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Original Research Article

Long term trends in the incidence of distal radius fractures in Sindhudurg, west coast of Maharashtra Retrospective analysis of 1776 distal radius fractures (1989 to 1999), hospital based study

Raghavendra Shankar Kulkarni[1]*, Rachana A Kulkarni[2], Ranjani R Kulkarni[3], Raghavendra S. Deshpande[4], SriRam R Kulkarni[5]

[1]*Dept. of Orthopaedics, SSPM Medical College & LT Hospital, Ranbambuli, Maharashtra, India*
[2]*Jawaharlal Nehru Medical College, Belgavi, Karnataka, India*
[3]*Government Polyclinic, Sindhudurg, Maharashtra, India*
[4]*Manipal Hospital, Bangalore, Karnataka, India*
[5]*Dept. of Orthopaedics, ACPM Medical College & Hospital,, Dhule, Maharashtra, India*

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ABSTRACT

Background: The over all incidences related to age, gender with secular trends and seasonal variation in the catchment area of Sindhudurg, are reported in this study.
Materials and Methods: This study included all the patients of distal radius fractures treated by the author at Government. hospital Kudal, Sindhudurg between 1989 to 1999. A retrospective analysis was done extracting the data from Government hospital OPD registers, indoor case papers, cross-checked with operation theatre, radiology files.
Results: Overall 1776 distal radius fractures conferred of which 692(39.0%) were women. The annual incidence was 1.41 for 1989 and 2.58 for 1999 per 10,000 inhabitants. There was an exponential increase in incidence of adolescents of 11 to 20 years [26(22.1%) in 1989 and 56(25.4%) in 1999] and between 51 to 70 years age group [37(31.4%) in 1989 and 82(37.2%) in 1999] in both genders. After 71 years there was gradual decline in incidence in both men and women. Low velocity injuries due to indoor and outdoor falling was the most common mechanism of injury in 1340(75.5%). Associated ulnar styloid fracture was seen in 912(51.3%). Surgical intervention was done in 522(57.2%) with ulnar styloid fracture and in 186(21.5%) with intact ulnar styloid.
Interpretation: The annual incidence of distal radius fracture is consistently increasing over a decade time, much more so in adolescents. Men and women between 51 to 70 years had a higher risk of fracture than other groups. Low energy injuries were most predominant.

1. Introduction

Distal radius fracture is the commonest fracture encountered by every orthopaedic surgeon. The data base by the same author and from the same institute determined that 12% of all emergency department visits were due to distal radius fractures.[1]

The distal radius fracture has a bimodal distribution, with peak incidence in adolescents[2] and in elderly patients[3] including low energy falls in both.[4] In contrast high energy trauma distal radius fractures are seen in young adults.[5]

Adolescents are particularly at high risk for distal radius fractures, due to rapidly growing long bones at

* *Corresponding author.*
E-mail address: medicalsuperintendent@sspmgroup.com (R. S. Kulkarni).

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puberty. There is a large dissociation between skeletal growth and mineralization during puberty. This accounted for increased fragility with additional cortical porosity of radius, metaphysis.[6] In turn contributing peak incidence of distal radius fractures seen during this period of rapid physiological development.

Distal radius fractures account up to 18% of all fractures in above 60 years of age group.Out of numerous risk contributing factors the major cause being architectural changes in bonewith osteopenia and osteoporosis.[7]

Multiple huge numbers of epidemiological studies have been done in western hemisphere for distal radius fractures. But little data is available in Indian population and surprisingly negligible documentation from Maharashtra regarding the incidence.

This hospital based retrospective study, with epidemiological data from Sindhudurg, Kokan region of Maharashtra aims to fill this paucity of knowledge for Indian population. This documentation reports about the incidence of age and sex profiles with secular trends and seasonal variations over a decade period in the catchment area of Government. Hospital, Kudal, Sindhudurg.

2. Materials and Methods

There are thirty-nine primary health centres, six rural hospitals, three sub district hospitals and one district hospital under technical and administrative control of District Civil Surgeon, Sindhudurg. The patients with distal radius fractures seek medical attention at Government hospital, Kudal as it is the only public hospital rendering full time Orthopaedic services, with largest orthopaedic outpatient clinic and indoor patients in Sindhudurg between 1989 to 1999.

For this study report a formal review and approval by appropriate institutional review board from District Civil Hospital Oros, Sindhudurg was obtained. For this observational retrospective study, identifiable human material, data from district hospital records, informed consents for its collection, & storage has been done.

The Government hospital outpatient registers and indoor case papers, operation theatre rosters and radiology documentations were studied retrospectively. All distal radius fractures treated by the author at one single centre of Government Hospital in Sindhudurg were included in this report. Patients primarily treated at other hospital, but followed in our hospital are also included in this report. To be included in this study report the distal radius fracture patient has to live in the catchment area of Sindhudurg district. Geographically, this is the southernmost district of Maharashtra state with adjoining border line district of Karnataka and Goa states. Hence the patients of Karnataka and Goa states treated at this district hospital, who were not the residents of Sindhudurg, are excluded from this study. The period of observation was from 1989 to 1999. The demographic features like age, sex, side of fracture along with Frykman classification of fracture with treatment modalities were recorded from the hospital data. As the rains are heavy in Sindhudurg, South kokan coastal region, the seasonal variation for occurrence of this fracture is also calculated. The population at risk was 832152 in 1989 and 847283 in 1999 which is the actual number of inhabitants in Sindhudurg. (Censes of India Series-28; 2001) The age and gender distribution of the catchment area of Government hospital, Kudal was available from Census population studies of Government of Maharashtra and district health office of Zillah Parishad, Sindhudurg. (Primary censes abstract 28 part XII-B; 2011).

The annual incidence, specified per 10,000 population person years was then calculated. Calculation of confidence limits for age specific incidence was performed. Comparison between categorical variables was done with x^2 test. T tests were used to compare groups with normally distributed continuous variables. Statistical significance was considered for p values < 0.05 and all tests were two-sided.

3. Results

1776 Patients with distal radius fracture were identified in this study. 692(39.0%) of them were women. Median age in men was 49 (0-94) years and 52(0-95) years for women. Right hand was involved in 1286(72.4%) patients. 796(44.8%) fractures occurred due to falls outdoors and 544(30.6%) indoor falls. The road traffic accidents and high velocity injuries accounted for 436(24.5%).

Distal radius fracture with ulnar styloid fracture (Frykman Type 2, 4, 6 and 8) occurred in 912(51.4%). There was much of gender difference with preponderance of males in occurrence of fractures with ulnar styloid, males 554 (60.7%) and females 358 (39.3%). Fractures with ulnar styloid fracture were treated by surgical intervention in 522(57.2%) and with intact ulnar styloid in 186(21.5%).

Out of total 1776 fractures 1068 (60.1%) were treated conservatively and 708 (39.9%) with surgical intervention.

The age and sex incidence of distal radius fractures are shown in (Tables 2 and 3). The incidence 26(22.1%) in 1989 and 56(25.4%) in 1999 increased with steep rise in 11 to 20 years in both sexes. Another high rise in incidence of fracture 37(31.4%) in 1989 and 82(37.2%) in 1999 was seen both men and women between 51 to 70 years of age without any tendency of levelling off even at higher ages. After the age of 71 years, in very elderly patients there was a gradual continuous, sustained decrease in the incidence of fractures in both men 128(11.8%) and women 125(18.1%).

For both the sexes, there was an age dependent decrease in the proportion of distal radius fractures, in men 12(17.9%) and women 9(17.6%) in 1989 where as in 1999 men constituted 10(9.61%) and women 19(16.4%) caused by low energy trauma. In both men and women less than

Table 1: Distal radius fractures between 1989 to 1999 forwomen

S. No.	Age in years	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1	0-10	2 (3.9%)	3 (5.8%)	2 (3.6%)	3 (5.0%)	3 (4.4%)	4 (5.6%)	3 (3.9%)	2 (2.5%)	4 (4.3%)	4 (4.0%)	3 (2.8%)
2	11-20	12 (23.5%)	14 (27.4%)	13 (23.6%)	15 (25.0%)	18 (26.4%)	19 (26.7%)	21 (27.6%)	22 (27.1%)	23 (25.2%)	25 (24.7%)	27 (26.2%)
3	21-30	4 (7.8%)	2 (3.9%)	3 (5.4%)	4 (6.6%)	3 (4.4%)	5 (7.04%)	4 (5.2%)	5 (6.1%)	6 (6.6%)	7 (6.9%)	8 (6.9%)
4	31-40	3 (5.8%)	3 (5.8%)	4 (7.2%)	3 (5.0%)	5 (7.3%)	4 (5.6%)	6 (7.8%)	5 (6.1%)	6 (6.6%)	6 (5.9%)	9 (7.7%)
5	41-50	4 (7.8%)	4 (7.8%)	5 (9.1%)	3 (5.0%)	4 (5.9%)	4 (5.6%)	5 (6.5%)	6 (7.4%)	7 (7.7%)	6 (5.9%)	8 (6.9%)
6	51-60	8 (15.6%)	9 (17.6%)	10 (18.2%)	12 (18.3%)	13 (19.1%)	12 (19.6%)	14 (18.4%)	16 (19.7%)	17 (18.7%)	18 (17.8%)	20 (17.2%)
7	61-70	9 (17.6%)	8 (15.6%)	9 (16.3%)	10 (16.6%)	11 (16.1%)	11 (18.0%)	13 (17.1%)	15 (18.5%)	17 (18.7%)	19 (18.8%)	22 (19.0%)
8	71-80	5 (9.8%)	4 (7.8%)	3 (5.4%)	5 (8.3%)	4 (5.9%)	6 (8.4%)	5 (6.5%)	4 (4.9%)	4 (4.4%)	5 (4.9%)	6 (5.1%)
9	81-90	2 (3.9%)	2 (3.9%)	3 (5.4%)	3 (5.0%)	4 (5.9%)	2 (2.8%)	3 (3.9%)	3 (3.7%)	4 (4.4%)	6 (5.9%)	7 (6.0%)
10	91-100	2 (3.9%)	2 (3.9%)	3 (5.4%)	2 (3.3%)	3 (4.4%)	4 (5.6%)	2 (2.6%)	3 (3.7%)	3 (3.3%)	5 (4.9%)	6 (5.1%)
	Total	**51**	**51**	**55**	**60**	**68**	**71**	**76**	**81**	**91**	**101**	**116**

Table 2: Distal radius fractures between 1989 to 1999 for Men

S. No	Age in years	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1	0-10	2 (3.0%)	4 (5.2%)	3 (4.0%)	4 (4.93)	4 (4.7%)	5 (5.5%)	4 (4.5%)	3 (3.4%)	3 (3.1%)	2 (2.0%)	4 (3.8%)
2	11-20	14 (20.9%)	16 (20.8%)	22 (29.0%)	24 (29.6%)	23 (26.7%)	21 (23.1%)	20 (22.7%)	24 (27.0%)	26 (27.3%)	28 (27.7%)	29 (27.9%)
3	21-30	5 (7.5%)	6 (7.8%)	4 (5.3%)	5 (6.2%)	6 (7.0%)	7 (7.7%)	6 (6.9%)	5 (4.5%)	4 (4.2%)	5 (4.9%)	5 (4.2%)
4	31-40	6 (8.9%)	5 (6.5%)	6 (7.9%)	2 (2.5%)	4 (4.6%)	6 (6.6%)	7 (8.0%)	6 (6.7%)	7 (7.4%)	6 (5.9%)	8 (7.7%)
5	41-50	8 (11.9%)	7 (9.1%)	4 (5.3%)	2 (2.5%)	5 (5.8%)	8 (8.8%)	8 (9.1%)	8 (9.0%)	9 (9.5%)	7 (6.9%)	8 (7.7%)
6	51-60	9 (13.43)	12 (15.6%)	16 (21.1%)	17 (21.00%)	14 (16.3%)	17 (18.6%)	15 (17.0%)	17 (19.1%)	18 (18.9%)	20 (19.8%)	21 (20.2%)
7	61-70	11 (16.41)	14 (18.2%)	12 (15.8%)	15 (18.5%)	13 (15.1%)	16 (17.6%)	17 (19.3%)	16 (18.0%)	17 (17.9%)	21 (20.8%)	19 (18.3%)
8	71-80	7 (10.4%)	5 (6.5%)	4 (5.3%)	6 (7.4%)	7 (8.1%)	8 (8.8%)	6 (6.9%)	3 (3.3%)	6 6.3%)	4 (4.0%)	3 (2.9%)
9	81-90	4 (6.00%)	5 (6.5%)	3 (4.0%)	4 (5.0%)	5 (5.8%)	2 (2.2%)	4 (4.5%)	4 (4.4%)	3 (3.1%)	4 (4.0%)	4 (3.8%)
10	91-100	1 (1.5%)	3 (3.9%)	2 (2.6%)	2 (2.4%)	5 (5.8%)	1 (1.1%)	1 (1.1%)	3 (3.3%)	2 (2.1%)	4 (4.0%)	3 (2.9%)
	Total	**67**	**77**	**76**	**81**	**86**	**91**	**88**	**89**	**95**	**101**	**104**

15% of all fractures above 70 years of age were considered to be of this type.

There was a considerable seasonal variation in distal radius fracture incidence, with a culmination during rainy season months, from June to September, of every year (Table 3). In fact during this rainy season, 441(40.7%) in men and 304 (43.9%) in women, fractures occurred compared to 514(47.4%) in men and 517(74%) in women during non-rainy season, winter and summer of October to May. This seasonal dependence was more prominently seen in elderly individuals of both sexes and also in adolescent girls and boys between 11 to 20 years of age.

The annual incidence was 1.41 for 1989 and 2.58 for 1999 per 10,000 inhabitants. The annual incidence for women in 1989 was 1.15 and 2.69 in 1999 per 10,000 population. Similarly, for men in 1989 it was 1.72 and 0.24 in 1999 per 10,000 population. (Tables 4 and 5)

4. Discussion

The detailed data of this study, point to a continuous rise in the incidence of distal radius fracture in adolescent, elderly populations over a decade time. For adolescent population this increase can likely be attributed to a surge in longitudinal growth velocity with puberty spurt in both boys and girls.[8] The increased incidence of fracture in elderly population may be due to continuous rise in active elderly men and women could be the direct related cause in this age group.

Females are more frequently affected from 63% to 84% which is supported by many studiesfrom the west.[9] In this study men have higher incidence rate than women, contrary to western literature. Similarly, in 11 to 20 years age group, adolescent boys were more frequently affected, when compared to girls of same age. This finding is in agreement with other studies from the west.[10]

The most common mode of injury in this study was low velocity injuries causing indoor and outdoor falls. This is similar to the reports of fall on outstretched hand in 65% and 79% as the commonest cause of fracture.[11]

Frykman type 1, 2,3,4,5 were the commonest types of fractures in this report. Many authors reported Frykman type 7, 8 are the commonest with a range of 68 to 80%. These studies mainly focussed young adults with high velocity injuries. Concomitant ulna fractures were found in half of patients in this study. Similar results were observed in previously published report of distal radius fracture by the same author from the same institute as needed for consistency with the new data.[12]

Among both men and women, we found an exponential increase in incidence between the ages of 51 to 70 years. It is well-established that post-menopausal women have an increased risk of distal radius fractures.This might be explained by reduced bone density and increased risk of osteoporosis. It is surprisingly seen in this report in men also between the same age group. Hence, it is necessary to think and give more attention for osteoporosis in physically active elderly males. Following this exponential increase incidence in both men and women, observed in this report unlike the other study populations of western hemisphere where the incidence continues to escalate with age. This difference could be due to the fact that elderly men and women in our population tend to be less physically active with age, all the while staying indoor, being nurtured by younger relatives at home, compared to western counterparts.[13]

The decreasing incidence of distal radius fracture, once past this peak of 51 to 70 years, which differs from previous studies, but similar to the study from west.[14] But recent western literature depicts**,** increase in distal radius fracture above 70 years, indicating that very old people are living added active life style, more often than before.[15]

The vast majority of epidemiological studies of distal radius fractures are performed in the west. However, it is noticed that our patient profile differed totally from the published western literature prompting this study.This study results show higher proportion of males to females. This reflects the kind of activities of our male population engaged in agriculture, office work, manual labour with risk of indoor, outdoor falls and young males predominantly with more of two-wheeler motorcycle accidents. The ratio of male to female of this entire district vide study is in direct contrast to previous studies; show a predominantly older age group female patient profile.[16] The reason in our country being males are generally the working populations, who get injured during work.[17]

The lateralizing predisposition for left side is documented in western literature in individuals whose dominant hand is right.[18] Contrary to this, present study data differed that predominantly the right side was involved in nearly more than two third of the patients. This showed a great correlation between hand dominance and fracture site. The age distribution of our study population peaking at 51 to 70 years age group is in partial agreement with the studies of Asian countries.[19]

Only two other studies looked at fracture classification according to AO system.[20] But our study was regarding Frykman classification system where in types 1, 2, 3, 4, 5 were the most common.

More than two-thirds of fractures in this report happen out doors which make the weather conditions as an important factor. A higher incidence of fractures in June to September, heavy rainy season months is reported, postulates as increased fracture risk. This is supported by high incidence of fractures during rainfall in the present study.A large proportion of patients in our population engaged in manual work in fields and house hold activities, construction work are affected with heavy rain fall.This risk of slipping in and around homes is maximum with seasonal weather, as compared to western literature of slipping on icy

Table 3: Distal radius fracture incidence with seasonal variation

	June to September Rainy Season		October to May Winter & Summer Season	
	Men	**Women**	**Men**	**Women**
1989	32 (47.8%)	21 (41.2%)	35 (52.2%)	30 (58.8%)
1990	37 (48.1%)	23 (45.1%)	40 (51.9%0)	28 (54.9%)
1991	35 (46.1%)	25 (45.5%)	41 (53.9%)	30 (54.5%)
1992	38 (46.9%)	23 (38.3%)	43 (53.1%)	37 (61.7%)
1993	39 (45.3%)	22 (32.4%)	47 (54.7%)	46 (67.6%)
1994	41 (45.1%)	24 (33.8%)	50 (54.9%)	47 (66.2%)
1995	40 (45.5%)	23 (30.3%)	48 (54.5%)	53 (69.7%)
1996	42 (47.2%)	25 (30.9%)	47 (52.8%)	56 (69.1%)
1997	42 (44.2%)	28 (30.8%)	53 (55.8%)	63 (69.2%)
1998	46 (45.5%)	42 (41.6%)	55 (54.5%)	59 (58.4%)
1999	49 (47.1%)	48 (41.4%)	55 (52.9%)	68 (58.6%)
Total	**441 (40.7%)**	**304 (43.9%)**	**514 (47.4%)**	**517 (74.7%)**

Table 4: Annual incidence trend with age wise population calculated for beginning and end of study for women

Age group	**Population**		**No of Fractures**		**Annual incidence rate per 10,000**	
	1989	**1999**	**1989**	**1999**	**1989**	**1999**
0-10	60232	59086	2	3	0.33	0.50
11-20	74385	73074	12	27	1.61	3.69
21-30	63750	63753	4	8	0.62	1.25
31-40	67121	66075	3	9	0.44	1.36
41-50	59817	58141	4	8	0.66	1.37
51-60	45433	43884	8	20	1.76	4.55
61-70	44967	43246	9	22	2.00	5.08
71-80	21326	19559	5	6	2.45	3.06
81-90	4609	4418	2	7	4.33	15.84
91-100	1128	1083	2	6	17.73	55.40
Total	**442768**	**431185**	**51**	**116**	**1.15**	**2.69**

Table 5: Annual incidence trend with age wise population calculated for beginning and end of study for men

Age group	**Population**		**No of Fractures**		**Annual incidence rate per 10,000**	
	1989	**1999**	**1989**	**1999**	**1989**	**1999**
0-10	58897	63495	2	4	0.33	0.62
11-20	72486	76766	14	29	1.93	3.77
21-30	56043	62205	5	5	0.89	0.80
31-40	57266	61351	6	8	1.04	1.30
41-50	54987	57463	8	8	1.45	1.39
51-60	38641	40688	9	21	2.32	5.16
61-70	31874	33501	11	19	3.45	5.67
71-80	15327	17489	7	3	4.56	1.71
81-90	3187	3590	4	4	12.55	11.14
91-100	676	784	1	3	14.77	38.26
Total	389384	416098	67	104	1.72	0.24

streets.[21]

The results of this study fill this insufficient knowledge expertise in epidemiology of a very common fracture. To our knowledge, there is scanty literature on this in Maharashtra, India as compared to large number of reports from west.Distal radius fractures occur in all age groups peaking at uniquely different ages in males and females. The mechanism of injury coordinates well with Frykman classification. In turn this classification correlates well with percentage of fractures treated by surgical intervention.

The data bares from the only Government hospital, serving largely practically to the whole of district, the documentations of hospital records cross-checked with more than a decade archives stand out among the various strengths of this study. However, this Government hospital during 1989 to 1999 period in this area of Sindhudurg district that treated all acute distal radius fractures and loss of patients to neighbouring hospitals from this Government

hospital has been found to be insignificant.[22]

Several international studies, suggest an increasing tendency for operative treatment.[23] Even though in this study, more than half of patients were treated conservatively, one fifth underwent surgical intervention. To the best of our knowledge we are unaware of any other extensive hospital based incidence data for distal radius fracture from Maharashtra state, India. In the absence of comparable data from other communities, in Maharashtra, it is difficult to demonstrate that Sindhudurg incidence rate reflect the situation nationally.

This epidemiological study of distal radius fracture helps the treating surgeon to select most appropriate treatment modality and also target preventive measures towards risk population. In Sindhudurg, Maharashtra state fall and fracture prevention programmes need to be developed for the elderly. Future studies are necessary to further monitor the changes and explore in deep the reasons in trend found in this study.

4.1. Interpretation

The crude distal radius fracture incidence rates in Sindhudurg have increased gradually over a decade time, more in men than women. The highest affected age group is 51 to 70 years in both men and women including adolescents, with increased secular trend from 1989 to 1999.

5. Author Contribution

Article Conception & Structuration: RSK, RRK & Ranjani R K, SRK, Literature search, analysis & manuscript drafting: RSD critical revision of manuscript content: RSK, SRK Conceived & designed protocol: RSK, SRK contributed for follow up of patients & analyzed X-rays: RSD, Ranjani RK, and integrity of data analysis. All authors revised the manuscript and contributed to the final manuscript.

6. Conflict of Interest

This research didn't receive grant from any funding agency in the public, commercial or not-for-profit sector.

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Author biography

Raghavendra Shankar Kulkarni, Medical Supdt., & Professor https://orcid.org/0000-0002-6135-2355

Rachana A Kulkarni, Assistant Professor https://orcid.org/0000-0003-1428-7746

Ranjani R Kulkarni, Medical Officer ECHS

Raghavendra S. Deshpande, Assistant Professor

SriRam R Kulkarni, MBBS https://orcid.org/0000-0002-1820-1578

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