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Comparison Of Radiological And Functional Outcomes Of Volar And Dorsal Plating For The Management Of Dorsally Displaced Distal Radius Fractures

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Abstract

Background- Distal radius fractures are one of the most common fractures of human skeleton accounting for one sixth of all fractures seen in emergency room. There is a high incidence of unsatisfactory results in the treatment of fractures of the lower end of the radius. Various methods for maintaining the reduction with additional fixation have been attempted like Kirschner wire, bridging and non-bridging external fixation, open reduction and internal fixation with dynamic compression plate and fixed angle/ variable angle locking plates and arthroscopic assisted reduction techniques. Open reduction and internal fixation which allow better restoration and preservation of distal radius radiological parameters is recommended for unstable distal radius fractures.

Aims and Objectives- The specific aim of this study was to compare the radiological and functional outcomes of volar and dorsal plating for the management of dorsally displaced distal radius fractures.

Materials and methods-The study was conducted on patients attending orthopaedic OPD and emergency in our tertiary care hospital. The fracture pattern will be classified according to AO/OTA and Frykman classification system. This is a analytic prospective comparative study with sample Size of 30. Taking the p value at 0.05 and desired percentage confidence of 80% which gives 'z' value of 1.28, we expect margin of error (ME) in our study to be 5%.

Results- After operation all patient has achieved acceptable reduction in both groups. As per lidstrom scoring all patient achieved good to excellent reduction in dorsal group, excellent in 7 patients and good in 9 patients. While in volar group all patient achieve good (8 patients) to excellent reduction(5 patients) except one, which had fair reduction, due to dorsal collapse, the result is not significant p - value = 0.5314 { $p > 0.05$ }

Conclusion- All patients had good to excellent functional outcome at final follow up in both groups. But volar plating result in better achievement of range of movement of wrist then dorsal plating.

Keywords: Distal radius fracture, Volar plating, Dorsal plating

Introduction

Distal radius fractures are one of the most common fractures of human skeleton accounting for one sixth of all fractures seen in emergency room.[1] Recent studies report an overall incidence of 125 per 10,000 medicare beneficiaries.[2] Additionally, a prospective, multicentre, epidemiological study estimated the incidence to be 36.8 out of 10,000 person years in women and 9.0 out of 10,000 person years in men aged more than 35 years.[3] The growth in the percentage of population more than 65 years of age in conjunction with an increased level of activity in elderly individuals can be expected to result in ever

increasing number of distal radius fractures in future.[4]

Although it was described 186 years back by Abraham Colles[5] controversies still exist regarding the best mode of treatment, immobilization and prediction of results. Thousands of articles published after, have failed to create a consensus on treatment protocol. 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.[5]

There is a high incidence of unsatisfactory results in the treatment of fractures of the lower end of the radius. By plaster cast method, deformity in about 60% of patients and unsatisfactory results in 32% of the patients are seen.[6] Recent advances in evaluation of fracture patterns and results of treatment have demonstrated the need for surgical intervention in fractures demonstrating instability with or without articular incongruity[7-9].

Distal radial fractures with dorsal angulation are common and tend to suffer secondary displacement after conservative treatment. Because the distal radius is important in kinematics of radio-carpal and radio-ulnar joints, open reduction of the articular surface, reconstruction of articular congruity and restoration of the radial length, volar angulation and radial inclination are the prerequisite for good clinical outcome.[10]

The degree of disability after distal radius fracture has been seen to correlate with the amount of residual deformity.[11] Many treatment options for obtaining acceptable alignment in these injuries have been described. Close reduction and cast immobilization used to be the mainstay of treatment of the fractures of the distal radius.[12,13] Various methods for maintaining the reduction with additional fixation have been attempted like Kirschner wire, bridging and non-bridging external fixation, open reduction and internal fixation with dynamic compression plate and fixed angle/ variable angle locking plates and arthroscopic assisted reduction techniques.[13]

Open reduction and internal fixation which allow better restoration and preservation of distal radius radiological parameters are recommended for unstable distal radius fractures.[3,10] Significant controversy exists about whether dorsal or volar plating is superior for fixation of dorsally comminuted distal radial fractures.

The dorsal approach to treating distal radius fractures has fallen into disfavour during the past few years because of reports of problems with tendon irritation, ruptures, and fracture collapse that occurred with plates that were anatomically correct but had a relatively high profile.[14,15,16] Discouraged by these results, the focus turned to the volar approach,[17,18] and the dorsal plates went out of fashion even though new plates with a lower profile were introduced to the market. Lately, new literature has confirmed that the results of dorsal plating are comparable to those of the volar approach.[19] To our minds, the big advantage of the dorsal plate fixation for dorsally displaced fractures is the direct visualization of the dorsal defects that are created by the collapse and multifragmentation present in most of these injuries, especially in the senior population.

Making a decision regarding the appropriate surgical approach for open reduction and internal fixation sometimes is based on the direction of fragment displacement and the extent of metaphyseal comminution.[20] Most surgeons select a surgical approach according to the direction of fragment displacement but regardless of the direction of fragment displacement unstable distal radius fractures can be treated with either volar or dorsal plating. Furthermore the appropriate surgical approach for distal end radius fractures with minimal dorsal or volar fragment displacement is not reported clearly in the literature. Combined approaches may be indicated for complex distal end radius fractures.[15]

In addition, although there are several studies in the literature regarding the functional outcomes of volar or dorsal plating or even of combined volar and dorsal plating, there is a paucity of studies comparing dorsal with volar plating.[17,21.22.23.24] Thus the surgical approach for open reduction and internal fixation for distal end radius fractures usually is based on the surgeon's preference and experience. The specific aim of this study was to compare the radiological and functional outcomes of volar and dorsal plating for the management of dorsally displaced distal radius fractures.

Aims And Objectives Of Study:

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To compare outcome of dorsally displaced fracture of distal end radius managed with dorsal plating vs volar plating.

Comparison to be made in terms of

1) Restoration of anatomy based on radiological assessment

2) Functional outcome.

3) Complications in each group

Materials And Methods:

Source Of Data:

Patients attending orthopaedic OPD and emergency in our tertiary care hospital. The fracture pattern will be classified according to AO/OTA and Frykman classification system.

Study Design:

Analytic prospective comparative study.

Sample Size: 30

Taking the p value at 0.05 and desired percentage confidence of 80% which gives 'z' value of 1.28, we expect margin of error (ME) in our study to be 5% .Now, in order to determine the sample size we use the following formula

Where,

n - Sample size

p - level of significance(Null Hypothesis)

z - percentage confidence

ME - margin of error

Inclusion Criteria:

The following fractures of the distal radius were included in the study:

1. Unstable fractures

2. Comminuted fractures

3. Fractures with or without injury to ulnar or other adjacent bones

4. Fractures with or without intra-articular extension

Exclusion Criteria:

The following fractures of the distal radius were excluded from the study:

1. Incomplete fractures

2. Undisplaced fractures

3. Fractures with previous or existing infection in the involved forearm

4. Open fractures after 12 hours

5. Patients who refused consent for treatment

Follow Up:

1st postoperative day, 6 weeks, 3 months, 6 months.

Surgical Techniques:

Patient was taken up for orthopaedic surgery after reviewing the investigations and obtaining pre-anaesthetic check-up and clearance.

The procedure was performed under general or regional anaesthesia. Preoperative prophylactic intravenous antibiotics were administered as per hospital protocol. Use of tourniquet and bipolar diathermy for homeostasis was a standard practice. Either of the following 2 surgical approaches was used.

1) For volar plating: The Henry and Trans-FCR Approach used

2) For dorsal plating: Trans-EPL Approach used

Results:

The present study enrolled 30 patients with dorsally displaced fracture distal end radius, (AO type A and C). These patients were divided into two groups, one group managed with volar plating and other with dorsal plating and selection of patients is random. One surgeon performed the procedures on all patients, and decision for selecting patient whether for volar or dorsal plating was based on the surgeon's preference.

The following observations were noted during the study period.

Gartland and Werley Score

Duration	Dorsal ($\mu \pm \delta$)	Volar ($\mu \pm \delta$)	t_{cal}	d.f	p-value

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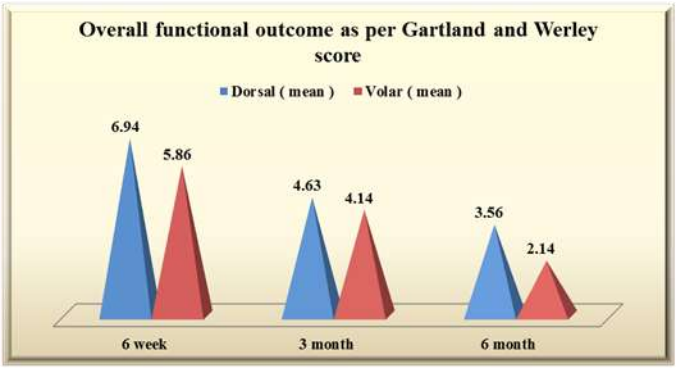
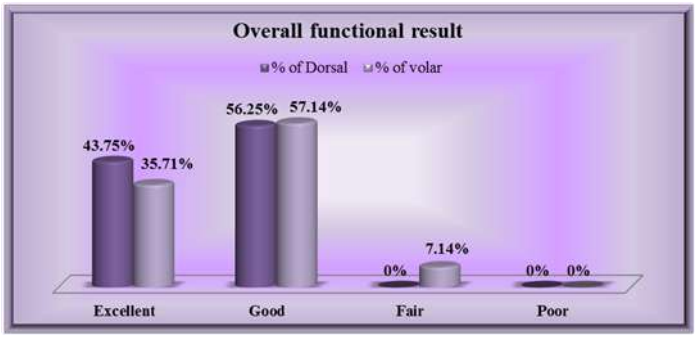
6 week	6.94 ± 3.49	5.86 ± 3.16	0.883	28	0.3846
3 month	4.63 ± 1.5	4.14 ± 2.88	-0.595	28	0.5563
6 month	3.56 ± 1.59	2.14 ± 1.83	-2.275	28	0.0308 *



Overall Functional outcome result

Score	Dorsal		Volar	
	No. of patients	Percentage	No. of patients	Percentage
Excellent	5	31.25%	5	35.71%
Good	11	68.75%	9	64.29%
Fair	0	0%	0	0%
Poor	0	0%	0	0%



Hence , there were Statistically not significant difference among the patients according to their overall functional out come result , with p - value = 0.1491 { p > 0.05 }

Overall functional outcome at final follow up in both groups result in, good to excellent result as per gartland and werley score. In dorsal plating group 11 patients had good result while 5 had excellent while in volar plating group 9 patients had good result and excellent in 5 patients. However the result is not statistically significant. with p - value = 0.1491 { p > 0.05).

Lidstrom Scoring

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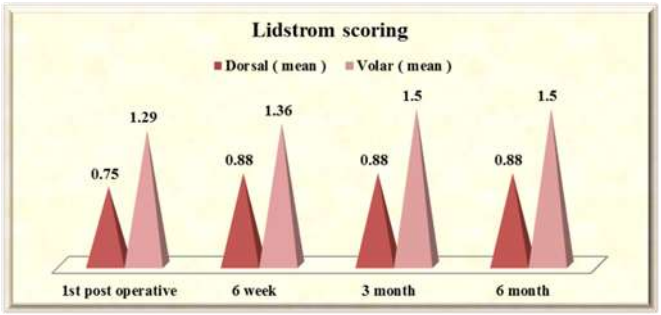
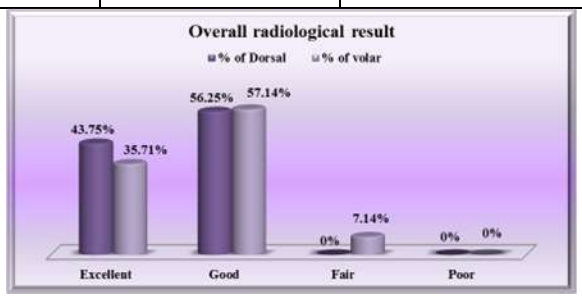
Duration	Dorsal (μ ± δ)	Volar (μ ± δ)	t_{cal}	d.f	p-value
1st post operative	0.75 ± 0.93	1.29 ± 1.20	1.387	28	0.1764
6 week	0.88 ± 0.96	1.36 ± 1.28	1.171	28	0.2514
3 month	0.88 ± 0.96	1.5 ± 1.40	1.430	28	0.1638
6 month	0.88 ± 0.96	1.5 ± 1.40	1.430	28	0.1638



radiological parameters were finally assessed as per lidstrom scoring systen and found mean score were less(better) in dorsal plating group then volar group at all follow up visit. But result wrer not statistically significant. { p > 0.05 }

Table no. :- 21 radiological outcome

Score	Dorsal		Volar	
	No. of patients	Percentage	No. of patients	Percentage
Excellent	7	43.75%	5	35.71%
Good	9	56.25%	8	57.14%
Fair	0	0%	1	7.14%
Poor	0	0%	0	0%



Hence , there were Statistically not significant difference among the patients according to their overall radiological outcome result , with p - value = 0.5314 { p > 0.05 }

After operation all patient has achieved acceptable reduction in both groups. As per lidstrom scoring all patient achieved good to excellent reduction in dorsal group, excellent in 7 patients and good in 9 patients. While in volar group all patient achieve good(8 paients) to excellent reduction(5 patients) except one, which had fair reduction, due to dorsal collapse. the result is not significant p - value = 0.5314 { p > 0.05 }.

Discussion:

1)Mean age of all patients was 46.8 years, while in Dorsal Group mean age 44.44 ± 14.73 years and in

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Volar Group Mean age 49.5 ± 10.36 years and maximum no of patients were in age group of 41-50.

2)There were 18 male and 12 were female.

3)Most common mechanism of injury was road traffic accident in 18 patients(60%) while 12(40%) had injury following fall.

4) Most common side involved was right hand 19 patients while 11 had left side fracture. Out of these 21 were in dominant hand.

5)As most common mode injury was RTA similarly most common type of fracture was type C, as per AO classification (18 patients,60%) while as per frykman classification 50% patients had type VI-VIII fractures.These denotes more complex nature of fracture pattern.

6) Also 50% patients had associated injuries like head injury, polytrauma, fracture clavicle, trochanter and neck of femur.

All patients were managed with open reduction and buttress plate in both group. and evaluation was done at 6 weeks, 3 months and 6 months post operatively. For radiological evaluation 1st post operative day measurements were also recorded.

7)In Volar plating group, at final follow up mean dorsiflexion was 63.21 ± 6.08, mean palmar flexion was 58.86 ± 6.46, mean pronation was 82.07 ± 5.81 and mean supination was82.07 ± 5.17 while in dorsal plating group mean dorsiflexion was 58.38 ± 5.69, mean palmar flexion was 57.75 ± 7.64, mean pronation was 77.5 ± 3.65. and mean supination was 78.44 ± 4.37. volar plating has better range of wrist movement in all directions with significant difference in dorsiflexion , pronation and supination movement.

8) As per Gartland and werley score , functional outcome in both groups increases post operatively with continued physiotherapy and rehabilitation. in volar plating 5 patient had excellent functional outcome(35.71%) and 9 patients had good result(64.29%). While in dorsal group 5 patient had excellent functional outcome(31.%) and 9 patients had good result(69%). The difference were non significant .

9)Radiological determinants were, volar angle, radial length and radial inclination. The mean volar tilt, radial length, radial inclination at final evaluation in volar plating group, 5.57±7.06, 9.50±1.60, 21.07 ±1.32. while, in dorsal plating group as 6.06 ±5.14,9.69 ±1.25,21.19±1.16. Results shows, marginal better maintenance of radiological parameters with dorsal plating then volar plating but the result are statistically non-significant, { $p > 0.05$ },between two groups .

The lindstrom score at final follow up in dorsal group is less(better) then the volar group(dorsal: volar;:0.625:1).But the difference is not statistically significant. $p=0.1638$,{ $p > 0.05$ }

10)Also as per lindstrom scoring all patient achieved good to excellent reduction in dorsal group, excellent in 7 patients and good in 9 patients. While in volar group all patient achieve good(8 paients) to excellent reduction(5 patients) except one, which had fair reduction, due to dorsal collapse. The result between two group is significant p - value = 0.5314 { $p > 0.05$ }.

11)Both volar plating and dorsal plating resulted in some complications, which were evaluated as per Mckay et al. The rate of Complications between two groups have no significant difference, p value=1.00, P>0.05. but the type of frequent complications in two type of plating is different. Incidence of neurological complication was more seen with volar plating, while dorsal plating associated with tendon irritation and hardware problems. Other complications faced were suture site infection, RSD.

Conclusions:

Distal end radius is very common fracture and a large majority were treated non operatively. But now a days in order to obtain better anatomic restoration and better functional outcome, Surgeons are favouring for open reduction and internal fixation with buttress plate.

Dorsal displacement of fracture fragment is most common deformity seen after fracture and can be managed by either dorsal approach or volar approach.

After treating 16 patients with dorsal plating and 14 patients with palmar plating in distal end radius we came to conclusion that

1) Both approach resulted in union of fracture in all patients.

2) All patients had good to excellent functional outcome at final follow up in both groups. But volar

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plating result in better achievement of range of movement of wrist then dorsal plating.

3)Anatomical restoration of distal end radius as seen on x rays was better in group with dorsal plating then volar plating especially better maintenance of dorso-palmar angle. but the difference were not statistically significant.

4) Complications were seen both groups and there is no statistically significant difference between them. Neurological complication was seen more with volar plating, while dorsal plating associated with tendon irritation and hardware problems.

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