ORIGINAL ARTICLE

Radiological Comparison of Palmer and Dorsal Flexion Cast Immobilization Technique of Extraarticular Distal Radial Fractures

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ABSTRACT

Objective: To compare the radiological outcome of palmar flexion with dorsiflexion position of immobilization of the wrist in extraarticular distal radial fractures.

Material and Methods: The study was conducted in the department of orthopedics and trauma, Hayatabad Medical Complex, Peshawar, from 1st Aprill 2010 to 1st October 2010. Both sexes in the age range of 20-60 years with closed extra articular distal radius fractures with the distal fragment displaced dorsally and presenting within 96 hours of trauma to the orthopedic department were included while patients having intra articular fractures,open fractures and poly trauma patients were excluded from the study. All the fractures were conservativelly treated by closed reduction and cast immobilization of the wrist in dorsiflexion or palmar flexion. The patients were followed for a period of 6 weeks after cast application.

Results: All the patients were in age ranged 20-60 years with mean age 35 years. Twenty seven (31%) patients were male and 59(69%) patients were female. 24 patients (28%) had fracture of the dominant hand while 62 patients (72%) had fracture of the non-dominant hand. 43 (50%) patients had dorsiflexion while 43(50%) patients had palmar flexion postion of wrist mobilization. At the final follow up, 39 patients (90.7%) of DF group had excellent to good results as compared to 35 patients (81.4%) in the PF group (p value = .00).

Conclusion: The radiological results are better in fracture lower end of radius if the wrists after reduction are immobilized in dorsiflexion as compared to the conventional palmer flexion immobilization.

Key Words: Radial inclination, dorsal tilt, radial height, cast immobilization, dorsiflexion, extra-articular fracture of lower end radius, palmar flexion .

INTRODUCTION

Distal radial fractures are among the most common fractures of the upper extremity and represent approximately 1/6th of all fractures treated in emergency department [1,2]. It is more common in female especially in post menopausal age due to osteoporosis[1, 3]. In younger patients it results from high energy trauma like sports injury and in elderly patients it is usually due to simple fall from standing height[1,3]. Its incidence is said to be 36.8/10000 person-year in women and 9.0/10000 person-year in men over the age of 35 years[4].

The management protocol of distal radial fracture is quite diverse, ranging from a plaster cast to advanced surgery. Conservative treatment usually gives satisfactory results[5].

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The basic principles of treating distal radial fractures are to reduce the fracture by restoring the various radiographic parameters (radial inclination, palmar tilt and radial shortening) within the acceptable range and to maintain the reduction in order to prevent redisplacement[6,7]. If anatomy is not properly restored, function of the hand may remain poor even after healing. Although it is easy to reduce distal radius fracture but maintaining that reduction is not always easy[7]. After reduction the wrist is immobilized either in palmar flexion or dorsiflexion but there is controversy about the best position for immobilization[8]. Conventionally these fractures are immobilized in palmar flexion and ulnar deviation[8]. But this conventional position has higher chances of redisplacement and inhibits hand function[6,8]. Whereas immobilization of the wrist in dorsiflexion would appear to provide better maintenance of reduction and it is also the best functional position for the hand[6].

In terms of treatment, several options exist. Non-operative management consists of closed

reduction and plaster cast immobilization. Conventionally these fractures are immobilized in palmar flexion and ulnar deviation but no clear consensus exists as to the best position for immobilizing the wrist in a cast in extraarticular fracture of lower end radius[7]

There are few studies in the literature based on radiological analysis of such fractures that have debated the role of cast immobilization in influencing the final radiological outcome.

The rationale of this study is to evaluate the radiological alignment of distal radius extra articular fractures treated with cast immobilization in palmar and dorsiflexion.

MATERIAL AND METHOD

This study was conducted in the Department of Orthopedics and Trauma, Post Graduate Medical Institute, Hayatabad Medical Complex, Peshawar From 1st April 2010 to 1st October 2010. Both sexes in the age range of 20-60 years with Closed extra articular distal radius fractures with the distal fragment displaced dorsally and Presenting within 4days of trauma to the orthopedic department were included while Patients having Intra articular fractures,Open fractures and Poly trauma patients were excluded from the study. Anteroposterior and lateral radiographs were taken of both the injured and the uninjured wrists. Patients were explained about the treatment and additional radiograph of normal side for comparison. Informed written consent was taken. The fracture was manipulated by longitudinal traction, ulnar deviation and palmar flexion at fracture site under intravenous sedation or haematoma block. Once the fracture was reduced, the patients were allocated dorsal or palmar flexed attitude of the wrist alternatively and a below elbow POP cast was applied for 6 weeks. The 1st patient was selected randomly by lottery method for the procedure and was taking alternate patient for the two procedures, so that to exclude any selection bias. As patients recover from sedation, they were discharged home. The patients were counseled about possible complications, and hand physiotherapy. Clear instructions were given regarding proper follow up. Their data was collected with the help of a Proforma which is constructed using the post reduction acceptability Criteria. The variables (dorsal tilt, radial shortening and loss of radial inclination), were measured pre- reduction, immediately post-reduction, two weeks and finally at six weeks. The radial inclination was measured as the angle between a line joining the tip of the radial styloid and the ulnar corner of the articular surface at the distal end of the radius and a line drawn perpendicular to the long axis of the radius. Average radial inclination is around 23º. On lateral view the angle created between the articular surface of the distal radius and a line perpendicular to the long axis of the radius denoted the palmar tilt. Average palmar tilt is around 11º. Radial length was Measured from the PA radiograph, this is the distance between two perpendiculars to the long axis of the radius, one drawn at the tip of the radial styloid process and one drawn at the distal articular surface of the ulna, which should be 11 to 12 mm. the radiological results of both the groups using the acceptability criteria were calculated by adding all the points and finally graded as: excellent, good, fair and poor. Both the DF group and PF group were compared with each other on the above mentioned criteria.

Excellent	Dorsal angulation ≤ 0º Shortening < 3mm Loss of radial deviation<4º
Good	Dorsal angulation 1-10º Shortening ≥3mm to ≤4mm Loss of radial deviation5-9º
Fair	Dorsal angulation 11-15º Shortening >4mm to ≤5mm Loss of radial deviation10-12º
Poor	Dorsal angulation >15º Shortening >5mm Loss of radial deviation>12º

RESULTS

The results were evaluated for 86 patients as under:

All the patients were in age ranged 20-60 years with mean age 35 years. Twenty seven (31%) patients were male and 59(69%) patients were female. 24 patients (28%) had fracture of the dominant hand while 62 patients (72%) had fracture of the non-dominant hand. 43 (50%) patients had dorsiflexion while 43(50%) patients had palmar flexion postion of wrist mobilization. At the final follow up, 39 patients (90.7%) of DF group had excellent to good results as compared to 35 patients (81.4%) in the PF group (p value = .00).

Dorsal angulations (Dorsal Tilt)

In immediate post reduction x rays 42 patients (97.7%) were having excellent to good dorsal

angulation in each of the two groups. The correction achieved in dorsal angulation was lost during subsequent follow up more in the PF group in comparison to the DF group.

At final follow up 40 patients (93.02%) of DF group had excellent to good dorsal angulation as compared to 36 patients (83.72%) in the PF group (p value = .00) (As shown in Table no 1).

Table 1: Dorsal Angulation N=(86)

Dorsal Angulations	**Final results after 6 weeks**	
	Dorsiflexion Group	**Palmerflexion Group**
≤ 0	17	14
1º -10º	23	22
11 -15º	3	7
> 15º	0	0
Total	43	43

Radial Shortening

In immediate post reduction x rays 42 patients (97.7%) were having excellent to good radial height in each of the two groups. The correction achieved in radial height was lost during subsequent follow up more in the PF group in comparison to the DF group.

At final follow up 40 patients (93.02%) of DF group had excellent to good radial height as compared to 36 patients (83.72%) in the PF group (p value = .00) (As shown in Table no 2).

Table 2: Radial Shortening N=(86)

Loss of radial deviation	**Final results after 6 weeks**							
			Dorsiflexion Group			**Palmerflexion Group**		
< 4º			11			6		
5º -9º			27			27		
10º -12º			5			10		
>12º	20	21	0	0	0	0	0	0
Total	43	43	43	43	43	43	43	43

Loss of Radial Deviation

In immediate post reduction x rays 41 patients (95.35%) were having excellent to good radial deviation in the DF group as compared to 40 patients (93.02%) in the PF group. Successive follow up showed decrease in tilt in both groups but more in the PF group.

On subsequent follow up at 2 weeks and 6 weeks, two and one respectively lost correction in the DF group as compared to four and three in the PF group.

At final follow up 38 patients (88.4%) of DF group had excellent to good radial deviation as compared to 33 patients (76.75%) in the PF group (p value = .00) as showen in table no 3.

End result at final follow up

At the final follow up, 39 patients (90.7%) of DF group had excellent to good results as compared to 35 patients (81.4%) in the PF group (p value = .00) as shown in table no 4.

Table 3: Loss Of Radial Deviation N=(86)

Radial Shortening	**Final results after 6 weeks**	
	Dorsiflexion Group	**Palmerflexion Group**
< 3 mm	21	19
≥ 3 - ≤4 mm	19	17
>4 - ≤5 mm	3	7
> 5 mm	0	0
Total	43	43

Table 4: Final Outcome at 06 Weeks N=(86)

Grade	**DF Group**	**PF Group**
Excellent	16	13
Good	23	22
Fair	4	8
Poor	0	0

DISCUSSION

Our first finding of the study was that the incidence of distal radius fracture appeared to be both gender and age specific. Out of 86 patients, 27(31%) were male and 59(69%) were female in our study and the incidence of distal radial fracture was highest (33%) in patients' age group 41-50 years. Studies conducted at various centres abroad also found a higher incidence of the distal radial fractures in female due to post menopausal osteoporosis[8].

In our study 24 patients (28%) had fracture of the dominant hand while 62 patients (72%) had fracture of the non-dominant hand . Rajan and Jain of India in 2008, documented the ratio of involved limb being dominant to non-dominant as 1:1.46[10].

In this study we compared the radiological results of extraarticular distal radial fractures treated conservatively in two groups, one with the wrist immobilized in DF and the other in PF. Radiologiacal parameters as measured by dorsal

tilt, radial shortening and radial inclination were not seen to differ much at the first follow-up between the DF and PF wrist immobilized patients. The maintenance of the parameters in successive follow-up was found to be better in the DF group as compared to the PF group. At the final follow up, 39 patients (90.7%) of DF group had excellent to good results as compared to 35 patients (81.4%) in the PF group (p value = .00).

Similar study was conducted by Rajan, Jain and Bhargava in India from September 2004 to july 2006. They included 64 patients in the study, 34 patients were immobilized in DF while 30 patients in PF. 31 (91.7%) patients in the DF group showed excellent to good results as compared to 20 (66.6%) in the PF group (p value = 0.013). it was concluded in their study that the flexion should be at the fracture site to make use of the periosteal hinge but the wrist should be immobilized in position of slight extension[10].

Another prospective study was made by Ajay Gupta of 204 consecutive patients with displaced colles' fractures at LNJP Hospital, New Delhi from june to November 1986. Patients were subjected to closed reduction and plaster immobilization randomely allocated to one of the three groups with respect to wrist position: palmar flexion, neutral or dorsiflexion. It was concluded in their study that after manipulation of a colles' fracture, immobilization of the wrist in dorsiflexion would appear to provide better maintenance of reduction. According to Gupta, the reason for the better results in the DF immobilized wrist can be understood by under standing the biomechanics of the wrist joint and fracture reduction. In the PF group the dorsal carpal ligament is taut, but can not stabilize the fracture because of its lack of attachment to the distal carpal row. Thus the deforming forces and the potential displacement of the fracture are parallel. While in the DF immobilization the volar ligament is taut which has attachement to the distal as well as proximal carpal row and tend to pull the fracture anteriorly. The deforming forces act at an angle that tends to reduce the displacement of the fracture, thus preventing redisplacement[11].

Van der Linden and Ericson conducted a study in Sweden by applying cast in different positions of wrist and compared between complete cast and splint. He studied the anatomical and functional outcome and found that the results were surprisingly same; thereby concluding that the technique of immobilization plays a subordinate role[12].

Zuppinge in 1910 and Bohler in 1929 recommended that the position of the wrist should be changed from slight palmar flexion at initial post reduction to neutral or slight extension but maintaining ulnar deviation at 10 to 14 days post reduction[13].

Thus it is concluded that in conservatively treated extra-articular fractures of the lower end radius, flexion should be at fracture site to make use of the periosteal hinge but the wrist should be immobilized in position of slight extension for the better results, both radiological and fuctional results.

CONCLUSION

Radiological results of extra-articular fractures of lower end radius are superior if the fractures after reduction are immobilized in dorsiflexion of wrist rather than in conventional palmar flexion position.

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