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Epidemiological profile of articular fractures of distal radius

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Abstract
This study was designed to look for the patients demographics, mechanism of injury and fracture characteristics.
Methods: Over all 40 cases of articular fractures of the distal radius were reviewed retrospectively. Patients who were treated for these fractures between 2015 and 2017 at a tertiary care academic institution were included in this study. Detailed radiological evaluation of wrist, fore-arm and hand x-rays were done.
Results: These patients were more likely (32%, n=13) to be between 30-40 years with a mean age of 39.86 years (range 2164 years). Seventy two percent (n=29) of the study group were males. MVC-Motor vehicle collision is the most common (72%, n=29) cause of this injury, followed by fall on outstretched hand. Frykman type VII and VIII were more frequent (52%, n=21). Complete articular fractures with varying degrees of metaphyseal comminution, (AO- types C2 and C1 =77.5%, n=31) were more common fractures. More than 80% of the fractures were displaced and three-fourth of the fractures were comminuted.
Conclusion: Articular fractures of distal radius mainly affects young individuals with male predominance. MVC is the most common cause of injury. Complete articular fractures of the distal radius with displacement and severe comminution (AO type C1 and C2) are most common. Understanding the epidemiology of this fracture can help surgeons to choose the most appropriate treatment strategies for the fracture and preventive measures towards at risk population.

Keywords: Distal radius fractures, intra-articular fractures, epidemiology, patient demographics. fracture pattern

Introduction
Fractures of the distal radius are among the most common orthopedic injuries representing approximately one-sixth of all fractures treated in emergency departments [1].
Data from the past 40 years has documented a trend towards an overall increase in the prevalence of distal radius fractures. There is a 17% increase of distal radius fractures in United States to almost doubled in Sweden [2, 3]. Information about the incidence of different types of fractures is important because fractures in terms of articular involvement and degree of fracture displacement determines the choice of treatment and may impact functional end result. The same factors would be of importance in determining the cost and resource allocation for these injuries [4].
Complications of fractures like malunion and neuropathies of median, radial and ulnar nerves are more frequent with increasing severity of the fractures. In this respect fracture displacement and fracture severity characteristics are important [5].
A wide variety of surgical options are available for the treatment of distal radius fractures. These include closed reduction and percutaneous pinning, external fixation, open reduction and internal fixation (ORIF) with volar locking plates and dorsal locking plates, intra medullary fixation as well as arthroscopic reduction and fixation. ORIF of distal radius fractures has become increasingly popular in recent years, particularly in relation to the use of volar locking plates. Combined approaches may be indicated for complex intra -articular distal radius fractures [6].
The purpose of this study is to determine the patient demographics, mechanism of injury and fracture characteristics.

Methods

Patients with acute intra-articular fractures of distal radius were analysed retrospectively treated during the period from 2015 to 2017 at a tertiary care academic institution. We analysed 40 distal radius fractures. Inclusion criteria: Acute intra-articular fractures of the distal radius with age above 21 years. We excluded extra articular fractures of distal radius. All the patients records were reviewed and date of injury, mode of injury, type of fracture – open or closed, intra-articular or extra articular were recorded. Patient demographics were also noted. Associated injuries in the ipsilateral upper limb and any other trauma in the whole body is also noted. The patients were evaluated radio logically with poster anterior and lateral radiographs of wrist and fore-arm and other x-rays. Fractures were classified according to the Frykman classification of distal radius fractures and also AO/ASIF classification system. All the fractures were treated by appropriate surgical fixation of the fractures after the routine pre-operative investigations and evaluation.

Results

Table no.1 shows patient demographics, table no.2 - shows age-wise distribution of patients. Table no.3 –Mechanism of injury. Table no.4 and 5 shows – Frykman's classification of distal radius fractures and AO- classification of distal radius fractures respectively. Table no.6 – The distribution of fracture characteristics and table no.7 – Comparison of AO fracture types with other studies.

Table 1: Patient Demographics: (n=40)

Gender	Number	%
Male	29	72.5%
Female	11	27.5%
Mean age Range Male Females	39.08 years 21 to 64 years 37.08 years 51 years	
Injured side:		
Right Left	18 22	45% 55%
Dominant side injured		
Dominant Non-dominant	20 20	50% 50%

Fracture displacement was volar in six fractures and dorsal in 24 fractures. Seventy two percent of the fractures were in men. The male to female ratio is 3:1.

Table 2: Age-wise distribution of patients: (n=40)

Age group	Numbers	Percentage
21-30 years	9	22.5%
31-40	13	32.5%
41-50	10	25%
51-60	5	12.5%
> 60 years	3	7.5%
Total	40	100%

These fractures were found more commonly in young adults (3rd and 4th decade). The mean age for males was found to be 37 years, lesser compared to females with mean age of 51 years.

Table 3: Mechanism of injury (n=40)

Mode of injury	Number	%
Falls	8	20
MVC	29	72.5
Others	3	7.5
Total	40	100

MVC – Motor vehicle collision
Others – Work related accidents, sports injuries

The commonest mode of injury is high velocity trauma - Road traffic accidents (RTA). Fall on outstretched hand is the second frequent cause for this injury.

Table 4: Frykman's classification of distal radius fractures[7]:

Frykman Type	Number	%
III	0	0
IV	11	27.5%
V	4	10%
VI	4	10%
VII	12	30%
VIII	9	22.5%

Type I and II – extra-articular fractures.

The severe forms of intra articular fractures – Frykman Type VII and VIII are more frequent > 52% (n=21).

Table 5: AO-Classification of distal Radius fractures (n=40)

AO Type		No.	Percentage
A-	Extra articular -	0	0
B-	Partial articular -	9	22.5
B1 B2 B3		2 2 5	5 5 12.5
C-	Complete articular	31	77.5%
C1 C2 C3		8 18 5	20 45 12.5

Complete articular fractures are more common 77% (n=31). C2 fractures followed by C1 subtypes are the commonest AO fracture types.

Table 6: The distribution of fracture characteristics: (n=40)

	Numbers	Percentage
Type of fracture		
Open Closed	4 36	10% 90%
Intra-articular fractures	40	100%
Displaced fractures	32	80%
Comminuted	29	72.5%
Concomitant ulnar styloid fracture or distal end ulnar fracture	19	47.5%

Most of the fractures (> 80%, n=32) were displaced. Three-fourth of the fractures were comminuted.

Associated injuries were present in 16 cases (40%). Ipsilateral concomitant upper limb injuries were present in 4 cases (10%). These included carpal bone fractures (Scaphoid fracture-1), fracture olecrenon, elbow dislocation and open fracture shaft humerus each.

Discussion

Current and past clinical data point to a rise in the incidence of distal radius fractures in the paediatric, adult and elderly populations in recent years. For the paediatric population, this increase can likely be attributed to a surge in sports related activities. The growth of the elderly population and a rise in the number of active elderly are directly responsible for the increase seen in this age group [2].

Intra-articular fractures of the lower end of the radius are one of the commonest injuries. Frykman reported an incidence of 60% and Melone reported 80% [7, 8].

Melone observed that these injuries occur more commonly in young adult males, holds true in this study also [8]. We have found a mean age of 39 years (range 2164). This is also similar in series reported by Foster and Kopta, Harish Kapoor with a mean age range of 36-40 years [9, 10]. Others reported higher mean age of 47 years (Ruch DS), 55 years (Margaret W.M.), 56 years (Abe *et al*) and 64 years (Gradl G) [11, 12, 13, 14].

Many studies reported that females were more frequently affected. Ruch DS reported 53%, Adiknson JM 53%, Toon DH 58% and Abe Y 64% females were affected [11, 15, 16, 13]. In `our study men were predominantly affected (80%, n=32). Margaret W.M. has reported similar results, 60% affected patients were men [12]. The male predominance in our study may be because majority of the patients (32/40) were young adults involved in road traffic accidents in our study. Brogen *et al* found that in the age group of 19-49 years men and women had almost identical incidence rates, however in the 19-65 years age group women had almost double the rate when compared to men owing to the onset of osteoporosis in women over 50 years old [4].

The most common mode of injury was MVC – Motor vehicle collision in our study accounting for 72% (n=29) of the cases. This is similar to the results reported by Harish Kapoor [10]. Adikson JM [15] and Ruch DS [11] in their studies reported fall on outstretched hand in 65% and 79% of cases respectively as the commonest cause for these injuries. In their studies more than 50% were women and their mean age was also higher. Fall on outstretched hand injury was due to underlying osteoporosis. In our study more than 80% were young adult men and also male drivers outnumber females, So MVC is the most common mechanism of injury in our study [15, 11].

Frykman type VII and VIII – 53% were the commonest type of intraarticular fractures. Most authors reported type VII and VIII are the commonest type of intra-articular distal radius fractures with a range from 48-80% (Conney, Harish Kapoor) [17, 10]. According to AO-classification complete articular fractures with varying degrees of metaphyseal comminution (C2-18, C1-8) were the commonest fractures in this study. These severe degree of fractures were due to high velocity injuries (72%) caused by RTA or MVC in our study. Our study is compared with other studies (Table No.7).

Table 7: Comparison of AO fracture types with other studies:

AO type of fractures	Toon DH 2017[16] n=60		Our study n=40	
	No.	%	No.	%
Type B Total	16	26.66%	9	22.5%
B1	7	11.66%	2	5%
B2	2	3.33%	2	5%
B3	7	11.66%	5	12.5%
Type C Total	44	73.33%	31	77.5%
C1	23	38.33% 23.33% 11.66%	8	20%
C2	14		18	45%
C3	7		5	12.5%

Type B- Partial Articular, Type C – Complete articular fractures.

Margaret WM also reported C2 and C3 as common type of fractures [12]. Adkinson JM *et al* has studied 434 distal radius fractures and found 11.98% (52/434) open fractures. Sixty four percent (277/434) of distal radius fractures were displaced and 48% (208/434) were comminuted. Concomitant ulna fracture was found in 52.76% (229/434) patients [15]. Similar results were observed in our study. Ten percent (4/40) of the fractures were open. The incidence of displaced fractures was 80% and comminution was present in 72%, higher rate than the above study. The fracture of ulnar styloid process was found in 48% almost same as above study. All displaced distal radius fractures should be reduced regardless of the need for future surgical intervention [18]. This recommendation is based upon potential adverse sequale of unreduced fractures includes nerve, blood vessel compression as well as tendon impingement. Additionally, appropriate reduction limits postinjury swelling, decreases pain and potentially prevents non union or mal union of the fracture fragments [19]. Assessment of fracture comminution is important that it can lead to deformity, arthritis, chronic pain and weakness and interference with tendon excursion [18]. Surgical management of these fractures is predicted almost exclusively by fracture characteristics (intra-articular involvement, comminution, displacement and concomitant ulna fracture).

Summary and conclusion: Epidemiology of distal radius fractures has changed during the last several decades. These fractures are more common in young adults and middle aged persons in our study. Road traffic accidents (MVC) are the most common cause in young adults, where as fall on outstretched hand is common in elderly people because of osteoporosis. Fractures are evenly distributed between dominant and non-dominant hand. Most of the fractures were displaced dorsally. Frykman type VII and VIII are more frequent. Complete articular fractures with varying degrees of metaphysical comminution (AO type C1 and C2) are the most common type

of intra-articular fractures. Our study shows that severely comminuted intra-articular fractures of distal radius are common and results from high velocity injuries like motor vehicle collisions.

Understanding the epidemiology of distal radius fractures helps the treating surgeon to select the most appropriate treatment options for the fracture and also target preventive measures towards at risk-populations.

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