

Comparison of Clinico-Radiological and Functional Outcome of Intra Articular Distal End Radius Fractures Managed by Volar Locking Plate versus External Fixation: An Observational Prospective Study

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Abstract:

Background: The most frequent fractures in the upper limb are distal end radius (DER) fractures. Intra-articular fractures can be treated by percutaneous pinning, closed reduction and external fixator application, or open reduction and internal fixation using a volar locking plate. Comparing the functional results of external fixation and volar locking plates was the aim of our investigation.

Methods: This prospective study was conducted at Department of Orthopaedics, SKMCH, Muzaffarpur, and Bihar from March 2022 to February 2023 on 46 patients with intra articular distal end radius fractures. Of them, 20 were controlled by an external fixator, while 26 were controlled by a volar locking plate. The radiographic parameters and range of motion attained after surgery were used to compare the outcomes of the two groups. The Gartland-Werley scale and the DASH score were used to assess the functional result.

Results: Patients treated with a volar locking plate (VLP) had superior grip strength and final range of motion as compared to those treated with an external fixator (EF). Radiographically, the VLP group outperformed the EF group in terms of volar tilt and radial height.

Conclusion: In comparison to external fixators, we found that VLP is a better way to keep reduction going until union occurs and avoids fracture collapse in intra-articular distal end radius fractures. Consequently, the functional and radiological results are superior to those of the external fixator.

Keywords: Intra articular DER fractures, ORIF with VLP, CR and external fixation, DASH score, Gartland–Werley scale.

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Introduction

With an average annual incidence of 17.5%, distal radius fractures are the most frequent fractures in the upper extremities [1] and is distributed in children and the elderly in a bimodal manner. [2] Although nonsurgical management is still the primary approach, fractures that are too unstable for nonoperative management can be treated in a number of ways.[3-5] These consist of percutaneous pinning, internal fixation, and external fixation. Restoring wrist function is the main objective of treatment for these fractures. [6] Because of its better biomechanical properties, the volar locking plate (VLP) has become the most preferred treatment for distal radius fractures over the last ten years.[7,8] Although external fixation (EF) is not as common, many surgeons have chosen it because of its ease of use, enhanced

reduction by ligamentotaxis, lack of additional procedures, and satisfactory outcomes. However, the increased prevalence of complications, such as complicated regional pain syndrome, loss of reduction, radial sensory nerve damage, and pintract infection, should raise concerns. [9–11]

Material and Methods

This observational prospective study was conducted in the Department of Orthopaedics, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar from March 2022 to February 2023. The study included all patients who met the inclusion criteria and were treated with an external fixator or a volar locking device. All patients gave their written, informed consent to be included in the study. All of the patients received thorough

explanations of the surgical process, anesthesia issues, and other related topics in language they could understand well in advance. The collected data of all the patients included in the study design was analyzed using EpiInfo Version 3.0 and Statistical package for social sciences (SPSS).

Patients who meet the Frykman and AO classification criteria, are medically fit, between the ages of 20 and 70, and have radiographic evidence of an intra-articular fracture of the distal end radius are eligible for surgery. This study covered closed fractures and intra-articular fractures that were less than 5 cm from the joint line.

This study excluded patients with undisplaced fractures, all open fractures, neglected wounds for more than four weeks, history of prior wrist pathology, malunited distal radius fractures, and those aged less than 20 and older than 70. Three of the 49 patients who were enrolled in the research were lost to follow-up. The remaining 46 patients (n=46) underwent routine follow-up, and their data was thoroughly examined. The patient's limb was

splinted and the proper analgesia was administered when they were brought into the emergency room. After that, the affected limb's AP and lateral radiographs were taken as needed (Figure 1a). In every instance, a computed tomographic (CT) scan was performed to determine the intra-articular extent of the fracture line. All baseline electrocardiograms (ECGs), chest X-rays, and blood investigations were completed.

The patient's fitness and the state of the soft tissues determined when surgery was scheduled. As a standard preventative measure, all patients got an intravenous injection of 1.5 g cefuroxime before to surgery.

General or regional anesthesia (interscalene or supraclavicular block) was used for all surgeries. The patient was placed on the side arm-board of the radiolucent table in a supine posture. To examine the distal radius, distal ulna, and articular surface in AP and lateral views, an image intensifier was placed beneath the arm-board.



Figure 1: Pre (a) and post-operative (b) x-rays of distal end radius fracture managed by volar locking plate



Figure 2: Pre (a) and Post-operative (b) x-rays of distal end radius fracture managed with external fixator and K-wires

Results

26 patients (n=46) with intra-articular distal end radius fractures were included in this study; 25 of these patients were male (54.34%) and 21 were female (45.65%). VLP was in charge of 26 patients (14 men and 12 women), while external fixators were in charge of 20 patients (11 men and 9 women). With a mean age of 54, the most prevalent age group was 50–60 years old. The mode of injury was RTA (20 patients), fall from standing height (23 patients), and other causes such as heavy item falls, sports injuries, and injuries from industrial equipment accounted for the remaining 3 patients. Twenty-four patients had damage to their right limb, while twenty-two patients had damage to their left limb but no bilateral limb impairment. Out

of 26 patients fixed with VLP 14 had injury to right limb and 12 had injury to left limb and in external fixator group 11 had injury to right side and 9 had injury to left side. The average surgical time for VLP was 74.6 minutes, whereas the average time for external fixator application was 56.8 minutes. Clinical union took an average of 7.6 weeks for VLP and 6.9 weeks for external fixators.

Compared to the contralateral side, which was not injured, the external fixator group's mean grip strength was 92%, while the VLP group's was 95%. Table 1 compares the wrist range of motion for the two groups at six weeks, three months, six months, and twelve months. It shows that patients treated with a volar locking plate had improved wrist range of motion.

Table 1: Comparison of wrist range of motion between patients managed by volar locking plate and external fixator

Wrist movements	Patients managed via VLP				Patients managed by External fixator			
	At 6 wk	At 3 mnth	At 6 mnth	At 12 mnth	At 6wk	At 3 mnth	At 6 mnth	At 12 mnth
Palmer flexion	69.9	72.2	76.4	78.4	60.1	64.4	67.9	70.9
Dorsiflexion	61.2	63.4	64.5	66.5	56.4	59.5	62.8	64.2
Pronation	71.5	73.1	75.1	76.8	65.7	67.1	68.4	70.9
Supination	74.3	75.2	76.1	79.5	66.4	67.5	69.4	71.1
Ulnar deviation	18.5	19.2	21.5	23.1	17.1	18.4	19.7	20.4
Radial deviation	19.4	20.2	20.7	21.1	17.5	18.1	19.4	19.9

Patients treated with a volar locking plate had mean Gartland-Wereley scores of 3.8 and 12, respectively, whereas patients treated with an external fixator had mean scores of 4.7 and 16.

Two patients experienced loss of reduction and needed to be readjusted, while five patients treated with external fixators complained of pin tract infection and needed a prolonged course of antibiotics. Three patients experienced wrist stiffness that went away with physiotherapy, and

two patients complained of damage to the radial nerve's sensory branch. Four of the patients treated with a volar locking plate complained of wrist stiffness, and two of them had a superficial infection that was treated with a two-week course of culture-specific antibiotics before the infection went away.

Two patients experienced tendinitis, and one patient experienced hardware symptoms.

Table 2: Comparison of radiographic parameters between patients managed by volar locking plate and external fixator

Radiographic parameter	Patients managed via VLP			Pat. managed by External fixator		
	At 3 mnth	At 6 mnth	At 12 mnth	At 3mnth	At 6mnth	At 12mnth
Volar tilt	11.3	11.8	12.4	10.4	10.9	11.3
Radial Inclination	22.9.	23.1	23.3	21.4	21.7	21.9
Radial length	-1.34	-1.22	-1.12	-1.31	-1.27	-1.24
Ulnar variance	12.9	12.7	12.4	12.7	12.5	12.1

Table 3: Comparison of Mean Gartland werley score and Mean DASH score between patients managed by volar locking plate and external fixator

Parameter	Patients managed via VLP	Patients managed by External fixator
Radial carpal articular step off	0.5±0.8	1.3+/-0.9
Mean Gartland werley score	3.8	4.7
Mean DASH score	12	16

Discussion

In order to treat intra-articular distal radius fractures, we compared the EF and VLP in this

study. We discovered that VLP is better at preserving joint stability and articular congruence while also enhancing joint mobility. The

application of VLP in the management of unstable distal radius fractures has grown in acceptance during the last ten years. The volar technique reduced the amount of compressed or impacted fragments by providing good exposure of fracture fragments for simple handling. Better support and fastening of the small fragments were made possible by the VLP's fixed-angle and locking screw/hole. Twenty-four of the forty-six research cases concerned the dominant right side. A more protective and early defense response while falling on the right side or using the right hand may be the cause of the comparatively higher susceptibility.

In a short-term research comparing internal and external fixation for closed, unstable intraarticular fractures of the distal radius, Zamzuri et al. found that the internal fixation group had better anatomical outcomes than the external fixation group. The volar tilt, radial inclination, and radial height were all kept in good condition. Nevertheless, there were no differences between these two types of fixation in the functional results after six months and a year. The external fixation group saw a greater rate of complications. [15]

Internal fixation is superior to external fixation in terms of early mobilization, grip strength, and subjective evaluation, according to Abramo et al.'s study comparing ORIF with plating to closed reduction external fixator. [16] The locking palmar plate fixation method showed significantly better radiological and functional results compared to external fixation and the non-locking palmar plating methods, according to Schmelzer et al.'s study comparing the efficacy of locking and non-locking palmar plating and external fixation for unstable distal radius fractures in the elderly. Plate fixation outperformed external fixation in terms of subjective evaluation. Both plate fixation groups saw less complications and reoperations. [17]

In comparison of functional outcome, the range of movements are nearly same as in study of Jupiter et al. [18]

Conclusion

Based on our study's findings, we can say that in cases of intra-articular distal end radius fracture, the VLP is superior to an external fixator. Compared to an external fixator, VLP offers a greater range of motion. Additionally, the external fixator group has a higher prevalence of wrist stiffness. External fixators, on the other hand, can be taken into consideration for patients for whom VLP was not possible and also produce adequate results, as evidenced by high DASH scores.

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