DOI: https://doi.org/10.53350/pjmhs22169781

ORIGINAL ARTICLE

The Functional Outcomes in Treatment of Displaced Extra Articular Distal Radius Fracture by Pop Alone or K-Wire Augmentation

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ABSTRACT

Background & Objective: A distal radius fracture is responsible for one-sixth visit to the orthopedic emergency room. Although these fractures are common, the best treatment for these fractures is still controversial. The objective of the study was to compare the functional outcomes in terms of union in displaced extra articular distal radius fracture by POP alone or k-wire augmentation.

Methods: A comparative study was conducted in the department of orthopedic surgery, Pakistan Institute of Medical Science, Islamabad from June to December 2021. A total of sixty (n=60) adult patients irrespective of gender with distal radial fracture were included in the study. Patients allocated in two groups, Group A included patients who were treated with above elbow POP casting after reducing the fracture, under sedation or blockage of hematoma and Group B included the patients in whom surgery was performed with k-wire by closed reduction and internal fixation. The main outcome measure of the study was functional outcomes in terms of excellent, good and fair. The chi square test was used between study groups for comparison of acceptable outcomes (excellent to good). A p value ≤ 0.05 was considered significant.

Results: The average age of the patients of both groups was 38.6±15.8 years. Among 60 patients, 70% (n=42) were male and 30% (n=18) were females. In group A (POP) 30% (n=9) patients showed excellent, 23.3% (n=7) showed good and 46.7% (n=14) showed fair outcome as per our study outcomes. In group B (k-wire) 56.7% (n=17) patients showed excellent, 36.7% (n=11) showed good and 6.6% (n=2) showed fair outcome with p value 0.002.

Conclusions: The study concluded that the functional outcomes in terms of union of displaced extra articular distal radius fractures, K-wire fixation showed better results than POP cast alone.

Keywords: Bone wires; Casts, Surgical; Internal fixators; Radius fractures.

INTRODUCTION

Distal radius fractures, commonly stated as wrist fractures and common in children & adults. They are occurring within 3 inches of radiocarpal joint to about 1cm, when the lower end of radius meets with lunate and scaphoid of wrist bones. Most are closed lesions, the upper skin remains the same.[1] A proposed classification is based on articular involvement, displacement and reduction (that fracture can be reduced; i.e., once reduced, fragments will remain intact).[2] A distal radius fracture is responsible for one-sixth visit to the orthopedic emergency room. Although these fractures are common, the best treatment for these fractures is still controversial.[3]

Different therapies have been developed to treat distal radius fractures. The treatment depends upon fracture type i.e., open or closed, simple or comminuted, stable or unstable.[4] The distal radius fracture stabilization enhanced by use of external fixator and k-wire fixation, which develops years ago in United States, 80-90% of patients have benefits in terms of anatomical and clinical outcomes.[5]

A local study reported that POP cast succeeds in achieving excellent and good results as compared to external fixation.[6] Efficacy of k-wire fixation in distal radius fractures, the intervention succeeded in yielding satisfactory results.[7] Therapeutic goals focus on restoring the anatomy of the distal radius (radial length, radial angle and volar tilt) with radio-carpal and radial-ulnar joints. Distal radius with intra-articular fracture results in pain, limited range of motion and degenerative arthritis. Malunion is occurred due to radial length, angle, volar tilt and intra-articular reduction.[8] Numerous researchers have recognized the importance of restoring articular congruity to prevent osteoarthritis.[9]

Keeping in mind the importance of wrist in daily life and disability associated with this injury, it is crucial to find an ideal and successful management procedure. So, we planned to conduct a comparative interventional study of K-wire fixation and conservative treatment with POP cast alone in the management of displaced extra articular distal radius fractures, so that better management option could be implemented locally. The hypothesis of the study was, K-wire fixation gives better functional outcomes than POP cast alone. The objective of the study was to compare the functional outcomes in terms of union in displaced extra articular distal radius fracture by POP alone or k-wire augmentation.

MATERIAL & METHODS

After getting ethical approval from ethical committee of Pakistan Institute of Medical Sciences (PIMS) Islamabad, this comparative interventional randomized controlled trial was conducted in the department of Orthopedic Surgery from June to December 2021. After informed consent, 60 patients with distal radius fracture were selected by volunteers. Sample size is calculated from the WHO sample size by the following parameters; anticipated population in POP casting group 30% and K-wire fixation group as 83%, confidence level 95%, alpha error 5% and power of test was 80%.[6] The non-probability consecutive sampling technique was used for patients' selection. All adult patients age between 18-60 years with distal radius fracture confirmed by radiographically were included in this study. Patients presenting after 1 week of injury, open fractures and associated injuries were excluded from the study. The investigator thoroughly gone through the case history, physical and radiographic examinations. Patients were randomly assigned to the POP cast (A) group and the K-wire fixation (B) group. Random sequencing numbers generated electronically by biostatistician and distribution were sealed in light envelopes to ensure encryption. The data was collected on predesigned patient proforma. The functional outcome of the two interventions was assessed in terms of excellent, good or fair on CHITEST clinical scoring. The clinical and radiological outcome were assessed after 08 weeks of cast removal. A standardized evaluation system for clinical and radiological outcome measurement with a score of 1-3, with the worst result as 1 and

the best as 3 points. Most outcome was measured by clinically and radiologically scores to each patient. 16-18 score was considered as excellent, 13-15 good, 912 fair, ≤ 9 poor. Good to excellent was the acceptable outcome. In the POP cast (A) group, patients were treated by placing POP above the elbow after reducing fracture, under sedation or blockage of hematoma. The block is made without epinephrine 3ml of 2% lidocaine and using 18G needle inserted under aseptic technique. Reduction of distal metaphyseal fragment by increasing the degree of deformity and using longitudinal suspension. When the palmar cortex was reshaped, the forearm was placed in a neutral position up to 30 degrees of supination and the palmar tilt was restored. Post POP casting and reduction X-rays were taken to confirm adequacy. The POP casting removed after 6th weeks. Patients were followed up to 4th and 8th weeks post removal of cast. In K-wire fixation group (B), the surgery was performed with K-wire by closed reduction and internal fixation. In both cases, K-wires measuring 1.5 to 2 mm in diameter were inserted with power drill. In the close reduction the K-wire is fixed percutaneously and is visible after procedure. After Kwire fixation the wrist kept in wrist brace for 6 weeks and intermittent exercises was allowed after one week. All medical procedures and patient examinations were performed under the strict supervision of an orthopedic consultant with at least 5 years of experience.

Data was entered and analyzed using SPSS software version 23.0. Data validity was assessed by the Shapiro-Wilk test for general and similarity, based on which parametric or nonparametric test was used to determine within the group and for all group differences in the two groups. The continuous numerical variables like age, radial length, radial angle and CHITEST score were calculated as means and standard deviations. For qualitative variables like gender, functional outcome (excellent to good), frequency and percentage were calculated. The chi-square test was used among the study groups for comparison between acceptable outcome (excellent to good). A p value of ≤ 0.05 was considered significant.

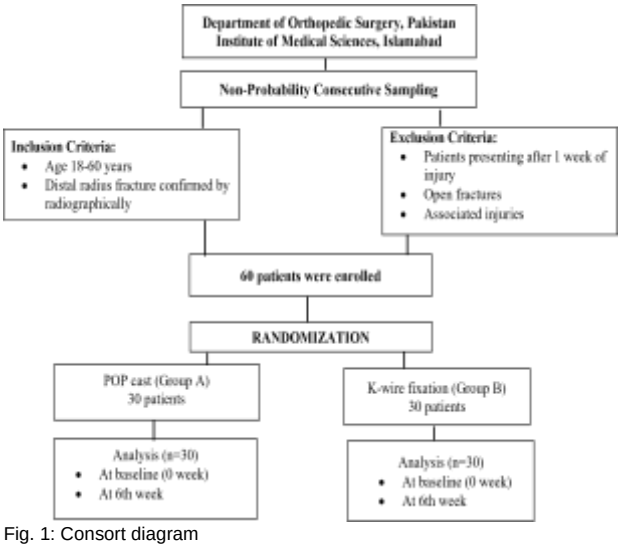

Fig. 1: Consort diagram

RESULTS

A total of 60 patients, 30 in each group was studied. For normality data, Shapiro-Wilk test was used and all the data was normative (p value ≥ 0.05). The average age of the patients of both groups was 38.6±15.8 years. Among 60 patients, 70% (n=42) were male and 30% (n=18) were females. Pre and post intervention, mean radial length and radial angle of both groups were measured (Table 1). In group A (POP), majority patients showed fair outcome as per our study whereas, in group B (K-wire), majority patients showed excellent outcome (Table 2).

Table 1: Pre and post intervention radial length and angle in both groups, n=60

POP cast group (A)		K wire group (B)		
Radial length	chi value	p value		
(mm)	Mean±SD	Mean±SD		
Pre intervention	3.23±3.01	5.13±2.79	2.723	.001
Post intervention	11.03±2.27	12.1±3.22	6.427	.037
Radial angle (degrees)				
Pre intervention	9.57±6.73	11.1±7.98	3.946	.001
Post intervention	18.5±4.41	17.43±4.87	4.841	.046

Chi square test

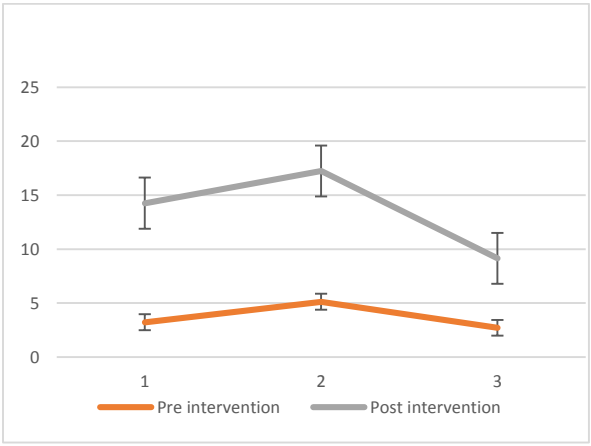

Figure 2: Radial length (mm) of POP cast group and K-wire group

Table 2: Functional outcome in both groups, n=60

Functional outcome	Groups	chi value	P value
POP (A)		K-wire (B)	
Excellent	9 (30%)	17 (56.7%)	002
Good	7 (23.3%)	11 (36.7%)	
12.489			
Fair	14 (46.7%)	2 (6.6%)	
Total	30	30	

Chi square test

DISCUSSION

This study enrolled 60 patients who were distal radius fracture. In group A (POP) most of the patients (n=14) showed fair outcome whereas, in group B (K-wire) most of the patients (n=17) showed excellent functional outcome (p = 0.002) as per our study outcomes. Our study results are similar with the already published studies on the subject. In a local study, Rahman O, et al compared radiological effect of external fixation with Plaster of Paris (POP) for distal radius of unstable intra-articular fractures. Their results showed that in group POP, most of the patients (n=19) showed fair results whereas, in group K-wire, most of the patients (n=14) showed excellent results.[6] In their study and in the present study, the results of K-wire group as compared to POP cast group patients were significantly better (p value ≤ 0.05).

Haddad M, et al examined radiological effect and functional outcome of distal radial fractures following external fixation. A small external AO device was used for distal radius intra-articular fractures. A visual analogue scale (VAS) was used to assess pain and Lidstrom scale was used to assess the effect of hand movements. Clinical and radiographic results were associated. They found that Lidstrom scale results were good in 61% of patients. VAS results were good. Most patients (n=35) experienced a good range of wrist, but only few (n=3) with significantly reduced range. There were statistically significant results between radiographical and clinical outcomes. They concluded that external fixation to be a better method for distal radius fractures.[10]

Kreder HJ, et al compared K-wire fixation with casting for distal radius fractures with metaphyseal displacement. Patients

were evaluated through Musculoskeletal Functional Assessment (MFA) score. Jebsen Taylor score and pinch & grip strength test was applied. Functional outcome and pain were measured by SF-36. The results showed that MFA, Jebsen Taylor score, SF-36 pain score and grip strength improved significantly in first year. Jebsen Taylor score and SF 36 pain score in both study groups were same in 2nd year of follow up. The study concluded that in distal radius fractures, there is a tendency for better results, clinically and radiographically when treated with K-wire fixation.[11]

Harley BJ, et al evaluated 2 general surgical techniques used to unstable distal radius fractures with radiographical and clinical. Patients under the age of 65 with unstable distal radius fracture were treated by percutaneous pins with casting or augmented external fixation. More than 80% fractures were AO-ASIF C2 or C3. They found that the use of augmented external fixation did not improve the average parameters of radial length, radial angulation, or volar tilt. No significant difference was found in mean arm, shoulder and hand scores, total range of motion, grip strength, or health-related quality of life.[12]

In summary, distal radial fractures have been treated by various surgical methods but the results remain inadequate due to limited scope of prospective and randomized studies. The choice of treatment for any given fracture should be considered first in all fracture stability. The best results are obtained from a stable fracture. Only a small displaced distal radius fractures can be treated effectively. The cast should be applied for 5 to 6 weeks with an above-elbow cast for 3 weeks in closed reduction. Percutaneous fixation provides better results in extra-articular fractures in younger patients. However, it should not be ignored in the elderly osteoporotic patients. Based on our results we recommend external fixation with K-wires in the management of displaced extra articular distal radius fractures in adults.

CONCLUSION

This study concluded that K-wire fixation showed better functional outcomes in terms of union of displaced extra articular distal radius fractures than POP cast alone. The choice of treatment for any given fracture should be considered first in all fracture stability.

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