



## Results of Percutaneous K Wire and External Fixator in Distal Radius Fracture

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### ABSTRACT

#### Background:

There are various treatment of distal radius fracture each its own merits and demerits. Most of the work done with percutaneous pinning has shown a significant residual stiffness of the hand and wrist. Our technique involves percutaneous pinning of the fracture and immobilization with external fixator in neutral position of the wrist for 6-8 weeks.

**Materials and Methods:** This is a prospective study of 29 patients aged between 18 to 70 years. The functional evaluation of the patients was done at 6 months follow-up using Sarmiento's modification of Lindstrom criteria and Gartland and Werley's criteria for evaluation of results.

**Results:** Excellent to good results were seen in 88% of the cases while 13% had fair results. The complications observed were pin loosening, pin tract infection, malunion, wrist joint stiffness.

**Conclusion:** Percutaneous pinning and external fixator of the wrist in neutral position is a simple, effective and quick method to maintain reduction and prevent stiffness and residual deformity of wrist.

**KEYWORDS :** Lower end radius fracture, percutaneous k-wire and external fixator, lindstorm criteria, Intra-articular distal radius fracture.

### INTRODUCTION:

Fractures of the distal radius are the most frequent fractures encountered by orthopaedic trauma surgeon accounting for 17.5% of all adult fracture[1].The incidence of distal radius fracture is more common in elderly people due to osteopenia and osteoporosis. Distal end radius fracture is treated mostly by close reduction and cast immobilization in palmer flexed and ulnar deviated position. But it leads to malunion and wrist deformity and also in many case there is a wrist and finger stiffness present. In percutaneous k wiring and cast immobilization there is also high chance of late radial collapse. The acute palmar flexed position of the wrist during the postoperative immobilization period was blamed as the main reason for stiffness [2]. And there is loss of major function of hand due to wrist and finger stiffness. To avoid palmer flexed position of wrist and late radial collapse we use percutaneous k wire and external fixator in neutral position.

This study was conducted to examine the functional outcome of distal end radius fractures treated with closed reduction and percutaneous K-wire and external fixator with immobilization in neutral position of the wrist and early physiotherapy.

### MATERIAL AND METHOD:

29 patient with distal radius fracture were prospectively studied.13 patient were male and 16 were female. Average age of patients was 42 years(range18 to70 years).In 19 patients fracture involve dominant hand.

### INCLUSION CRITERIA:

- FRACTURE OF AO TYPE A2,A3,C1,C2,C3
- Age 18 to 70 years.

### EXCLUSION CRITERIA:

- More than 1 week duration
- Associated with ulnar shaft fracture
- Polytrauma patient
- Open fracture

- Age less than 18
- Intraarticular fracture with AO type B1,B2,B3.

Out of the 29 patients enrolled for the study, none of them were lost to follow-up.The mode of trauma was a simple fall on the outstretched hand in 21 patients and RTA injury in 8 patients. All were closed fractures. Fractures were classified according to the AO classification, using the preoperative anteroposterior and lateral roentgenogram. 10 patients had AO type A2 fractures,7 are A3,8 are C1 ,4 are C2 . Additionally radial length, palmar tilt and radial angulation were measured.

### Operative Procedure

Closed reduction of the fracture was achieved by longitudinal traction and direct pressure over the displaced fragment under regional anesthesia either axillary block or supraclavicular block.. Hyperextension or flexion manoeuvres to disimpact the fragments were not recommended. Reduction was checked under image intensifier in both anteroposterior and lateral planes. As an assistant held the wrist with fracture in the reduced position, the first K-wire of 1.5-2.0 mm was inserted from the dorsolateral aspect of the distal radius fragment across the fracture and into the proximal fragment under image intensifier guidance. A second K-wire was passed from the dorsomedial aspect of the distal fragment across the fracture into the proximal fragment. After checking the stability of the fracture under image intensifier, if required, a third K-wire was passed from dorsolateral aspect from distal to proximal fragment. The wires were drilled to engage the opposite cortex. K-wires were bent at a right angle and cut short outside the skin for easy removal. In some case when fracture is intra articular and distal radioulnar joint involved transverse k wire from radius to ulna inserted. With the wrist in the neutral position, 2 schanz screw of 3.5mm size inserted in radius shaft in safe zone occupying four cortex proximal to fracture.. 1 schanz screw in base of 2<sup>nd</sup> and 3<sup>rd</sup> metacarpal occupying 4 cortex and one schanz screw in 2<sup>nd</sup> metacarpal shaft at neck shaft junction occupying 2 cortex. Rods and clamp applied. Traction given and fixator applied in neutral position and sterile dressing done. Below elbow volar slab given. Post-operative anteroposterior and lateral X-ray done.[image4,5]

Postoperatively, the limb was kept elevated for 24 hours. Active finger, shoulder and elbow mobilization was started at the immediately. Patients were discharged 24 hours post-surgery after ensuring good distal circulation of fingers. At 4 weeks follow-up, X-rays were taken, both in the anteroposterior and lateral planes to check the position of the fracture. The external fixator was removed at 6 to 8 week according to fracture pattern. Active finger, wrist exercises and forearm pronation and supination exercises were started with below elbow splint. Handgrip was improved by using soft ball exercises. At 8 weeks, anteroposterior and lateral view radiographs were repeated. K-wires were then removed at 8 to 10 weeks without anaesthesia. Wrist physiotherapy and handgrip exercises were continued for another 2 to 4 weeks. [image6,7]

Results were evaluated clinically and radiologically at 6 months using Sarmiento's modification of Lindstrom criteria [3] [Table 1] and by the Sarmiento *et al*, modification of the demerit point system of Gartland and Werley [4] (described below) [Image 1].

Sarmiento's modification of Lindstrom criteria: TABLE 1

	Residual deformity	Loss of palmer tilt(degree)	Loss of radial height(mm)	Loss of radial deviation(degree)
Excellent	No/Insignificant	0	Less than 3	5
Good	Slight	1-10	3-6	5-9
Fair	Moderate	11-14	7-11	10-14
Poor	Severe	More than 15	More than 12	More than15

The Sarmiento *et al*, modification of the demerit point system of Gartland and Werley :[Image 1]

Residual deformity	
Prominent ulnar styloid	1
Residual dorsal tilt	2
Radial deviation of hand	2-3
Point range	0-3
Subjective evaluation	
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
Objective evaluation*	
Loss of dorsiflexion	5
Loss of ulnar deviation	3
Loss of supination	2
Loss of palmarflexion	1
Loss of radial deviation	1
Loss of circumduction	1
Loss of pronation	2
Pain in DRUJ	1
Grip strength – 60% or less of opposite side (using dynamometer)	1
Point range	0-5
End result point ranges	
Excellent	0-2
Good	3-8
Fair	9-20
Poor	21 and above

\*Objective evaluation is based on the following ROM is being minimum for normal function, Dorsiflexion - 45°, Palmarflexion - 30°, Radial deviation - 15°, Ulnar deviation - 15°, Pronation - 60°, Supination - 50°, DRUJ - Distal radio ulnar joint

RESULTS:

All fractures showed union at the end of follow up.Average time of all fractures was 3 months. Restoration of anatomy was excellent in 19 patients (65.51%) and 6 patients (22.71%) had good anatomical outcome while 4 (13.78%) had fair results. Preoperative radiographic assessment showed that the average radial height was 2 mm (range 1-4 mm) and volar tilt was 15° (range 8 to -18 °). Assessment of postoperative radiographs revealed that the average radial height was 10 mm (range 8-14 mm) and volar tilt was 12 (range 8-16) on the immediate postoperative X-rays. At the time of pin removal at 8 to 10 weeks radial height was 9 mm (range 5-13 mm) and volar tilt 11° (range 4-16 °). The radial height was 8.6 mm (range 2-12 mm) and volar tilt 11 ° (range -2 - 16°), at 6 month follow-up[image 8,9]



OUTCOMES:

Sarmiento's modification of Lindstrom criteria						Functional outcome after 6 month
	Residual deformity (patients)	Loss of palmer tilt (patients)	Radial shortening (patients)	Loss of radial deviation (patients)	Mean (patients)	
Excellent	24	18	21	16	19	23
Good	3	8	4	9	6	4
Fair	2	3	4	4	4	2
Poor	0	0	0	0	0	

**COMPLICATIONS:**

Postoperative complication	No. of patients
Pin loosening	5
Pin tract infection	1
Malunion	2
Joint stiffness	2
Reduced grip strength	2

**DISCUSSION:**

Distal radius fracture is a common injury. Good anatomical reduction and maintenance of reduction is necessary for good function of wrist and hand. In fractures with articular displacement greater than 2 mm, radial shortening greater than 5 mm or dorsal angulation greater than 20, has poor outcome and wrist deformity[5].

Accurate reduction of the fracture is the first step in the treatment of distal radial fractures.. The most common traditional method is closed reduction and cast immobilization, but this often fails to prevent early radial collapse and is associated with a high risk of malunion, joint stiffness and painful wrist[6]. Another option is, percutaneous K-wire fixation of distal radius fracture and cast is given in palmer flexed position which results in wrist stiffness and deformity. And When we use only External fixators, it can maintain radial length and radial inclination by ligamentotaxis, but cannot effectively maintain palmar tilt [7]. And results in loss of functions of wrist. Open reduction and internal fixation should be reserved for complex intra-articular distal radius fractures.

We use Percutaneous pinning with K-wires and external fixation which is simple and inexpensive procedure. Radial length and radial inclination can be better achieved and maintained by use of external fixator. There were no problem of plaster sore and other skin problem.

In our study, 5 cases had wrist stiffness which required mobilization exercises under the supervision of physiotherapist and functional outcome were good at the end of follow up.

Radial shortening which remains the main displacement in distal end radius fractures, especially intra-articular and comminuted fractures was observed in only one patient of our study. Through external fixator radial height was maintained and chances of late collapse of the fracture was reduced specially of those having intrarticular extension.

Two cases in our series had pin tract infection, but this was superficial and did not necessitate early removal of the pins. The infection subsided with antibiotics and removal of pins at 8 weeks. One patient also had malunion with radial shortening, wrist joint stiffness and reduced grip strength and had fair outcome.

Loosening of one of the K-wires was observed in 5 cases at the time of removal of the pins but it did not lose the fracture reduction. Due to external fixator, if pin loosening occur it will maintain the alignment and radial height and prevent further collapse.

In our study Intrarticular fracture needed more time of external fixator than extra articular fractures. External fixator was removed in intrarticular fractures after radiological confirmation.

So by percutaneous pinning with external fixator we can avoid radial shortening and loss of fracture reduction with residual deformity in such fractures.

**CONCLUSION:**

Percutaneous pinning and immobilization of the fracture with external fixator in neutral position for 6-8 weeks and early physiotherapy is a simple and effective procedure for distal radius intrarticular and extrarticular fracture. It provides anatomic fracture reduction and fixation and allows earlier rehabilitation without loss of the fracture alignment. In older people use of k-wire and external fixator for intrarticular fracture is good option than open reduction and internal fixation, it is simple and quick procedure and give good results in all type fractures.

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