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EFFECT OF RADIOLOGICAL PARAMETERS ON FUNCTIONAL OUTCOME IN MANAGEMENT OF INTRA-ARTICULAR FRACTURES OF DISTAL END OF RADIUS – A RETROSPECTIVE STUDY

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Abstract

Background/Purpose: Distal radius fractures are one of the most common injuries to the musculoskeletal system. Functional outcome in these fractures depend on many factors. Our main aim was to study if good radiological outcome has any effect on functional outcome.

Methods: We retrospectively studied 80 patients, of which 53 were males & 27 females. 40 cases were treated with conservative management & 40 cases with surgical management.

Results: Most of the patients were between 20-30 years (Mean 40.35 years). Most commonly the mode of injury, wrist involvement & fracture type were RTA (51.7%), Right side (53.3%) & Frykmans III (41.7%) respectively. Mean pain score & Function score (PRWE) and loss of movements were less among patients where radiological parameters were restored.

Conclusion: From this study, we conclude that restoration of radiological parameters will help in good functional outcome in treatment of intra-articular fractures of distal end of radius.

Key words: Distal radius fractures, Frykmans, intra-articular fractures, Functional outcome, Radiological outcome.

Introduction

Distal radius fractures are one of the most common injuries of the musculoskeletal system. Good long term outcome depends on many factors like patient related factors, velocity of injury, fracture pattern and treatment given. The first three factors cannot be modified by surgeon. Hence the outcome may not be good and same in all cases after treatment. Treatment should help to restore normal or near normal anatomy of wrist with good radiological outcome¹, prevent loss of reduction and functional rehabilitation of patient. Studies have been done to study relationship between anatomical reconstruction and the functional outcome.¹

Methods

We retrospectively studied 80 patients with intra-articular distal radius fracture managed with various modalities of treatment at Department of Orthopaedics, Victoria hospital and Bowring and lady Curzon hospitals, BMCRI, Bangalore from 1st October 2010 to 30th September 2012. Aims and objective of study was to find any correlation between radiological and functional outcome of distal radius fractures. Inclusion and exclusion criteria were as follows:

Inclusion criteria - Males and females, 20 to 80 years of age, with intra-articular distal radius fractures.

Exclusion criteria - Patients with open fractures, bi-lateral distal radius fractures, fractures with carpal instability and shaft of radius or ulna.

The patients who visited the hospital with intra-articular distal radius fractures, who had been managed conservatively or surgically and came for follow-up (at least six months) were taken up for study after taking consent from them for the study. Check x rays of the affected wrist in antero posterior and lateral views were taken. Radial angle, palmar tilt, residual step and radial length were analyzed. Fracture classification was done based on according to Frykmans and AO classification² from previous records available. Pain and function score were graded according to PRWE (Patient Rated Wrist Evaluation)³ (which has 50 points each for pain and function score, 1 being having least pain and least difficulty in performing function) and overall results were recorded according to Demerit point system Score^{4,5} as poor fair good and excellent. Functional grading was made depending on pain, mobility, work, grip strength, range of movements and any complications. Radiological grading was made based on varus or valgus deformity, shortening, signs of osteoarthritis and union of fracture. The

final outcome was compared with other studies.

Observation and Results

We studied retrospectively 80 Patients, with intra-articular distal radius fracture in which 40 were treated with conservative management, 10 each were managed by pinning and ligamentotaxis and 20 by plating. Most-common-age group was between 20-30 yrs which constituted 28.8% of cases. There were 53 male (71.7%) and 27 female (28.3%). RTA was the most common mode of injury in our study which accounted for 51.7% of cases followed by self-fall, fall from height and assault. Frykmans type III and AO type C3(31.25%) was the most common fracture followed by, B1(23.7%), C2(18.75%), B3(17.5%), & B2(5%) and C1(5%).

Mean pain score: There were less pain scores among the patients who retained the radial inclination ($P=0.01$), radial length ($p<0.01$), and in patients with no intra-articular step ($P=0.053$) and no malunion ($p<0.01$) (Table 1). Among the patients who had intra articular step pain scores were less with the patient who had less than 2 mm step ($P=0.01$).

Table 1: Correlation of pain Score with radiological parameters

Pain score	Radial Inclination (n=80)				Radial Length (n=80)				Intra-articular Step (n=80)				Malunion (n=80)			
	Lost		Retained		Lost		Retained		Lost		Retained		Lost		Retained	
00-10	4	12.90%	27	55.10%	3	9.38%	29	60.42%	6	21.43%	25	48.08%	0	0%	31	48.44%
11-20	11	35.48%	15	30.61%	12	37.50%	14	29.17%	9	32.14%	17	32.69%	7	43.75%	19	29.69%
21-30	5	16.13%	6	12.24%	7	21.88%	4	8.33%	5	17.86%	6	11.54%	2	12.50%	9	14.06%
31-40	7	25.80%	1	2.04%	7	21.88%	1	2.08%	5	17.86%	3	5.77%	4	25.00%	4	6.25%
41-50	3	9.68%	1	2.04%	3	9.38%	1	2.08%	3	10.71%	1	1.92%	3	18.75%	1	1.56%
	31	100%	49	100%	32	100%	48	100%	28	100%	52	100%	16	100%	64	100%

Mean function score: Was significantly ($P=0.004$) less in patients with surgical management, values being 29.2 for conservative group and 20.7% for Surgical group (Table 6a). There were less function scores among the patients who retained the radial inclination ($p<0.01$), radial length ($p<0.01$), and in patients with no intra-articular step ($P=0.003$) and no mal-union

($p<0.01$) (Table 2). Among the patients who had intra articular step function scores were less with the patient who had less than 2 mm step ($P=0.119$). Some patients had good function score in spite of radiological parameters being affected. Those were mainly patients with less physical demands and patients more than 60 years.

Table 2: Correlation of Function Score with radiological parameters

Func-tion Score	Radial Inclination (n=80)				Radial Length (n=80)				Intra-articular Step (n=80)				Malunion (n=80)			
	Lost		Retained		Lost		Retained		Present		Absent		Present		Absent	
0-10	1	3%	11	22%	1	3%	11	23%	1	4%	11	21%	0	0%	12	19%
11-20	4	13%	24	49%	5	16%	23	48%	10	36%	19	37%	2	12%	33	52%
21-30	8	26%	8	16%	8	25%	8	17%	7	25%	9	17%	3	18%	11	17%
31-40	5	16%	0	0%	5	16%	4	8%	0	0%	9	17%	5	29%	4	6%
41-50	13	42%	0	0%	13	41%	2	4%	10	36%	5	10%	7	41%	8	13%
	31	100%	49	100%	32	100%	48	100%	28	100%	52	100%	17	100%	63	100%

Loss of movements: Percentage of loss of movements was less among the patients who retained the radial inclination ($p < 0.05$), radial length ($p < 0.05$), and in patients with no intra-articular step ($P = 0.002$) and

malunion ($p < 0.05$) (table 3). Among the patients who had intra articular step Percentage of loss of movements was less with the patient who had less than 2 mm step ($P = 0.006$).

Table 3: Correlation of percentage of loss of movements with radiological parameter

% of loss of movements	Radial Inclination (n=80)				Radial Length (n=80)				Intra-articular Step (n=80)				Malunion (n=80)			
	Lost		Retained		Lost		Retained		Present		Absent		Present		Absent	
0-25	5	16.10%	34	69.30%	6	18.75%	33	68.75%	7	25%	32	61.53%	1	6.25%	38	59.38%
26-50	19	61.20%	14	28.50%	19	59.75%	14	29.16%	15	53.57%	18	34.61%	9	56.25%	24	37.50%
51-75	3	9.60%	1	2.20%	3	9.37%	1	2.08%	2	7.14%	2	3.84%	2	11.76%	2	3.17%
76-100	4	12.90%	0	0%	4	12.50%	0	0%	4	14.28%	0	0%	4	23.52%	0	0%
Total	31	100%	49	100%	32	100%	48	100%	28	100%	52	100%	16	100%	64	100%

Figure 1(a-h): X-Ray of Right wrist and Clinical pictures of patient managed with Plating for Intra-articular distal radius fracture with restoration of Radiological parameters and good range of movements.



Fig 1a



Fig 1b

Fig 1a and 1b: X-rays showing old united Intra-articular distal radius fracture fixed with volar plate with restoration of radial inclination, length and no intra-articular step in antero-posterior view (Fig 1a) and restoration of palmar tilt lateral view (Fig 1b).

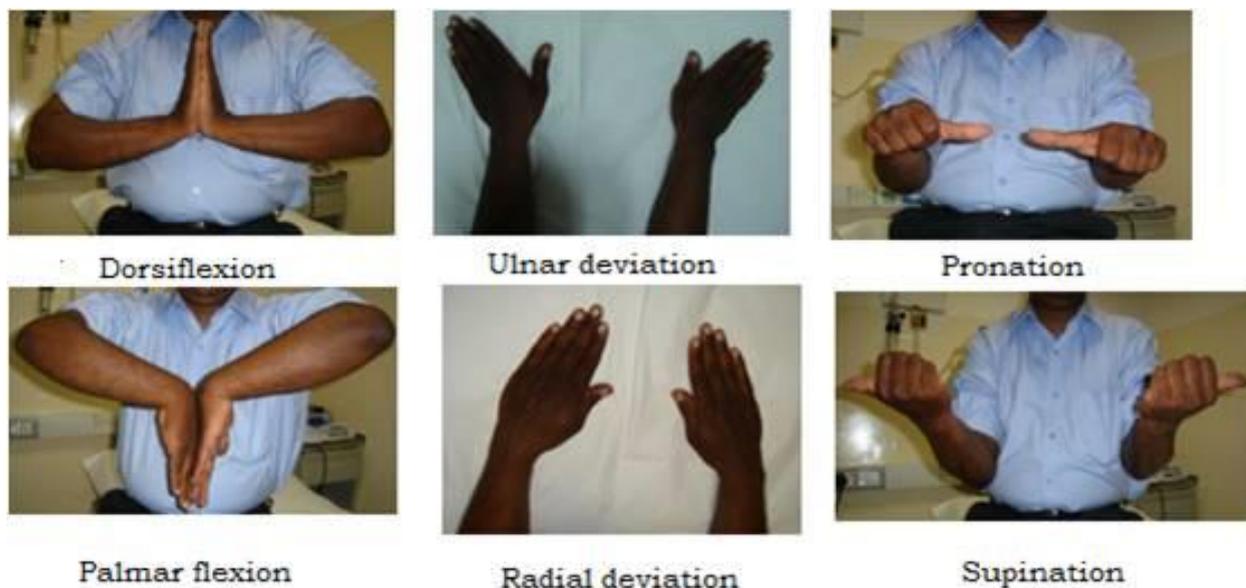


Fig 1c: Clinical pictures showing normal range of wrist movements in same patient

Figure 2(a, b, c): X-Ray and Clinical pictures of patient managed with Pinning for Intra-articular distal radius fracture with loss of radiological parameters and loss of movements.



Fig 2a and 2b: X-ray Right wrist showing old united Intra-articular distal radius fracture with loss of radial inclination, length and no intra-articular step in antero-posterior view (Fig 2a) and restoration of palmar tilt lateral view (Fig 2b).



Fig 2c: Clinical pictures of same patient showing reduced dorsi-flexion, palmar flexion, radial and ulnar deviation but normal supination and pronation.

Complications: Malunion was seen in 20% cases. Mal-union was seen in case of fractures with excess initial displacement, excess comminution. Intra-articular step was seen in 35% cases. Radial inclination was lost in 38.75% cases. Radial length was lost in 40% cases.

Results: Excellent results were seen in 37.5% of cases, Good in 23.75%, fair in 27.5% and poor in 5% of cases. Affection of radiological parameters (radial inclination, radial length, Intra articular step and malunion) had effect on final outcome.

Excellent results were less comminuted fracture patterns but was not statistically significant. Excellent results (73% of excellent results were among less than 40 years age group) were more in younger age group ($p < 0.01$). Good and excellent results were more among patient without any radiological parameters affected. Better outcome was seen in patients whose number of radiological parameters affected were less in number ($p < 0.01$) (Table 4c). Excellent results were more in patients with less than 2 mm step ($P = 0.018$).

Table 4: Correlation of results with number of radiological parameters affected

Number of radiological parameters affected	Poor Result (n=9)		Fair Result (n=22)		Good Result (n=19)		Excellent Result (n=30)	
Zero (37)	-	-	-	-	7	37%	24	80%
One (11)	0	0%	3	14%	4	21%	4	13%
Two (10)	0	0%	3	14%	6	32%	1	3%
Three (11)	3	33%	6	27%	2	11%	1	3%
Four (11)	6	67%	4	18%	0	0%	0	0%
Total	9	100%	22	100%	19	100%	30	100%

Discussion

Distal radius fractures are one of the most common fractures treated in casualty¹. There is trimodal distribution 5 to 14, males less than 50, and females more than of 40 years. Decreased bone mineral

density, female gender, ethnicity, heredity, and early menopause have all been shown to be risk factors for this injury. Good long term outcome depends on many factors like patient related factors, velocity of injury, fracture pattern and treatment given. The first three factors cannot be modified by

surgeon. Hence the outcome may not be good and same in all cases after treatment. Treatment should help to restore normal or near normal anatomy of wrist with good radiological outcome¹, prevent loss of reduction and functional rehabilitation of patient. Studies have been done to study relationship between anatomical reconstruction and the functional outcome.^{1,6}

Functional and radiological outcome, after management in our study depended on age, type of fracture, management method and complications. Good outcome was seen among young individuals. The time of union was less in younger patients compared to older ones. Among conservatively managed patients outcome depended on fracture pattern. Good outcome was present in minimally displaced and less comminuted fractures in patients managed conservatively, whereas the fracture pattern did not affect the outcome much in surgical management. Some studies⁶ have shown that fracture pattern did not affect the outcome where as some studies have shown that poor outcome was seen in high energy trauma^{7,8}, with articular⁸ and soft tissue damage⁸, comminuted⁹ or unstable fracture pattern¹⁰ and axial compression (>2mm)¹¹ which cause degenerative changes¹².

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The radiological parameters which were considered in our study were loss of radial inclination and radial length, presence of intra-articular step and mal-union. The range of movements was directly related to the number of these parameters affected, in most of our patients. Loss of palmar tilt^{11,13} and radial length^{13,14,15}, presence of intra-articular step^{10,16,17} and degenerative changes in wrist^{12,15} and hence affection of radiological parameters have been reported to affect the functional outcome in many studies^{6,7,11}.

Some studies disagree with radiological parameters affecting functional outcome^{18,19,20,21,22}. Most of these studies were for older individuals with less functional expectation²¹. Even in our study we had good patient satisfaction in older individuals with poor radiological outcome as compared to young and active individuals.

Conclusion

The radiological parameters have an effect on functional outcome in our study at six month follow up especially in young active individuals. The more the number of radiological parameters affected poorer is the functional outcome.

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