

# Comparison of outcome between K-wire fixation and plaster of Paris cast for the management of intra-articular distal radius fracture

HAROON UR REHMAN GILLANI<sup>1</sup>, MUHAMMAD KAMRAN SHAFI<sup>2</sup>, KASHIF RAZA KHAN<sup>3</sup>, ASIM RASOOL<sup>4</sup>, MAJID RASHID<sup>5</sup>

<sup>1</sup>Associate Professor, Department of Orthopedic Surgery, DHQ Teaching Hospital/Sahiwal Medical College, Sahiwal

<sup>2</sup>Associate Professor (OPS) of Orthopedic Surgery, Nishtar Hospital Multan

<sup>3</sup>Associate Professor, Department of Orthopedic Surgery, DHQ Teaching Hospital/Sahiwal Medical College, Sahiwal

<sup>4</sup>Assistant Professor, Department of Orthopedic Surgery, DHQ Teaching Hospital/Sahiwal Medical College, Sahiwal

<sup>5</sup>Assistant Professor, Department of Orthopedic Surgery, DHQ Teaching Hospital/Sahiwal Medical College, Sahiwal

Correspondence to: Haroon ur Rehman Gillani, Cell: 0301 6326469, Email: Haroonurrehmangillani@gmail.com

## ABSTRACT

**Aim:** To compare the outcome between K-wire fixation versus plaster of Paris cast for the management of intra-articular distal radius fracture.

**Methods:** This randomized controlled trial was conducted at Department of Orthopedic Surgery, Sahiwal Medical College, Sahiwal from October 2019 to June 2020 and duration was 8 months. Total 100 Patients with intraarticular distal radius fracture, either male or female having age between 20-50 years and duration of injury <7 days were included in this study. Group A was managed with K-wire fixation and group B managed with plaster of Paris. Functional outcome was compared between the both groups.

**Results:** Average age of the patients was 33.91±8.32 years. In study group A and B, mean age was 33.92±8.05 years and 33.90±6.67 years respectively. In study group A, outcome was found excellent in 41(82%) patients, outcome was good in 7(14%) patients and in 2(4%) patients was fair. No patient was found with poor outcome. In study group B, outcome was excellent, good, fair and poor in 29 (58%) patients, 12(24%) patients, 5(10%) patients and 4(8%) patients respectively. Difference of functional outcome between the groups was significant (P=0.034).

**Conclusion:** This study concluded that outcome is better after K-wire fixation versus plaster of Paris cast management of intra-articular distal radius fracture.

**Keywords:** Distal radius fracture, k-wire fixation, plaster of paris, functional, outcome.

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## INTRODUCTION

High energy trauma is cause of fractures of distal radius, resulting in intra articular involvement and comminution.<sup>1</sup> Management of these injuries are very difficult. There is significant association between these fractures and high rate of complications.<sup>2</sup> It is also known that extra-articular malalignment can lead to decreased grip strength and endurance as well as limited motion and carpal instability.<sup>3</sup> The goal of management to such fractures is to achieve certain intra articular and extra articular criteria during healing. Several management options are available for the management of these complex fractures<sup>4</sup>. These fractures can be managed with non-operative or operative techniques. Successful healing is almost always accomplished; however, Due to post traumatic arthritis, loss of motion and pain, function of wrist can be impaired<sup>5</sup>. Most of the extra articular fractures are managed by cast immobilization and closed reduction<sup>5</sup>. There is an association between loss of reduction and cast immobilization<sup>6</sup>. Compartment syndrome, neurovascular injury and soft tissue necrosis are also associated with this technique.<sup>7</sup> Since 1908, K-wire fixation is used to treat distal radius fractures<sup>8</sup>. This technique is advocated to manage extra articular and minimally displace intra articular distal radius fractures. The cortical bone should be primarily intact because the metaphyseal bone provides minimal stability<sup>9,10</sup>.

On searching the literature, we had found no local randomized trial and stats between K-wire fixation versus plaster of Paris cast management of intra-articular distal radius fracture as well as the literature available is outdated, so, we had decided to conduct this randomized controlled trial to compare the outcome between K-wire fixation versus plaster of Paris cast management of intra-articular distal radius fracture in local population. This study may help us to establish which technique is better in terms of good outcome, so that a standard technique could be opted in our general practice for the management of intra-articular distal radius fracture in order to reduce the morbidity of our patients.

### Operational Definitions

**Distal radius fracture:** presence of loss of radial length, loss of radial tilt, and comminution at the fracture line on antero-posterior x-ray was taken as positive.

**Outcome:** was measured by gartland and werley scoring system<sup>11</sup> at the end of 3 months.

## MATERIAL METHODS

This randomized controlled trial was conducted at Department of Orthopedic Surgery, Sahiwal Medical College, Sahiwal from October 2019 to June 2020, duration of study was 8 months. Total 100 Patients with intraarticular distal radius fracture (as per-operational definition), either male or female having age between 20-50 years and duration of injury <7 days were recruited for this study. Patients with pathological fractures (assessed on history), open fracture (open wound on examination) and

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fractures having intra-articular step off >2mm were excluded from the study. Study was approved by ethical committee and written informed consent was taken from every patient. Patients were randomly divided into two study groups A and B. In groups A patients, K-wire fixation was done while in group B, plaster of Paris (POP) cast treatment was applied. All patients were followed till 3 months at which the outcome (as per-operational definition) was assessed in both groups. All this information was collected through pre-designed performa.

Collected was analyzed by using SPSS version 18. Age was presented as mean and SD. Frequencies and percentages were calculated for the gender and outcome (excellent/good/fair/poor). Chi-square tests was used to compare study variable i.e. outcome, in both groups and p-value  $\leq 0.05$  was taken as significant. Stratification was done for age, gender, duration of injury and BMI. Post stratification chi square tes was applied. P-value  $\leq 0.05$  was considered as significant.

## RESULTS

Total 100 patients between 20-50 years were included. Mean age was  $33.91 \pm 8.32$  years. In study group A and B, mean age was  $33.92 \pm 8.05$  years and  $33.90 \pm 8.67$  years respectively.

In study group A, outcome was noted excellent in 41(82%) patients, outcome was good in 7(14%) patients and in 2(4%) patients was fair. No patient was found with poor outcome. In study group B, outcome was excellent, good, fair and poor in 29(58%) patients, 12(24%) patients, 5(10%) patients 4(8%) patients respectively. Difference of outcome between plaster cast group and K-wire group was significant ( $P = 0.034$ ) (Table 1).

Total 3 age groups, age group 20-30 years, age group 31-40 years and age group 41-50 years were created. In study group A, 18(36%) patients belonged to age group 20-30 years followed by 20(40%) patients to age group 31-40 years and 12(24%) patients belonged to age group 41-50 years. In study group B, total 18(36%) patients belonged to age group 20-30 years, 18(36%) patients to age group 31-40 years and 14(28%) to age group 41-50 years. In age group 20-30 years, outcome was excellent in 15 (83.33%) patients, good in 2(11.11%) patients, fair in 1(5.56%) patient and no patient was found with poor outcome of study group A, while in study group B, excellent outcome was noted in 11(61.11%) patients, good in 5(27.78%) patients, fair in 1(5.56%) patient and poor in 1(5.56%) patient. Difference of outcome between both groups was statistically insignificant with p value 0.407. In age group 31-40 years, total 15(75%) patients of study group A found with excellent outcome, 5 (25%) with good outcome and no patient found with fair and poor outcome. In study group B, outcome was found excellent, good, fair and poor in 11(61.11%), 3(16.67%), 3(16.67%) and 1(5.56%) patients respectively. Difference of outcome between plaster of Paris group and K-wire group was not statistically significant with p value 0.170. In the age group 41-50 years, total 11(91.67%) patients of study group A found with excellent outcome, no patient found with good outcome, 1 (8.33%) patient found with fair outcome and no patient found with poor come. In study group B, outcome

was found excellent in 7 patients, good in 4 patients, fair in 1 patient and poor in 2 patients. Difference of outcome between both groups was not statistically significant with p value 0.079. (Table 2)

In study group A, 37(74%) patients were male and study group B, 38(76%) patients were male. In study group B, 13(26%) patients were female and in study group B, 12(24%) patients were female. In male patients of study group A, excellent outcome was found in 30(81.08%) patients, good in 5(13.51%) patients, fair in 2(5.41%) patients and no patient was found with poor outcome. In study group B, total 22(57.89%) male patients found with excellent outcome, 9(23.68%) male patients with good outcome, 3(7.89%) male patients with fair out come and 4 (10.52%) male patients with poor outcome. Difference of outcome between the plaster of Paris group and K-wire group was statistically insignificant with p value 0.087. In study group A, total 11(84.62%) female patients found with excellent outcome, 2(15.38%) female patients with good outcome and no female found with fair and poor outcome. In study group B, 7(58.33%) female patients found with excellent outcome, 3(25%) female patients with good outcome, 2(16.67%) female patients with fair outcome and no female patient found with poor outcome (Table 3).

Two groups were made according to duration of disease i.e.,  $\leq 3$  days group and  $>3$  days group. Total 34(68%) patients of study group A and 32(64%) patients of study group B belonged to  $\leq 3$  days group. Total 16 (32%) patients of study group A and 18(36%) patients of study group B belonged to  $>3$  days group. In  $\leq 3$  days group, outcome was found excellent in 25(73.53%) patients of study group A, good in 7(20.59%) patients, fair in 2(5.88%) patients and no patient was found with poor outcome. In study group B, outcome was excellent in 19(59.38%) patients, outcome was good in 8(25%) patients, outcome was fair in 2(6.25%) patients and outcome was poor in 3 (9.38%) patients. Difference of outcome between the plaster of Paris group and K-wire group was found statistically insignificant ( $P=0.281$ ). In  $>3$  days group, 16(100%) patients of study group A found with excellent outcome and no patient found with good, fair and poor outcome. In study group B, outcome was excellent in 10 (55.56%) patients, outcome was good in 4(22.22%) patients, outcome was fair in 3(16.67%) patients and poor in 1 (5.56%) patient (Table 4).

Total 27 (54%) patients and 26(52%) patients were non-obese respectively in study group A and study group B respectively. In study group A, 23(46%) patients were obese and in study group B, 24(48%) patients were obese. Outcome was found excellent in 21(77.78%) non-obese patients of study group A, good in 4(14.81%) patients, fair in 2(7.41%) patients and no patient of study group A found with poor outcome. In study group B, 15(57.69%) patients found with excellent outcome, 5(19.23%) patients with good outcome, 4(15.38%) patients with fair outcome and 2(7.69%) patients with poor outcome. Difference of outcome between plaster of Paris group and K-wire group was statistically insignificant ( $P=0.289$ ). Among 20(86.96%) obese patients of study group A, outcome was excellent, good in 3(13.04%) patients and no patient found with fair and poor outcome. In study group B, 14(58.33%) patients found with excellent outcome, 7(29.17%) with good

outcome, 1(4.17%) with fair outcome and 2(8.33%) with poor outcome. Difference of outcome between plaster of Paris group and K-wire group was statistically significant (P = 0.004) (Table 5).

Table 1: Comparison of outcome between both Groups.

| Outcome   | Group A (Plaster of Paris) |      | Group B (K-wire) |      | P-value |
|-----------|----------------------------|------|------------------|------|---------|
|           | Frequency                  | %age | Frequency        | %age |         |
| Excellent | 41                         | 82.0 | 29               | 58.0 | 0.034   |
| Good      | 07                         | 14.0 | 12               | 24.0 |         |
| Fair      | 02                         | 4.0  | 05               | 10.0 |         |
| Poor      | 00                         | 0.0  | 04               | 8.0  |         |

Table 2: Comparison of outcome between the both groups for different age groups.

| Age of patients (years) | Group A      |            |           |          | Total (%) | Group B      |            |            |            | Total (%) | P-value |
|-------------------------|--------------|------------|-----------|----------|-----------|--------------|------------|------------|------------|-----------|---------|
|                         | Outcome      |            |           |          |           | Outcome      |            |            |            |           |         |
|                         | Excellent(%) | Good (%)   | Fair (%)  | Poor (%) |           | Excellent(%) | Good (%)   | Fair (%)   | Poor (%)   |           |         |
| 20-30                   | 15 (83.33)   | 02 (11.11) | 01 (5.56) | 00       | 18 (36)   | 11 (61.11)   | 05 (27.78) | 01 (5.56)  | 01 (5.56)  | 18 (36)   | 0.407   |
| 31-40                   | 15 (75)      | 05 (25)    | 00        | 00       | 20 (40)   | 11 (61.11)   | 03 (16.67) | 03 (16.67) | 01 (5.56)  | 18 (36)   | 0.170   |
| 41-50                   | 11 (91.67)   | 00         | 01 (8.33) | 00       | 12 (24)   | 07 (50)      | 04 (28.57) | 01 (7.14)  | 02 (14.29) | 14 (28)   | 0.079   |

Table 3: Stratification of outcome in both groups according to gender.

| Gender | Group A (n=50) |            |           |          | Total (%) | Group B (n=50) |            |            |            | Total (%) | P-value |
|--------|----------------|------------|-----------|----------|-----------|----------------|------------|------------|------------|-----------|---------|
|        | Outcome        |            |           |          |           | Outcome        |            |            |            |           |         |
|        | Excellent (%)  | Good (%)   | Fair (%)  | Poor (%) |           | Excellent(%)   | Good (%)   | Fair (%)   | Poor (%)   |           |         |
| Male   | 30 (81.08)     | 05 (13.51) | 02 (5.41) | 00       | 37 (74)   | 22 (57.89)     | 09 (23.68) | 03 (7.89)  | 04 (10.52) | 38 (76)   | 0.087   |
| Female | 11 (84.62)     | 02 (15.38) | 00        | 00       | 13 (26)   | 07 (58.33)     | 03 (25)    | 02 (16.67) | 00         | 12 (24)   | ----    |

Table 4: Stratification of outcome in both groups according to duration of disease.

| Duration of disease (days) | Group A (n=50) |            |           |          | Total (%) | Group B (n=50) |            |            |           | Total (%) | P-value |
|----------------------------|----------------|------------|-----------|----------|-----------|----------------|------------|------------|-----------|-----------|---------|
|                            | Outcome        |            |           |          |           | Outcome        |            |            |           |           |         |
|                            | Excellent (%)  | Good (%)   | Fair (%)  | Poor (%) |           | Excellent(%)   | Good (%)   | Fair (%)   | Poor (%)  |           |         |
| ≤3                         | 25 (73.53)     | 07 (20.59) | 02 (5.88) | 00       | 34 (68)   | 19 (59.38)     | 08 (25)    | 02 (6.25)  | 03 (9.38) | 32 (64)   | 0.281   |
| >3                         | 16 (100)       | 00         | 00        | 00       | 16 (32)   | 10 (55.56)     | 04 (22.22) | 03 (16.67) | 01 (5.56) | 18 (36)   | ----    |

Table 5: Stratification of outcome in both groups according to BMI.

| BMI       | Group A (n=50) |            |           |          | Total (%) | Group B (n=50) |            |            |           | Total (%) | P-value |
|-----------|----------------|------------|-----------|----------|-----------|----------------|------------|------------|-----------|-----------|---------|
|           | Outcome        |            |           |          |           | Outcome        |            |            |           |           |         |
|           | Excellent (%)  | Good (%)   | Fair (%)  | Poor (%) |           | Excellent (%)  | Good (%)   | Fair (%)   | Poor (%)  |           |         |
| Non-obese | 21 (77.78)     | 04 (14.81) | 02 (7.41) | 00       | 27 (54)   | 15 (57.69)     | 05 (19.23) | 04 (15.38) | 02 (7.69) | 26 (52)   | 0.289   |
| Obese     | 20 (86.96)     | 03 (13.04) | 00        | 00       | 23 (46)   | 14 (58.33)     | 07 (29.17) | 01 (4.17)  | 02 (8.33) | 24 (48)   | 0.004   |

## DISCUSSION

Total 100 patients between 20-50 years were included. Mean age was 33.91±8.32 years. In study group A and B, mean age was 33.92±8.05 years and 33.90±8.67 years respectively. In study group A, outcome was noted excellent in 41 (82%) patients, outcome was good in 7 (14%) patients and in 2 (4%) patients was fair. No patients was found with poor outcome. In study group B, outcome was excellent, good, fair and poor in 29 (58%) patients, 12 (24%) patients, 5(10%) patients 4(8%) patients respectively. Difference of outcome between plaster cast group and K-wire group was significant (P=0.034). In study group A, 37(74%) patients were male and study group B, 38(76%) patients were male. In study group B, 13(26%) patients were female and in study group B, 12(24%)

patients were female. In male patients of study group A, excellent outcome was found in 30(81.08%) patients, good in 5(13.51%) patients, fair in 2(5.41%) patients and no patient was found with poor outcome. In study group B, total 22(57.89%) male patients found with excellent outcome, 9(23.68%) male patients with good outcome, 3(7.89%) male patients with fair out come and 4(10.52%) male patients with poor outcome. Difference of outcome between the plaster of Paris group and K-wire group was statistically insignificant with p value 0.087. In study group A, total 11(84.62%) female patients found with excellent outcome, 2(15.38%) female patients with good outcome and no female found with fair and poor outcome. In study group B, 7(58.33%) female patients found with excellent outcome, 3(25%) female patients with good outcome,

2(16.67%) female patients with fair outcome and no female patient found with poor outcome.

Gupta et al<sup>11</sup> reported that among patients managed with plaster cast, 40% patients found with excellent outcome, 40% with good outcome and remaining 20% with fair outcome. In K-wire fixation group, total 78% patients found with excellent outcome, 18% patient found with good outcome and 4% with poor outcome. K-wire fixation is minimally invasive, simple and avert re-displacement of fracture fragments, this method is used for extra articular or intra articular fractures<sup>12</sup>. Distal radius fractures are managed by using arthroscopic reduction at present, which had better functional outcome than conventional management of these fractures<sup>13</sup>. In one study by Baig et al<sup>14</sup> among 33 patients managed with k wire fixation, outcome was excellent in 21.2% patients, good in 75.8% patients and fair in 3% patients. In study of Low et al<sup>15</sup> total 177 patients of distal radial fractures were managed with intra-focal pin fixation, they found excellent functional outcome in 54 patients, good functional outcome in 109 patients, fair in 9 patients and poor in 5 patients. In some local studies<sup>16-17</sup> intra-articular Colles fractures managed with K-wire fixation showed 80-95% good to excellent functional outcome. In study of Das et al<sup>18</sup> 32 patients of distal radius fracture managed with K-wire fixation, they found excellent or good functional outcome in 93.75% patients, fair in 6.25% patients. In study by Modi et al,<sup>2</sup> 25 patients were managed with plaster cast and 25 patients managed with K-wired. In plaster cast group, functional outcome was excellent in 10% patients, good in 24% patients, fair in 12% patients poor in 4% patients. While in K-wire group, excellent functional outcome was found in 10% patients, good in 26% patients, fair in 14% patients and no patient found with poor outcome.

## CONCLUSION

This study concluded that the outcome is better after K-wire fixation versus plaster of Paris cast management of intra-articular distal radius fracture. So, we recommend that K-wire fixation should be used as a first line management for treating intra-articular distal radius fracture in order to reduce the morbidity of these patients.

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