



Comparison of External Fixation with Illizarov Method Versus Open Reduction with Locking Plate in Comminuted Distal Radius Fractures

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ABSTRACT

Introduction: One of the most prevalent injuries encountered in orthopedic practice is a distal radius fracture. They account for 8% to 15% of all adult bone injuries. Fracture of the distal end of the radius with an intra-articular element typically signifies high-impact trauma in adolescents and young adults. The utilization of cast immobilization for the management of distal radius fractures has been substituted by several different surgical options over the last thirty years, such as the application of locking plates and external fixation.

Aims & Objectives: To compare the outcome of external fixation with the Illizarov method versus Open Reduction Internal Fixation (ORIF) with locking T-plate in comminuted distal radius fracture.

Place and duration of study: The study was performed in the Department of Orthopedics Surgery, Lahore General Hospital, Lahore over a period of six months from 10-07-2020 to 10-01-2021.

Material & Methods: A randomized controlled trial was conducted after enrolling 80 patients fulfilling selection criteria, admitted through emergency & OPD of the same center. (N=40 in each group). Group A received external fixation with Illizarov method & Group B open reduction and internal fixation by applying T-plate). After Informed consent, surgeries were done under general anesthesia by a single surgical team with the assistance of the researcher. Follow-up for evaluation of grip strength and DASH score (as per operational definition) were in progress according to proforma and all information was calculated by the researcher himself through a Proforma (attached). Data was analyzed using SPSS version 22. P-value<0.05 was considered significant.

Results: Mean age was calculated as 33.87±9.32 years in group A and 32.98±10.70 years in group B. There were 37.5 % (n=30) males and 12.5% (n=10) females in group A. Whereas group B had 32.5 % (n=26) male and 17.5% (n=14) females. Mean grip strength in group A was 26.55±4.57 and 54.32±2.91 in group B (p-value <0.05).

Conclusion: We concluded that there was a significant difference found in both groups (p-value<0.05). Therefore, external fixation with the Illizarov method produces better grip strength and DASH (Disabilities of the Arm, Shoulder & Hand) score as compared to open reduction with a locking T-plate.

Keywords: Distal radius fractures, T-Plate, Open reduction

INTRODUCTION

According to estimates, one-sixth of all fracture-related visits to the emergency room are due to distal radius fractures¹. The incidence of fractures encountered in the emergency room is 26 per 10,000 per year². The incidence and fracture patterns of the distal radius are on the rise due to the explosion in speed trauma³. Bridge external fixation is a tried-and-true technique. Open reduction and internal fixation employing T-plates have become alternatives in recent years⁴.

Evidence that the strategy is crucial is that it is less complicated than others⁵. It has been found in a study that the mean grip strength was 46±24.1 with external fixation and 72±22.8 with open reduction (p<0.05)⁶. While another study found in a study that the mean grip strength was 29.34 (±3.12) with external fixation and 27.54 (±2.45) with open reduction (p>0.05) and the mean DASH score was 26.18 (±1.87) with external fixation and 21.98 (±3.74) with open reduction (p>0.05)⁷.

The primary objective of this study is to compare the results of external fixation with Illizarov method versus open reduction using a locking T-

plate in comminuted distal radius fractures. Due to its simplicity, external fixation is frequently used in various surgical setups, but it is also fraught with difficulties. This might be because there isn't enough local evidence, which is why we decided to carry out this study. Therefore, the goal of this study was to gather local information that could later be applied to the local population to better manage comminuted distal radius fractures and enhance patient outcomes.

Objective: To compare the outcome of external fixation with Illizarov method versus open reduction using a locking T-plate in comminuted distal radius fractures.

Operational Definition:

Comminuted distal radius fracture: It is defined as the presence of fracture in distal radius into ≥ 2 fragments confirmed on x-ray and patients presented within 7 days of fractures.

Outcome: It will be assessed after 12 weeks of surgery in terms of the following:

1. Mean Grip Strength: It will be assessed as objective function tests expressed as percentages. The uninjured wrists will be weighed as controls.

2. Mean DASH Score: It will be evaluated using a validated 30-item self-reported metric of upper extremity function on a scale of 100 points, with 0 points denoting no disability and 100 points denoting the greatest degree of disability.

Hypothesis: There is a difference in the outcome of open reduction with locking T-plate versus closed reduction with the Illizarov method in comminuted distal radius fracture.

MATERIAL AND METHODS

Permission for the Randomized Controlled Trial was obtained vide CPSP/REU/OSG-2019-069-2177

Setting: Department of Orthopedic Surgery, Lahore General Hospital, Lahore.

Duration Of Study: Six months after approval of synopsis.

Sample Size: Sample size of 80 cases; 40 cases in each group are calculated with 80% power of the study, 95% confidence interval, and taking the magnitude of mean grip strength i.e., 29.34 ± 3.12 with external fixation and 27.54 ± 2.45 with open reduction with T-plate for management of comminuted fracture of distal radius⁸.

Sampling Technique: Non-probability consecutive sampling.

Sample Selection:

Inclusion Criteria: Patients of age 16-75 years, either gender, Comminuted fracture of the distal

radius (on x-ray) as defined in the operational definition.

Exclusion Criteria: ASA III & IV, diabetes (BSR > 20mg/dl), infection at the fracture site (x-ray), Patients presented after 7 days of fracture and taking jarrah treatment (on history), Patients of osteoporosis (BMD < -1.0 on DEXA). Open fracture with infection and debris (on clinical examination), Bilateral cases.

Data Collection Procedure: 80 patients fulfilling the selection criteria, were selected from the emergency of the Orthopedics Department of Lahore General Hospital, Lahore. Demographic information like name, age, gender, laterality, cause, and duration of fracture was noted. After obtaining consent, patients were randomly split into two groups with 40 each using the lottery method. In Group-A, patients were operated on by using external fixation with the Illizarov method. Group-B patients were undergone open reduction & internal fixation by applying T-plate. A single surgical team performed each procedure while under general anesthesia with the aid of a researcher. Patients were evaluated for grip strength (via dynamometer in kg) and DASH score (as per operational definition). All the information was calculated by the researcher himself through a Proforma.

Data Analysis: Data were entered and analyzed using SPSS 22. Quantitative data like age, duration of fracture, grip strength, and Dash score were presented by mean \pm SD. Qualitative data like gender, operative side, and cause of fixation were presented by frequency and percentages. Both groups were compared for mean grip strength and DASH score by using independent samples t-test. P-values ≤ 0.05 were considered significant. Data was stratified for age, gender, BMI, lateral side, duration, and cause of fracture to control effect modifiers. Post-stratification, both groups were compared for mean grip strength and Dash score by using independent samples t-test for each strata keeping the p-value ≤ 0.05 as significant.

RESULTS

A total of 80(40 in each group) patients were selected to compare the outcome of the study. Age distribution of the patients was done, and it showed that mean SD (group A) = 33.87 ± 9.32 years & Mean SD (group B) = 32.98 ± 10.70 years is shown in Chart-1. A comparison of both groups for Grip strength using an independent sample T-test n= 80 is shown in Chart 2. A comparison of

both groups for DASH score using an independent sample T-test is shown in Chart-3. Gender distribution showed that 37.5 % (n=30) were male whereas 12.5% (n=10) were females in group A and 32.5 % (n=26) were male whereas 17.5% (n=14) were females in group B. Distribution of duration of fracture, showed that Group A (mean \pm SD = 4.30 \pm 1.55 & 26.55 \pm 4.57) & Group B (mean \pm SD=3.70 \pm 1.53 & 54.32 \pm 2.91 respectively. Stratification for grip strength and DASH score concerning age and gender using an independent sample t-test is explained in Table-1 & Table-2 respectively.

Mean grip strength in group A was 26.55 \pm 4.57 and 54.32 \pm 2.91 in group B (p-value <0.05) whereas the Mean DASH score in group A was 22.98 \pm 2.91 and 42.05 \pm 8.18 in group B (p-value <0.05).

Stratification for grip strength with respect to age using independent sample t-test N= 80							
Age group	Group	N	Mean	SD	Std. Error Mean	P-value	
16-40 yrs	Grip strength	A	27	25.2	2.9	0.5	0.001
		B	32	54.0	3.1	0.5	
41-75 yrs	Grip strength	A	13	29.4	6.1	1.7	0.001
		B	8	55.4	2.2	0.7	
Grip strength with respect to gender using independent sample t-test N= 80							
M	Grip strength	A	30	27.4	4.4	0.9	0.001
		B	26	54.7	3.2	0.6	
F	Grip strength	A	10	24.1	1.9	0.6	0.001
		B	14	53.7	2.2	0.5	

Table-1: Stratification for grip strength with respect to age using independent sample T-test N= 80.

Stratification for DASH score with respect to age using independent sample t-test N= 80							
Age group	Groups	N	Mean	SD	Std. Error Mean	P-value	
16-40 yrs	Grip strength	A	27	22.6	1.9	0.4	0.001
		B	32	42.1	8.2	1.4	
41-75 yrs	Grip strength	A	13	23.7	4.3	1.2	0.001
		B	8	41.8	8.8	3.1	
Stratification for DASH score with respect to Gender using independent sample t-test N= 80							
Gender	Groups	N	Mean	SD	Std. Error Mean	P-value	
M	DASH score	A	30	23.4	3.2	0.6	0.001
		B	26	42.5	7.8	1.4	
F	DASH score	A	10	21.8	7.8	0.4	0.001
		B	514	41.3	9.2	2.4	

Table-2: Stratification for DASH score with respect to age using independent sample t-test N= 80.

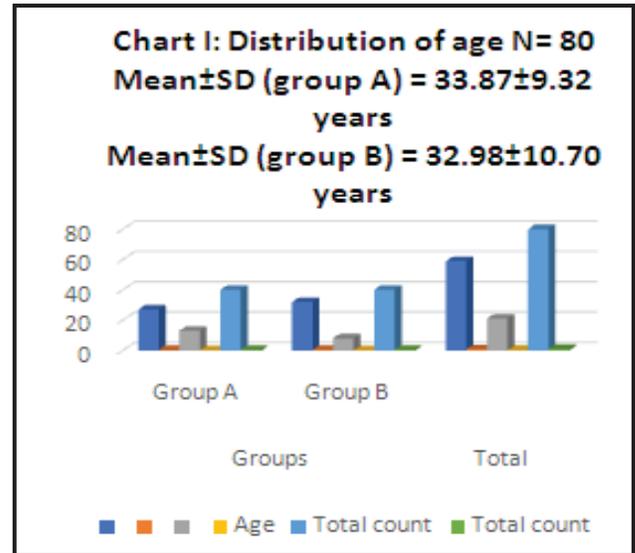


Fig-1: Distribution of age N= 80, Mean \pm SD (group A) = 33.87 \pm 9.32 years, Mean \pm SD (group B) = 32.98 \pm 10.70 years.

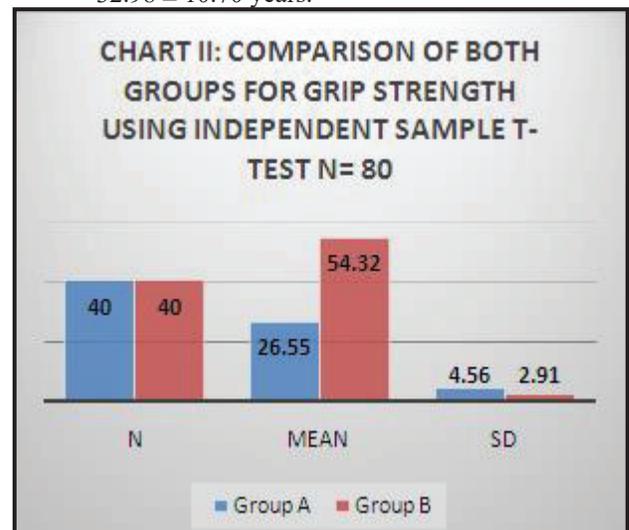


Fig-2: Comparison of both groups for Grip strength using independent sample T-test N= 80.

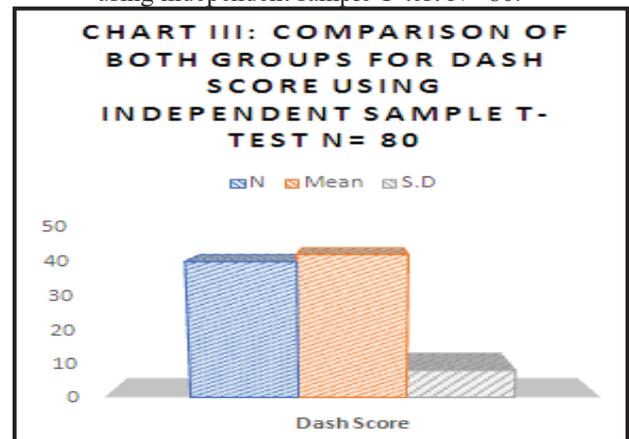


Fig-3: Comparison of both groups for DASH score using independent sample T-test N= 80.

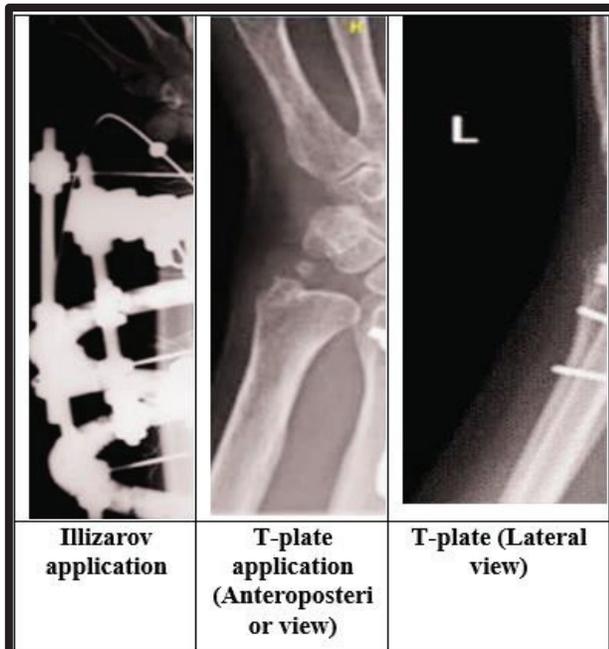


Fig-4: Radiographs of cases for Illizarov and T-plate application.

DISCUSSION

One of the most frequent injuries seen in orthopedic practice is a distal radius fracture (DRF) accounting for 8% to 15% of all adult bone injuries⁷. Trauma surgeons treat fractures involving the distal radius most frequently⁹, accounting for 16% of all fracture¹⁰. Young men and post-menopausal women have the highest DRF incidence, while the distribution of DRFs in the entire population is bimodal. High-energy trauma is most frequently linked to DRFs in younger patients with healthy bone stock, whereas older patients with underlying osteopenia or osteoporosis are more likely to sustain an injury from low-energy trauma, such as a fall from a standing position^{8,10}.

Another study found that the mean grip strength was 29.34 (± 3.12) with external fixation and 27.54 (± 2.45) with open reduction ($p > 0.05$) and the mean DASH score was 26.18 (± 1.87) with external fixation and 21.98 (± 3.74) with open reduction ($p > 0.05$).⁶ Same has resulted in our study as the Mean grip strength in Illizarov application group was 26.55 \pm 4.57 changed as 54.32 \pm 2.91 in the internal fixation group (p -value < 0.05).

Distal end radius fractures typically result from low energy accidents (falls from standing height), which account for 66 to 77% of occurrences, while wrist fractures are typically caused by high energy injuries (10%)^{12,13}. Extra-articular fractures account for 57% to 66% of fractures, partial-articular fractures for 9% to 16%, and complete-

articular fractures for 25% to 35%. One of the most prevalent issues impacting the senior population is osteoporosis^{13,14}. The link between a previous wrist fracture and subsequent osteoporotic fractures at different sites has been described by some recent research^{14,15}.

A prior wrist fracture raises the chance of a hip fracture in women by 1.4 to 1.8 times^{16,17}. The hazard of hip fracture climbs 2.3–2.7-fold in elderly males¹⁸. In the remaining years of their lives, 10% of white women over 65 will develop a DRF¹⁹. Distal radius fractures have substantial social and financial impacts²⁰. Although some fractures will result from high-impact trauma, falling on an outstretched hand from a standing height is the most common cause of this type of fracture. People who fall on their outstretched hands are generally fitter and have better reflexes than those who suffer elbow or humerus fractures^{20,21}. If the impact is severe enough, such as after a vehicle accident or a fall off a bike, a broken wrist can occur even in people with healthy bones^{22,23}. Some fractures may be avoided with the aid of wrist protectors, but not all²⁴.

The increasingly frequent use of open reduction internal fixation (ORIF), particularly for Intra articular Fracture Distal Radius (IFDR), (Fig-4) is one of the most current advancements in the treatment of distal radius fractures²⁵. For two categories of fractures, internal fixation, and open reduction are recommended treatments; the two-part shear fracture (Barton fracture), which is essentially a radio-carpal fracture dislocation, is included in the first group^{26,27}. Even though the anatomical reduction is occasionally achieved by closed methods, these fractures are exceedingly unstable and challenging to manage in plaster²⁸, as in our cases. Illizarov's standard operating procedure, with a ring fixator wrapped around the wrist for weeks, as application at the distal radius does not appear to be cosmetically good (Fig-4). Complex intra-articular fractures with displaced, rotated or impacted articular fragments that are not susceptible to reduction by a restricted operative exposure are included in the second group²⁹.

14 out of 15 patients who had surgical repair of the distal radial articular surface had acceptable or exceptional results, according to Melone's report on a group of 15 patients³⁰.

CONCLUSION

We concluded that in comminuted distal radius fractures external fixation with closed reduction applying the Illizarov method gave better grip

strength and DASH score as compared to open reduction with a locking T-plate.

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