

## “Five Pin Technique” in management of distal radius fractures

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### Abstract

One of the most frequent injuries seen in orthopaedics is a fracture of the distal radius. They account for between 8% and 15% of all adult bone injuries. These include 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. The research was done on 40 patients with distal radius fractures admitted to Benha University Hospital's Orthopedic Department. In order to determine the effectiveness of the Five Pin Technique as a surgical therapy for distal radius fractures, Results: We have 15 women and 25 males in our research. Age ranged from 23 to 76 at the time of the operation, with a mean of 48.32 years. 22 (55%) of our patients had their dominant hand affected, whereas 18 (45%) of our patients did not participate in our research. About Frykman categorization, 5 (12.5 percent) patients were Type 1, 11 (19.75%) were Type 2, 3 (7.5%) were Type 3, 3 (7.5%) were Type 4, and 5 (12.5%) were Type 5. Six (15%) of them were Type 7, and five (12.5%) were Type 8. 22 (55%), 13 (32.5%), and 5 (12.5%) of the research participants had surgery within one to two weeks of each other, respectively, over the course of the study. The study's subjects' radiological results suggest In 19 (47.5 percent) of the patients, the loss of radial tilt was excellent, good, fair, or bad in 13 (32.5 percent). It was outstanding in 24 (60 percent) patients, good in 9 (22.5 percent), fair in 4 (10 percent), and bad in 3 (7.5 percent) patients. radial shortened There were 23 (57.5 percent) patients with excellent loss of radial deviation; 9 (22.5 percent) patients with good loss; 6 (15 percent) patients with fair loss; 2 (5 percent) patients with bad loss. 19 (47.5 percent) patients were outstanding, 13 (32.5 percent) patients were good, 5 (12.5 percent) patients were fair, and 3 (7.5 percent) patients were bad in the research participants' functional outcomes by the short DASH score. One-fifth (18%) of the patients had no problems, while 10% had deformity, while 10% had extensor tendon tethering, while 22.5% had superficial pin tract infection, and 12.5% had deformity and superficial pin tract infection as a result of their surgery. It is safe and successful to use the "five pin approach" to treat displaced intra and extra-articular fractures without damaging the joint or the metaphysis. For distal radius fractures, closed reduction with the 5-pin configuration of K-wire fixation is a cost-effective and safe approach that provides great outcomes in terms of pain, mobility and stability.

**Key words:** Five Pin Technique, distal radius fractures.

### 1. Introduction

An orthopedic surgeon is often called to treat distal radius fractures, the most common skeletal injury. About 1/6th (16 percent) of all fractures seen and treated in emergency departments are upper extremity fractures from falls and other accidents.[1] Many of the social consequences of these fractures extend beyond the enormous medical expenditures, such as reduced school attendance, missed job hours, loss of independence, and persistent impairment.[2] 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.[3] 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.[4] 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.[5] 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 maintaining reduction. For distal radius fractures, the study's goal was to assess and evaluate the Five Pin Technique as a surgical treatment option.

### 2. Patients and Methods

This study carried out on 40 patients with fracture of distal radius admitted to Orthopedic Department, Benha University Hospital.

#### **Inclusion criteria:**

1. Patients after puberty.
2. Patients with displaced intra articular and extra articular fractures of the distal radius

#### **Exclusion criteria:**

Any cases with the following criteria will be excluded

1. Patients before puberty.
2. Patients with volar Barton's fracture.
3. Patients with compound fracture.
4. Patients with associated ipsilateral upper limb trauma.

#### **Demographic features:**

#### **Sex incidence:**

There were 25 males and 15 females.

**Age incidence:**

The age of the patients ranged from 23 to 76 years.

**Side of injury:**

Out of the 40 patients, there were 22 dominant and 18 non-dominant.

**Patient evaluation:****Patient's history:**

- Clinical history was taken from the patient in the sort of name, sex, age, job, address and smoking habits.
- Associated illness like diabetes, hypertension and cardiac condition.
- Patients were asked about the mechanism of injury and if there is any associated injuries.

**Clinical examination:**

Standard hand examination was performed in the form of:

- Side affected.
- Presence of pain and swelling.
- Skin condition overlying the fracture.
- Presence or absence of associated vascular or neurological injuries.

**Radiological evaluation:**

➤ Plain radiographs (postero-anterior (PA) view and lateral view.

➤ Computed Tomography (CT)

**Surgical Technique:****Fitness to surgery:**

The patients were assessed for fitness for surgery by clinical history, examination and routine pre-operative laboratory investigations.

**Consent:**

Standard consent was taken from the patients

**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:**

**Closed reduction:**

Performed using Charnley's method and checked under image intensifier to confirm acceptable reduction and proceed with fixation.[6]

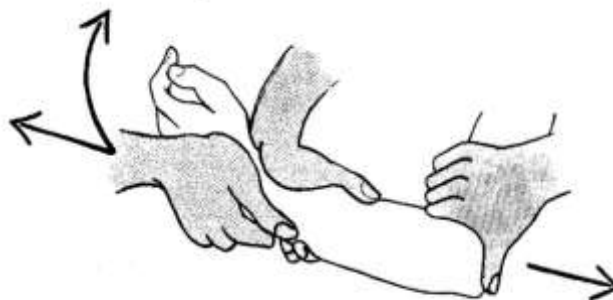
❖ **Step 1- Disimpaction**

An assistant takes hold of the elbow and offers counter-traction. The surgeon applies traction with the right hand, sited as just described, at the same time



Fig. (1) Disimpaction of fracture.

❖ **Step 2- Reduction**



Robert Jones grip applied. Pressure is applied with 'reducing' hand on distal fragment against the counter-pressure on the proximal fragment from the 'anvil' hand. Traction maintained.

Fig. (2) Reduction of fracture.

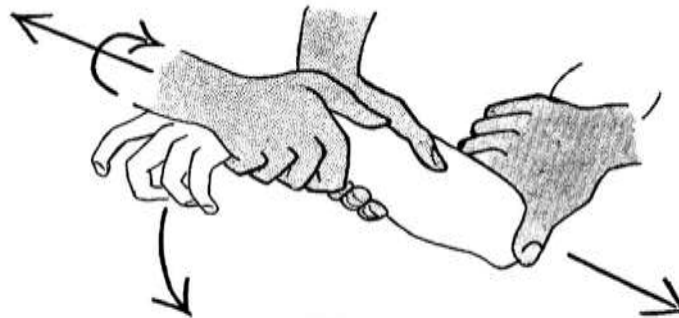
❖ Step 3- Locking the reduction by pronation



Locking the reduction by pronation. The 'anvil' hand remains stationary while the pronation is done entirely by the 'reducing' hand. The wrist is forced into ulnar deviation by this same manoeuvre.

Fig. (3) Locking the reduction by pronation.

❖ Step 4-Plastering technique



Locking the reduction by pronation. The 'anvil' hand remains stationary while the pronation is done entirely by the 'reducing' hand. The wrist is forced into ulnar deviation by this same manoeuvre.

Fig. (4) Plastering 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 5).



Fig. (5) five pin technique.

*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.

### 3. Results

**Table (1)** Baseline characteristics of the study participants

		Study participants (n =40)
<b>Age (years)</b>	<b>Mean ± SD</b>	48.32 ± 17.18
	<b>Range</b>	23 - 76
<b>Gender</b>	<b>Male</b>	25 (62.5%)
	<b>Female</b>	15 (37.5%)
<b>Dominant hand involved</b>	<b>Yes</b>	22 (55%)
	<b>No</b>	18 (45%)

Regarding the baseline characteristics of the study participants, age ranged from 23 to 76 years with a mean value of  $48.32 \pm 17.18$  years. 25 (62.5%) patients were males and 15 (37.5%) were females. 22 (55%) patients had their dominant hand involved and 18 (45%) patients didn't.

**Table (2)** Frykman classification of the study participants.

		Study participants (n =40)
<b>Frykman classification</b>	<b>Type 1</b>	5 (12.5%)
	<b>Type 2</b>	11 (27.5%)
	<b>Type 3</b>	3 (7.5%)
	<b>Type 4</b>	3 (7.5%)
	<b>Type 5</b>	2 (5.0%)
	<b>Type 6</b>	5 (12.5%)
	<b>Type 7</b>	6 (15.0%)
	<b>Type 8</b>	5 (12.5%)

Regarding Frykman classification, 5 (12.5%) patients were type 1, 11 (27.5%) were type 2, 3 (7.5%) were type 3, 3 (7.5%) were type 4, 2 (5%) were type 5, 5 (12.5%) were type 6, 6 (15%) were type 7, and 5 (12.5%) were type 8.

**Table (3)** Time of surgery in the study participants.

		Study participants (n =40)
<b>Time of surgery</b>	<b>&lt; 1 week</b>	22 (55%)
	<b>1 - 2 weeks</b>	13 (32.5%)
	<b>2 - 3 weeks</b>	5 (12.5%)

Regarding time of surgery in the study participants, 22 (55%) patients were less than 1 week, 13 (32.5%) patients were within one to two weeks, and 5 (12.5%) patients were within two to three weeks.

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

		Study participants (n =40)
<b>Loss of radial tilt</b>	<b>Excellent</b>	19 (47.5%)
	<b>Good</b>	13 (32.5%)
	<b>Fair</b>	6 (15%)
	<b>Poor</b>	2 (5%)
<b>Radial shortening</b>	<b>Excellent</b>	24 (60%)
	<b>Good</b>	9 (22.5%)
	<b>Fair</b>	4 (10%)
<b>Loss of radial deviation</b>	<b>Poor</b>	3 (7.5%)
	<b>Excellent</b>	23 (57.5%)
	<b>Good</b>	9 (22.5%)
	<b>Fair</b>	6 (15%)
	<b>Poor</b>	2 (5%)

Loss of radial tilt was excellent in 19 (47.5%) patients, good in 13 (32.5%) patients, fair in 6 (15%) patients, and 2 (5%) poor patients.

Radial shortening was excellent in 24 (60%) patients, good in 9 (22.5%) patients, fair in 4 (10%) patients, and poor in 3 (7.5%) patients.

Loss of radial deviation was excellent in 23 (57.5%) patients, good in 9 (22.5%) patients, fair in 6 (15%) patients, and poor in 2 (5%) patients.

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

		Study participants (n =40)
<b>Quick-DASH</b>	<10 Excellent	19 (47.5%)
	11-15 good	13 (32.5%)
	16-20 fair	5 (12.5%)
	>20 poor	3 (7.5%)

Regarding functional outcome in the study participants by quick DASH score, 19 (47.5%) patients were excellent, 13 (32.5%) patients were good, 5 (12.5%) patients were fair, and 3 (7.5%) patients were poor.

**Table (6)** Complications in the study participants.

		Study participants (n =40)
<b>Complications</b>	<b>None</b>	18 (45%)
	<b>Deformity</b>	4 (10%)
	<b>Extensor tendon tethering</b>	4 (10%)
	<b>Superficial pin tract infection</b>	9 (22.5%)
	<b>Deformity and Superficial pin tract infection</b>	5 (12.5%)

Regarding the complications in the study participants, 18 (45%) didn't have any complications, 4 (10%) had deformity, 4 (10%) had extensor tendon tethering, 9 (22.5%) superficial pin tract infection, and 5 (12.5%) patients had deformity and superficial pin tract infection.

**4. Discussion**

15 women and 25 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. 22 (55%) of our patients had their dominant hand affected, whereas 18 (45%) of our patients did not participate in our research.

About Frykman categorization, 5 (12.5 percent) patients were Type 1, 11 (19.75%) were Type 2, 3 (7.5%) were Type 3, 3 (7.5%) were Type 4, and 5 (12.5%) were Type 5. Six (15%) of them were Type 7, and five (12.5%) were Type 8.

22 (55%), 13 (32.5%), and 5 (12.5%) 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.

Retrospective studies of 269 individuals by Solgaard [7] found the greatest correlation between a favourable functional result and radial height.

Wilcke et al. [8] found a link between a low DASH score and a decrease of radial inclination more than 10 degrees.

Van der Linden et al. [9] 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, 19 (47.5 percent) patients had outstanding results; 13 (32.5 percent) patients had good results; 6 (15 percent) patients had medium results; and there were only 2 (5 percent) patients with bad results. It was outstanding in

24 (60 percent) patients, good in 9 (22.5 percent), fair in 4 (10 percent), and bad in 3 (7.5 percent) patients. radial shortened There were 23 (57.5 percent) patients with excellent loss of radial deviation; 9 (22.5 percent) patients with good loss; 6 (15 percent) patients with fair loss; 2 (5 percent) patients with bad loss.

After analysing 344 cases, Schneiders et al. [10] 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.[11]

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 [12] compared K wire fixation with volar plating, and the DASH scores were 13.12 versus 11.25.

There were 19 outstanding, 13 good, 5 fair, and 3 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.

## 5. Conclusion

In order to repair displaced intra- and extra-articular fractures with little articular and metaphyseal comminution, the "five pin approach" was developed. For distal radius fractures, closed reduction with the 5-pin configuration of K-wire fixation is a cost-effective and safe approach that provides great outcomes in terms of pain, mobility and stability.

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