

A Prospective Study of Unstable Distal End of Radius Fracture Treated with Volar Plating

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Abstract

Distal radius fracture constitute about 10% of total skeletal trauma involving both elderly and young patients and can be both extrarticular and intrarticular and has been treated with various modalities. Conservative mode of treatment has been in practice since time immemorial. However with enhanced anatomical learning and advent of increased operative procedures and implants, distal end of radius involving articular surface have increasingly being operated (atin). There are many shortcomings such as prolonged immobilisation, malunion, pin tract infection, which may result in fixed range of movements therefore this study was done to different types of wrist fracture and their management with open reduction and internal fixation with volar plating and its relative complication. OA classification has been considered in this study and post operative progress was determined with help of modified Gartland and Werley's wrist grading system. (shushrut)

Keywords: Distal radius fracture; Volar plating.

Introduction

Distal radius fractures are the most common fractures of the upper extremity in adults.

The fractures of the lower end of radius crush the mechanical foundation of man's most elegant tool the hand. No other fracture has a greater potential to devastate hand function. A thorough understanding of the pathophysiology and

treatment of distal radius is important as high energy trauma to distal radius in adults is becoming more common and long term functional results are unclear, these common injuries must be evaluated thoroughly and treated adequately. The cause of injury are fall on outstretched hand, work related accidents, car accidents, and sports injuries.

For comminuted intra-articular fractures most authors combine fixation with kirschner wires,

cancellous bone graft and external fixation after closed or open reduction and have report good to excellent results The long period of immobilisation and prolonged rehabilitation, however can be a major problem in this type of management¹. In the early 1950s, James Ellis from England started using a specially designed T-plate to buttress the small marginal fragment in volar Barton's fractures. In 1970s, the AO group designed plates specifically for the treatment of distal radius fractures. There are two types of plates for fractures of the distal radius: (a) Conventional plates and (b) fixed angle locking compression plates.

With conventional plates and screws, stability is achieved by compression of the plate to a bone by bicortical screws but with fixed locking plates, the locking screws support subchondral bone and resist axial forces. Compression of locking compression plate to the bone is unnecessary and preserve periosteal blood supply. Fixed angle construct provide additional strength to fixation by constructing a scaffold under the distal radial articular surface. Volar fixed angle locking plates are an effective treatment for unstable extra-articular radius fractures allowing early post operative rehabilitation. Primary stability achieved with locking screw in a plate prevents secondary displacement irrespective of the bone enabling good results in osteoporotic bones and young patients.²

Hence this study was undertaken to study different types of fracture of distal radius in adults, their management with open reduction and internal fixation with volar plating and relative complications¹.

Materials and Methods

A total of 50 patients have been selected from S. Nijalingappa Medical college from the department of Orthopaedics for a period of two and half years and clinical data with relevant radiological data with informed consent has been obtained from the patients.

Inclusion criteria

1. All the patients above 18 years of age irrespective of gender.
2. Skeletally mature patients.
3. Patients with distal end of radius fracture with or without associated other trauma.
4. Unstable distal end radius coming under AO classification.

Exclusion criteria

1. Patients below 18 years of age
2. Uncooperative patients
3. Patients with severe bleeding disorder
4. Patients with compound fracture and vascular compromise.
5. Pathological fracture
6. Patient lost to follow up

Results

A total of 50 cases has been studied for a period of two and half years and the cases are tabulated with respect to age, gender and outcome of surgery with the help of Gartland and Werley scale. Out of 50, 34 were male and 16 were female with average age of 42 years and the range was 18–70 years of age. Modified Gartland and Werley scoring system had been used in the present study and had shown 86% good to fair results (Table 1).

There were no complications and patient outcome was good in majority of cases. Most of the patients had resumed their former activity of daily living with no significant limitation and no secondary operation has been done till date.

Table 1: Gender distribution

Gender (total 50)	Frequency	Percentage (%)
Male	34	68
Female	16	32
Total	50	100

Table 2: Age distribution of patients

Range	Frequency	Percentage (%)
18–20	02	04
21–30	21	42
31–40	09	18
41–50	09	18
51–60	03	06
61–70	03	06
71–80	03	06
Total	50	100

Total number patients were 50 for the present study, out of which 68% were male and 32% were female. Maximum number of cases were seen in the range of 20–50 years of age comprising of 42% and 18% in 20–30 18% and 30–40 years of age. Most common cause of injury in those patients were fall in outstretched hands followed by road traffic accidents and trivial injury to hand (Table 2).

Most common operated hands was right hand and remaining were in left hand

Table 3: Association between gender and side of operating hand of patient

Gender	Side of operating hand		Total
	Right	Left	
Male	28	06	34
Female	10	06	16
Total	38	12	50

Out of 50 patients, 38 were operated on right hand out of which 28 were in male and 10 in female and 12 in left hand which is equal in number in both males and females (Table 3).

Table 4: Number of cases in different type of fracture according to AO classification

Types of fracture	AO Classification	Percentage of cases
23A2.2	05	10
23A2.3	03	06
23B3.3	02	04

Types of fracture	AO Classification	Percentage of cases
23B1.2	01	02
23B2.1	01	02
23B2.2	04	08
23B2.3	02	04
23B3.1	02	04
23B3.2	10	20
23C1.1	01	02
23C1.2	10	20
23C1.3	02	04
23C2.2	01	02
23C3.1	02	04
23C3.2	02	04
23C3.3	02	04

Most common type of fracture according to AO classification for distal end of radius ulna was partial articular fracture of radius volar rim with simple large fragment, followed by partial articular fracture of dorsal rim of radius with sagittal fracture, and complex complete articular fracture of radius with frontal articular fracture line (Tables 4,5).

Table 5: Mean value of postoperative range of movements of hand

Range of movements	N	Maximum	Minimum	Mean	Std. deviation
Palmer Flexion	50	75	65	66.5	7.21
Dorsiflexion	50	75	50	69.83	6.09
Pronation	50	75	55	18.83	2.15
Supination	50	89	65	27.17	3.64
Radial deviation	50	20	15	70.0	6.43
Ulnar deviation	50	30	25	72.67	4.87

Table 6: Association of modified Gartland and werley scoring system for outcome of patients in different gender of patients

Outcome of patients	Male	Female	Total
Excellent	05	03	08
Fair	06	05	11
Good	14	12	26
Poor	03	02	05

The outcome of patients according to Modified Gartland and Werley scoring was mostly good to fair in majority of patients and was poor in few cases because of underlying diseases such asin uncontrolled diabetes, poor nutritional status, improper immobilization weak vascular supply, malunioand because of large displaced fracture (Tables 6).

Discussion

In treating intra articular distal radial fracture, the main aim is to achieve and maintain anatomic reduction and get satisfactory function and rehabilitation. The biomechanical results show that locking volar plates provides significantly greater resistance to fracture gap motion compared with significantly standard volar plates in a dorsally

committed distal radial fractures. Fixed angle volar plates prove stronger under cyclical loading tests and locking screws help in attaining implant stability and in addition spares the vascularity and periosteum.³

Heightened awareness of the complexity of the distal end of radius fracture has stimulated a growing interest and promoted new ideas regarding their optional management.

A thorough study of the nature of fracture, the extend of the fracture, the type of fracture and planned approach towards the fracture treatment with anticipated results, the treatment of distal end of radius fracture by using Open reduction and internal fixation with volar plating will always be fruitful.¹

In the present study we had studied 50 patients maximum number of male patients comprising of 68% of total when compared to females. This is more probably due to more number of road traffic accidents seen in males as compared to females which is only 32%.

In a study done by Shushrut et al¹ and Sohail et al² they had maximum number male patient also quoted the same reason as in the present study. In the present study patients below 18 years of age were not considered because their epiphysis don't fuse before 18 years and management differs from the adult which may not give consistent results in our study and hence was excluded from the study.

In the present study maximum number of patients were found in between 20-50 years of age comprising of total 78% mean average age being 42 years and few cases were also reported in study done by Alvin et al.⁴ on who studied on 30 patients with age range of 18-85 years of age and mean average age is 53 years.

In the present study the mean range of movement in palmer flexion is 66.5, dorsiflexion is 69.53, supination 27.17, pronation 18.83, ulnar deviation 72.8, radial deviation is 70.0 and in the study done by Sushrut et al.¹ on 30 patients his findings for range of motion after surgery was dorsiflexion 69.830, palmar flexion 66.50, radial deviation 18.830, ulnar deviation 27.170, supination 700, pronation 72.670 which is in concordance with this study.

According to study done by Ansari et al.⁵ palmar flexion attained was 77 degree and dorsiflexion mean was 82 degree and in our study flexion and extension in our study was 75 degree which is slight lower than their study.

In a study conducted by Kenny Kwan et al.⁷ meansupination and pronation were 86 and 80, and Ansari et al. had 85 degrees supination and 80 degrees pronation. Radial and ulnar deviations are 11 and 25 degrees in study done by Ansari et al.⁵ while 23 and 37 degrees respectively in Denju Osada et al.⁶ series whereas in our study radial and ulnar deviation was 20 and 30 degree respectively which is in concordance with study done by Ansari et al.⁵

Volar plating for dorsally displaced, unstable fractures of the distal radius has several advantages compared with dorsal plating. The volar approach, fracture reduction, and volar plating techniques are easier than dorsal plating. Volar plating preserves vascular supply to dorsal metaphyseal fragments and does not cause extensor tendon problems.³

Most complications of distal radial fracture treatment are the consequence of require immobilization of the wrist for between 4 and 6 weeks with either a plaster cast or an external fixator. This also applies to operative methods either by volar plating with non-locking screws, combined volar and dorsal plating AO OTA type A and B fractures with less comminution rarely need a period of immobilization though Type C also don't require immobilization fixed with latest locking low profile fragment specific plate.⁵

In this study the most common type of fracture according to AO classification was used in which most common was B3, C1 and subgroup common was B3.2, B3.3, and C1.2. Comprising of 9 to 20%. Ansari et al.⁵ had 60% and Atin et al.³ and Shushrut et al.¹ had 20% of B type of fracture in their respective study which shows B type of fracture is most common in general population, although Atin³ in their study had 60% Type C fracture which does not agree with our present study which is due to their less number of sample size 30 as compared to ours in which we had observed 50 patients. Another study Wang et al.¹¹ on 31 patients most common type of fracture in their study was A3 comprising of 48.4%. followed by B3 19%, C1 25% and C2 6% which when compared to our study they had more number A3 type of fracture whereas in our study we had seen more number of B3, C1 accounting to 20% which is in concordance with our study.

In the present study we had taken modified Gartland and Werley scale into consideration for measuring the outcome of patient and we had almost 50% of patient giving good to fair results and 20% showing excellent results and 10% showed poor result which could be due to any underlying

disease such as patient being malnourished, uncontrolled diabetes improper immobilization, malunion, and large displaced fracture.

Conclusion

1. Accurate anatomical reduction of distal end radius fracture with internal fixation with volar locking plate is promising and proven technique. Screws penetration inside joint and dorsal cortex can be avoided.
2. Volar plating has its own drawbacks but are less compared to other modality of treatments.
3. Flexor as well as extensor tendons are safeguarded by meticulous volar approach and by learning plate fixation techniques.
4. Fractures of the distal radius are not simple injuries and thus required careful evaluation of the radio carpal joints, Distal radio-ulnar joint, and carpal bones. However educated decision making based on objective data and patients profile can lead to optimal outcome of these challenging fractures.
5. Important aspect of this classification system can be summarized as followed; an intact volar buttress is the key to a stable reduction. When disrupted this buttress must be restored. The intra articular fractures in young adult is a complex injury with a considerable associated morbidity and therefore it needs to be managed appropriately.

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