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## Management of distal end radius fractures by five k - wire fixation

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### Abstract

**Background:** One of the most frequent bone injuries seen in orthopaedics accounting for about 15% is a fracture of the distal radius. Treatment includes closed reduction and POP application, external fixation, internal fixation and percutaneous pin insertion. When comparing non-operative and operational treatment options, percutaneous pin fixation is the least traumatic option available. For distal radius fractures, the research sought to see how well the Five Pin Technique performed when used as a surgical treatment option.

**Material and Methods:** The research was done on 20 patients (12 females and 8 males) with distal radius fractures admitted in ACPM Medical College, DHULE Orthopaedics Department. Age ranged from 23 to 76. By Frykman categorization, 9 (45%) patients were Type 1, 3 (15%) were Type 2, 4 (20%) were Type 3, 1 (5%) were Type 4, and 1 (5%) were Type 6, 2 (10%) of them were Type 7. 14 (70%), 4 (20%), and 2 (10%) of the research participants had surgery within one to two weeks of each other, respectively, over the course of the study.

**Results:** The study's subjects radiological results suggested that in 10 (50%) of the patients, the loss of radial tilt was excellent, good in 6 (30%), fair in 3 (15%), and bad in 1 (5 percent).

It was outstanding in 12 (60%) patients, good in 4 (20%), fair in 2 (10%), and bad in 2 (10%) patients with radial shortening.

There were 9 (45%) patients with excellent loss of radial deviation; 7 (35%) patients with good loss; 3 (15%) patients with fair loss; 1 (5%) patient with bad loss.

10 (50%) patients were outstanding, 7 (35%) patients were good, 2 (10%) patients were fair, and 1 (5%) patient was bad in the research participants' functional outcomes by the short DASH score.

45% of the patients had no problems, while 10% had deformity, while 10% had extensor tendon tethering, while 25% had superficial pin tract infection, and 10% had deformity and superficial pin tract infection as a result of their surgery.

**Conclusion:** "Five pin approach" is safe to treat displaced intra-articular and extra-articular distal end radius fractures without damaging the joint or the metaphysis.

**Keywords:** Five pin technique, distal radius fractures

### Introduction

About 1/6<sup>th</sup> (16%) of all fractures seen and treated in emergency departments are upper extremity fractures from falls and other accidents <sup>[1]</sup>. Younger people are more likely to suffer relatively high energy upper extremity damage, whereas the elderly are more likely to have both high energy injuries and insufficiency fractures, according to the data <sup>[2]</sup>.

In fracture therapy, it is essential to achieve a correct reduction of the fracture and then utilize an immobilization technique that will keep the reduction stable. When it comes to regaining normal function after a fractured distal radius, there is a lot of debate over the best course of action <sup>[3]</sup> over time, many approaches to avoiding or limiting the loss of reduction in unstable distal radius fractures have emerged. These include functional bracing, pin plaster immobilization, various external fixation assemblies, percutaneous pinning and open reduction, and various implants for internal fixation <sup>[4]</sup> there are proponents and opponents of each therapeutic strategy. Restoration of normal articular architecture should be included in any treatment plan. This includes correcting abnormalities in radial length, joint surface continuity, and the distal radial angle. In fractures of the distal radius when anatomical reduction is achievable, percutaneous pinning is a straightforward and less invasive method for

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maintaining reduction. For distal radius fractures, the study's goal was to assess and evaluate the Five Pin Technique as a surgical treatment option.

### Patients and Methods

This study carried out on 20 patients with fracture of distal radius admitted to Orthopaedic Department, ACPMMC, Dhule.

### Inclusion criteria

Patients after puberty with displaced or non-displaced extra articular fractures of the distal radius, dorsal Barton fractures.

### Exclusion criteria

Patients before puberty, volar Barton fracture, compound fracture, associated ipsilateral upper limb trauma.

### Patient evaluation

**Patient's history:** Clinical history was taken from the patient in the sort of name, sex, age, job, address, mechanism of injury, if there is any associated injuries, addiction habits; Associated illness like diabetes, hypertension and cardiac condition.

### Clinical examination

Standard hand and wrist examination was performed in the form of Side affected, Presence of pain and swelling, Skin condition overlying the fracture and Presence or absence of associated vascular or neurological injuries.

### Radiological evaluation

Plain radiographs anteroposterior (AP) view and lateral view.

**Consent:** Standard consent was taken from the patients.

### Surgical Technique

**Fitness to surgery:** The patients were assessed for fitness for surgery by clinical history, examination and routine preoperative laboratory investigations.

### Surgical procedure

**Position:** Patients were operated on a standard orthopedic table, in supine position. With the shoulder abducted to 90 degrees, elbow flexed to 90 degrees, forearm pronated and wrist in neutral position.

### Implants used

1.8 and 2 mm smooth K wires.

Double cortical purchase recommended- Intrafocal pins accepted.

### Fracture reduction and the 5 pin technique

#### The five pin technique

The five pin technique for fixation of distal radius fractures is a modification of the existing closed reduction and K wire fixation technique. The technique involves closed reduction followed by internal fixation with 5 K wires (Figure 1).



Fig 1: Radial styloid wire

#### First K-wire – (Radial styloid wire)

It goes from the radial styloid process and stabilises the radial column [Figure 2]. Adequate care must be taken while inserting the radial styloid wire to avoid injury to the superficial radial nerve [5].



Fig 2: Ulnar corner wire

#### Second K-wire – (Ulnar corner wire)

It goes from the dorso-ulnar corner of distal radius to the lateral-volar cortex of the proximal radius. It stabilizes the intermediate column. (Figure 3)



Fig 3: Lister's tubercle wire

**Third K-wire – (Lister’s tubercle wire)**

Adequate care must be taken not to injure the tendon of the extensor pollicis longus by staying radial to the tubercle to engage the volar cortex of the proximal radius [7] This wire prevents dorsal tilt of the distal fragment [7].

**Fourth K-wire – (Distal radioulnar wire)**

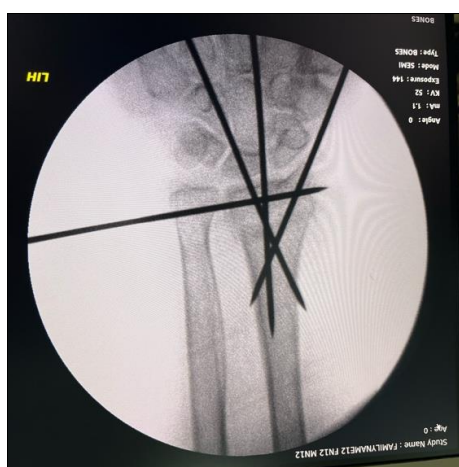
K-wire inserted from distal fragment of the radius to the ulna (Through distal radioulnar joint) parallel to the wrist joint line at the subchondral level in fully supinated position of the forearm, all the while maintaining the reduction with traction. This K-wire maintains radial length [Figure 5]. In unfractured forearms, the radiographically measured tilt was significantly affected by rotation. Palmar tilt increased with supination and decreased with pronation.[8] Sarmiento *et al.* advocated immobilization in a position of supination to decrease the deforming force of the brachioradialis, which may cause loss of reduction [9]. (Figure 4)



**Fig 4:** Distal radioulnar wire

**Fifth K-wire– (Proximal radioulnar wire)**

It is the most important of all, passing from the radial shaft to the ulna in full supinated position. It controls the proximal radius and along with the distal radioulnar wire and intact ulna works like an external fixator sparing the wrist [10]



**Fig 5:** Proximal radioulnar wire

C-arm images showing (5 k wires) in supination AP and lateral views All puckering of the skin caused by the K-wire entry were relieved with small stab incisions to prevent any chance of skin necrosis/infection at the pin site.

**Statistical analysis**

The collected data was revised, coded, tabulated and introduced to a PC using Statistical package for Social Science (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.). Data were presented and suitable analysis was done according to the type of data obtained for each parameter.

**Results**

**Table 1:** Baseline characteristics of the study participants

		Study participants (n =20)
Age (Years)	Mean± SD Range	48.32±17.18 23 - 76
Gender	Male	8 (40%)
	Female	12 (60%)
Dominant hand involved	Yes	13 (65%)
	No	7 (35%)

Regarding the baseline characteristics of the study participants, age ranged from 23 to 76 years with a mean value of 48.32±17.18 years. 8 (40%) patients were males and 12 (60%) were females. 13 (65%) patients had their dominant hand involved and 7 (35%) patients didn't.

**Table 2:** Frykman classification of the study participants.

		Study participants (n =20)
Frykman classification	Type 1	9 (45%)
	Type 2	3 (15%)
	Type 3	4 (20%)
	Type 4	1 (5%)
	Type 5	0 (0)
	Type 6	1 (5%)
	Type 7	2 (10%)
	Type 8	0 (0)

Regarding Frykman classification, 9 (45%) patients were type 1, 3 (15%) were type 2, 4 (20%) were type 3, 1 (5%) were type 4, 0 were type 5, 1 (5%) were type 6, 2 (10%) were type 7, and 0 were type 8.

**Table 3:** Time of surgery in the study participants.

		Study participants (n =20)
Time of surgery	< 1 week	14 (70%)
	1 - 2 weeks	4 (20%)
	2-3 weeks	2 (10%)

Regarding time of surgery in the study participants, 14 (70%) patients were less than 1 week, 4 (20%) patients were within one to two weeks, and 2 (10%) patients were within two to three weeks.

**Table 4:** Radiological outcome by modification of the Lindstorm Criteria in the study participants.

		Study participants (n =20)
Loss of radial tilt	Excellent	10 (50%)
	Good	6 (30%)
	Fair	3 (15%)
	Poor	1 (5%)
Radial shortening	Excellent	12 (60%)
	Good	4 (20%)
	Fair	2 (10%)
	Poor	2 (10%)
Loss of radial deviation	Excellent	9 (45%)
	Good	7 (35%)
	Fair	3 (15%)
	Poor	3 (15%)



Loss of radial tilt was excellent in 10 (50%) patients, good in 6 (30%) patients, fair in 3 (15%) patients, and 1 (5%) poor patients.

Radial shortening was excellent in 12 (60%) patients, good in 4 (20%) patients, fair in 2 (10%) patients, and poor in 2 (10%)

patients.

Loss of radial deviation was excellent in 9 (45%) patients, good in 7 (35%) patients, fair in 3 (15%) patients, and poor in 1 (5%) patients.

**Table 5:** Functional outcome by quick DASH score in the study participants.

		Study participants (n =20)
Quick-DASH	<10 Excellent	10 (50%)
	11-15 good	7 (35%)
	16-20 fair	2 (10%)
	>20 poor	2 (10%)

Regarding functional outcome in the study participants by quick DASH score, 10 (50%) patients were excellent, 7 (35%)

patients were good, 2 (10%) patients were fair, and 1 (5%) patients were poor.

**Table 6:** Complications in the study participants.

		Study participants (n =20)
Complications	None	9 (45%)
	Deformity	2 (10%)
	Extensor tendon tethering	2 (10%)
	Superficial pin tract infection	5 (25%)
	Deformity and superficial pin tract infection	2 (10%)

Regarding the complications in the study participants, 9 (45%) didn't have any complications, 2 (10%) had deformity, 2 (10%) had extensor tendon tethering, 5 (25%) superficial pin tract infection, and 2 (10%) patients had deformity and superficial pin tract infection.

## Discussion

12 females and 8 males took part in our research. Age ranged from 23 to 76 at the time of the operation, with a mean of 48.32 years. 13 (65%) of our patients had their dominant hand affected, whereas 7 (35%) of our patients non-dominant hand affected.

About Frykman categorization, 9 (45%) patients were Type 1, 3 (15%) were Type 2, 4 (20%) were Type 3, 1 (5%) were Type 4, and 1 (5%) were Type 6, 2 (10%) of them were Type 7. 14 (70%), 4 (20%), and 2 (10%) of the research participants had surgery within one to two weeks of each other, respectively, over the course of the study.

It's not uncommon to see distal radius fractures in the medical setting. If these fractures aren't treated properly, they may cause a lot of pain and handicap for the patient. When it comes to distal radius fracture therapy, the choices range from cast immobilization to column-specific plating, which only raises more problems than answers. The five pin technique is a variation of the current closed reduction and pinning method. We had no choice but to use this process since it brings together the best of both worlds: traditional casting and intrusive plating.

Even though it is straightforward and practical, closed reduction and cast immobilization leads to a high risk of debilitating stiffness and late fracture collapse, resulting to a poor functional outcome. Open reduction and plating, although allowing for anatomical reduction, has its own set of difficulties due to the procedure's invasiveness.

Anatomical reduction, fracture stability, early mobilization, pain-free range of motion, and minimum consequences are the main objectives of treating distal radius fractures. The five pin approach for fixing distal radius fractures may accomplish all of the aforementioned objectives.

Early mobilization is a benefit of the five pin approach. A reduction in stiffness after surgery may be achieved by

allowing early mobility using radio ulnar pins and pins across the fracture site.

The five pin technique's adaptability is an additional key benefit. Individualizing therapy for distal radius fractures is critical due to the wide variety of patterns in which they may develop. We are able to obtain the requisite fragment-specific fixation thanks to this method.

## The most important radiological factors that dictate outcome are

- Radial height.
- Ulnar variance.
- Palmar tilt.
- Carpal alignment.
- Articular alignment.

But even if radiological result does not necessarily correspond with excellent functional success, it is among the few changeable elements in deciding the outcome.

Wilcke *et al.* [11] found a link between a low DASH score and a decrease of radial inclination more than 10 degrees.

Van der Linden *et al.* [12] found that improved decrease of dorsal tilt resulted in better grip strength, range of motion, and residual discomfort in 250 patients studied.

When it came to loss of radial tilt, 10 (50%) patients had outstanding results; 6 (30%) patients had good results; 3 (15%) patients had medium results; and there were only 1 (5%) patient with bad results.

It was outstanding in 12 (60 percent) patients, good in 4 (20 percent), fair in 2 (10 percent), and bad in 2 (10 percent) patients with radial shortening.

There were 9 (45%) patients with excellent loss of radial deviation; 7 (35%) patients with good loss; 3 (15%) patients with fair loss; 1 (5%) patient with bad loss.

After analysing 344 cases, Schneiders *et al.* [13] found that the radial length and intra-articular step-off were the most important radiological parameters.

Only when the dorsal tilt surpassed 20 degrees and the radial angle decreased to less than 10 degrees did a decrease in grip strength occur.

A similar discovery was found in our work, and we would like to infer that a decent anatomic reduction, but not an

absolute one, is necessary for a functional result to be achieved.

Brennan *et al.* [14] compared K wire fixation with volar plating, and the DASH scores were 13.12 versus 11.25.

There were 10 outstanding, 7 good, 2 fair, and 1 bad individuals in our study's quick DASH score, according to the results of the DASH questionnaire. In most situations, the DASH scores were either exceptional or good.

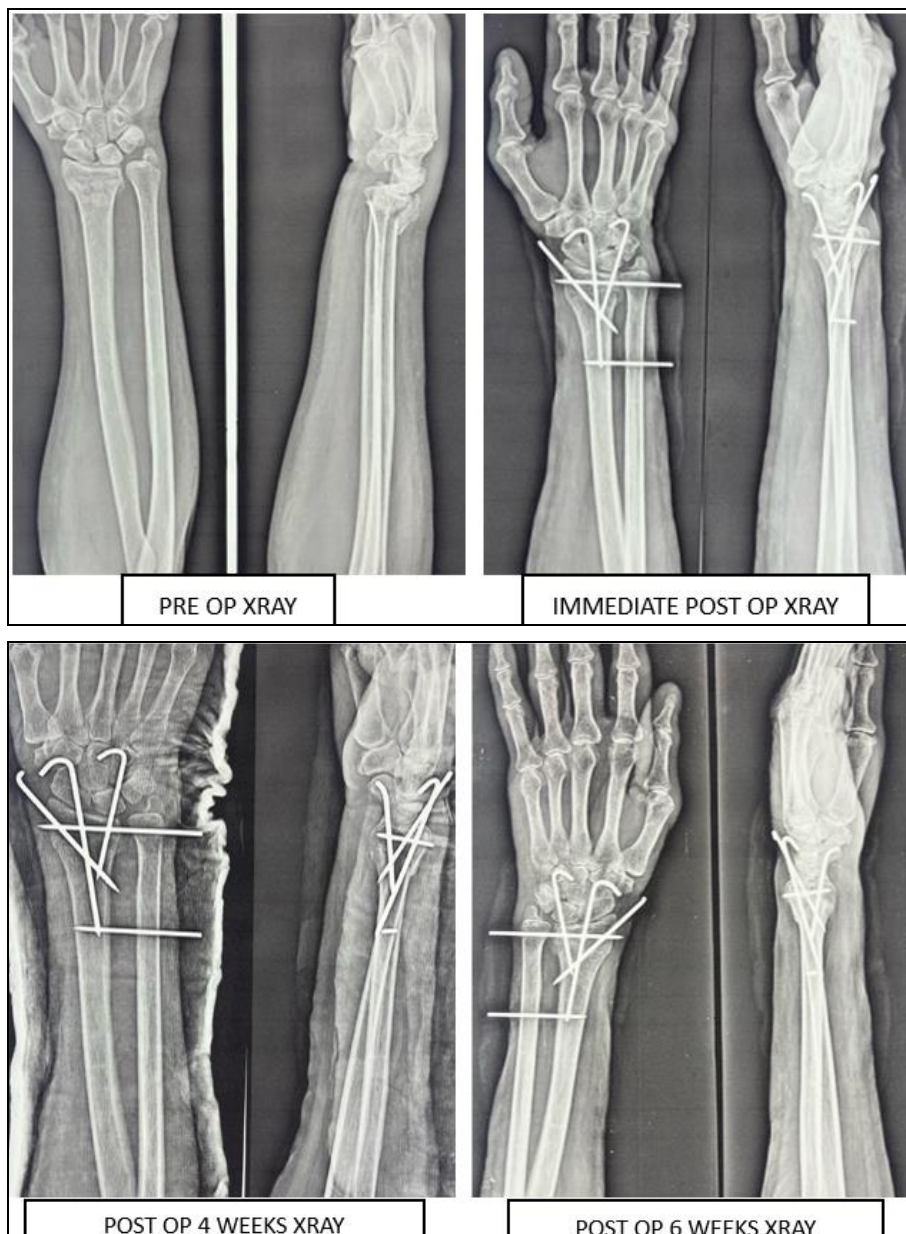
Deformity, extensor tendon tethering and superficial pin tract infection were the most common problems in the study, accounting for 18 of the 45 percent of patients who did not have any difficulties. With the removal of the infected pin and oral antibiotics, instances of extensor tendon tethering and superficial pin site infections were resolved. Although it was

not always the case, a lower functional result was associated with deformity and fracture collapse.

Implant costs are low, the operation is simple, and it can be done as an emergency even in patients with comorbidities, there is minimal risk of nerve damage, early mobilization, less scarring and more cosmetic, easy availability of the implants, and moreover, it can be performed as a daycare surgery under local or regional anesthesia.

**Conclusion**

For distal radius fractures, closed reduction with the 5pin configuration of K-wire fixation is a cost-effective and safe approach that provides great outcomes in terms of pain, mobility and stability.



**Conflict of Interest**

Not available

**Financial Support**

Not available

**References**

1. Vishwanath C, Harish K, Gunnaiah KG, Ravooof A. Surgical outcome of distal end radius fractures by
2. Bagul RR, Deshmukh A, Salgia A, Agarwal T, Rajani D, Sooknundan M. Comparative evaluation in the measurement of the radial height, radial inclination, and ulnar variance in fracture distal end radius treated conservatively by closed reduction and cast and closed reduction, Kirschner wire and cast. *Med J DY Patil Univ.* 2014;7:590-595.
3. Meena S, Sharma P, Sambharia AK, Dawar A. Fractures

ligamentotaxis. *J Orthop. Allied Sci.* 2017;5:68-73.

- of distal radius: An overview. *J Family Med Prim Care*. 2014;3(4):325-332.
4. Shah M, Shafiq M, Ali MA, Shah SA, Aziz I. Treatment of unstable distal radius fractures by percutaneous pinning and plaster cast immobilization. *Gomal. J Med. Sci.* 2015;13:166-169.
  5. Nordvall H, Glanberg-Persson G, Lysholm J. Are distal radius fractures due to fragility or to falls? A consecutive case-control study of bone mineral density, tendency to fall, risk factors for osteoporosis, and health-related quality of life. *Acta Orthop*. 2007;78:271-277.
  6. Sarmiento A, Pratt GW, Berry NC, Sinclair WF. Colles' fractures. Functional bracing in supination. *J Bone Joint Surg. Am.* 1975;57:311-17.
  7. Cowie J, Anakwe R, McQueen M. Factors associated with one-year outcome after distal radial fracture treatment. *J Orthop. Surg. (Hong Kong)*. 2015;23:24-28.
  8. Meena S, Sharma P, Sambharia AK, Dawar A. Fractures of distal radius: An overview. *J Family Med. Prim. Care*. 2014;3:325-332.
  9. Chavhan A, Dudhekar U, Badole C, Wandile K. Functional and radiological outcome in distal radius fractures treated with locking compression plate. *Int. J Res. Med. Sci.* 2017;5:574.
  10. Vasudevan P, Lohith B. Management of distal radius fractures: A new concept of closed reduction and standardised percutaneous 5-pin fixation. *Trauma*. 2018;20:121-130.
  11. Wilcke MK, Abbaszadegan H, Adolphson PY. Patient-perceived outcome after displaced distal radius fractures. A comparison between radiological parameters, objective physical variables, and the DASH score. *J Hand Ther.* 2007 Oct-Dec;20(4):290-298; quiz 299.
  12. Van der Linden W, Ericson R. Colles' fracture. How should its displacement be measured and how should it be immobilized? *J Bone Joint Surg. Am.* 1981 Oct;63(8):1285-1288.
  13. Schneiders W, Biewener A, Rammelt S, Rein S, Zwipp H, Amlang M. Distal radius fracture. Correlation between radiological and functional results. *Unfallchirurg*. 2006 Oct;109(10):837-844.
  14. Brennan SA, *et al.* Volar plate versus k-wire fixation of distal radius fractures. *JINJ*. 6367.

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