

**Volar Barton's Fractures: Comparison between Two Techniques****Om Prakash Khichi<sup>1</sup>, Hoshiyar Sharma\*<sup>2</sup>, Raju Lal Yadav<sup>3</sup>**<sup>1,2</sup>Medical officer (Orthopaedics), Civil Hospital, Narnaul, Haryana<sup>3</sup>Assistant Professor, Department of Orthopaedics, ESIC Medical College, Alwar, Rajasthan

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Conflict of interest: Nil

**Abstract:**

**Background:** One of the most frequent injuries that orthopaedic surgeons treat is a fracture of the distal radius. A clear consensus regarding the best management strategy could not be achieved because there are numerous therapeutic options described in the literature. Since the invention of buttress plates, young adults prefer open plating as a treatment.

**Aims:** The present study was conducted to compare the outcome between open reduction and plating or by Kirschner wire fixation with external JESS fixation in Volar Barton Fracture.

**Material and Methods:** 40 patients of distal end radius fracture aged 18-60 years with Volar Barton pattern (AO type B3.2 and B3.3, intra-articular involvement with a volar fragment and volar subluxation of the carpus) were either treated by open reduction and plating (22 cases) or by Kirschner wire fixation with external JESS fixation (18 cases).

**Results:** All 22 plating and 16 pinning patients had satisfactory results at the most recent follow-up, according to the functional outcome of the wrist.

**Conclusion:** Both open reduction with stabilization by buttress plates and closed reduction with stabilisation by pinning and external fixation can achieve excellent success rates in the current investigation. Both methods have benefits and drawbacks, but the plating procedure appears to produce better outcomes.

**Keywords:** Volar Barton Fracture, Open Reduction And Plating, Kirschner Wire Fixation.

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**Introduction**

Fractures of the distal end of the radius are a varied group of wounds with different fracture patterns. They were first described by Pouteau (1783) and Colles (1814). [1] Distal radius fractures are the most common upper extremity fractures [2, 3].

These were once classified as either a Barton or a Colle's fracture, but the Frykman's Classification is now used to classify them. Volar Barton fractures are quite common in our daily trauma outpatient department and can be caused by high or low energy traumas. These injuries are distributed bimodally, affecting young people through high-energy mechanisms and the elderly through low-energy falls caused by osteoporosis. [4,5]

Achieving a precise fracture reduction before implementing an immobilisation strategy that will support and hold that reduction is the cornerstone of fracture therapy. The possible therapeutic alternatives include closed reduction and casting, pins and plaster, external fixation, limited open reduction, open reduction, internal fixation, and intramedullary nailing. The best functional and radiological outcomes have been achieved with open reduction combined with volar buttress

plating or closed reduction combined with external fixation and percutaneous Kirschner pinning. (6–9).

There are several articles detailing the surgical management of volar Barton's fractures, but there aren't many that concurrently compare the two methods discussed. This study aimed to compare these two surgical approaches and suggest the most effective one.

**Subjects and Methods****Study Design, Settings and Participants:**

It was a hospital-based prospective study carried out in the orthopaedics department of a tertiary care hospital in Haryana, India, over the course of two year, from January 2020 to December 2021. The study comprised 40 patients, aged 18 to 60, who had distal end radius fractures with Volar Barton pattern (AO types B3.2 and B3.3, intra-articular involvement with a volar fragment, and volar subluxation of the carpus). Excluded from the study were patients with comorbid distal Ulna fractures, bilateral wrist fractures, proximal metaphyseal fractures (greater than 2.5 centimetres from the articular surface), prior distal radius fractures in the

same limb, carpal bone fractures, and polytrauma cases where definitive treatment was occasionally postponed.

### Data collection

After obtaining informed written agreement, study participants who were patients of the orthopaedics department were added to the study. After stabilising the patient's vitals in the OPD, a Below elbow slab was used to immobilise the fracture. Within 48 hours of the injuries, all of these fractures were treated. Ice packs, limb elevation, and anti-inflammatory drugs were used to reduce the initial swelling. The surgeon's personal experience and opinion on that particular fracture pattern was the treatment option; it was carried out within 48 hours, so the reduction goal was not compromised.

### Technique for K-wire fixation

All of the patients had brachial block anaesthesia, and linear manual traction was applied with three fingers and the thumb. A 2.0 mm Kirschner wire is then pushed firmly through the radial styloid process and into the ulnar side of the proximal cortex, replacing the volar fragment. A JESS type distractor external fixator from Joshi's external stabilising system was employed to span the wrist joint and enforce wrist stability. The fracture reduction and diversion were aided by this diversion device.

### Technique for open reduction and plating

We used the Ellis approach for open reduction. The wrist joint's volar aspect was opened. (10) The dissection includes the Flexor carpi radialis and the Palmaris longus. While the radial artery was found and secured, the median nerve was shifted ulnarward. The pronator quadratus marked the end of the radius. The fracture was lessened indirectly by putting a cloth underneath the volar fragment and using a 5 mm osteotome under direct vision. The volar aspect was then fitted with a buttress plate. In certain instances, it was necessary to bend the plate by approximately 10 degrees, tilt it to the volar side, and apply an arm splint.

### Postop protocol

After two weeks, the splint was removed, and a functional brace was placed on until the fracture had healed. The short arm splint or Kirschner wire that was utilised for external fixation was removed after six weeks.

Active wrist range of motion exercises was recommended. Over time, the wrist could become severely burdened. Patients at the outpatient department were followed up with a six-week, three-month, annual, and other intervals as needed. Radiographs and bone healing processes were

recorded. Using the Pattee and Thompson criteria, the wrist function was assessed, and an outstanding or good grade was considered a satisfactory result. (11) A good result had occasional mild pain, no disability, and 15° or less loss of wrist flexion or extension; a fair result had mild to moderate pain, modification of some activities, continued employment at the pre-injury occupation, and 25° or less loss of motion; and a poor result had severe pain, residual disability requiring occupation change, and more than 25° loss of motion. An excellent result had no pain, no disability, and no more than 5° loss of wrist flexion or extension.

A fracture union was characterised clinically and radiographically as the absence of pain or soreness during normal activity with loading and as the trabeculae having spanned the primary fracture fragments. If a fracture did not heal after a year of treatment, it was deemed non-union.

### Statistical analysis

Data were analyzed and statistically evaluated using SPSS software, version 17 (Chicago II, USA). Quantitative data was expressed in mean, standard deviation while qualitative data were expressed in percentage. Statistical differences between the mean of two groups were tested by Mann Whitney U test. 'p' value less than 0.05 was considered statistically significant.

### Ethical issues

All participants were explained about the purpose of the study. Confidentiality was assured to them along with informed written consent. The study was approved by the Institutional Ethical Committee.

### Results & Observation

Patients were aged from 18 to 60 years (median, 39 years) with a male to female ratio of two to one. The causes of fracture included 13 motorcycle accidents, five tripping over, three sports injuries and two falls from a height. All the fractures were closed and 22 were in the dominant limb.

The mean follow-up period was 20 months (range, 17-24 months). 22 fractures were treated with plating and 18 with pinning. All fractures healed within three months and the union rate was 95%. There were no perioperative complications. There were no cases of failed closed pinning that needed to be converted to plating.

The mean radioulnar variance, the ulnar prominence of the distal radioulnar joint, the mean volar inclination, and the mean ulnar angulation, the volar tilting of the distal radial joint, were comparable between the two groups postoperatively. The comparison between the two approaches was similarly not significant at the

follow-up (table 1). No nonunion or malunion (> 2 mm step-off of the joint surface, > 5 mm radioulnar variance, > 10 degrees dorsal inclination, 10 degrees ulnar angulation) or superficial or deep wound infection existed.

All 22 plating and 16 pinning patients had satisfactory results at the most recent follow-up,

according to the functional outcome of the wrist ( $p = 0.19$ ). Both patients in the pinning group had mild radiocarpal arthrosis, as seen on the plain radiographs. The functional outcome for both patients was fair.

**Table 1: Comparison of Radiographical Features between both groups**

	Plating group (n=22) Mean (range)	Pinning group (n=18) Mean (range)	p value
<b>Radioulnar variance</b>			
Postop	-2.2 (-2 to +1 mm)	-1.7 (-2 to +2 mm)	0.51
At follow up	-1 (-2 to +2 mm)	-1.4 (-3 to +2 mm)	0.43
p value	0.09	0.07	
<b>Volar inclination</b>			
Postop	+ 5.4 (0-10 degree)	+ 5.8 mm (1-10 degree)	0.58
At follow up	+5.8 (-1 to +10 degree)	+6.2 mm (-2 to +10 degree)	0.81
p value	0.11	0.13	
<b>Ulnar angulation</b>			
Postop	19.4 (15-24 degree)	17.7 (15-22 degree)	0.12
At follow up	18.2 (12-25 degree)	17.3 (14-22 degree)	0.27
p value	0.16	0.11	

## Discussion

A minimal space, an appropriate supply of nourishment, and sufficient stability are all necessary for fracture repair. [12] Large cancellous bone can speed up the healing process in distal radius fractures.

Thus, a nonunion in this area is unusual. However, malunion is not uncommon, and volar subluxation of the carpus is often the outcome of volar Barton's fractures. Reducing and stabilising anatomical anomalies is the primary objective of treatment [6, 7]. [6] Volar Barton's fracture malunion can cause serious disability and is very challenging to cure. Another option is a severe injury to the articular cartilage that inhibits regeneration. [13, 14]

Therefore, in order to eliminate the need for treatment, it is imperative to prevent a malunited volar Barton's fracture. In this study, Kirschner pinning offered sufficient stability during the fracture healing process when combined with plating or external fixation. Stated differently, both approaches provide adequate stability for the healing process to occur. Threaded Kirschner wires explain why external fixation increases stability and gives a better grip in osteoporotic fractures, and we used threaded 2.5 mm pins for distractor fixation in our investigation.

Clinically speaking, there are benefits and cons to both approaches. Plating treatment allows for more precise piece reduction and stabilisation. [6,7] However, this requires that the fracture site be opened. Closing the incision site may be quite challenging if the local edoema is considerable,

even though the incision is usually not large and the danger of infection is low. The properties of the cancellous bone also inhibit any postponement of fracture repair. The outcome is a high success rate.

Since the pinning procedure keeps the fracture site closed, there are no problems at the incision site. Stabilisation and fragment reduction, however, might not work as well. Furthermore, thumb and index finger movement obstruction may result from tendon penetration of the external fixation. [15,16] Thankfully, after the external fixation is usually removed after six weeks, range-of-motion exercises for the wrists and fingers can begin. As a result, the wrist joint's functional outcome is mainly excellent.

The literature rates the satisfaction with volar plating at 77 to 94%. [6,7,11] All 22 fractures in this series, however, had satisfactory results and a 100% positive outcome rate. Given that volar Barton's fractures affect the articular surface and that wounded articular cartilage usually does not regenerate, the degree of wrist arthrosis largely determines the long-term results. [13, 14] As a result, the success rate falls with increasing follow-up time. In the current dataset, the average follow-up period was 20 months, and longer follow-up was carried out in the published studies. [6,7,11] But since the wrist is not a joint that bears weight, degradation should occur gradually. As a result, the satisfaction rating will progressively drop over time. Even after the Kirschner wire scan and external fixation were removed after six weeks, several patients still had stiff fingers. JESS distractor pins need to be positioned laterally in a safe area in order to use a C Arm correctly. [17-19]

These solutions have both benefits and downsides. As soon as it is practical, wrist and finger range-of-motion exercises should be initiated to avoid impaired joint function. This is especially important in cases of articular cartilage-related Barton fractures.

### Conclusion

Volar Barton's fractures are prevalent, to sum up. Modern surgical methods can offer a great level of satisfaction. Both open reduction with stabilisation by buttress plates and closed reduction with stabilisation by pinning and external fixation can achieve excellent success rates in the current investigation. Both methods have benefits and drawbacks, but the plating procedure appears to produce better outcomes.

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