

## Original Research Article

# Clinico-radiological outcome of distal radius fractures managed with closed reduction during COVID-19 pandemic

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### ABSTRACT

**Background:** distal radius fractures are the most common fractures of the upper extremity and account for more than 1/6 of all fractures treated in emergency department the elderly population account for 18% of all distal end radius fractures and have a significant impact on health of young adults. An optimal outcome of closed treatment of a Colle's fracture may depend on accurate reduction and adequate immobilization.

**Methods:** A total 45 patients with displaced Colle's-type fractures were subjected to treatment with closed reduction with manual manipulation. The fractures were assessed radiographically by measurement of the radial angle, dorsal tilt, and radial shortening before reduction, immediately after reduction, and at one and five weeks after reduction. Data was recorded and assessed.

**Results:** Anatomical outcome as per Sarmiento criteria. 66.67% patients had excellent result with no residual Deformity, 17.77% patients had good result with mild residual deformity, 8.88% of them show fair results with moderate residual deformity and 6.66 % had poor outcome.

**Conclusions:** Coronavirus disease 2019 (COVID-19) pandemic was burden on all including patients and medical fraternity, and considering looming threat of third wave and delta variant of virus, our study material can be used to make guidelines for optimal utilisation of orthopaedic fraternity, who have to work in COVID wards as well as trauma wards, our study shows that proper technique of fracture reduction with patient counselling and early physiotherapy can yield good results in fracture which can be managed conservatively.

**Keywords:** Distal end radius fracture, Conservative management, COVID-19

### INTRODUCTION

Fracture of the distal radius is one of the first fractures described in the literature written by Abraham Colles, in 1814 Colles called into question without X rays those who described all wrist injuries as dislocations he also described the patient outcome with famous statement "despite deformity they all do well".<sup>1</sup> distal radius fractures are the most common fractures of the upper extremity and account for more than 1/6 of all fractures treated in emergency department the elderly population account for 18% of all distal end radius fractures and have a significant impact on health of young adults.<sup>1,2</sup> The distal

radius fractures are a great therapeutic challenge due to variety of anatomical patterns the complexity of intra articular disruption and associated soft tissue and bone injuries while most distal radius fractures especially dorsal displaced and dorsal angulated extra articular fractures in elderly can be adequately treated non operatively approximately, thirty percent are more complex and require surgical treatment. common mechanisms in younger individuals include fall from height motor vehicle accidents or injuries sustained during athletic participation.<sup>3</sup> In elderly individuals a disturbed structure may arise from low energy mechanisms such as simple fall from standing height and as such are considered a facility

fracture .most common mechanism of injury is fall on outstretched hand with wrist in dorsi flexion fractures of distal radius are produced when Dorsi-flexion of wrist varies between 40 and 90 degrees, the radius initially falls in tension on volar aspect with fracture propagating dorsally whereas bending movement forces induced compression stresses resulting in dorsal communication cancels impaction of the metaphysis further compromises dorsal stability additionally shearing forces influence the injury pattern often resulting in particular surface involvement.<sup>4</sup>

There are different methods of distal end radius fracture management in adults and children, but the coronavirus disease 2019 (COVID-19) pandemic altered the healthcare management in India as well as whole world in year 2020, though the virus can affect children as well as adult equally the larger brunt of disease was taken by the adults.<sup>5</sup> The COVID-19 pandemic has impeded general access to specialist care and altered daily clinical practice and admission in the routine in both emergencies as well as primary care settings most of the hospitals changed its routine to special care in crisis mode cancelling or limiting planned admissions and only emergency surgeries were taken up due to the limited availability of anaesthetics and operating team, some trauma and orthopaedic units and some emergency wards had also been converted into COVID-19 care wards, despite having suffered injury, some patients particularly the elderly and those with commodities have avoided seeking medical help at emergency or orthopaedic centre due to fear of contacting COVID-19 also for safety of medical personnel and to reduce number of non-emergency admissions some hospitals increased the indication for conservative management of fractures.<sup>5,6</sup> The guidelines of hospitals for conservative management of fractures tend to accept that in some patients the possibility of complications and deformity is to be accepted which can be corrected with a surgery later. The goal of treating injuries during the COVID-19 pandemic is rapid and safe treatment.<sup>7</sup> The objective of our study is to determine guidelines for conservative management of fractures during COVID-19 pandemic.

## **METHODS**

This study was conducted at a tertiary care hospital for treatment of fracture distal end radius. This is a retrospective study of 45 cases over a period of 15 months. This is study to gauge functional and radiological outcome in patient with fracture distal end radius treated with closed reduction and cast application during COVID-19 pandemic. A.O. classification was used to classify fractures distal end radius. In present study, Right side injury is more common and involved in 57.8% of the patient, i.e., 25 (55.6%) patients. The distribution of patients was done according to AO Classification, there were 35 (77.8%) patients who had fracture type A and 5 (11.1%) patients who had fracture type B and C. They were assessed and followed up at 1.5 months, 3 months,

and 6 months each from the date of reduction and casting (minimum range of follow up between 6 to 12 months). Data was collected using interviews and observation of clinical findings. The subjective, objective, and radiological outcomes of these patients were done using the Demerit scoring system of Gartland and Wesley and Sarmiento modification of Lindstrom scoring system

### ***Inclusion criteria***

Patients having extra articular or Intraarticular fracture of distal end of radius, who have consecutively consented for the study. Patients who are above the age of 18 years and less than 65 years. Closed type of fractures.

### ***Exclusion criteria***

Compound fractures of the wrist Gustilo Anderson more than 1. Those patients who are below 18 years and above 65 years. Fractures which require open reduction.

### ***Reduction technique***

Closed reduction with cast application was done under supraclavicular block / short general Anaesthesia as per requirement. Longitudinal traction was applied to the forearm and allow direct pressure to be applied to the distal radial fragments from dorsal to volar if dorsally displaced and volar to dorsal if volar displaced. Traction was applied along the axis of the limb to dis-impact the fracture, and the wrist was then fully deviated ulnarly and flexed to approximately 15°. The fracture was then reduced by manual pressure on the dorsoradial aspect of the distal fragment, and reduction was confirmed by portable fluoroscopy, Flexion of the wrist may assist in producing some restoration of volar tilt. After reduction achieved, below elbow plaster of Paris cast was applied in pronation, palmar flexion, and ulnar deviation.

Posteroanterior and lateral radiographs of the affected wrist were made after reduction, and a below-the-elbow Colles type plaster-of-Paris cast was applied. The cast was split immediately and then overwrapped at a subsequent evaluation at the fracture clinic, usually after one week. Patients were given clear instructions about the care of the plaster cast and were encouraged to perform a gentle finger, elbow, and shoulder exercise program until the cast was removed. Within 7 days after the reduction, the patients were seen by an orthopaedic surgeon in the fracture clinic to assess the adequacy of the reduction and immobilization. They were then seen at one and five weeks following the reduction.

All casts were worn for five weeks. Posteroanterior and lateral radiographs were made of the affected wrist at the one-week evaluation and were made of both wrists at five weeks. Patient were seen at six months for the clinical and functional assessment based on modification by Sarmiento et al of the demerit point rating system of Gartland and Wesley.

**RESULTS**

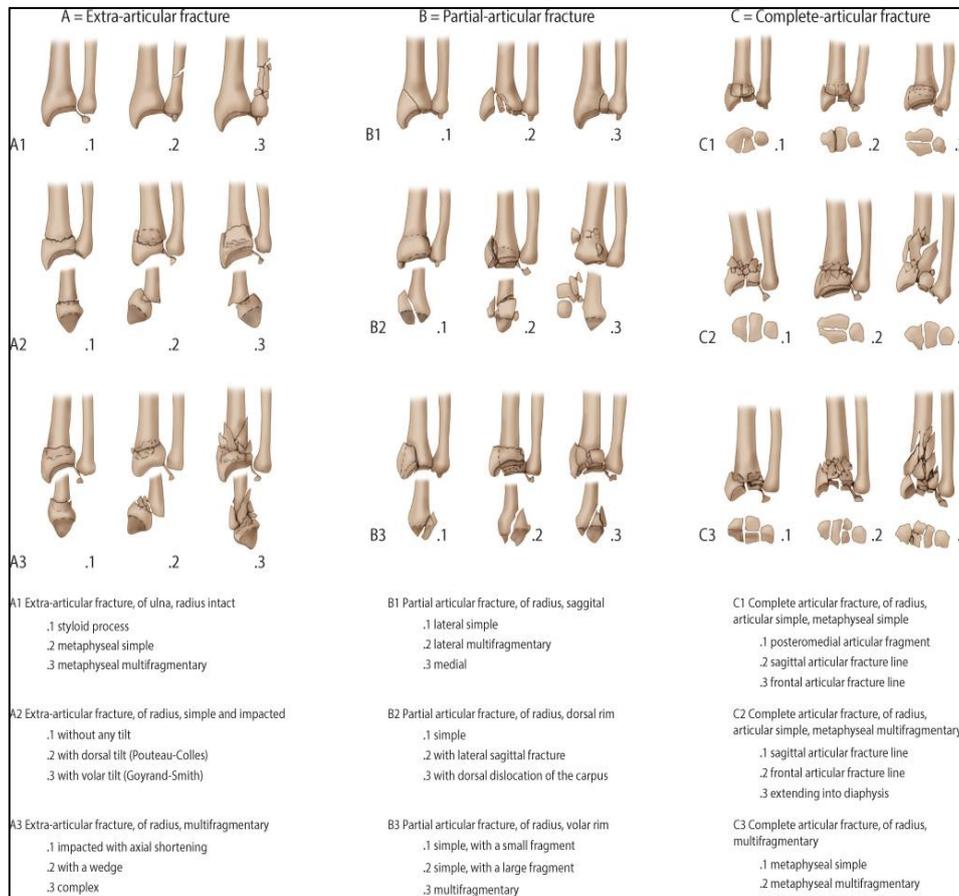
In present study, right side injury is more common and involved in 57.8% of the patient, i.e., 25(55.6%) patients. The distribution of patients was done according to AO Classification, there were 35 (77.8%) patients who had fracture type A and 5 (11.1%) patients who had fracture type B and C.

Complications which were noticed were, 4 (4.44%) patients due to Stiffness of wrist. 5 (5.55%) patients due to Stiffness of finger. 9 (10.00%) patients due to residual

pain, 5 (5.55%) patients due to Malunion and 9 (10.00) patients due to Reduced Grip Strength.

**Table 1: Fracture type and distribution.**

Fracture type as per AO/OTA classification	Male	Female	Total
<b>A2/A3</b>	21	14	35
<b>B1/B2/B3</b>	3	2	5
<b>C1/C2/C3</b>	3	2	5
<b>Total</b>	27	18	45



**Figure 1: Classification of distal end radius fractures as per AO/OTA.**

**Table 2: Sarmiento’s Modification of Lindstrom criteria.**

	Residual deformity	Loss of radial tilt (°)	Radial shortening (ml)	Loss of radial deviation (°)
<b>Excellent</b>	No deformity/ insignificant	0	<3	5
<b>Good</b>	Slight	1-10	3-6	5-9
<b>Fair</b>	Moderate	11-14	7-11	10-14
<b>Poor</b>	Severe	At least 15	≥12	>14

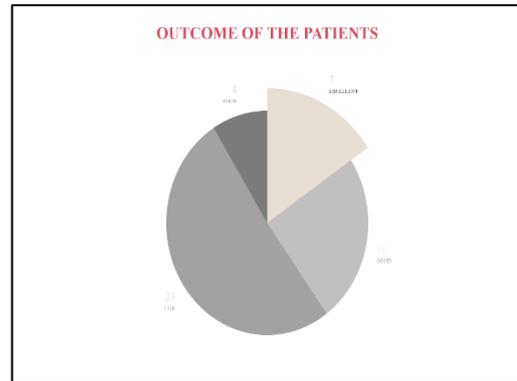
**Table 3: Functional and radiological outcome of the patients at the end of study.**

Results	Points
<b>Residual deformity</b>	
Prominent ulnar styloid	1
Residual dorsal tilt	2
Radial deviation of hand	2-3
Point range	0-3
<b>Subjective evaluation</b>	
Excellent. No pain. Disability or limitation of motion	0
Good, occasional pain, slight limitation of motion, no disability	2
Fair, occasional pain, some limitation of motion, feeling of weakness in wrist, no particular disability if careful, activities slightly restricted	4
Poor, pain, limitation of motion, disability, activities more or less markedly restricted	6
Point range	0-6
<b>Objective evaluation</b>	
Loss of dorsiflexion	5
Loss of ulnar deviation	3
Loss of supination	2
Loss of palmar flexion	1
Loss of radial deviation	1
Loss of circumduction	1
Pain in distal-radial joint	1
<b>Complications</b>	
<b>Arthritic change</b>	
Minimal	1
Minimal with pain	3
Moderate	2
Moderate with pain	4
Severe	3
Severe with pain	5
Nerve complications (median)	1-3
Poor finger function due to cast	1-2
End-result point ranges	0-5
Excellent	0-2
Good	3-8
Fair	9-20
Poor	21 and above

The distribution of patients according to functional assessment at 6 month the range of motion in mean value of affected limb such as dorsiflexion, palmer flexion, supination, pronation, ulnar deviation, and radial deviation, were  $64.00 \pm 2.02$ ,  $66.55 \pm 3.66$ ,  $67.66 \pm 4.95$ ,  $60.88 \pm 3.41$ ,  $24.33 \pm 3.12$ ,  $15.22 \pm 1.83$  respectively.

The distribution of patients according to radiological assessment at 3 months mean value of radial height, radial inclination, and volar height (AP and lateral view) were  $9.06 \pm 1.26$ ,  $20.08 \pm .70$  and  $16.88 \pm 3.53$  respectively,

functional outcome in 7(15.55%) patients were Excellent, 10 (22.22%) patients were good, 24 (53.33%) patients were fair, and 4 (8.88%) patients were poor.



**Figure 3: Outcome of the patients.**



**Figure 4: Sequential radiographs taken from time of presentation to reduction of fracture to recent latest follow up.**



**Figure 5: Range of motion at the 9 months follow-up.**



**Figure 6: Sequential radiographs taken from initial presentation to latest follow-up.**



**Figure 7: Range of motion in female patient at end of 8 months.**

Anatomical outcome as per Sarmiento criteria. 66.67% patients had excellent result with no residual deformity, 17.77% patients had good result with mild residual deformity, 8.88 % of them show fair results with moderate residual deformity and 6.66 % had poor outcome. Regarding loss of palmar tilt, 42 % patients had no loss of palmar tilt, 24 % patients had upto 10degree loss of palmar tilt, 9% of patients had loss between 11 to 15 degrees. About radial shortening, 72% patients had radial shortening less than 3 mm, 28 % has between 3 to 6 mm. In 6.66% of patients there is significant radial shortening present. In 58%of patients' loss of radial deviation less than 5 mm, 5 to 9 mm loss seen in another 36%, 10 to 14 mm of loss of radial inclination seen in 6% of patients.

## DISCUSSION

Distal radius fractures constitute a social problem. The COVID-19 pandemic has had a considerable impact on the lives of both adults and children around the world.<sup>9</sup> Most of the schools have been shut down, causing children to

stay at home, and some adults are working from home. Mostly due to extended lockdowns mobility of people was reduced drastically. There have not been many studies comprehensively evaluating the important issue of treatment of DRFs in adult patients during the COVID-19 pandemic.

Bram et al noted a decreased incidence of injuries due to sports and other outdoor activities, with an increased incidence of high-energy injuries due to falls from trampolines and bicycles.<sup>7</sup> Baawa-Ameyaw reported that 54% of 92 patients with DRF managed nonoperatively during the COVID-19 pandemic had indication for operative management.<sup>8</sup> Nabian reported no changes in either the mean age of patients or the male-to-female patient ratio during the COVID-19 pandemic. According to their report, the total number of fractures decreased by 61%, there were no changes in the male-to-female ratio, and the mean age of patients decreased from 9.4 to 7.5 years.<sup>9</sup> Poggetti et al reported a 28.6% decrease in the number of patients undergoing surgery due to hand and wrist trauma in one of Italian hospitals during the COVID-19 pandemic. In one of the Turkish hospitals, the total number of fractures recorded during the COVID-19 pandemic was by 61.6% lower than the number of fractures recorded in 2019.<sup>9,10</sup> Hashmi reported a 50% decrease in both elective and emergency admissions to orthopaedic wards, with no changes in either the mean age or male-to-female ratio in patients in the COVID-19 pandemic period in comparison with the relevant pre-pandemic.<sup>11</sup>

Ritsuno et al in BMC Musculoskeletal Disorders over the COVID-19 pandemic period (compared to period prior to the COVID-19 pandemic) have been reported in other countries (19–69%).<sup>12</sup> The reduced numbers of Distal radius fracture -associated hospitalizations can be attributed to the lockdown measures, reduced exercise and sports activities , and the imposition to stay indoors during the pandemic. Young adults limited their exercise by staying at home; this made them less prone to injuries/falls, which are the most common mechanism of DRFs. The elderly stayed mostly at home due to fears of infection. Some of them did not seek medical attention despite their injury and let it heal without any orthopaedic intervention.

Evaluating the individual treatment methods usually employed in treatment of distal end radius fractures, we considered that most high-energy fractures would require surgical treatment, with most low-energy injuries managed with closed reduction and follow up.<sup>13</sup>

The lower mean age of patients hospitalized due to DRF can be attributed to the nature of the SARS-CoV-2 virus, which is more virulent in the elderly. Lv et al reported a significant increase in the mean age of patients presenting with fractures during period of infection, elderly patients submitted more eagerly to lockdown restrictions. Moreover, some of the oldest patients never reached a hospital due to fears of infection and allowed their

fractures to heal without seeking medical attention.<sup>14</sup> The increased number of DRFs in males in comparison to that in females can be attributed to uninterrupted work involving physical labour in construction, mining, and smelting industries, despite lockdown restrictions elsewhere. The increased male-to-female ratio among DRF patients is also associated with the differences in the type of work done by men and women. Jobs requiring physical labour, which tend to be more commonly held by men were exempt from lockdown restrictions, which increased the proportion of men who incurred injuries. Moreover, men who self-quarantined at home remained actively involved in work around the house and in renovations. The women who stayed at home were more likely to engage in low-energy activities, such as cleaning or childcare, which are less traumatic and less likely to cause DRFs.

The limitation of our work may be the fact, that the epidemiology of DRF during the COVID-19 pandemic may be influenced by other factors, such as medical and bioethical framework, the surgeon, and hospital policy (confounding factors).<sup>15</sup>

In our study fall on outstretched hand was the common mode of injury in both the group (65.6%) where RTA was the second common mode of injury in both the group (34.4%). In our study show 57.8% fracture distal end radius was involving right side while 42.2 % involving left hand side. Right wrist fracture was more common in comparison to left wrist, Colle's' fractures can be difficult to treat and there remains no absolute consensus on the best method for treatment. Conservative management can be a safer option giving an acceptable clinical outcome. Sarmiento advocated immobilizations in the position of supination to decrease the deforming force of the brachioradialis, which may cause loss of reduction. In contrast, Wahlstrom recommended immobilization in pronation because he claimed pronator quadratus as a deforming force which is responsible for the loss of reduction.<sup>16</sup>

According to John Charnley, Colles' fracture should be treated by closed reduction, cast immobilization in palmar flexion, and ulnar deviation as the dorsal periosteal hinge provides stability. But this conventional position has a higher chance of re displacement, inhibits hand functions and has greater associated complications like median nerve compression.<sup>17</sup> Hand dominance is an important factor in the treatment of Colle's' fracture. Elderly patients might not need too much power in their non-dominant hand, nor do they use the non-dominant hand frequently after trauma.<sup>18,19</sup> Therefore, grip power was one of the most important factors in achieving a good subjective evaluation in patients with the fractured dominant hand. In our study majority of the patient were right hand dominant. Therefore, a good result in our study may be due to more involvement of fracture in a dominant hand which bothered the patients but proper reduction and counselling about post reduction care and early physiotherapy has

yielded good results. Our study is only limited with lapses in follow up from a large number of patients as they were very sceptical to visit tertiary care hospitals which were declared COVID care centres.

## CONCLUSION

In a conservatively treated Colle's' fracture, flexion should be maintained at the fracture site to make use of periosteal hinge, but the wrist should be immobilized in a position of slight dorsiflexion to achieve a better functional and radiological outcome. This position also enhances the rehabilitation of the fingers and wrist. COVID-19 pandemic was burden on all including patients and medical fraternity, and considering looming threat of third wave and delta variant of virus, our study material can be used to make guidelines for optimal utilisation of orthopaedic fraternity, who have to work in covid wards as well as trauma wards our study shows that proper technique of fracture reduction with patient counselling and early physiotherapy can yield good results in fracture which can be managed conservatively.

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