Original Article

Comparison Of The Outcome Of Distal Radius Intra-Articular Fracture Treated With Volar Locking Plate Versus Wrist Spinning External Fixator

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Abstract

Objective: To compare the functional outcome of patients with comminuted intra-articular distal radius fractures managed with volar locking plate and wrist spanning external fixator using the QuickDASH Score.

Methods: This prospective comparative study was conducted at –removed for blind review-- from December 2024 to May 2025, and a total of 46 patients were included in the study, with 23 patients in each group . Non-probability consecutive sampling was used. The QuickDASH score was calculated after the 16th post-operative week. The functional outcome score between the two groups was analysed using an independent sample t-test using SPSS 27.

Results: The mean age of patients in the VLP group was 48.00 ± 10.78 years, while in the Exfix group it was 45.43 ± 12.09 years. A higher proportion of patients were male, accounting for 73.9% of the study population, whereas females comprised 26.1%. The mean QuickDASH score in the VLP group (8.38 ± 3.43) was significantly lower than the mean score in the Exfix group (11.16 ± 3.99), indicating better functional outcomes in the VLP group. This difference was statistically significant with t(44) = -2.532 and p = 0.015.

Conclusion: Management of distal radius, comminuted intra-articular fractures with volar locking plate offers superior short-term functional outcomes, as demonstrated by lower QuickDASH scores at 16 weeks postoperatively.

Keywords: radius fracture, Intra-articular fractures, External fixator, Comminuted fracture, Anatomical reduction, Premature degenerative osteoarthritis.

Introduction

Fracture of the distal radius (DRF) is of the common fractures, accounting for almost 17% fractures that present to surgical emergencies.[1] These fractures follow a bimodal age distribution, occurring most commonly in post-menopausal women and young men.[2] Young patients have good bone stock, so DRFs are associated with high-energy trauma where whereas in elderly patients, osteoporosis leads to weak bone stock, so low-energy injury, e.g. simple slipping on an outstretched hand, can lead to such fractures.[3] Bone Mineral density is directly proportional to the complexity of these fractures but inversely proportional to clinical outcomes.[4]
Over the years, management of these fractures was conservative, but in recent years, surgical indications have increased owing to improved patient outcomes by restoring congruity of articular surface and maintaining axial alignment to prevent premature post-traumatic arthritis.[5] Surgical options for DRF management include pinning, percutaneous, wrist-spanning external fixator, internal fixation with locking plate and fragment-specific fixation.[6]
Open reduction and internal fixation with volar locking plate(VLP) provides better reduction, greater stability and shorter rehabilitation time.[7] However, demerits include scar, infection, wrist stiffness, rupture of extensor tendons and reflex sympathetic dystrophic syndrome.[4] However, a study (Singh et al, 2023) shows that wrist spanning external fixation (Exfix) is a minimally invasive procedure, reduces fracture by traction, avoids tissue dissection, short learning curve. On the other hand, there is an increased risk of loss of reduction secondary to pin loosening, malunion, and pin tract infection.[8] Therefore, there is contrasting evidence in the literature which provides the rationale for our study.
The study aims to compare the functional outcome of distal radius intra-articular fractures managed with volar locking plate vs wrist spanning external fixator.

Materials And Methods

This prospective comparative study was conducted from December 2024 to May 2025. After taking approval from the board of ethical review of –removed for blind review---. A sample size of 46 patients was taken as calculated by using the WHO calculator 7.4a with a level of significance of 5% and a power of the test 90 %. Non-probability consecutive sampling was done, and patient between 18 to 65 years of age with a fresh closed distal radius fracture extending into the radio-carpal joint was included in the study. Exclusion criteria include any previous fracture around the wrist joint, ipsilateral forearm fracture, pathological fracture, associated head, spine or neurovascular injury, or local disorders like rheumatoid disorder or infection.
Patients who fulfilled the inclusion criteria were included in the study, and written consent was taken. The study sample was divided via lottery method into two groups, i.e. Group A and Group B, and each group

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RRA, RA - Acquisition, Analysis, Interpretation
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included 23 patients. Group A patients had open reduction and internal fixation with VLP, and Group B had closed reduction and external fixation with wrist spanning external fixator(Exfix).

Both procedures were done by at least a senior registrar-level orthopaedic surgeon under general anaesthesia with above-elbow tourniquet application. In Group A, the patient's fracture site was opened via the Modified Henry approach, the fracture was reduced manually using longitudinal traction under fluoroscopic guidance, and was preliminary fixed with K wires. T- buttress volar locking plate was positioned using fluoroscopy and fixed with locking screws. The ulnar styloid will be fixed if it makes the radio-ulnar joint unstable using K-wires. In Group B fracture was reduced manually under fluoroscopy and was preliminary fixed with K-wires. Two 3.5 mm shawnz screws at least 1.5 cm apart were inserted on dorso-radial aspect of 2th metatarsal (angled 30 to 45 degree dorsal to frontal plane of hand and forearm) and two 3.5 mm shawnz screws at least 1.5 cm apart were inserted dorsal to midline at-least 8-10cm proximal to radio-carpel joint (with angle if 30 degree dorsal to frontal plane of forearm). The wrist-spanning external fixator frame was applied across Shawn's screw.[9]

Most of the patients were discharged on the 1st post op day. Physiotherapy in the form of active finger movements was started in both groups on the 1st Op day and was advanced over the next 3 to 4 weeks in the volar locking plate group, but progressive physiotherapy was started in the external fixator group after its removal. Patients were followed up after 2 weeks for wound assessment and removal of stitches, and after 6 weeks for removal of ex-fixator. Final follow was done after 16th post-operative weeks when the functional outcome using Quick QUICKDASH score was calculated.

QuickDASH Score stands for Quick Disability of Arm, Shoulder and Hand score.[10] Patients were asked to rate the symptoms and physical function from 11 –11-item questionnaire. The score out of 100 is calculated, and higher scores represent more disability. Score is calculated using the formula [{(sum of n responses/n) -1} multiply by 25] where n is the number of responses.

Data was analysed using SPSS Version 27. An independent sample t-test (or Mann-Whitney U test may be used if data is not normally distributed) will be used to test the hypothesis after assessing for normality of the obtained data. The QuickDASH score was taken as the dependent variable, and the type of procedure conducted was taken as the independent variable, with a P value <0.05 being considered significant. Differences in frequencies of post-operative complications will be analysed using the Chi-square test, with a P value <0.05 being considered significant.

Results

The mean age of patients in the VLP group was 48.00 ± 10.78 years, while in the Exfix group it was 45.43 ± 12.09 years. A higher proportion of patients were male, accounting for 73.9% of the study population. Left-sided fractures were more prevalent in both treatment groups. Table 1 shows detailed demographic data of study participants.

Table 1: Demographic details of study participants

Variable		VLP group (n=23)	Exfix group (n=23)
Age		48 ± 10.78	45.43±12.08
Gender	Male	18 (78.3%)	16 (69.6%)
	Females	5 (21.7%)	7 (30.4%)
Fractured Side	Right	9 (39.1%)	8 (34.8%)
	Left	14 (60.9%)	15 (65.2%)
Type of fracture	23C2	11 (47.8%)	10 (43.5%)
	23C3	12 (52.2%)	13 (56.5 %)

The common mechanism of injury was road traffic accidents (32.4 %), followed by falls on outstretched hands (30.4 %) in both study groups.

The QuickDASH scores were found to be not normally distributed with a P-value of the Kolmogorov-Smirnov test, <0.001. The mean QuickDASH score of both groups was compared using Mann Mann-Whitney U test. It revealed that the mean QuickDASH score in the VLP group (8.38 ± 3.43) was significantly lower than the mean score in the ExFix group (11.16 ± 3.99), indicating better functional outcomes in the VLP group. This difference was statistically significant with t(44) = -2.532, p = 0.015. An excellent QuickDASH outcome (score 1-5) was observed in 5 patients (21.7%) in the VLP group, compared to only 1 patient (4.3%) in the Exfix group. The majority of the patients had a good QuickDASH score in both groups. 73.9 % in the VLP group and 78.3 % in the ExFix group had a good score, i.e., between 6 to 15.

Tables 3 and 4 show a comparison of the means of QuickDASH scores of both groups.

Table 3: Comparison of QuickDASH scores of both groups (Mann-Whitney U test for comparing means)

Intervention done	N	Minimum	Maximum	Mean	Std. Deviation	P-value
VLP	23	2.27	15.90	8.3817	3.43	0.015
External fixator	23	4.54	18.18	11.16	3.99	

Table 4: Categories of patients based on QuickDASH score

QuickDASH score categorization	VLP (n=23)	External fixator (n=23)
Excellent (1-5)	5 (21.7 %)	1 (4.3 %)
Good (6-15)	17(73.9 %)	18 (78.3 %)
Satisfactory (16-35)	1(4.3 %)	4 (17.4%)

The prevalence of complications is perceived to be higher in the ExFix group compared to the VLP group. However, chi chi-square test showed it to be statistically insignificant with a p-value of 0.314. Table 5 shows various post-operative complications among the patients of both groups.

Table 5: Post-operative complications in both groups

Complications	VLP group (n=23)	ExFix group (n=23	P-value
Surgical Site Infection	1 (4.3 %)	2(8.7 %)	0.314
Wrist stiffness	2 (8.7 %)	1(4.3 %)	
CRPP	1 (4.3 %)	0 (0 %)	
Pin loosening	0 (0 %)	2(8.7 %)	
Mal-union	0(0 %)	2(8.7 %)	
Nil	19 (82.6 %)	16(69.6 %)	

Discussion

Treatment of DRFs aims to restore the joint surface, maintain radial alignment and height, preserve hand and forearm function through early mobility, and ensure stability for proper healing.[8]

In our study, the average age at the time of injury was 46.72 years, which is comparable to the 45.5 years reported by Dk et al.,[1] but higher than the 33.68 years reported by Ali et al.[4] Gender distribution in our study depicts male predominance, which is similar to studies by Satyanarayana Y.[11] and Misha et al.[12] Left-sided fractures were more common in our population, similar to a study done by Satyanaryan Y.[11] but different from reported by Ali et al.[4]

Fracture due to low-energy trauma, such as falling on an outstretched hand, was a common mechanism of injury in elderly patients. Ten patients sustained fractures from falls from height, most of whom were painters or construction workers. Additionally, four patients sustained fractures due to a direct blow to the wrist, resulting either from physical assault or the impact of a falling heavy object—such as a tool or vehicle part, as seen in car mechanics.

A study by Dk et al.,[1] showed that the QuickDASH score at the 16th week was 7.1 ± 2.9 for the volar locking plate (VLP) group and 10.4 ± 4.7 for the external fixator (ExFix) group.[1] Similarly, a study by Gill et al. found mean QuickDASH scores of 12.35 ± 1.35 for VLP and 12.20 ± 2.99 for ExFix.[13] The findings of both studies are consistent with our results, indicating that the functional outcome with VLP is superior to that with external fixation. However, a study by Ali et al,[4] Reported that there is a difference in functional outcome between VLP and Ex fix, with mean QuickDASH score of (7.54±6.18) and (9.41±10.36), respectively.[4]

A frequency of complications was observed to be higher in the external fixator (ExFix) group compared to the volar locking plate (VLP) group, which is consistent with the findings of Dk et al. and Gill et al.[1,13] Surgical site infections were successfully managed with oral antibiotics. In the ExFix group, two patients developed malunion due to loss of reduction, suggesting that external fixators may be less effective in maintaining fracture alignment. In the VLP group, two patients experienced wrist stiffness, which may be attributed to extensive soft tissue dissection during open reduction or poor compliance with postoperative physiotherapy.

Conclusions

This comparative analysis demonstrated that the treatment of patients with distal radius intra-articular fracture using volar locking plate was associated with better outcomes than patients treated with wrist spanning external fixator. The VLP group proved more functional recovery, greater improvements in DASH scores and returned to daily activities sooner. Besides this, complications were also more prevalent in the external fixator group, consisting of pin tract infections, loss of reduction, and stiffness, as compared to the volar locking plate group, giving more stability and predictability of outcomes. In light of this evidence, the volar locking plate can be regarded as more efficacious among the two therapeutic modalities to provide optimal recovery in distal radius intra-articular fractures. Surgical management of comminuted intra-articular fractures with volar locking plate offers superior short-term functional outcomes in the management of intra-articular distal radius fractures, as demonstrated by lower QuickDASH scores at 16 weeks postoperatively. This approach enables earlier postoperative range of motion exercises and provides more reliable, stable and anatomical restoration compared to external fixation. Among the greatest advantages of this research is the fact that it directly compared two frequently used methods of treating distal radius intra-articular fractures, i.e. the volar locking plate technique and the wrist spanning external fixator technique. The presence of validated functional outcome measures like the DASH score also gives the study objective results of recovery as opposed to subjective clinical impressions. The other strength is that it measures not only functional improvement but also the complications to have an overall view of the patient outcome. Both types of fixation methods are broadly applied in everyday orthopaedic practice; thus, the findings are highly clinically applicable and can be directly used in the decision regarding the treatment. Also, inclusion of only the patients with intra-articular fractures made the study population homogeneous, leading to greater reliability of the comparisons between the two groups.

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