

# Effects of Malunited Fractured Distal End of Radius on the Morphometric Parameters of Distal Radioulnar Joint in Old Age Group

Ajmal Mohd<sup>1</sup>, Rehman  
Fazalur<sup>2</sup>, Faruqi NA<sup>3</sup>

<sup>1</sup>Senior Resident, Department of Anatomy, J.N.M.C, Aligarh, A.M.U, U.P., India.

<sup>2</sup>Associate Professor, Department of Anatomy, J.N.M.C, Aligarh, A.M.U, U.P., India.

<sup>3</sup>Professor, Department of Anatomy, J.N.M.C, Aligarh, A.M.U, U.P., India.

**Date of Submission:** 20-10-2015

**Date of Acceptance:** 06-01-2016

**Date of Publishing:** 23-06-2016

## ABSTRACT

**Background:** Fifteen per cent of all upper limb fractures occur in distal end of the radius. Occurrence of such fracture has increased in last 50 years. Normal values of four radiographic distal radius parameters are commonly used for accurately evaluating malunions i.e., a radial length of 11 to 12 mm, a radial inclination of 22° to 23°, an ulnar variance of ±1mm and a palmar inclination of approximately 11° to 12°. Our clinical practice is based on western figure due to the absence of the local database. **Methods:** Study was carried out on seventeen elderly (>50yr) females. Invariably the patients have a unilateral radial fracture belonging to universal classification type-π. **Results:** Data of normal and malunited distal radius for each parameter were compared. In old age mean differences showed by radial length, radial inclination, ulnar variance and palmar tilt were 2.47 mm, 9.36°, 1.85 mm and 5.59° respectively. **Conclusion:** Most of our patients with radial shortening and increased dorsal tilt have pain and diminished grip strength, therefore restoration of radial length has been considered the most important determinant of functional outcome.

**Keywords:** Morphometry, Malunion, Fracture, Distal Radius, Distal Radioulnar Joint.

## INTRODUCTION

Fifteen per cent of all upper limb fractures occur in distal end of radius. Ideal treatment of such cases is normal anatomical alignment.<sup>[1]</sup> Occurrence of such fracture has increased in last 50 years.<sup>[2]</sup> It is interesting to note that most commonly involved group is that of elderly women with osteoporosis.<sup>[3]</sup> Normal values of four radiographic distal radius parameters are commonly used for accurately evaluating malunions i.e., a radial length of 11 to 12 mm, a radial inclination of 22° to 23°, an ulnar variance of ±1 mm and a palmar inclination of approximately 11° to 12°, on a neutral position postero-anterior (PA) and lateral radiographs.<sup>[3]</sup>

### Name & Address of Corresponding Author

Dr Mohd Ajmal  
Senior Resident,  
Department of Anatomy,  
JNMC, A.M.U., Aligarh, U.P., India.  
E mail: drajmal2k3@gmail.com

Any deviation from aforementioned values lead to significant alterations in the normal biomechanics of wrist with associated clinical manifestation.<sup>[4]</sup> Our clinical practice is based on western figure due to the absence of the local data base. The aim of present study is to establish the normal and malunited values of morphometric parameters of the distal radius in elderly patient of the Aligarh region of North India.

## MATERIALS AND METHODS

A prospective study carried out at JNMC Hospital, AMU, Aligarh, India from Dec. 2011 to Oct. 2013 on seventeen elderly (>50yr) female patient. Invariably the patients have a unilateral radial fracture belonging to universal classification type-II. PA radiograph of wrist on hand were obtained with shoulder in 90° abduction and elbow in 90° flexion and wrist and forearm in a neutral position. For a lateral view of the same region, the shoulder is adducted and elbow is kept in 90° flexed position with hand in the sagittal

plane.<sup>[5]</sup> The orientation of the beam and position of different part of upper limb influence bony landmark which in turn affect the accuracy of measurement.<sup>[6-10]</sup>

A comparative evaluation was made between the healed fractured distal end of radius and normal contralateral wrist. Following four parameters were used for evaluation:

**1-Radial length** (radial styloid length)- Distance between the tip of radial styloid at the level of distal point on ulnar head articular surface [Figure 2].

**2-Radial inclination** –Angle between long axis of radius and the line connecting the radial and ulnar limits of the distal articular surface of radius [Figure 2].

**3-Ulnar variance** – Distance between two parallel lines perpendicular to the central axis of radius one passing through distal articular surface of head of ulna and other through inferior margin of ulnar notch of radius [Figure 2].

**4-Palmar tilt/Dorsal tilt** –Angle between a line perpendicular to long axis of radius and line connecting the dorsal and palmar margins of the distal articular surface of the lower end of radius in the lateral view [Figure 2].

Results were analysed by using Student’s ‘t’ test.

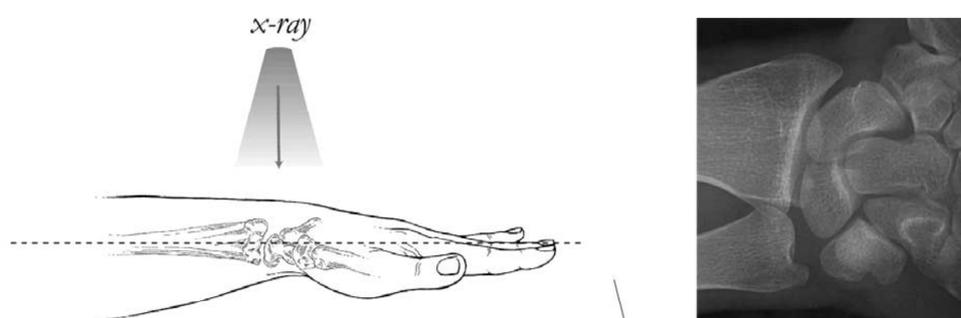


Figure 1A: Standard PA wrist position and radiograph.

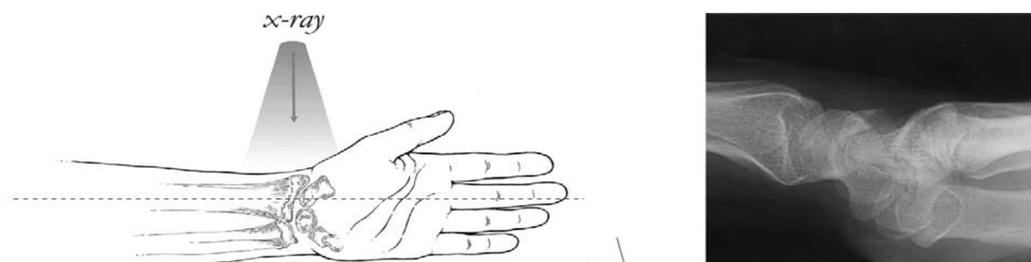


Figure 1B: Standard lateral wrist position and radiograph.

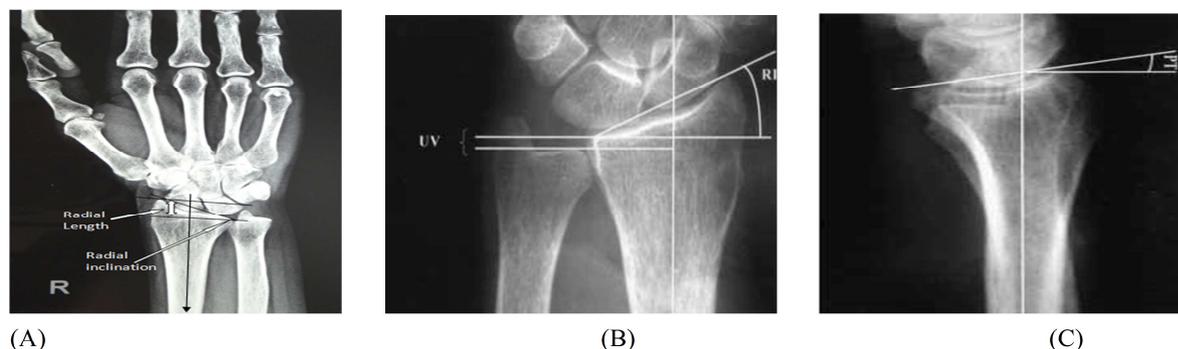


Figure 2: (A), Radial length and radial inclination (RI), (B) ulnar variance (UV), radial inclination (C) and palmar tilt (PT).

**RESULTS**

In old age group (above 50 years) Mean  $\pm$ SD of normal distal radius aforementioned parameters were  $9.97 \pm 1.32$  mm,  $21.71^\circ \pm 0.69^\circ$ ,  $0.33 \pm 0.01$  mm,  $10.06^\circ \pm 0.66^\circ$  respectively. Similarly the Mean  $\pm$ SD of malunited distal radius aforementioned parameters were  $7.63 \text{ mm} \pm 0.94$  mm,  $12.35^\circ \pm 1.06^\circ$ ,  $2.18 \text{ mm} \pm 0.26$  mm,  $15.65^\circ \pm 2.47^\circ$  respectively. Data of normal and malunited distal radius for each

parameters were compared. In old age group mean differences showed by radial length, radial inclination, ulnar variance and palmar tilt were 2.47mm, 9.36°, 1.85mm and 5.59° respectively. For all the above data p values were  $<0.0001$  So there was significant difference between the two groups at 1% level of significance so we might say that with 99% confidence, there was significant difference between mean of normal and malunited groups.

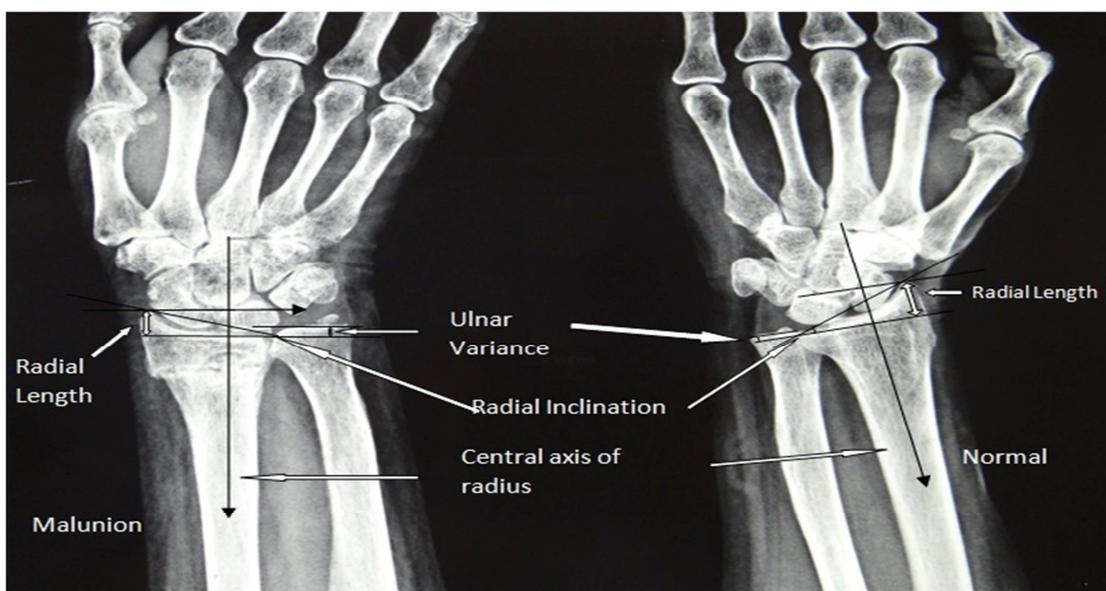


Figure 3A: Radiograph of patient hands with wrist (PA view).

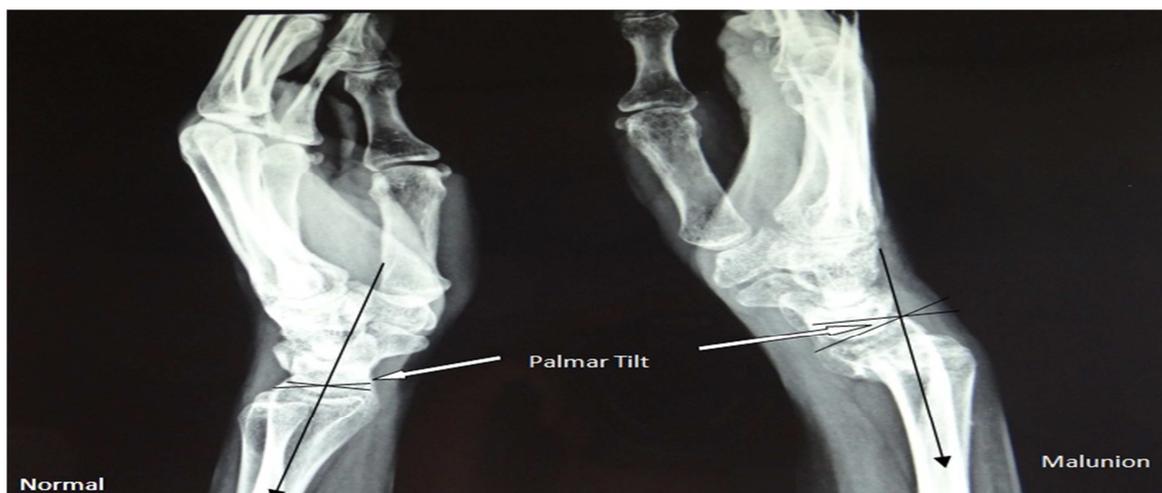


Figure 3B: Radiograph of patient hands with wrist (Lateral view).

**Table 1:** Descriptive statistical data of measured parameters (between normal and malunited DR) in old age group.

S.N	Parameter	Type of distal radius	Mean $\pm$ S.D.	Mean difference of normal and malunited distal radius	P value
	Radial Length (mm)	Normal	9.97 $\pm$ 1.32	2.47	P<0.0001
		Malunited	7.50 $\pm$ 0.64		
	Radial Inclination (degree)	Normal	21.17 $\pm$ 0.69	9.36	P<0.0001
		Malunited	12.35 $\pm$ 1.49		
	Ulnar variance (mm)	Normal	0.33 $\pm$ 0.01	1.85	P<0.0001
		Malunited	2.18 $\pm$ 0.26		
	Palmar tilt (degree)	Normal	10.06 $\pm$ 0.66	5.59	P<0.0001
		Malunited	15.65 $\pm$ 2.47		

Data presented as Mean  $\pm$  SD, 'P' value < 0.01 is taken as significant.

## DISCUSSION

In our study, all the old age fractures occurred as the result of a fall. Similar finding were recorded by Cuenca J et.al.<sup>[11]</sup> We studied on fractured malunion distal radius in elderly patients with co-morbidities and low functional demands have shown poor correlation between radiographic and functional outcome.<sup>[12-14]</sup>

A combination of radial shortening over 5 mm, radial angle of less than 15° and dorsal tilt of over 15° are associated with poor results.<sup>[15]</sup> Differing views have been expressed on the radiologic and clinical outcomes of distal radius fractures in the literature. In patients of more than 65 years old, a maximum of 30° of dorsal angulation and 5 mm of radial shortening could be accepted.<sup>[16]</sup> A dorsal angle of more than 20° and a radial inclination of less than 15° were associated with more complaints and patient's dissatisfaction.<sup>[17]</sup>

**Radial length shortening:** Generally, up to 3 mm of radial shortening is considered as 'acceptable' although up to 5 mm of radial shortening has been accepted in older patients. The results of the present study show that permanent radial shortening is strongly associated with persistent wrist pain.

**Loss of radial angle (inclination):** The angle of radial inclination is commonly used to assess the adequacy of the reduction of fractures of distal end of radius. Rubinovich and Rennie concluded that a radial angle of less than 10° results in reduced grip strength.<sup>[18]</sup> While Altissimi et al. on the other hand reported 100% unsatisfactory results when the radial angle was less

than 5°.<sup>[19]</sup>

**Ulnar variance:** In all our patients with malunited distal radius there is positive ulnar variance, as a result of which the consequence of a positive ulnar variance is the ulnar impaction or ulnar abutment syndrome with resulting limitation of rotation.

**Palmar tilt:** In our patients increased volar angulation or palmar tilt in malunited fracture was due to union of fracture in position, that required to maintain the reduction in palmar flexion and ulnar deviation at the time of close reduction and plaster application. No literature is available to correlate the cause of increased palmar tilt. In our study, impact of palmar tilt is not clear.

Elderly patients recovered more slowly than young patients and patients over 60 years of age recovered slower in both mobility and strength.<sup>[20]</sup>

## CONCLUSION

Most of our patients with radial shortening and increased dorsal tilt have pain and diminished grip strength therefore restoration of radial length has been considered the most important determinant of functional outcome.

## REFERENCES

1. Hove LM, Fjeldsgaard K, Skjeie R, Solheim E. Anatomical and functional results five years after remanipulated Colles' fractures. *Scand J Plast Reconstr Surg Hand Surg.* 1995; 29 : 349-355.

2. Brogren E, Etranek M, Atroshi I. Incidence and characteristics of distal radius fractures in Southern Swedish region. *BMC MusculoskeletDisord*. 2007; 8: 48-55.
3. Gartland JJJ, Werley CW. Evaluation of healed Colles' fractures. *J Bone Joint Surg Am*. 1951; 33-A(4): 895-907.
4. Adams BD. Effects of radial deformity on distal radioulnar joint mechanics. *J Hand Surg Am*. 1993; 18(3): 492-498.
5. Johnson PG, Szabo RM. Angle measurements of the distal radius a cadaver study. *Skeletal Radiol*. 1993; 22: 243-46.
6. Epner RA, Bowers WH, Guilford WB. Ulnar variance :the effect of wrist positioning and roentgen filming technique. *J Hand Surg [Am]*. 1982; 7: 298-305.
7. Friberg S, Lundstrom B. Radiographic measurements of the radio-carpal joint in normal adults. *ActaRadiolDiagn (stockh)*. 1976; 17: 249-56.
8. Friberg S, Lundstrom B. Radiographic measurements on the radio-carpal joint in distal radial fractures. *ActaRadiolDiagn (Stockh)*. 1976; 17: 869-76.
9. Palmer AK, Glisson RR, Werner FW. Ulnar variance determination *J Hand Surg [Am]*. 1982; 7: 376-379.
10. Capo JT, Accousti K, Jacob G, Tan V. The effect of rotational malalignment on x-rays of the wrist. *J Hand Surg Eur*. 2009; 34: 166-72.
11. Cuenca J, Martinez AA, Herrera A, Domingo J. The incidence of distal forearm fractures in Zaragoza (Spain). *Chir Main*. 2003; 22(4): 211-215.
12. Beumer A, Mcqueen MM. Fractures of the distal radius in low-demand elderly patients: closed reduction of no value in 53 of 60 wrists. *ActaOrthop Scand*. 2003; 74(1): 98-100.
13. Young BT, Rayan GM. Outcome following nonoperative treatment of displaced distal radius fractures in low-demand patients older than 60 years. *J Hand Surg Am*. 2000; 25(1): 19-28.
14. Anzarut A, Johnson JA, Rowe BH, Lambert RG, Blitz S, Majumdar SR. Radiologic and patient-reported functional outcomes in an elderly cohort with conservatively treated distal radius fractures. *J Hand Surg Am*. 2004; 29(6): 1121-1127.
15. Graham T. Surgical Correction of Malunited Fractures of the Distal Radius. *J Am AcadOrthop Surg*. 1997; 5(5) : 270-281.
16. Kelly AJ, Warwick D, Crichlow TPK, Bannister GC. Is manipulation of moderately displaced Colles' fracture worthwhile? A prospective randomized trial. *Injury*. 1997; 4: 283-287.
17. Jacob M, Mielke S, Keller H, Metzger U. TherapieergebnissenachprimärkonservativerVersorgungdistaler RadiusfracturenbeiPatientenim Alter von über 65 Jahren. *Handchir Mickroschir Plast Chir*. 1999 ; 31 : 241-245.
18. Rubinovich RM, Rennie WR. Colles' fracture: end results in relation to radiologic parameters. *Can J Surg*. 1983; 26: 361-363.
19. Altissimi M, Antenucci R, Fiacca C, Mancini GB. Long-term results of conservative treatment of fractures of the distal radius. *ClinOrthop*. 1986; 206: 202-210.
20. Foldhazy Z, Tornkvist H, Elmstedt E, Andersson G, Hagsten B, Ahrengart L. Longterm outcome of non-surgically treated distal radius fractures. *J Hand Surg [Am]*. 2007; 32: 1374-1384.

**Copyright:** Academia Anatomica International is an Official Publication of "Society for Health Care & Research Development". This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

**How to cite this article:** Mohd A, Rehman F, Faruqi NA. Effects of Malunited Fractured Distal End of Radius on the Morphometric Parameters of Distal Radioulnar Joint in Old Age Group. *Acad. Anat. Int*. 2016;2(1):8-12.

**Source of Support:** Nil, **Conflict of Interest:** None declared.