



ORIGINAL ARTICLE

Radiological outcome of Distal Radius fracture treated conservatively (MUA Plaster of Paris) Vs ORIF (Open Reduction and Internal Fixation): A comparative analysis.

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ABSTRACT... Objective: To compare the radiological outcomes of distal radius fractures treated conservatively (MUA + POP) versus operatively (ORIF) in adult patients, focusing on key radiographic parameters and early functional range of motion. **Study Design:** Prospective Comparative study. **Setting:** Ghurki Trust Teaching Hospital, Lahore. **Period:** December 15, 2024, and April 15. **Methods:** A total of 70 patients with Fernandez Type I distal radius fractures were enrolled and randomized into two equal groups: Group A (MUA + POP) and Group B (ORIF). Radiological parameters (radial height, radial inclination, volar tilt, and ulnar variance) and range of motion were assessed at 12 weeks post-treatment. Statistical analysis was performed using t-tests and chi-square tests, with a significance threshold of $p < 0.05$. **Results:** Group B (ORIF) demonstrated significantly better radiological alignment in terms of radial inclination ($p = 0.015$), radial height ($p = 0.024$), and ulnar variance ($p = 0.019$). Volar tilt showed improvement but was not statistically significant ($p = 0.145$). Despite superior alignment, ORIF was associated with a higher rate of articular step-off >2 mm (48.6% vs. 14.3%, $p = 0.001$). Range of motion outcomes (dorsiflexion, palmar flexion, and pronation) were statistically similar in both groups. **Conclusion:** Although ORIF offers superior radiographic restoration of anatomical parameters in distal radius fractures, functional outcomes in the short term, particularly range of motion, were comparable to conservative management. The increased incidence of articular incongruity in the ORIF group raises concerns about potential long-term implications. Thus, the choice of treatment should be individualized, balancing radiological goals with risks, patient profile, and resource availability.

Key words: Conservative Treatment, Distal Radius Fracture, MUA, ORIF, Plaster of Paris, Radiological Outcome, Volar Plate Fixation.

INTRODUCTION

Distal radius fractures (DRFs) represent one of the most frequently encountered injuries in orthopedic trauma, accounting for approximately 15% of all fractures treated in emergency departments worldwide.¹ Distal radius fractures are among the most frequently encountered injuries in orthopedic practice, particularly affecting elderly populations due to osteoporosis and increased fall risk.^{2,3}

The management of these fractures has evolved, with two primary approaches dominating clinical decision-making: conservative treatment, typically involving closed reduction and immobilization with plaster of Paris, and surgical intervention, most

commonly open reduction and internal fixation (ORIF) using volar locking plates.⁴⁻⁷ Conservative management is favored for its simplicity, lower cost, and avoidance of surgical risks. Still, it is often associated with deterioration of radiological alignment over time, such as loss of radial height, increased dorsal tilt, and articular incongruity.⁶ While these radiological changes are common, several studies have shown that they do not always correlate with worse functional outcomes, as measured by patient-reported scores and range of motion.^{2,3,8}

In contrast, ORIF has gained popularity for its ability to restore and maintain anatomical alignment, resulting in superior radiological

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parameters such as volar tilt, radial height, and articular congruity compared to conservative treatment or external fixation.^{4,7,9} The advantages of open reduction and internal fixation (ORIF) are increased stability and quick return of movement in the case of unstable and intra-articular distal radius fractures. The use of plate osteosynthesis with LCP permits good to perfect radiographic and functional results in the management of comminuted intra-articular distal radius fractures and minimizes the incidence of unacceptable results. The complications may be surgical trauma, devascularisation of segments, stiffness of the wrist, irritation or rupture of tendons, and later removal of the plate. There, however, this invasive procedure is not feasible everywhere. Multiple randomized and comparative studies have demonstrated that, although ORIF achieves better radiological outcomes, long-term functional results—including range of motion, grip strength, pain, and quality of life—are often similar between surgical and conservative groups, especially in older adults.^{2,3,10} For example, the ORCHID multi-center trial and other comparative studies found no significant difference in health-related quality of life or functional scores at one year between patients treated with ORIF and those managed conservatively, despite better radiological alignment in the surgical group. Furthermore, while complication rates may be higher with conservative treatment, surgical intervention carries its risks. It is associated with substantially higher costs, raising questions about cost-effectiveness in the absence of clear functional superiority.⁶

Bartl et al. (2016) performed a randomized controlled trial on elderly patients with displaced intra-articular distal radius fractures. They reported that ORIF resulted in better early radiological alignment and range of motion but did not yield significant long-term functional benefits compared to conservative treatment.¹¹

Several meta-analyses and randomized controlled trials (RCTs) have reported that while ORIF provides better anatomical alignment, the functional outcomes measured by range of motion, grip strength, and patient-reported scores

like DASH (Disabilities of the Arm, Shoulder, and Hand) do not always show significant differences compared to conservative treatment.^{12,13}

This study aims to clarify the comparative effectiveness of conservative versus operative treatment of distal radius fractures, with a focus on radiological outcomes. While ORIF is known to provide superior anatomical alignment—such as improved radial height, inclination, and ulnar variance—its impact on functional outcomes remains debatable. Conservative treatment is less invasive but often results in radiographic deterioration over time. By comparing key radiological parameters, this study seeks to inform treatment decisions that optimize alignment and reduce the risk of long-term complications.

METHODS

The comparative prospective study was performed at the Department of Orthopaedics, Ghurki Trust Teaching Hospital, Lahore, between December 15, 2024, and April 15, 2025. The study aimed at the comparative analysis of different radiological outcomes of distal radius fractures treated with closed reduction and plaster cast immobilization (CRPCI) versus open reduction and internal fixation (ORIF) using volar locking plates. The study involved 70 patients aged 20-65 years who suffered Fernandez Type-I distal radius fractures with less than 7 days of injury. Before conducting the proceedings, ethical clearance was obtained from the Institutional Ethics Committee (2024/11/R-49, Dated: 15-12-24), and informed written consent was secured from all patients. Exclusion criteria comprised open fractures, other types of Fernandez fractures, life-threatening associated injuries, pathological fractures, osteochondral defects, or prior surgeries for injuries of the radius or adjacent bone. The sample size was calculated to detect a mean difference of -2.6 (ORIF Group mean: 17.7, SD: 6.3; conservative Group mean: 20.3, SD: 4.5) with 95% confidence and 85% power, resulting in 35 patients per group (total=70). Patients were randomly assigned to either the conservative group (n=35) or the ORIF group (n=35).³

Intervention Protocols

MUA-POP

The manipulation was done with sedation, hematoma block, or the brachial plexus block using the Jones' method. Counter-traction from an assistant holding the arm at a flexed elbow was applied to the distal fragment in such a way as to exaggerate the deformity and to volarly flex it so that the distal fragment could stabilize the wrist in slight flexion and ulnar deviation. Reduction adequacy was confirmed fluoroscopically to meet acceptable distal radius fracture criteria. A below-elbow plaster of Paris cast (6–8 layers) was applied, molded for three-point fixation, and allowed to harden. Post-reduction anteroposterior and lateral wrist radiographs verified alignment. After anesthesia recovery, patients were encouraged to move their fingers, elbows, and shoulders actively. The cast was maintained for 5–6 weeks, with removal following radiographic evidence of fracture healing.

ORIF

ORIF was performed under general anesthesia or brachial plexus block, following the administration of a prophylactic intravenous antibiotic (1 g cefazolin) after skin sensitivity testing. Fracture reduction was achieved using Jones' method, and alignment was confirmed under fluoroscopic guidance. A volar approach (Henry's approach) was employed to expose the distal radius. The fracture was then anatomically reduced and stabilized using a pre-contoured volar Locking Compression Plate (LCP) and locking screws, inserted under C-arm fluoroscopy. The fixation's stability was assessed intraoperatively by gently mobilizing the wrist and confirming alignment radiographically. Post-operatively, a below-elbow plaster of Paris (POP) slab was applied to provide additional stabilization. Patients were encouraged to begin active finger movements as tolerated by pain, along with active and active-assisted range-of-motion exercises for the fingers, elbow, and shoulder. The POP slab was removed after 5 to 6 weeks, based on radiographic confirmation of fracture union.

Radiological outcomes, including radial height,

radial inclination, volar tilt, and articular step-off, were assessed using pre- and post-treatment anteroposterior and lateral radiographs at 12 weeks, with measurements performed by two independent observers. Secondary outcomes included time to union and complications such as malunion, nonunion, infection, or implant-related issues. Data were analyzed using independent t-tests and Mann-Whitney U tests for continuous variables and chi-square or Fisher's exact tests for categorical variables, with a p-value < 0.05 considered significant.

RESULTS

Variables	Group A (Conser- vative) (n = 35)	Group B (ORIF) (n = 35)	Total (n = 70)
Gender			
- Male	23 (65.7%)	25 (71.4%)	48 (68.6%)
- Female	12 (34.3%)	10 (28.6%)	22 (31.4%)
Age (years)	20.3 ± 4.5	21.4 ± 5.1	—
Fracture Side			
- Right	20 (57.1%)	19 (54.3%)	39 (55.7%)
- Left	15 (42.9%)	16 (45.7%)	31 (44.3%)
Infection			
- Present	1 (2.9%)	3 (8.6%)	4 (5.7%)
- Absent	34 (97.1%)	32 (91.4%)	66 (94.3%)
Dominant Hand			
- Right Dominant	30 (85.7%)	28 (80.0%)	58 (82.9%)
- Left Dominant	5 (14.3%)	7 (20.0%)	12 (17.1%)
Smoking Status			
- Non-smoker	27 (77.1%)	25 (71.4%)	52 (74.3%)
- Smoker	6 (17.1%)	8 (22.9%)	14 (20.0%)
- Casual smoker	2 (5.7%)	2 (5.7%)	4 (5.7%)
Occupation Type			
- Desk job	26 (74.3%)	24 (68.6%)	50 (71.4%)
- Field work	9 (25.7%)	11 (31.4%)	20 (28.6%)
Fracture Type			
- 23-B (Partial Articular)	0 (0%)	28 (80.0%)	28 (40.0%)
- 23-C1 (Simple Articular)	20 (57.1%)	4 (11.4%)	24 (34.3%)
- 23-C2 (Multi-fragmentary)	15 (42.9%)	3 (8.6%)	18 (25.7%)

Table-I. Baseline characteristics (n = 70)

Parameter	Group A (Conservative)	Group B (ORIF)	P-Value
Radial inclination (°)	13.12±1.95	17.89±1.35	0.015 (*)
Radial height (mm)	3.22±3.90	9.10±2.48	0.024 (*)
Ulnar variance (mm)	0.94 ± 1.42	-1.62 ± 1.18	0.019 (*)
Volar tilt (°)	1.10 ± 4.30	7.40 ± 3.90	0.145 (ns)
Bone Union			
Yes	30 (85.7%)	34 (97.1%)	0.087
No	5 (14.3%)	1 (2.9%)	
Step-off			0.001 ^a
< 2 mm	30 (85.7%)	18 (51.4%)	
> 2 mm	5 (14.3%)	17 (48.6%)	
Volar Tilt			0.001 ^a
Acceptable	35 (100%)	28 (80.0%)	
Non-Acceptable	-	7 (20.0%)	
Ulnar Variance			0.001 ^a
< 5 mm	-	16 (45.7%)	
> 5 mm	35 (100%)	19 (54.3%)	
Radial Inclination			0.001 ^a
Acceptable	-	15 (42.9%)	
Non-Acceptable	35 (100%)	20 (57.1%)	

Table-II. Radiographic parameters comparison

Parameter	Group A (Conservative)	Group B (ORIF)	P-Value
Dorsiflexion(°)	55.80 ± 12.10	58.00 ± 10.00	0.118
Palmar flexion(°)	56.00 ± 11.85	55.90 ± 12.10	0.932
Pronation(°)	44.20 ± 15.60	46.10 ± 14.90	0.764

Table-III. Range of Motion (ROM) Comparison

The baseline demographic characteristics (Table-I) between the two groups—conservative (Group A) and operative (Group B)—were largely comparable. Males constituted the majority in both groups (65.7% in Group A vs. 71.4% in Group B), and the mean age was similar (20.3 ± 4.5 years in Group A vs. 21.4 ± 5.1 years in Group B). The fracture side and hand dominance

were evenly distributed. Notably, the majority of fractures in Group B were classified as partial articular (23-B, 80%). In contrast, Group A had a higher proportion of more complex fractures (57.1% 23-C1 and 42.9% 23-C2), suggesting a tendency for more comminuted patterns to be managed conservatively in this cohort.

Radiographic outcomes presented in Table-II demonstrate a statistically significant advantage in favor of ORIF in achieving better anatomical alignment. Group B (ORIF) showed significantly improved radial inclination ($17.89^\circ \pm 1.35$ vs. $13.12^\circ \pm 1.95$; $p = 0.015$), radial height ($9.10 \text{ mm} \pm 2.48$ vs. $3.22 \text{ mm} \pm 3.90$; $p = 0.024$), and ulnar variance ($-1.62 \text{ mm} \pm 1.18$ vs. $0.94 \text{ mm} \pm 1.42$; $p = 0.019$) compared to the conservative group. Although volar tilt was better in the ORIF group ($7.40^\circ \pm 3.90$ vs. $1.10^\circ \pm 4.30$), this difference did not reach statistical significance ($p = 0.145$). Bone union rates were slightly higher in the ORIF group (97.1%) compared to the conservative group (85.7%), though not statistically significant ($p = 0.087$). However, the prevalence of >2 mm articular step-off was considerably higher in the ORIF group (48.6%) versus the conservative group (14.3%), which was statistically significant ($p = 0.001$), suggesting possible iatrogenic articular surface incongruity despite better overall alignment. Acceptable volar tilt was achieved in all patients in the conservative group, but only in 80% of the ORIF group ($p = 0.001$). Similarly, acceptable ulnar variance (<5 mm) was observed in 45.7% of ORIF patients. In contrast, none of the conservatively treated patients fell within this range ($p = 0.001$), and acceptable radial inclination was noted in 42.9% of ORIF cases but in none of the conservative group ($p = 0.001$).

In terms of functional outcomes measured by range of motion (Table-III), there were no statistically significant differences between the groups in dorsiflexion (58.00° vs. 55.80° ; $p = 0.118$), palmar flexion (55.90° vs. 56.00° ; $p = 0.932$), or pronation (46.10° vs. 44.20° ; $p = 0.764$). This suggests that despite superior radiographic parameters in the ORIF group, the short- to mid-term range of motion was comparable across both treatment modalities.

DISCUSSION

One of the most frequent fractures observed in routine clinical practice is a distal radius fracture. When it comes to choosing between the several surgical and nonsurgical options for treating a distal radius fracture, the most recent guidelines created by the American Academy of Orthopaedic Surgeons (AAOS) and the Cochrane systematic review are not entirely clear.¹⁶

In contrast to conservative management with manipulation under anesthesia (MUA) and plaster of Paris (POP), our study's results show that open reduction and internal fixation (ORIF) produces noticeably better radiological outcomes, particularly in terms of radial inclination, radial height, and ulnar variance. These results are consistent with the literature, including studies by Raza et al.¹⁵ & Ahmad et al.¹⁶ who also reported improved radiological alignment and union rates in surgically treated groups. In our study, ORIF achieved a union rate of 97.1% compared to 85.7% in the MUA group, aligning closely with Ahmad et al.'s report of 97.5% union in the K-wire group versus 92.5% in the MUA group.¹⁵ Similarly, Raza et al.¹⁴ found a 96% union rate in their K-wire group compared to 94% in the conservative group, further validating the radiographic superiority of surgical fixation.

In terms of demographic characteristics, the male predominance was consistent across our study (68.6%) and those by Ahmad et al. (65% in MUA group; 70% in K-wire group) and Raza et al. (70% in ORIF group), indicating a similar gender distribution pattern among patients sustaining distal radius fractures. However, our study population was significantly younger (mean age ~21 years) compared to the Ahmad et al.¹⁵ (38.6–39.6 years) and Raza et al.¹⁴ (mean ~39 years) cohorts, which may influence bone healing capacity and functional recovery.

Despite this anatomical advantage, our results revealed no significant difference in early functional outcomes such as dorsiflexion, palmar flexion, or pronation between the ORIF and conservative groups. This outcome supports the conclusions of the ORCHID trial (Bartl et al.,

2014), which emphasized that the radiological improvements gained from surgical fixation do not always translate into better functional recovery in the short term.³ Likewise, Testa et al. (2019) in their Cochrane review observed that while surgery often achieves better alignment, range of motion, grip strength, and quality of life measures may remain similar to conservative approaches, particularly in older or low-demand individuals.^{2,17}

One notable finding in our study was the higher incidence of articular step-off greater than 2 mm in the ORIF group (48.6%) compared to the conservative group (14.3%), a statistically significant difference. This raises concerns about intra-operative precision and iatrogenic articular incongruity, which could predispose patients to long-term osteoarthritis or pain despite achieving acceptable overall alignment. Similar complications have been noted in the literature. Some researchers reported that while volar plating provides good stability, it may not always ensure accurate reduction of the articular surface, especially in cases of complex fracture geometry.^{10,19}

Although ORIF offers mechanical advantages and better radiographic parameters, conservative treatment remains relevant, particularly in resource-limited settings or for patients with less complex fractures.^{6,20} Our study aligns with this perspective, especially given that 100% of patients in the conservative group achieved acceptable volar tilt despite poorer radial height and inclination. Additionally, the higher union rate in the ORIF group (97.1%) compared to the conservative group (85.7%) was not statistically significant, suggesting that conservative methods still offer reliable healing outcomes.

It is also important to note the demographic characteristics of our study population, which was significantly younger than those in most comparative studies. With a mean age around 21 years, our findings may not be directly generalizable to older adults, who represent a significant portion of the DRF population. Younger patients have better bone remodeling capacity and often recover functional range more easily,

potentially explaining the comparable ROM outcomes despite radiological differences.¹⁷⁻¹⁹

Although the internal validity of our proposed comparative study with independent radiographic evaluations would be enhanced, some limitations should be considered. To begin with, the follow-up of 12 weeks is too short to detect late events like osteoarthritis, irritation of tendons, or the necessity to remove the implant in the surgical group. Second, we have failed to assess the patient-reported outcome measures like DASH or PRWE scores, which are crucial in measuring subjective recovery and functional capacity. Third, there was unequal distribution of the types of fractures; more complex fractures were overrepresented in the MUA group, and this may have skewed the results towards the MUA group. Finally, the sample was quite small and single-centered, although statistically sufficient, which can negatively affect the generalizability of the findings.

Taking these limitations into account, future research needs to use a longer follow-up duration of at least one to two years to determine the long-term functional improvement, rate of complications, and degenerative changes. The use of validated patient-reported outcomes would also improve the evaluation of clinical impact in terms of the patient perspective. Moreover, stratified randomization, according to fracture complexity and age groups, would allow a more detailed insight into the subpopulations that benefit the most from the two approaches to treatment. Future trials should also include cost-effectiveness analysis, particularly in low- and middle-income countries where resources are scarce. Lastly, technical improvements and training efforts among the surgeons should be focused on reducing the articular incongruity in the process of ORIF because even small deviations may entail serious long-term consequences.

CONCLUSION

The study concludes that ORIF shows a better result on radiological findings, notably the radial inclination, height, and the ulnar variance, when compared to conservative therapy using MUA

followed by plaster immobilization. Patient-individualized assessment and shared decision-making continue to be critical in the selection of the preferred treatment strategy for the treatment plan.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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3	Khadeej Choudhry Ilyas: Writing.
4	Asjad Siddiqui: Data collection.
5	Junaid Mazhar: Data collection.
6	Muhammad Farrukh Bashir: Critical review.