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# A Comparison of the Effectiveness of Fixing the Distal Radioulnar Joint (DRUJ) Versus Non-Surgical Management in Patients with an Extra-articular Distal Radius Fracture

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**ABSTRACT**
Fractures of the distal radius are highly prevalent, accounting for a significant proportion of emergency department visits. Among patients seeking treatment for fractures, approximately one in six individuals are diagnosed with distal radius fractures. Managing these fractures presents a challenge due to the potential for undetected instability in the distal radio-ulnar joint (DRUJ), which can have a negative impact on the outcome. Reported frequencies of DRUJ instability one year after distal radius fractures vary widely, ranging from 2-37%. This study was conducted at the Sanjay Gandhi Institute of Trauma and Orthopaedics, involving 50 cases. The participants included individuals with extra-articular distal radius fractures and concurrent DRUJ instability, while those with open or bilateral distal radius fractures were excluded. Treatment options for the distal radius fractures consisted of plating or k-wire fixation, while management of DRUJ instability involved either conservative measures or k-wire fixation. Follow-up assessments were conducted at one month, three months, six months and one year post surgery, utilizing the Gartland and Werley scoring system to evaluate treatment effectiveness. The study encompassed a total of 50 patients, with 35 males and 15 females. Among them, 25 patients were managed conservatively, while the other 25 received k-wire fixation for DRUJ instability. In the conservative group, six patients achieved an excellent outcome and nine had a good outcome. In the k-wire group, four patients attained an excellent outcome and ten had a good outcome. Poor results were observed in three patients in the conservative group and two in the k-wire group. No notable difference in functional outcomes was observed between the two groups. A few complications were reported, including pin tract infections and wrist joint stiffness. Distal radius fractures commonly result in instability of the distal radio-ulnar joint (DRUJ). Intraoperative testing is the most reliable method for diagnosing DRUJ instability following fixation of distal radius fractures. The main objective of treating DRUJ instability is to restore painless supination and pronation activities, facilitating daily living tasks. Conservative management with a plaster of Paris (POP) cast and k-wire fixation are the commonly employed treatments for DRUJ instability. This study suggests that both conservative management and k-wire fixation yield similar outcomes for DRUJ instability following distal radius fractures.

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**Key Words**
Distal radius fracture, plating, k-wiring, DRUJ, conservative, surgical fixation

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## INTRODUCTION

Distal radius fractures are the most common type of upper limb fracture, accounting for more than 16% of all fractures seen in emergency departments. These fractures have a bimodal age distribution with high-energy trauma being more common in younger individuals and low-energy trauma in the elderly[1]. Females are more likely to suffer from distal radius fractures, possibly due to a higher incidence of osteoporosis and falls. The metaphyseal region of the distal radius is vulnerable to fractures due to its weaker cancellous bone and lower amount of solid cortical bone. The significant risk factors for distal radius fractures include low bone mineral density and a tendency to fall.

Most distal radius fractures were treated conservatively with good results in the past. However, recent research has shown that surgical correction of intra-articular step-off and radial shortening improves patient outcomes in younger and high-demand elderly patients. One potential complication of distal radius fracture treatment is distal radio-ulnar joint (DRUJ) instability, which can negatively impact the outcome and often go unnoticed during injury. The incidence of DRUJ instability following a distal radius fracture range from 2-37%[2].

The treatment of DRUJ instability following a distal radius fracture is widely debated in the literature. It can range from conservative immobilisation to surgical management with k-wire fixation. However, conservative management can result in prolonged immobilisation and increased joint stiffness, while surgical management can lead to post-operative infections and functional disability.

**Aims and objectives:** To compare the functional outcome following conservative management and surgical fixation of distal radioulnar joint following instability in distal radius fractures.

**Inclusion criteria:**

- Age limit: >18 years
- Closed extra-articular distal radius fractures with distal radioulnar joint instability

**Exclusion criteria:**

- Patients with pathological fractures
- Bilateral cases
- Chronic cases with arthritis of DRUJ

## MATERIALS AND METHODS

Patients who arrived at the emergency or Outpatient department were admitted for a comprehensive evaluation. This involved taking a detailed medical history to identify any other injuries, determine the duration and mode of the injury and check for any pre-existing medical conditions or previous surgeries. This was done as part of a screening process to rule out any major system involvement in the trauma.

The affected limb was thoroughly examined for injuries to the skin such as abrasions, contusions, lacerations and puncture wounds. Fractures were diagnosed through clinical examination, which involved assessing tenderness, swelling, deformity and abnormal mobility. Particular attention was paid to the vascular examination of the distal forearm and hand, including checking the radial and ulnar artery pulses using the Allen test. In addition, the Allen test was used to determine the patency of the radial, ulnar and digital arteries. The peripheral nerves were also examined carefully, focusing on the median nerve due to its anatomical position and susceptibility to injury. In addition, any signs of compartment syndrome were evaluated to rule out those fractures from the study. Finally, all eligible patients who met the inclusion criteria underwent further radiological evaluation.

This study's analysis and interpretation relied on the information gathered from data collection. Descriptive and inferential statistics were utilised to compare the results and the data was entered into an excel sheet and analysed using SPSS software. The categorical variables were analysed using percentages and the one-tailed Pearson correlation coefficient test was used for correlation. A $p<0.05$ was considered statistically significant.

The study involved treating 50 cases of DRUJ instability following a distal radius fracture. The study participants who consented were assigned to either the conservative or k-wire group alternatively. The two treatment options conservative and K-wire fixation were equally preferred or applicable to the study population, with no significant preference for one treatment over the other.

## RESULTS

In our study, a significant portion of the participants (32%) were aged 45 or older, indicating a higher representation of older individuals. Among the subjects, the majority (70%) were male, comprising 35 participants, while the remaining 30% (15 individuals) were female. Thus, the study exhibited a notable male predominance, with a male-to-female ratio of 7:3. Regarding the location of fractures, slightly more than half of the subjects (54%) had fractures on the left side, totaling 27 participants. Conversely, 46% of the subjects (23 individuals) had fractures on the right side, resulting in a left-to-right ratio of approximately 6:5. The study revealed that the most prevalent mode of injury among the subjects was road traffic accidents (RTA), which accounted for 58% of the cases. Assault was identified as the second most common mode of

Table 1: Distribution of study subjects according to age

| Age (groups) | No. of subjects | Percentage |
|---|---|---|
| <25 years | 8 | 16 |
| 26-35 years | 15 | 30 |
| 36-45 years | 11 | 22 |
| 45+ years | 16 | 32 |
| Total | 50 | 100 |

Table 2: Distribution of study subjects according to sex

| Sex | No. of subjects | Percentage |
|---|---|---|
| Male | 35 | 70 |
| Female | 15 | 30 |
| Total | 50 | 100 |

Table 3: Distribution of study subjects according to side

| Side | No. of subjects | Percentage |
|---|---|---|
| Left | 27 | 54 |
| Right | 23 | 46 |
| Total | 50 | 100 |

Table 4:Distribution of study subjects according to mode of injury

| Mode of injury | No. of subjects | Percentage |
|---|---|---|
| Assault | 13 | 26 |
| Fall from height | 4 | 8 |
| RTA | 29 | 58 |
| Slip and fall | 4 | 8 |
| Total | 50 | 100 |

injury, comprising 26% of the subjects. The remaining 16% of the cases were evenly distributed between Falls from height and Slips and falls, with each mode of injury accounting for 8% of the total cases (Table 1-3).

The study examined the residual deformity in two treatment groups, namely the conservative management group and the K-wire fixation group at various time intervals (1, 3, 6 months and 1 year). Statistical analysis using a p-value of 0.4726, which is greater than the predefined significance level of 0.05, indicated that there was no significant difference in the mean residual deformity between the two treatment groups at any of the time points. The data revealed that the mean residual deformity was similar for both treatment groups across all time intervals. Notably, the conservative management group exhibited a slightly higher mean residual deformity (0.76±1.0) compared to the K-wire fixation group (0.54±0.91) at each time point. The standard deviation, reflecting the variability of the residual deformity within each group was also comparable between the two treatment groups at all time points (Table 4).

The subjective scores for the conservative management and K-wire fixation groups were assessed at multiple time points (1, 3, 6 months and 1 year) and statistical tests were performed to determine if there were any differences between the groups. At each time point, the calculated p-values were greater than 0.05, indicating that there was no significant difference in subjective scores between the conservative and K-wire treatment groups. The mean subjective scores were similar for both groups across all time points, with no statistically significant variations. The conservative management group exhibited slightly higher mean subjective scores at 1 and 3 months, while the K-wire fixation group had slightly higher mean

Table 5: Distribution of study subjects according to Group

| Group | No. of subjects | Percentage |
|---|---|---|
| Conservative | 25 | 50 |
| K-wire | 25 | 50 |
| Total | 50 | 100 |

Table 6: Group and its association with age among the subjects

| | Group | | | |
|---|---|---|---|---|
| Age | Conservative | k-wire | $\chi^2$-value | p-value |
| <25 years | 3 | 5 | | |
| 26-35 years | 9 | 6 | | |
| 36-45 years | 5 | 6 | 1.3578 | 0.715 |
| >45 years | 8 | 8 | | |
| Total | 25 | 25 | | |

Table 7: Group and its association with sex among the subjects

| | Group | | | |
|---|---|---|---|---|
| Sex | Conservative | k-wire | $\chi^2$-value | p-value |
| Male | 19 | 16 | | |
| Female | 6 | 9 | 0.0053 | 0.942 |
| Total | 25 | 25 | | |

Table 8: Group and its association with side among the subjects

| | Group | | | |
|---|---|---|---|---|
| Side | Conservative | k-wire | $\chi^2$-value | p-value |
| Left | 14 | 13 | | |
| Right | 11 | 12 | 0.2203 | 0.639 |
| Total | 25 | 25 | | |

subjective scores at 6 months and 1 year. The standard deviation, which measures the variability of subjective scores within each group was also comparable between the two treatment groups at every time point evaluated (Table 5-8).

The objective evaluation scores for the conservative management and K-wire fixation groups were assessed at different time points (1, 3, 6 months and 1 year) and statistical tests were performed to examine differences between the groups. The calculated p-values for each time point were all greater than 0.05, indicating that the null hypothesis, suggesting no significant difference in objective evaluation scores between the conservative and K-wire treatment groups could not be rejected. Moreover, the mean objective evaluation scores were found to be similar for both treatment groups at each time point, with no statistically significant differences. The K-wire fixation group displayed slightly higher mean objective evaluation scores at 1 month, while the conservative management group exhibited slightly higher mean scores at 3, 6 months and 1 year. The standard deviation, which reflects the variability of objective evaluation scores within each group was also comparable between the two treatment groups at every time point.

Based on the statistical analysis, there are no significant differences between the conservative and k-wire groups in terms of residual deformity, subjective evaluation, objective evaluation and total score at 1, 3, 6 months and 1 year post-treatment. Furthermore, all p-values are greater than 0.05,

Table 9: Comparison of residual deformity between the groups

| | Groups | | |
|---|---|---|---|
| | Conservative | k-wire | |
| Residual deformity | Mean±SD | | p-value |
| 1 months | 0.76±1.0 | 0.54±0.91 | 0.4726 |
| 3 months | 0.76±1.0 | 0.54±0.91 | 0.4726 |
| 6 months | 0.76±1.0 | 0.54±0.91 | 0.4726 |
| 1 year | 0.76±1.0 | 0.54±0.91 | 0.4726 |

Table 10: Comparison of subjective evaluation between the groups

| | Groups | | |
|---|---|---|---|
| | Conservative | k-wire | |
| Subjective | Mean±SD | | p-value |
| 1 months | 3.71±1.52 | 3.81±1.36 | 0.8148 |
| 3 months | 2.47±1.36 | 2.59±1.29 | 0.7789 |
| 6 months | 1.33±1.01 | 1.5±0.96 | 0.5840 |
| 1 year | 1.17±0.9 | 1.3±0.74 | 0.5632 |

Table 11: Comparison of objective evaluation between the groups

| | Groups | | |
|---|---|---|---|
| | Conservative | k-wire | |
| Objective evaluation | Mean±SD | | p-value |
| 1months | 18.14±1.0 | 19.13±4.68 | 0.4523 |
| 3months | 7.23±6.55 | 6.95±6.68 | 0.8891 |
| 6months | 6.28±6.50 | 5.5±5.68 | 0.6751 |
| 1 year | 5.63±6.1 | 4.7±5.39 | 0.5729 |

Table 12: Comparison of total score between the groups

| | Groups | | |
|---|---|---|---|
| | Conservative | k-wire | |
| Total score | Mean±SD | | p-value |
| 1 months | 22.61±6.11 | 23.5±6.33 | 0.6452 |
| 3 months | 10.47±8.55 | 10.09±8.26 | 0.8814 |
| 6 months | 8.38±8.22 | 7.54±7.01 | 0.7220 |
| 1 year | 7.73±8.1 | 7.29±6.73 | 0.6837 |

Table 13: Distribution of outcomes in the study

| Outcome | Conservative | K-wire |
|---|---|---|
| Poor | 3 | 2 |
| Fair | 7 | 9 |
| Good | 9 | 10 |
| Excellent | 6 | 4 |
| Total | 25 | 25 |

indicating insufficient evidence to reject the null hypothesis that there is no significant difference between the two treatment groups (Table 9 and 10).

The statistical analysis also shows no significant differences between the conservative and k-wire groups regarding age, sex, side, residual deformity, subjective evaluation, objective evaluation and total score at all time points. Therefore, both options appear similarly effective for treating the given condition.

For the conservative treatment group, 3 out of 25 patients had a poor outcome, 7 had a fair outcome, 9 had a good outcome and 6 had an excellent outcome. For the K-wire treatment group, 2 out of 25 patients had a poor outcome, 9 had a fair outcome, 10 had a good outcome and 4 had an excellent outcome. Interestingly, the K-wire group had a slightly higher percentage of patients with good and excellent outcomes than the conservative group. However, the difference in outcomes between the two groups does not appear statistically significant (Table 11-13).

## DISCUSSIONS

A meta analysis by Chaudhry *et al*.[3] found that percutaneous K-wire and volar locking plate fixation effectively treated distal radius fractures. Still, volar locking plate fixation resulted in a significantly better functional outcome. Similarly, Zong *et al*.[4] found that volar locking plate fixation was associated with better functional outcomes than conventional percutaneous methods. Conservative treatment has also been compared to surgical treatment for distal radius fractures with associated DRUJ injuries. A study by Dehghani *et al*.[5] found that surgical treatment was associated with better functional outcomes and a lower DRUJ instability risk than conservative treatment. However, it is important to note that surgery is not without risks and complications such as nerve injury, implant failure and infection can occur[6]. It is worth noting that conservative treatment for distal radius fractures has been controversial. Some studies suggest that surgical treatment should be the first line of treatment for all patients. For example, Egol *et al*.[7] found that surgical treatment resulted in better functional outcomes and a lower risk of complications compared to nonoperative treatment in elderly patients with distal radius fractures. However, a Cochrane review by Handoll and Madhok[8] found insufficient evidence to support the routine use of surgery for distal radius fractures in adults. Qazi *et al*.[9] also found that conservative treatment can result in good outcomes in patients with distal radius fractures with associated DRUJ injuries.

Distal radius fractures with associated DRUJ injuries can be treated conservatively or surgically, depending on various factors such as the severity of the injury, the fracture pattern and the surgeon's preference. Conservative management for distal radius fractures with associated DRUJ injuries involves immobilisation with a cast or splint to promote bone healing and restore stability to the joint[10]. The main advantage of conservative treatment is its non-invasive nature, which can result in a shorter recovery time and lower risk of complications compared to surgery[11]. Several studies have reported good outcomes with conservative management, particularly for stable fractures without DRUJ injuries[12].

In these cases, a cast or splint can be applied to immobilise the joint and promote bone healing. The type and duration of immobilisation depend on the severity of the fracture and the presence of associated injuries. A recent study found that immobilisation for 6 weeks with a below-elbow cast resulted in good functional outcomes and low rates of complications for stable distal radius fractures with associated DRUJ injuries.

Physical therapy and rehabilitation can also play an important role in conservatively managing distal radius fractures with associated DRUJ injuries. Once the

cast or splint is removed, patients can begin range-of-motion and gentle strengthening exercises to restore function and prevent stiffness. In addition, a systematic review found that early mobilisation and physical therapy can lead to better functional outcomes than delayed or no mobilisation.

It is worth noting that conservative treatment for distal radius fractures with associated DRUJ injuries may not be appropriate for all patients. Factors, like patients age, comorbidities and functional demands must be considered before planning the management of distal radius fracture with DRUJ instability. Therefore, treatment choices should be individualised based on the patient's unique clinical situation.

In conclusion, treatment choice should be individualised based on the patient's unique clinical situation. Further research is needed to determine the optimal approach to the conservative management of distal radius fractures with associated DRUJ injuries.

## SUMMARY AND CONCLUSION

Distal radius fractures often lead to distal radio ulnar Joint (DRUJ) instability. Intraoperative testing is the best method for diagnosing DRUJ instability following distal radius fracture fixation. Physical examination should raise suspicion of DRUJ instability if the distal ulna is malpositioned or lax. Males are more commonly affected by DRUJ instability than females. The most common mode of trauma leading to DRUJ instability is RTA, followed by falls from height, slips and falls and assault. Diagnostic investigations used to diagnose DRUJ instability include X-rays, CT scans, MRI scans and arthroscopy. The primary goal of treating DRUJ instability is to allow painless supination and pronation activities and to aid in daily living activities. Conservative management with POP and K-wire fixation are the treatments commonly used for DRUJ instability. Gartland and Werley Score were used to follow up with patients at 1st, 3rd and 6th month after treatment. The study suggests that DRUJ instability followed by DRF can be treated with conservative management or K-wire fixation with similar outcomes.

**Age distribution:** Most patients in the sample were between the ages of 26-45 years with 30 and 22% of the sample falling into the 26-35 years and 36-45 years age groups, respectively. 32% of the sample was over 45 years of age. Only 16% of the sample was below 25 years of age.

**Sex distribution:** The sample was predominantly male, with 70% of the patients being male and 30% female.

**Side of the injury:** About 54% of patients had injuries on the left side and 46% had injuries on the right side.

**Mode of injury:** RTA (Road traffic accident) was the most common cause of injury (58%), followed by assault (26%).

**Treatment approach:** The treatment was divided equally between conservative and k-wire groups (50% each).

**Residual deformity:** There was no significant difference in residual deformity between the conservative and k-wire groups at 1, 3, 6 months and 1-year post-treatment.

**Subjective evaluation:** There was no significant difference between the conservative and k-wire groups at 1, 3, 6 months and 1-year post-treatment.

**Objective evaluation:** There was no significant difference in objective evaluation between the conservative and k-wire groups at 1, 3, 6 months and 1-year post-treatment.

**Total score:** There was no significant difference in total score between the conservative and k-wire groups at 1, 3, 6 months and 1-year post-treatment.

**Outcome:** Both treatment groups had similar outcomes, with most patients reporting good or excellent outcomes (76% and 64% for conservative and k-wire groups, respectively). In conclusion, the study did not find any significant difference in outcomes between the conservative and k-wire treatment groups. Both approaches resulted in good to excellent outcomes for most patients, regardless of age, sex or side of the injury. The study highlights the importance of individualising treatment approaches for each patient, considering the unique characteristics of the injury and the patient's preferences and needs.

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