular distal radius fractures were included. At 3, 6, and 12

weeks, the grip strength was 16, 21, and 25, respectively. The Mayo score was 84.7 at three weeks, 92.7 at six weeks, 98.5 at twelve weeks, and 99.2 at the 24 weeks [11]. According to Khalil M and colleagues, there was a substantial rise in the distribution of Mayo scores (88.88, 94.44, & 98.33), range of motion (113.22, 115.27, & 121.66), and grip strength (91.0, 95.44, & 98.0) from 6 weeks to 3 months and 6 months, respectively [12].

In a study by Kundu AK et al., volar plate fixation was used to handle intraarticular distal radius fractures, and the result was evaluated using the Gartland and Werley score. In that, 70% of cases had great outcomes, 16% had good outcomes, and 14% had fair outcomes. No example demonstrated a poor functional result [13]. According to Rozental et al., volar fixed-angle plating effectively restored the anatomic alignment of the distal radius in patients who had unstable distal radius fractures, with an average follow-up of 17 months [14]. By the end of six months, subjects with distal radius fractures had acceptable grip strength and wrist motion, according to Anakwe R et al. [15]. Similar to this, the majority of cases in the current study achieved grip strength by the end of the sixth month and finished by the end of the year. External fixation provides a better functional outcome than volar locked plating, according to a study by Shukla R et al. [10], and cases younger than 50 had a better functional outcome at one year's follow-up. According to research by Patel Shivam et al., LCPs allowed for early wrist mobilisation, early functional mobility, early revocation of daily activities, and improved the patient's quality of life [11].

The outcomes of column-specific fixation of the distal radius can be good in complex intraarticular fractures, according to a study by Gavaskar AS et al. [16]. Dorsal LFS plates showed significantly less displacement and greater stiffness in axial loading than VLPs for dorsal rim and

radial styloid fractures of the distal radius, according to Martin et al. [17], who compared volar locking plates (VLP) and locking fragment-specific (LFS) dorsal and radial styloid plates for the fixation of the distal radius fractures. Volar plating, according to Chavhan AN et al., is a successful therapeutic option for preventing wrist joint stiffness and loss of reduction in distal radius fractures [18].

Few studies have shown that volar plating provides a number of benefits over dorsal plating when treating unstable fractures of the distal radius.

The dorsal metaphyseal pieces' vascular supply is preserved, and extensor tendon issues are not present [19]. The present study results showed similar findings that of above studies where fragment specific fracture fixation was an effective in the management of intraarticular distal radius fractures. The present study has limitations in terms of low sample size with fragment specific fracture fixation.

Further large-scale studies are required to assess the effect of different management options for distal radius fractures.

Conclusion

In conclusion, fragment specific fracture fixation was an efficient treatment modality for comminuted intraarticular distal radius fractures in terms of superior rate of fracture union, early mobilisation, excellent grip strength and range of motion, and better functional outcome.

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