



## Original Article



## Comparison of Volar Locking Plate and Percutaneous Pinning Using the Faisal Technique for Volar Barton Fractures

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## ARTICLE INFO

## Keywords:

Volar Barton Fracture, Percutaneous Pinning, Faisal Technique, Volar Plate Fixation, Distal Radius Fracture

## How to Cite:

Aslam, S., Ali, M. A., Saqlain, S. S., Asif, H. S., Aslam, H. M. A., Iqbal, M., & Hameed, S. (2025). Comparison of Volar Locking Plate and Percutaneous Pinning Using the Faisal Technique for Volar Barton Fractures: Faisal Technique for Volar Barton Fractures. *Pakistan Journal of Health Sciences*, 6(5), 307-312. <https://doi.org/10.54393/pjhs.v6i5.2842>

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[shoaibkurrer@yahoo.com](mailto:shoaibkurrer@yahoo.com)Received Date: 6<sup>th</sup> February, 2025Revised Date: 20<sup>th</sup> May, 2025Acceptance Date: 26<sup>th</sup> May, 2025Published Date: 31<sup>st</sup> May, 2025

## ABSTRACT

Volar plates are employed for buttressing volar fragments in most situations, and even dorsal fragments are stabilized by this technique. K-wires are often preferred. **Objective:** To compare the frequency of excellent outcomes in volar Barton fractures of the distal radius managed with open reduction and internal fixation using volar plates versus percutaneous pinning by the Faisal technique. **Methods:** A total of 60 patients with volar Barton fractures, aged 20 to 70 years of both genders, were included. Patients with bilateral fractures, recurrent fractures on the same side, open fractures, wrist dislocations, arthritic wrists, neurovascular injury, and Chauffeur's fractures were excluded. In Group A, a volar plate was implanted. In Group B, percutaneous pinning using K-wires was performed. After 3 months, patients were evaluated for functional outcomes using the Green O'Brien Scoring System. **Results:** The mean age of patients in Group B was  $42.37 \pm 15.23$  years, and in Group A was  $42.33 \pm 14.04$  years. The majority of patients, 31 (51.67%), were between 20 to 45 years of age. Of the 60 patients, 47 (78.33%) were male and 13 (21.67%) were female, with a male-to-female ratio of 3.6:1. An excellent outcome was observed in 24 (80.0%) patients in Group B and 11 (36.67%) patients in Group A, with a p-value of 0.001. **Conclusion:** This study concluded that the frequency of excellent outcomes in volar Barton fractures of the distal radius was significantly higher with percutaneous pinning by the Faisal technique compared to volar plate fixation.

## INTRODUCTION

Distal radius fractures are the most prevalent fractures of the forearm and account for about 16% of all skeletal fractures. They most often occur from falling onto an outstretched hand but also result from direct trauma or axially loaded forces. These fractures are classified based on the direction of radial angulation and displacement, the involvement of the joint surface (intra-articular or extra-articular), and the presence or absence of associated ulnar

or carpal bone injuries [1, 2]. Displaced fractures involving the articular surface of the distal radius generally have a worse prognosis than extra-articular fractures. This is due to the potential for incongruity and arthrosis of the radiocarpal and distal radioulnar joints, carpal subluxation, and associated intercarpal ligament injuries [3]. Among the specific types of distal radius fractures are Colles' fracture, Smith's fracture, Barton's fracture, and Chauffeur's



fracture. The latter received its name because the crank used to start early automobiles would sometimes kick back and break the chauffeur's wrist in a specific pattern. While these eponyms are still used to describe fracture patterns, there remains some confusion, particularly since "Colles' fracture" is often used as a generic term for distal radius fractures [2]. Intra-articular fractures of the distal radius represent a greater therapeutic challenge when compared with unstable extra-articular fractures [1, 2]. Most distal radius fractures, including 89.6% of AO C3-type fractures, can be successfully treated with volar locking plates [3]. Volar locking plates have recently gained widespread acceptance as the primary treatment option for this trauma. However, dorsally displaced fractures accompanied by certain conditions remain difficult to manage using a single volar locking plate [4, 5]. Although dorsal plating offers an advantage in the reduction and fixation of dorsally displaced fractures, it has fallen out of favor due to a historically higher complication rate, including extensor tendon injuries [4, 6]. Nevertheless, volar plating remains an appropriate treatment option for highly selected cases of dorsally displaced, comminuted intra-articular distal radius fractures particularly when soft tissue coverage is intact [7]. Overall, volar locking plates continue to be widely used for the osteosynthesis of distal radius fractures [8]. Clinical studies have demonstrated variable outcomes between fixation techniques. One trial reported excellent outcomes (Green and O'Brien score >90-100) in 86.67% of patients treated with percutaneous K-wires compared to 53.33% treated with volar plates for volar Barton fractures ( $p = 0.0463$ ) [9]. Another study provided further support for Faisal's technique defined as closed reduction by dorsiflexing the wrist, reducing the fragment through ligament taxis, and applying percutaneous pinning in an anti-glide fashion showing promising results that merit further investigation through randomized controlled trials [10]. Conversely, some evidence still favors volar plating through open reduction and internal fixation as the preferred method for managing unstable distal radius fractures [11]. The rationale for this interventional study was to compare the excellent outcomes of volar Barton fractures of the distal radius managed with open reduction and internal fixation using volar plates versus percutaneous pinning by Faisal's technique. Although the volar plate method is generally preferred for volar fractures, conflicting results in the literature have raised uncertainty about its superiority over the percutaneous approach. Limited research, especially at the local level, has been conducted to address this controversy. Therefore, this study aims to confirm the beneficial role of volar plates in managing these fractures. The findings will potentially improve clinical practice and inform future updates to local guidelines for the

management of volar Barton fractures.

## METHODS

The study was an interventional study conducted in Unit I, Department of Orthopedic Surgery, Mayo Hospital, Lahore from 31st July 2019 to 30th January 2021. The ethical approval was obtained from Green International University (Ref. No: IRC-GIU-156-04-2025). The sample size was 60 cases, with 30 cases in each group, calculated with 80% power of study, 5% level of significance, and taking the expected percentage of excellent outcome (on Green and O'Brien Score >90-100 points) i.e., 86.67% with percutaneous K-wires and 53.33% with volar plate for volar Barton fracture [9]. Non-probability consecutive sampling technique was applied. Inclusion criterion was patients of age 20-70 years of either gender, presenting with volar Barton fracture (as per operational definition) within 15 days of fracture. Excluded were the patients with bilateral fracture, recurrent fracture of the same side (on medical record), patients with open fractures, with dislocation of wrist, arthritic wrists, neurovascular injury and Chauffeur's fracture. After taking approval from the Green International University ethical committee, 60 patients fulfilling the selection criteria were included in this study from emergency of Department of Orthopedic Surgery, Mayo Hospital, Lahore. An informed consent was obtained. Demographic profile (name, age, gender, anatomical side, cause of fracture and duration of volar Barton fracture) were noted. Patients were randomly divided into two interventional groups by using lottery method. In Group A, volar plate fixation was performed. In Group B, percutaneous pinning using K-wires was done. It was reduced closed by dorsiflexing the wrist and by ligamentotaxis, followed by percutaneous pinning in anti-glide mode from the dorsal proximal fragment of the distal radius into the volar fragment and along the subchondral cortex under image intensifier. In some cases, additional cross K-wires were added for increased stability. A short arm cast in volar flexion was used to support fixation stability. Less than 2 mm of articular step-off was acceptable (Annexure I). All surgeries were performed under general anesthesia by a single surgical team with assistance of the researcher. Patients were followed up for 3 months. After 3 months, patients were evaluated for functional outcome using Green O'Brien Scoring system. A total score of 90-100 points was recorded as excellent outcome (as per operational definitions). Data were entered and analyzed in SPSS version 21.0. The quantitative variables like age and duration of fracture were presented as mean & standard deviation. The qualitative variable like gender, anatomical side, cause of fracture and excellent outcome were presented as frequency and percentage. Chi-square test was used to compare excellent outcome in both groups.  $P$ -value < 0.05 was considered as significant. Data were stratified for age, gender, anatomical side, BMI, cause of fracture and duration of fracture. Post-

stratification, Chi-square test was used to compare excellent outcome in both groups. P-value<0.05 was considered as significant.

## RESULTS

Age range in this study was from 20 to 70 years with mean age of  $42.34 \pm 14.56$  years. The mean age of patients in group B was  $42.37 \pm 15.23$  years and in group A was  $42.33 \pm 14.04$  years. Majority of the patients, 31 (51.67%), were between 20 to 45 years of age. Out of these 60 patients, 47 (78.33%) were male and 13 (21.67%) were females with ratio of 3.6:1. The mean duration of injury in group B was  $5.40 \pm 2.39$  days and in group A was  $5.40 \pm 2.16$  days. Mean BMI was  $28.83 \pm 2.91$  kg/m<sup>2</sup>. Distribution of patients according to anatomical side (Table 1).

**Table 1:** Distribution of Patients According to Duration of Fracture, BMI, and Anatomical Side Fractured (n=120)

Variables	Group A Frequency (%) / Mean $\pm$ SD	Group B Frequency (%) / Mean $\pm$ SD	Total Frequency (%) / Mean $\pm$ SD
<b>Duration (Days)</b>			
$\leq 7$ Days	28 (93.33)	26 (86.67)	54 (90.0)
8–15 Days	02 (6.67)	04 (13.33)	06 (10.0)
Mean	$5.40 \pm 2.16$	$5.40 \pm 2.39$	$5.40 \pm 2.21$
<b>BMI (Kg/m<sup>2</sup>)</b>			
$\leq 27$	10 (33.33)	10 (33.33)	20 (33.33)

**Table 3:** Stratification of Excellent Outcome with Respect to Age, Gender, and BMI of Patients (n=60)

Variables	Category	Group A (Excellent)	Group A (Not Excellent)	Group B (Excellent)	Group B (Not Excellent)	p-Value
Age	20–35	3	12	13	3	0.001
	36–50	8	7	11	3	0.153
Gender	Male	6	18	19	4	0.0001
	Female	5	1	5	2	0.612
BMI	$\leq 27$	5	5	8	2	0.160
	$> 27$	6	14	16	4	0.001

Stratification of excellent outcome with respect to duration of fracture, cause of fracture, and anatomical side is shown in Table 4.

**Table 4:** Stratification of Excellent Outcome with Respect to Duration of Fracture, Cause of Fracture, and Anatomical Side (n=60)

Variable	Category	Group A (Excellent)	Group A (Not Excellent)	Group B (Excellent)	Group B (Not Excellent)	p-Value
Duration (days)	$\leq 7$	11	17	21	5	0.002
	$> 7$	0	2	3	1	0.083
Cause	Trauma	2	5	5	3	0.189
	RTA	9	14	19	3	0.001
Anatomical Side	Right	5	9	13	3	0.011
	Left	6	10	11	3	0.024

## DISCUSSION

Distal radius fractures constitute a high percentage of presentations in accident and emergency departments [12, 13]. They are most frequently the result of road traffic accidents, falls from height, industrial injuries, and sporting injuries [12]. Traditionally the treatment for intra-articular distal radius fractures consisted of the application of plaster casts. Conservative treatment in this

$> 27$	20 (66.67)	20 (66.67)	40 (66.67)
Mean	$28.93 \pm 3.03$	$28.77 \pm 2.84$	$28.83 \pm 2.91$
<b>Anatomical Side</b>			
Right	14 (53.33)	16 (53.33)	30 (50.0)
Left	16 (46.67)	14 (46.67)	30 (50.0)

Excellent outcome was seen in 24 (80.0%) patients in group B (percutaneous pinning by Faisal technique) and 11 (36.67%) patients in group A (volar plate) with p-value of 0.001. Comparison the frequency of excellent outcome of volar Barton fracture of distal radius with open reduction and internal fixation with volar plate versus percutaneous pinning by Faisal technique (n=60) were Analyzed (Table 2).

**Table 2:** Volar Barton fraction of distal radius with reduction and internal fixation with volar versus percutaneous pinning

Outcome	Group A Yes (%)	Group B Yes (%)
Excellent	11 (36.67%)	24 (80.0%)
Not Excellent	19 (63.33%)	6 (20.0%)

\*P value is 0.001 which is statistically significant.

Stratification of excellent outcome with respect to age, gender, and BMI of patients is shown in Table 3.

fashion resulted in collapse of the fracture fragments and radial shortening, angulation, and irregularities in the joint surface that would lead to permanent deformity. Loss of alignment also results in ulnar overlengthening and subsequent medial wrist pain. Traditional terms like Colles', Smith's, and Barton's fractures have now been consolidated into the general term Distal Radius Fractures

(DRF) that encompasses both intra- and extra-articular fractures. While several classification systems have been created, the Fernandez Classification remains one of the most widely accepted [13]. Plate fixation, in particular locking plates, has gained prominence due to the stability that it provides, the shorter period of immobilization, and the simplicity of early return to normal activities. It offers precise anatomical restoration of the articular surface and the alignment of the fragments and produces better functional outcomes and less likelihood of early-onset osteoarthritis [14, 15]. Nevertheless, Open Reduction and Internal Fixation (ORIF) possesses several drawbacks including the potential for skin scarring, tendon injury, the need for further surgery for hardware removal, higher cost, and the requirement for higher surgical skills than percutaneous fixation by K-wires. Volar plates are usually utilized for volar fragments and also stabilize dorsal fragments by the same method. K-wires are still the preferred choice in most situations because they are easy to insert, cause little disruption to the soft tissue, and are applied traumatically, minimizing swelling and stiffness [16, 17]. They also have the added advantages of less risk of infection and good fracture healing [17, 18]. I have conducted this study to compare the frequency of excellent outcome of volar Barton fracture of distal radius with open reduction and internal fixation with volar plate versus percutaneous pinning by Faisal technique. The mean age of patients in group B was  $42.37 \pm 15.23$  years and in group A was  $42.33 \pm 14.04$  years. Majority of the patients 31 (51.67%) were between 20 to 45 years of age. Out of these 60 patients, 47 (78.33%) were male and 13 (21.67%) were females with ratio of 3.6:1. Excellent outcome was seen in 24 (80.0%) patients in group B (percutaneous pinning by Faisal technique) and 11 (36.67%) patients in group A (volar plate) with p-value of 0.001. One trial found that excellent outcome (Green and O'Brien score  $>90 - 100$ ) was achieved in 86.67% with percutaneous K-wires and 53.33% with volar plate for volar Barton fracture ( $p=0.0463$ ) [9]. Another study reaffirmed the evidence and documented successful outcomes using Faisal's Technique—closed reduction by wrist dorsiflexion, fragment reduction by ligamentotaxis, and percutaneous anti-glide pinning—in the management of volar Barton's fractures. The outcome suggests the need for further randomized controlled trials in order to establish the efficacy of the technique in such circumstances [10]. But another trial suggested that volar plating through open reduction and internal fixation is the preferred method of managing unstable distal radius fractures [19, 20]. Beharrie et al., in 2004 published a study comparing these two methods [21]. Radwan conducted a randomized trial comparing two treatments for late-presenting displaced distal radius fractures, while Hull et al., evaluated functional outcomes of volar locking plates versus K-wire fixation in acute distal radius fractures [22, 23]. Gartland and Werley proposed a widely used scoring system for evaluating functional outcomes of healed Colles'

fractures [24]. Their results are contrary to this but the outcome measured at the end of their work was radiological restoration of articular surface unlike this. A satisfactory result in 68.3% was obtained by Gartland and Werley by the method of casting. Sarmiento et al., also obtained a higher 82% satisfaction by the same method [25]. Spira and Weigl [27] observed that there was an unsatisfactory result in 51.4% in the treatment of comminuted distal radius fractures involving the articular surface by the method of reduction and simple casting alone [28]. Closed percutaneous pinning either by intra-focal manipulation and pinning or by manual traction and subsequent pinning and anatomical reduction has been described by many authors. Clancey achieved satisfactory outcome in 96.4% in 30 patients who were percutaneously pinned if the radial articular surface wasn't fractured into more than two fragments [29, 30]. McMurtry et al., described techniques and outcomes of distal radial osteotomy for correcting deformities following malunited distal radius fractures [31]. While external fixators were found superior in the restoration of radial length than percutaneous pinning and casting, they were typically insufficient in the restoration of normal volar tilt [32]. Green reported an 86% satisfactory result with this technique used in the treatment of 75 patients with severely comminuted intra-articular fractures [33]. The technique is so easy that most surgeons become familiarized with this procedure in a relatively short time. The wires usually can be withdrawn in the outpatient clinic with relative ease when healing is sufficient. All three authors Shukla et al., Kreder et al., and Saving reported that external fixation performed better than internal fixation for the treatment of distal radius fractures [33-35]. Kreder et al., in the Randomized Controlled Trial (RCT) of displaced intra-articular distal radius fractures, reported that patients who underwent indirect reduction and external fixation regained function more quickly and overall results were improved provided that the articular gap and the step-off were adequately minimized [34]. Similarly, Shukla et al., in one Level 4 prospective RCT involving 110 patients with Cooney's Type 4 displaced intra-articular distal radius fractures, reported that patients who underwent external fixation had superior wrist range of motion, grip strength, and overall results than patients who underwent volar locking plates. Pain scores and activity scores were the same between the two groups, leading the authors to conclude that external fixation yielded superior results than Open Reduction and Internal Fixation (ORIF) by volar locking plates at one year [33]. In another RCT, 118 patients compared who were either treated by volar locking plates or external fixators for unstable distal radius fractures. They found that the functional outcomes were the same between the two treatment groups, yet the volar plate group developed more post-traumatic arthrosis and more reoperations. However, Kapoor et al., reported in their RCT that internal fixation proved to have less associated



articular complication secondary to better anatomical restoration. They further included that functional results were worse in severely comminuted fractures secondary to the difficulty in achieving stable fixation using locking plates [36]. The Faisal technique may be superior due to its minimally invasive nature, preservation of soft tissue integrity, and reduced surgical trauma. Early stabilization with K-wires under image guidance could facilitate quicker functional recovery and lower complication rates compared to volar plating. This study has limitations including a relatively short follow-up duration, which limits the assessment of long-term outcomes such as arthritis. We also did not include radiological parameters like volar tilt or radial height, and potential observer bias may have influenced functional scoring.

## CONCLUSIONS

This study concluded that frequency of excellent outcome of volar barton fracture surgery of distal radius with open reduction and internal fixation was higher in percutaneous pin by Faisal technique than volar plates. Health care systems should prefer percutaneous pinning for catering fracture cases.

## Authors Contribution

Conceptualization: SA

Methodology: HSA, SH

Formal analysis: SHS, HMAA, SH

Writing, review and editing: SA, MAA, SSS, HAS, HMAA, MI

All authors have read and agreed to the published version of the manuscript

## Conflicts of Interest

All the authors declare no conflict of interest.

## Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

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