Section: Orthopaedics

Original Research Article

# OUTCOMES OF EXTERNAL FIXATION WITH LIGAMENTOTAXIS IN THE MANAGEMENT OF COMMINUTED DISTAL RADIUS FRACTURES: A PROSPECTIVE STUDY

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**ABSTRACT**

**Background:** Distal radius fractures are among the most common fractures in adults, particularly in active individuals and the elderly. Comminuted fractures pose a challenge due to their complexity and high risk of complications. External fixation with ligamentotaxis is frequently used to manage these fractures, providing stability and promoting functional recovery.

**Materials and Methods:** This prospective study was conducted from January 2024 to December 2024 over a one-year period in the Department of Orthopedics at Govt Medical College/ Govt General Hospital, Siddipet. Twenty-five adult patients with comminuted distal radius fractures were included. Patients underwent external fixation with ligamentotaxis, and demographic data, mechanism of injury, fracture characteristics, and post-operative outcomes were recorded. The Frykman classification was used to categorize fractures, while functional outcomes were assessed using the modified Gartland-Werley scoring system.

**Results:** The majority of patients were male (76%), aged between 31 and 40 years. Low-impact falls accounted for 68% of injuries, while 32% were due to high-impact road traffic accidents. Post-operative complications included deformity (8%), infection (4%), and various levels of movement restriction. Functional outcomes were favorable, with 16% achieving excellent, 60% good, 16% fair, and 8% poor results based on the Gartland-Werley scoring system.

**Conclusion:** External fixation with ligamentotaxis is effective in managing comminuted distal radius fractures, with most patients achieving satisfactory functional outcomes. However, careful patient selection and surgical technique are essential to minimize complications. This study supports the continued use of this method for complex fractures while underscoring the importance of tailored treatment strategies.

**Keywords:** Distal radius fracture, external fixation, ligamentotaxis, Gartland-Werley scoring, comminuted fracture.

## INTRODUCTION

Fracture of the distal radius is one of the most common fractures seen in adults, particularly in older individuals, accounting for nearly 17.5% of all adult fractures.[1] Its high prevalence is largely attributed to the vulnerability of the distal radius in falls and trauma, with the risk of fracture increasing with age due to osteoporosis and other degenerative changes.[2] Commonly, fractures of the distal radius occur due to a fall on an outstretched hand (FOOSH), which transmits force through the wrist and places stress on the distal radius, often leading to a break.[3] Additionally, motor vehicle accidents and high-

impact sports can lead to more severe, often comminuted fractures.[4]

Management of distal radius fractures depends on the fracture type, displacement, patient age, and overall functional demands. Stable, minimally displaced fractures are typically managed conservatively with casting, which allows for proper alignment and healing.[5] However, in cases of displaced or unstable fractures, surgical intervention may be required to restore anatomical alignment and stability.[6] One of the preferred treatments for comminuted distal radius fractures is external fixation with ligamentotaxis. This approach is particularly valuable when there is extensive comminution that makes internal fixation difficult.[7] External fixation provides stability by anchoring pins in the metacarpal and radial shafts, which are then connected by an external frame. Through ligamentotaxis, external fixation indirectly reduces the fracture by maintaining tension on the soft tissue ligaments, pulling fracture fragments into alignment.[8]

The application of external fixation has been shown to be effective in managing highly comminuted distal radius fractures, reducing complications and preserving function.[9] It allows early mobilization of the wrist and hand, contributing to faster recovery of motion and reducing the risk of stiffness.[10] While external fixation offers numerous benefits, it is not without risks; pin-site infections, over-distraction, and tendon irritation are potential complications.[11] Thus, careful monitoring and management are essential for optimal outcomes in these cases.

This study was conducted with an aim to evaluate the effectiveness of external fixation with ligamentotaxis in patients with comminuted distal radius fractures.

## MATERIALS AND METHODS

This study was conducted to assess the outcomes of external fixation with ligamentotaxis in the management of comminuted distal radius fractures. The research was carried out from January 2024 to December 2024 over a one-year period at the Department of Orthopedics, Govt Medical College/ Govt General Hospital, Siddipet, involving a sample of 25 adult patients diagnosed with comminuted fractures of the distal radius.

The inclusion criteria included adults aged 18 years and older who presented with comminuted distal radius fractures. Patients with multiple limb injuries, open fractures, or those with a history of distal radius fracture in the same limb were excluded to maintain sample uniformity and reduce confounding variables.

Data collection included pre-operative, operative, and post-operative phases, ensuring comprehensive coverage of all aspects of patient management and outcomes. All patients underwent closed reduction and external fixation with ligamentotaxis. The procedure involved the placement of external fixator pins in the radial shaft and second metacarpal. Ligamentotaxis was achieved by applying controlled tension to the fixator, which helped align fracture fragments by leveraging the surrounding ligaments and soft tissues.

The primary data points collected included patient demographic details, mechanism of injury, fracture pattern, time to union, and complications. Functional outcomes were assessed using the Mayo Wrist Score and the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire, measured at three-month and six-month follow-up intervals. Radiological assessments, including anteroposterior and lateral X-rays, were used to evaluate fracture alignment, joint congruity, and bone healing.

Quantitative data, including scores were analyzed statistically to assess functional outcomes. The mean, standard deviation, and percentage improvements in function and pain levels were calculated, with the results stratified according to age, sex, and fracture complexity. Data were analyzed using SPSS software version 25, applying paired t-tests to compare pre- and post-operative functional scores. P-values <0.05 were considered statistically significant, indicating a meaningful difference in outcomes post-treatment.

Ethical approval was obtained from the institutional ethics committee at Govt Medical College/ Govt General Hospital, Siddipet, before the study commenced. Informed consent was acquired from all participants, ensuring they were fully aware of the study's purpose, procedures, and potential risks. Data confidentiality was strictly maintained throughout the study.

## RESULTS

The study included 25 patients with comminuted distal radius fractures, with a majority aged 31-40 years (48%) and most being male (76%). Regarding the mechanism of injury, 68% of fractures resulted from low-impact falls, while 32% were from high-impact road traffic accidents. The left side was more commonly affected (72%) than the right (28%). Fracture classification according to Frykman's criteria showed a distribution across types, with Types III, VII, and VIII being the most frequent (each 20%).

**Table 1: Age and gender wise distribution**

| Demographic characteristics | | frequency |
|---|---|---|
| age | <21 years | 1 |
| | 21-30 years | 2 (8%) |
| | 31-40 years | 12 (48%) |
| | 41-50 years | 6 (24%) |
| | 51-60 years | 2 (8%) |

| | | |
|---|---|---|
| | >60 years | 2 (8%) |
| **Gender** | Males | 19 (76%) |
| | Females | 6 (24%) |

Associated injuries were noted in 48% of patients, reflecting the severity of the trauma involved. Post-operative complications included deformity in 8% of cases, surgical site infection in 4%, and varying levels of movement restriction, with 8% experiencing severe restrictions (>50%). Functional outcomes, evaluated using the Gartland-Werley scoring system, were predominantly favorable: 16% had excellent results, 60% achieved good results, 16% fair, and 8% poor outcomes. This data underscores that external fixation with ligamentotaxis, while associated with minor complications, generally leads to satisfactory functional recovery in the majority of patients with comminuted distal radius fractures.

**Table 2: Fracture characteristics**

| Characteristics of fracture | | Frequency |
|---|---|---|
| Mode of injury | Fall (low impact) | 17 (68%) |
| | Road traffic accident (high impact) | 8 (32%) |
| Side of injury | Left side | 18 (72%) |
| | Right side | 7 (28%) |
| Frykrnan classification of distal radius fractures | Type III | 5 (20%) |
| | Type IV | 4 (16%) |
| | Type V | 3 (12%) |
| | Type VI | 3 (12%) |
| | Type VII | 5 (20%) |
| | Type VIII | 5 (20%) |
| Presence of associated injuries | | 12 (48%) |

**Table 3: Post-operative characteristics**

| | **Deformity** | **2 (8%)** |
|---|---|---|
| Post-operative complications | Surgery site infection | 1 (4%) |
| | Restriction of movements (<20%) | 2 (8%) |
| | Restriction of movements (20%-50%) | 2 (8%) |
| | Restriction of movements (>50%) | 2 (8%) |

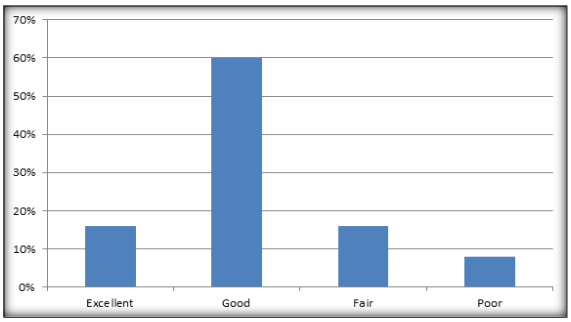


**Figure 1: End Result Using Gartland - Werley System**

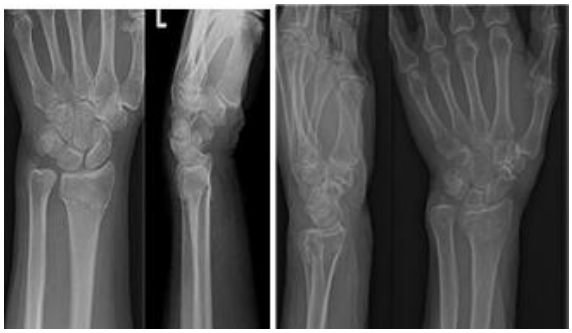

**Figure 2-5: Pre-op, immediate post-op; post-op after 6 weeks; post-op follow-up at 6 months**

## DISCUSSIONS

The present study evaluated the outcomes of external fixation with ligamentotaxis in managing comminuted distal radius fractures. The demographic data revealed a higher incidence among males (76%) and a predominant age group of 31-40 years (48%). These findings align with those of Van Lancker et al,[13] who reported a similar demographic distribution in distal radius fractures, emphasizing a higher prevalence in younger, active males.

The mechanism of injury in our study was predominantly low-impact falls (68%), with the remaining 32% resulting from high-impact road

traffic accidents. This distribution is consistent with the observations of Jafari et al,[14] who noted that distal radius fractures commonly result from falls on an outstretched hand, leading to forced extension of the carpus and impact loading of the distal radius.

Fracture classification according to Frykman's criteria in our study showed a varied distribution, with Types III, VII, and VIII each accounting for 20% of cases. This variation underscores the complexity of comminuted distal radius fractures and the necessity for individualized treatment approaches. The presence of associated injuries in 48% of patients highlights the severity of trauma involved, a finding corroborated by Singh et al,[15] who reported similar associations in their cohort.

Post-operative complications in our study included deformity (8%), surgical site infection (4%), and varying degrees of movement restriction. These complication rates are comparable to those reported by Karantana et al,[16] who found that external fixation, while effective, carries risks such as pin-site infections and joint stiffness. However, the overall functional outcomes in our study were favorable, with 76% of patients achieving excellent or good results based on the Gartland-Werley scoring system. This outcome is in line with the findings of Jafari et al,[14] who demonstrated that applying distractive force perpendicular to the distal radius articular surface improves radiological outcomes, likely due to better reduction maintenance .

The efficacy of external fixation with ligamentotaxis in restoring anatomical alignment and facilitating early mobilization is well-documented. Our study's results support this, showing satisfactory functional recovery in the majority of patients. Nonetheless, the potential for complications necessitates careful patient selection and meticulous surgical technique. Comparative studies, such as the meta-analysis by Anderson et al,[17] have highlighted that while external fixation is effective, it may not be superior to other methods like volar plating in terms of functional outcomes.

## CONCLUSION

The study in conclusion, in conclusion, our study reinforces the role of external fixation with ligamentotaxis as a viable treatment option for comminuted distal radius fractures, yielding favorable functional outcomes in a significant proportion of patients. However, the risk of complications underscores the importance of individualized treatment planning and adherence to surgical best practices.

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**Conflicts of Interest:** The authors declare no conflicts of interest related to this study.

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