

# Study of the Functional and Radiological Outcome of Surgical Management of Unstable Extra - Articular Fracture of Distal End of Radius by Closed Reduction and Internal Fixation with K Wire

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**Abstract:** Introduction: Extraarticular Distal End Radius fracture comprises of 16 % of all fractures treated in Emergency Room. Treatment consists of Conservative Management to k wire, Ex fix and Plating. Aim of Study Is to observe the outcome of Extra articular Distal end Radius fracture by closed reduction and internal fixation with k wire. Material and methods: A Total 60 patients with extra articular distal end radius fracture included in this study after careful Inclusion and Exclusion criteria and were classified according to AO classification and were managed with CRIF with k wire and were then followed at Regular Interval. The final outcome was assessed based on Gartland & Werley and Sarmiento scoring system. Results: According to gartland and werley score excellent results achieved in 44 (73%) patients, good in 22 (13%) patients fair in 2 (3%) of patients, poor in 1 (2%) of patients. According to Sarmiento scoring system excellent results achieved in 40 (67%) patients, good in 19(32%) patients, fair in 1(1%) patients and poor in 0(0%) patients. 5 cases of pin site infection and 4 cases of pin loosening with 1 case of carpal tunnel syndrome is seen in our study. Conclusion: Closed Reduction and Internal fixation with k wire for reducible unstable extra articular Distal end Radius fracture shows good Anatomical and Functional outcome and prevent collapse of fracture and maintains radial height and palmar tilt.

**Keywords:** distal radius fracture, extra articular, Kirschner wire, Arbeitsgemeinschaft fur Osteosynthesefragen, CRIF- Closed reduction and internal fixation

## 1. Introduction

A Fracture of distal end of radius constitute most common skeletal injuries treated by orthopaedic surgeon. It comprises of 16% of all skeletal injury evaluated in emergency room. It is most commonly seen in elderly population. Vast majority of fracture are either Extra articular or Intra articular which leads to disruption of radio carpal joint and radio ulnar joint. Extra-articular fracture is most common in elderly population because of low energy trauma like fall from standing height and osteoporosis. Distal end radius fracture is frequently comminuted and this responsible for slipping of reduction which is rather late feature. It is observed that fracture has little or no stability following closed reduction and cast application and it goes for gradual collapse. Achievement of good alignment is essential from functional and cosmetic point of view. Various modalities of treatment available but most cost effective and minimally invasive method is closed reduction and internal fixation with k wire with minimal complication and minimal expenditure in Indian scenario. Aim of our study to observe functional and radiological outcome of extra articular fracture of distal end radius by closed reduction and internal fixation with k- wire.

## 2. Materials and Methods

60 indoor patients, fitting within the inclusion criteria, who have consecutively consented for the study, who have undergone closed reduction and internal fixation with k-wire for unstable extra-articular fracture of distal end of radius at Dr. Balabhai Nanavati Hospital, Mumbai, between April 2014 to Feb 2016. On admission, detailed examination after hemodynamic stabilization of patient was carried out and then standard posteroanterior and lateral views of distal end

radius were taken and were classified according to AO classification. Prior ethical committee approval Taken before study.

### Inclusion criteria

- 1) Patients having extra articular fracture of distal end of radius, treated surgically who have consecutively consented for the study.
- 2) Patients who are above the age of 20 years and less than 80 years.
- 3) Closed type of fractures.
- 4) Patients who are deemed medically fit for surgery
- 5) Patients with a normal contralateral limb free from fractures or joint affection
- 6) Patient present within one week of injury.

### Exclusion criteria

- 1) Compound fractures of the wrist Gustilo Anderson more than 1
- 2) Those patients who are below 20 years and above 80 years.
- 3) Fractures which require open reduction/ligamentotaxis.
- 4) Patients who are treated by non-operative methods.
- 5) Patients who are medically unfit for surgery.
- 6) Patients with bilateral wrist fractures or if the other limb has a
- 7) Previous fracture history or joint affection.

They were assessed and followed up at 1.5 months, 3 months and 6 months each from the date of surgery (minimum range of follow up between 6 to 18 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

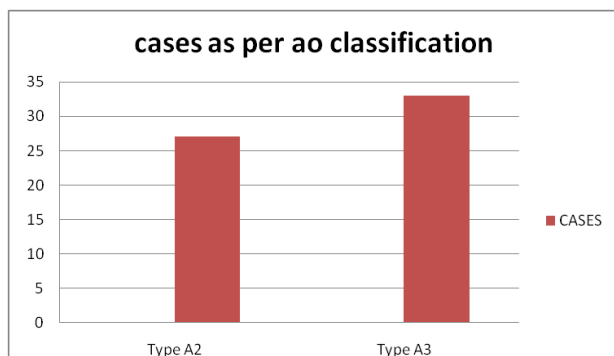
scoring system of Gartland and Werley and Sarmiento scoring system.

**Surgical Technique:**

The patient was positioned supine on the OT table, with the limb on a side table. Under Regional Anaesthesia (If unsuccessful then it was converted to General Anaesthesia at the discretion of the anaesthetist) the parts were painted and draped. The fracture alignment was achieved by traction – counter traction, and the reduction confirmed by the image intensifier. 1.5 Or 2mm k-wires were passed from the radial styloid crossing the fracture site obliquely to exit the dorso- ulnar cortex of the radial shaft. Another K-wire was passed from the dorso-ulnar aspect of the distal radius between the 4<sup>th</sup> and 5<sup>th</sup> extensor compartments and directed to engage the volar radial cortex of the proximal fragment. The exposed ends of the K-wires were then either bent or the ends were inserted into metal balls. The pin sites were then dressed. Then a below elbow cast with the wrist in neutral position.

**3. Results**

- 1) Majority of patients were between age group 41 to 50 with median age group is 46.16.
- 2) Gender distribution of the study Majority of patients were females, 31 out of 60 accounting for 52 %.
- 3) Majority of the patients (70%), sustained the injury due to a fall on outstretched hand accounting for 70%. 30 % patient sustained injury due to road traffic accident.
- 4) 37 patients out of 60 which are around 62 % show right side involvement which is dominant side. 23 out of 60 patients which is around 38% shows left side involvement which is non dominant side. This study shows dominant side is more involve then non dominant side.
- 5) Cases as per AO classification shows in our study 27 out of 60 patients (45%) are AO type 2 and 33 out 60(55%) are AO type 3 fractures.



- 6) Result as per AO classification. Excellent result seen in 22 patients in A2 fracture type and 22 patients in A3 fracture type respectively. Good result seen in 5 patients in A2 fracture type and 8 patients in A3 fracture type respectively. Fair result seen in only with A3 fracture type accounts for only 2 patients. Poor result seen with only A3 fracture type in only 1 patient

Result	A2	A3
Excellent	22	22
Good	5	8
Fair	0	2
Poor	0	1

- 7) Outcome analysis as per gartland and werley score shows 57 patients shows excellent to good result and 2 patients shows fair result and 1 patient shows poor result.

Result	End Result	
	Number of Cases	
Excellent	44	(73.0%)
Good	13	(22.0%)
Fair	2	(3.0%)
Poor	1	(2.0%)

- 8) Anatomical outcome as per Sarmiento criteria. 75% patients had excellent result with no residual Deformity, 22% patients had good result with mild residual deformity, 3% of them show fair results with moderate residual deformity.

Regarding loss of palmar tilt, 38% patients had no loss of palmar tilt, 28% patients had upto 10degree loss of palmar tilt, 9 % of patients had loss between 11 to 15 degree.

About radial shortening, 67% patients had radial shortening less than 3 mm, 30% has between 3 to 6 mm. In 3% of patients there is significant radial shortening present.

In 48%of patients loss of radial deviation less than 5 mm, 5 to 9 mm loss seen in another 48%, 10 to 14 mm of loss of radial inclination seen in 4% of patients.

Result	Residual	Loss of	Radial	Radial
	Deformity	Palmar Tilt	Shortening	Deviation
Excellent	45 (75%)	38 (63%)	40 (67%)	29 (48%)
Good	13 (22%)	17 (28%)	18 (30%)	29 (48%)
Fair	2 (3%)	5 (9 %)	2 (3%)	2 (4%)
Poor	0	0	0	0

At final follow-up by ‘The Gartland & Werley Criteria for Functional Outcome’ 44 (73%) patients had Excellent result, 13 (22%) had Good result, 2 (3%) had Fair result and 1 (2%) had a Poor result. The Anatomical evaluation by Sarmiento’s Criteria showed 40(67%) patients with Excellent result, 19 (32%) patients with Good result and 1(1%) with a Fair result.

There are 5 cases of pin site infection, 4 cases of pin loosening, 4 cases stiffness of wrist joint,6 cases of malunion, no single case of EPL tendon rupture seen as complication in our study.1 case of carpal tunnel syndrome and 1 case of RSD seen, and one case of chronic ulnocarpal pain seen.

It is evident from our study whenever there is extra articular distal end radius AO type 2 and type 3 closed reductions and internal fixation with k wire should be treatment of choice not closed reduction and cast application alone.

#### 4. Discussion

Distal radius fracture is a common injury. The importance of anatomic reduction has been demonstrated by clinical studies as well as by laboratory assessment of force and stress studies.

Accurate reduction of the fracture is the first step in treatment. Many options are available to maintain this initial reduction. The most common being closed reduction and cast application, but this is often associated with failure and complications. External fixators cannot effectively maintain palmar tilt; Also they also have been associated with complications as high as 60%.

Percutaneous pinning with K-wires was first recommended by Green<sup>1</sup> as a simple and inexpensive procedure.

The mean age of patients in our study was 46.16 (range 19-72) which is comparable to other studies published earlier. As age advances there is osteoporosis and more chance of collapse of the fracture; also the elderly may have a harder time keeping to the rehabilitation protocol.

Therefore we are agreed with Mackenney<sup>2</sup> conclusion that patients' age, metaphyseal comminution and ulnar variance were the most important factors deciding instability after distal end radius fracture. Axel Jubal<sup>3</sup> also concluded that intra-focal k wire fixation in older patient is a suitable method to attain and hold sufficient bony reduction.

In this study as with other studies, there were marginally more Women than men (31:29). This might be accounted for by the fact that more women have osteoporosis than men.

The mode of injury was a fall on outstretched hand in about 42 patients and a RTA in the other 18 patients.

RTA's are generally associated with greater forces and therefore more severe fracture pattern. RTA as a cause for injury was more common in the younger age group in this study.

Closed reduction and internal fixation with k wire is very simple and In-expensive procedure and it also reduces duration of stay in hospital that's why we are agreeing with conclusion of Glickel<sup>4</sup>.

That closed reduction and percutaneous pinning for distal end radius fracture had excellent range of motion, complication are few and low cost treatment for distal end radius fracture.

Shyamalan G<sup>5</sup> also compared the cost between volar lock plate and k wire and found that there is significant increase in cost and operative time with volar lock plate.

Srinivasa reddy<sup>6</sup> also concluded that closed reduction and percutaneous pinning and immobilization for 3 weeks and early physiotherapy is a simple inexpensive procedure for extra articular non comminuted distal radius fracture.

There is statistical significance to side involve in fall. In our study dominant side is more involved than non-dominant side.

10 patients (17%) of patients in our study had associated injuries. However patients with associated injuries in the same limb were not included in this study, as post op mobilization and thus scoring may have been compromised.

Various studies have suggested that closed reduction and percutaneous pinning may not achieve a satisfactory result. Yet this study suggests that, satisfactory results may be achieved even with minimally comminuted fractures; provided adequate reduction can be achieved with closed reduction. Therefore we are agreeing with studies of Strummer, Tristan Barton and Kurup .

Strummer<sup>7</sup> concluded that closed reduction and pinning from dorso-ulnar aspect is most effective treatment for extra articular fracture.

Kurup<sup>8</sup> also recommends use of two k wires one from radial styloid and other from dorsal side for extra articular fracture.

Whereas Barton<sup>9</sup> concluded that closed reduction and k wiring is an attractive technique and non-invasive as compared to external fixation and plating. This technique successfully maintains reduction of dorsal angulation but not radial shortening so radial shortening must be reduced to zero after reduction for this loss of radial height.

The functional results in this study are lower than the study by Abhishek K Das<sup>10</sup>. In his study excellent result seen in 81% of patient but in our study excellent result seen in 74% of patients. However the reason for this could be that patients with extra-articular fractures with dorsal comminution and also treated with percutaneous pinning. ; also there were two patients who were unwilling for any intervention with plates or ex-fix. The results suggest that further research is needed to further evaluate this method of treatment in more complex fractures.

The anatomical outcome was evaluated using Sarmiento's modification of Lidstrom's criteria. The results of this study are comparable to the other studies that have been done previously.

The comparison between the results of the functional outcome as evaluated by the Gartland-Werley scoring system and the Anatomical outcome evaluated as mentioned above, confirm what other studies have previously shown, that the functional result need not mirror the anatomical evaluation.

In this study there were 5 cases of pin site infection. 3 of which settled with antibiotics and the other 2 after removal of the K-wires. There was no persistence of the infection in any of the cases. Therefore we accept conclusion of Lakshmanan<sup>11</sup> that k wire should be buried under the skin to decrease infection. 2 cases with pin site infection experienced loosening of the pins. However the fracture progressed to healing satisfactorily. One of the patients with pin tract infection developed Reflex Sympathetic



Dystrophy. Malunion seen in 5 cases. Chronic ulno-carpel pain seen in one patient for which ulnar shortening osteotomy is done. As with other study before by Srinivasa Reddy percutaneous pinning and immobilization in cast for 3 weeks followed by early physiotherapy allows early

rehabilitation without Jeopardizing the fracture Alignment. However patient did not mobilize her wrist or fingers post-surgery and she was immobilized for a period of 6 weeks as fracture did not show signs of adequate union.

At final follow up



## 5. Conclusion

Closed reduction and percutaneous pinning for reducible, unstable extra articular distal radius fractures have shown to achieve good anatomical and functional outcome. The complications arising from the procedure were within acceptable limits. In Indian scenario where patient affordability is a major issue and patient presentation to the hospital is a major problem. Still in 21<sup>st</sup> century patients goes to bone setter for distal end radius fracture to avoid fear about surgery and also non affordability of anatomical even regular distal radius plate. So these extra articular radius fracture can be managed by minimally invasive and low implant cost surgery like closed reduction and internal fixation with k wire. Furthermore duration of stay in hospital is also reduced. The morbidities arising from prolonged anaesthesia were also avoided. Also the financial impact to the patient was less as compared with other modes of operative treatment. Further studies are required to assess its efficacy in various other fracture types. CRIF with K wire can also be tried in partial articular AO type fracture mainly in type A2 and A3.

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