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Consequences of malunited fractured distal end of radius on the morphometric parameters of distal radioulner joint in middle age group

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ABSTRACT:
Background: Inorthopedics, one of the most common fracture is Distal end of radius. Younger patients may also sustain distal radius fractures, often caused by a high-energy mechanism such as a motor vehicle accident, and these patients may have additional orthopedic injuries. Therefore this study is intended to find the consequences of malunited fractured distal end of radius on the morphometric parameters of distal radioulner joint in middle age group
Material and methods: In this study normal and malunited fracture of distal end of radius, Anteroposterior and lateral view radiograph was taken.Parameters evaluated include radial styloid length, the radial inclination, the ulnar variance and palmar tilt.
Result: In middle age group (below 50 years) Mean±SD of normal distal parameters (radial length, radial inclination, ulnar variance and palmar tilt) were 10.22±1.38, 21.00±0.71, .37±0.01 and 9.47±0.51 respectively similarly the Mean ±SD of malunited distal radius parameters (radial length , radial inclination , ulnar variance and palmar tilt)were 7.50±0.64 , 11.65±0.49, 1.58±0.29 and 13.29±2.23.
Conclusion: Restoration of radial length has been observed as the primary functional outcome in most of the patients in this study.
Keywords: Radius, Malunion, Fracture,distal,restoration

Introduction:

Inorthopedics, one of the most common fracture is Distal end of radius [1]. Distal radius fractures account for up to 15% of all upper limb fractures[2] and the goal of treatment being restoration of the normal anatomical alignment[3].Younger patients may also sustain distal radius fractures, often caused by a high-energy mechanism such as a motor vehicle accident, and these patients may have additional orthopedicinjuries[4]. Four radiographic distal radius parameters with well-established normal values are commonly used to describe the anatomy of the distal radius and are essential for accurately evaluating malunions. The distal radius typically demonstrates a radial length of 11 to 12 mm, a radial inclination of 22º to 23º, an ulnar variance of ±1 mm and a palmar inclination of approximately 11º to 12º, on a neutral rotation posterior-anterior (PA) and lateral radiograph[5]. The main goal in treating distal radius fractures is the rapid restoration of normal anatomy and function, with attention given to the prevention of chronic disability.Therefore this study is intended to find the consequences of malunited fractured distal end of radius on the morphometric parameters of distal radioulner joint in middle age group

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Material and Methods:

In this prospective study, total 64 subjects were enrolled of which 30 patients were below 50 years with unilateral radial fracture and fracture belonging to Universal Classification Type-II (extra articular displaced/stable distal radial fracture). Consecutive wrist radiographs with lower end radius of patients who presented with fractured distal end of radius unilaterally at the emergency unit and OPD of hospital during the study period were evaluated. PA radiograph is with the shoulder in 90◦ of abduction, the elbow in 90° of flexion and the wrist and forearm in a neutral position (figure 1A). For the lateral view, the shoulder is adducted and the elbow is in 90° 0f flexion with the hand positioned in the same plane as the humerus(figure 1B) . The orientation of the beam and the position of the wrist, forearm and arm have been shown to influence the appearance of the bony landmarks, which in turn can affect the accuracy of the measurements.

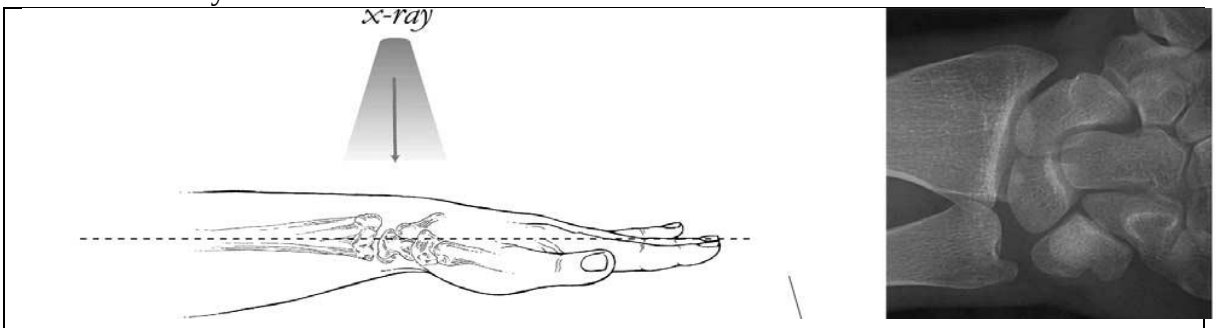

Figure 1A. Standard PA wrist position and radiograph

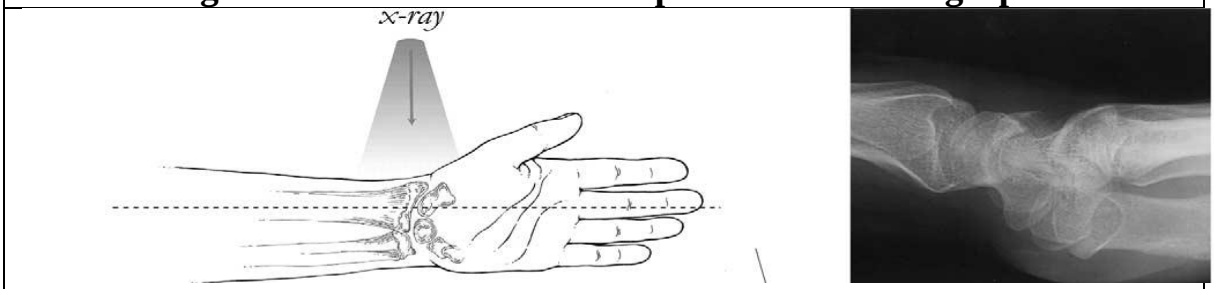

Figure 1B. Standard lateral wrist position and radiograph

Comparison was made between normal and injured wrist for each patient. In order to obtain a baseline for comparison radiographic evaluation of healed fractured distal end of radius and the normal contralateral wrist is essential. These radiographs will allow determination of the anatomic parameters and quantification of the magnitude and direction of the malunion. Films that were rotated or not centred on the wrist were excluded. Only wrists with closed epiphyseal plates were included in this study. Parameters evaluated include radial styloid length, the radial inclination, the ulnar variance and palmar tilt (Figure2&3).

1. Radial length (radial styloid length) is the distance between the tip of the radial styloid and the level of distal point on ulnar head articular surface. Radial styloid length averages 11 to 22 mm.

2. Radial inclination is the angle between a line perpendicular to the central axis of the radius and the line connecting the radial and ulnar limits of the distal articular surface of the lower end of radius (or an angle between, a line joining the tip of radial styloid and the medial edge of the distal end of radius, and a line perpendicular to the long axis of the radius) (fig.2). Radial inclination averages 22° (range 13° to 30°) [99]. Ulnar variance, radial length and radial inclination were measured on posteroanterior' radiograph and palmar tilt was measured on lateral view (figure 2A).

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3. Ulnar variance is the distance in millimeters between two parallel lines perpendicular to the central axis of the radius, one line passing through the distal articular surface of the head of ulna and the other through inferior margin of ulnar notch at distal end of radius. Changes in the length of the ulna relative to the length of the radius, designated ulnar variance, alter the distribution of compressive forces across the wrist. Normally, the radius and ulna are almost the same length. Ulnar variance is negative when the ulnararticular surface is more proximal with respect to the radial articular surface i.e. the ulna is shorter than the radius and positive if it is more distal i.e. ulna is longer than radius. This is an accurate indication of the degree of radial shortening. The consequences of negative ulnar variance lead to increased force to the radial side of the wrist and to the lunate bone, which may explain the association of negative ulnar variance and Kienböck's disease. With such variance, the TFC is thicker, and abnormalities of the TFCC are uncommon. A consequence of a long ulna, or positive ulnar variance, is the ulnar impaction or ulnar abutment syndrome, with resulting limitation of rotation. The TFC is thinner in instances of positive ulnar variance, and degenerative perforation of this structure (as well as disruption of the lunotriquetralinterosseous ligament) may be observed (Figure 2B).
4. Palmar tilt/ Dorsal tilt is the angle between a line perpendicular to the central axis of the radius and a line connecting the dorsal and palmar margins of the distal articular surface of the lower end of radius in the lateral view (figure 2C). It is designated as positive if the tilt is in a volar direction and negative if there is a dorsal tilt. Normal range is 11° of volar tilt to 4° of dorsal tilt.

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

To standardize the anatomic measurements of the distal radius posteroanterior measurement guidelines and lateral measurement guidelines were devised as follows:
(A)Posteroanterior measurement guidelines: (1) Thecenter of the radial shaft is determined at 3 cm and 5 cm above the mid-region of the proximal lunate articular surface. This line represents the central long axis of the radius. (2) A line perpendicular to the central long axis of the radius is drawn at the level of the most distal aspect of the radial articular surface. (3) A line perpendicular to the central long axis of the radius is drawn at the level of the ulnar margin of the distal radial articular surface. (4) The radial and ulnar margins of the distal radial articular surface are connected. (5) A line perpendicular to the central long axis of the radius is drawn at the level of the distal ulnar articular surface. (6) A line tangential to the most radial point on the radial metaphysis is drawn parallel to the central long axis of the radius (Figure 3 A).
(B) Lateral measurement guidelines. (1) The center of the radial shaft is determined at 3 cm and 5 cm above the mid-region of the proximal lunate articular surface. This line represents the central long axis of the radius. (2) A line perpendicular to the central long axis

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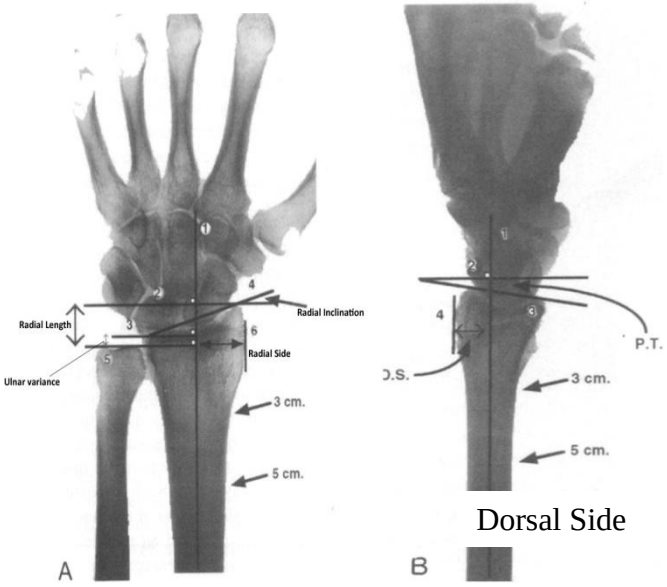
of the radius is drawn at a convenient level. (3) The dorsal and anterior margins of the distal radial articular surface are connected. (4) A line tangential to the most dorsal point on the radial metaphysis is drawn parallel to the central long axis of the radius (Figure 3 B).



Dorsal Side

Palmar Tilt

Figure 3.
(A) Reference points and lines for Anteroposterior measurement,
(B) Reference points and lines for lateral measurement.

Angle of inclination and palmar tilt were measured using a long armed goniometer, all other parameters were measured using sliding verniercallipers.Wrist radiographs taken at the time of initial presentation to fulfill the inclusion criteria, and 6 week, 3 months and 6 months post-injury were compared with radiographs of the uninjured contralateral wrist and the differences in radial shortening, radial inclination, ulnar variance and palmar tilt were measured**.**

Observation and results:

In middle age group (below 50 years) Mean±SD of normal distal parameters (radial length, radial inclination, ulnar variance and palmar tilt) were 10.22±1.38, 21.00±0.71, .37±0.01 and 9.47±0.51 respectively similarly the Mean ±SD of malunited distal radius parameters (radial length , radial inclination , ulnar variance and palmar tilt)were 7.50±0.64 , 11.65±0.49, 1.58±0.29 and 13.29±2.23. Data of each parameters were compared beteween normal and malnutritive

Descriptive statistical data of measured parameters (Between normal &malunited DR) in middle age group (below 50 Year).

S.N	Parameter	Type of distal radius	Number of patient	Mean ±S.D.	Mean Difference of Normal and malunited distal radius	P Value
1	Radial Length (mm)	Normal	30	10.22± 1.38	2.59	P<0.0001
		Malunited	30	7.63± 0.94		
2	Radial Inclination (°)	Normal	30	21.00± 0.71	9.35	P<0.0001
		Malunited	30	11.65± 0.49		
3	Ulnar variance (mm)	Normal	30	0.37± 0.01	1.21	P<0.0001
		Malunited	30	1.58± 0.29		
4	Palmar tilt (°)	Normal	30	9.47± 0.51	3.82	P<0.0001
		Malunited	30	13.29± 2.23		

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*Since P< 0.01, so there is significant difference between two group at1% level of significance that means we may say with 99% confidence, that there is significant difference between means of normal group and malunion group.

Discussion:

In this study we used true PA and lateral radiograph of forearm with wrist in the neutral position for morphological parameters of distal radioulnar joint as this position can be adjusted easily in living persons. Distal radius fractures are a common injury, particularly in the elderly population. In terms of treatment several options exist, in this study we have considered non-operative management i.e. closed reduction and plaster cast immobilization for treatment.Our first finding of the study was that the incidence of distal radius fracture appeared to be both gender and age specific. Majority of the patients were female in our study. The mode of injury of fracture distal radius was fall on outstretched hand in majority of our patients [6]. Majority of injuries in the younger patients are secondary to motor vehicle accidents and sports [7,8]. Similar findings were recorded by Cuenca J et. al in his studies [9]. It is commonly believed that fracture of the distal radius causes more disability in young adults, assumed to have higher physical demands on the wrists. Fracture malunion has been shown to associate with higher disability among young and middle-aged adults in several studies [10-12**].**Treatment guidelines have also been advanced for distal radius fractures based on the anatomic deformity. It is generally accepted that treatment of a distal radius fracture should aim at achieving the best possible anatomical reduction in the young active patient[13].

Conclusion:

The ultimate aim of treatment radiologically and functionally is restoration of the normal anatomical alignment and a pain free, mobile wrist joint without functional limitation. The quality of reduction is assessed mainly by degree of restoration of radial angle of inclination and palmar tilt. Restoration of radial length has been observed as the primary functional outcome in most of the patients in this study.

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