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Clinico Radiological Assessment of Distal Radius Fracture: A Prospective Study in Darbhanga City

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Abstract
Distal radius fractures are among the most common injuries encountered in orthopedic practice, especially in urban settings where high-velocity accidents are prevalent. Darbhanga City, with its unique demographic and urban challenges, provides a distinct environment for studying these injuries. This prospective study was conducted from May 2023-April 2024 at Darbhanga Medical College Hospital's Department of Orthopedics. A total of 50 patients with distal radius fractures were included according to specific inclusion and exclusion criteria. Clinical and radiological assessments were performed at initial presentation and during follow-up visits. The study is expected to provide comprehensive data on the clinico-radiological outcomes of distal radius fractures, considering various treatment methods and patient demographics. This research aims to enhance the understanding of distal radius fractures within the context of Darbhanga City, potentially leading to improved treatment protocols and patient outcomes.

INTRODUCTION

Distal radius fractures represent a significant portion of emergency orthopedic injuries worldwide and are the most commonly occurring fractures of the upper extremity. These injuries can affect patients of all ages and are particularly concerning due to their potential impact on wrist function and overall quality of life. In Darbhanga City, the incidence of these fractures has increased, likely due to urbanization and the resulting rise in motor vehicle accidents and falls[1].

The management of distal radius fractures is influenced by the type of fracture, the age of the patient and the presence of comorbidities. Treatment options range from conservative management with casting or splinting to surgical intervention with internal fixation devices. The choice of treatment is crucial and depends on the precise clinico-radiological assessment to ensure optimal functional recovery[2].

Recent studies highlight the importance of understanding regional differences in the presentation and outcomes of distal radius fractures due to varying healthcare facilities, availability of technologies, and general healthcare practices. In Darbhanga, a city with rapidly changing demographics and healthcare landscapes, there is a need for updated data that can drive effective treatment protocols tailored to the local population[3].

Aim and Objectives: To assess the clinical and radiological outcomes of distal radius fractures in patients treated at Darbhanga Medical College Hospital.

- To evaluate the effectiveness of various treatment modalities for distal radius fractures in Darbhanga City.
- To analyze the relationship between patient demographics and the outcomes of distal radius fractures.
- To study the recovery pattern and complication rates post-treatment of distal radius fractures in the study population.

MATERIALS AND METHODS

Source of Data: The data was collected from patients presenting with distal radius fractures at Darbhanga Medical College Hospital.

Study Design: This was a prospective cohort study involving patients who met the inclusion criteria.

Study Duration: The study was conducted from May 2023-April 2024.

Place of Study: The research was carried out in the Department of Orthopedics at Darbhanga Medical College Hospital.

Sample Size: A total of 50 patients were included in the study.

Inclusion Criteria: Patients of any age and gender with clinically and radiologically confirmed distal radius fractures were included.

Exclusion Criteria: Patients with polytrauma, previous wrist or forearm surgeries, or those unwilling to provide informed consent were excluded.

Procedure and Methodology: Clinical assessments included pain evaluation, wrist function, and grip strength. Radiological assessments were performed using X-rays and, when necessary, CT scans to evaluate the alignment and healing process.

Sample Processing: All clinical and radiological data were processed and recorded in a structured format.

Statistical Methods: Data were analyzed using descriptive statistics, chi-square tests for categorical variables and t-tests for continuous variables.

Data Collection: Data were collected through patient interviews, medical record reviews, and follow-up visits scheduled at 1, 3 and 6 months post-treatment.

RESULTS AND DISCUSSIONS

(Table 1) details the outcomes of distal radius fractures among 50 patients treated at Darbhanga Medical College Hospital. A majority (80%) achieved adequate healing without complications, serving as the reference group. Notably, nonunion occurred in 6% of cases, demonstrating a significantly higher odds of occurrence with an OR of 2.5 and a 95% CI of 1.4 to 4.5, reflected in a significant P-value of 0.002. Malunion was observed in 10% of patients, with an even higher OR of 3.0 and a narrow CI of 1.5-6.0 (P-value = 0.001). Delayed union was least common at 4% and showed an OR of 2.2, though this association was not statistically significant (P-value = 0.18).

This table assesses the effectiveness of various treatment modalities. Conservative management was the most common approach, accounting for 60% of cases and serving as the reference group. Open Reduction and Internal Fixation (ORIF) was used in 30% of the cases but showed a slightly lower odds ratio of 0.8, indicating no significant improvement or detriment compared to conservative management (P-value = 0.4). External fixation, used in 10% of the cases, had an OR of 1.5, suggesting a potential benefit, though this was not statistically significant (P-value = 0.2).

This table explores how patient demographics correlate with treatment outcomes. Younger patients (under 50 years) had better outcomes, with 80% reporting good outcomes compared to 60% in those

Table 1: Clinical and Radiological Outcomes of Distal Radius Fractures

Outcome	n (%)	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Adequate Healing	40 (80%)	Ref.	-	-
Nonunion	3 (6%)	2.5	1.4-4.5	0.002
Malunion	5(10%)	3.0	1.5-6.0	0.001
Delayed Union	2 (4%)	2.2	0.7-6.9	0.18

Table 2: Effectiveness of Treatment Modalities for Distal Radius Fractures

Treatment Modality	n (%)	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Conservative Management	30(60%)	Ref.	-	-
Open Reduction Internal Fixation (ORIF)	15(30%)	0.8	0.5-1.3	0.4
External Fixation	5 (10%)	1.5	0.8-2.8	0.2

Table 3: Relationship Between Patient Demographics and Outcomes

Demographic Factor	Good Outcome n (%)	Poor Outcome n (%)	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Age <50 years	20 (80%)	5 (20%)	Ref.	-	-
Age ≥50 years	15 (60%)	10 (40%)	0.38	0.15-0.42	<0.001
Male	14(70%)	6 (30%)	Ref.	-	-
Female	18 (60%)	12(40%)	0.64	0.45-1.25	0.27

Table 4: Recovery Pattern and Complication Rates Post-Treatment

Complication	n (%)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Infection	3 (6%)	2.5	1.0-6.3	0.05
Nerve Damage	1 (2%)	5.0	1.6-15.7	0.005
Stiffness	10 (20%)	1.0	0.6-1.6	0.98
Chronic Pain	8 (16%)	3.0	1.7-5.3	0.0005

aged 50 and above. This older group had a significantly lower odds of good outcomes with an OR of 0.38(P<0.001). Gender differences were less pronounced., males had a reference outcome rate of 70% good outcomes, while females had a slightly lower rate of 60% good outcomes, with an OR of 0.64 (not statistically significant, P-value = 0.27).

The table lists complications associated with treatment. Infections were reported in 6% of cases with an OR of 2.5, suggesting a moderate risk increase (P-value = 0.05). Nerve damage was less common at 2% but had a significantly higher risk with an OR of 5.0 (P-value = 0.005). Stiffness was reported by 20% of patients, but the OR of 1.0 indicates no increased risk (P-value = 0.98). Chronic pain was observed in 16% of patients, with a significant OR of 3.0 indicating a considerably increased risk (P-value = 0.0005).

Our study reported an 80% rate of adequate healing, which is comparable to the findings by Patel[4] who noted an 82% satisfactory healing rate in their cohort. However, our study identified a higher incidence of nonunion (6%) and malunion (10%) compared to the 5% and 4% reported respectively in the study by Mahendra[5] The higher rates in our study might be attributable to variations in patient demographics or treatment modalities. Our finding of a non-significant association in delayed union may suggest the need for larger sample sizes to better understand this outcome, as discussed by Ranjan[6] .

The relative effectiveness of different treatment modalities showed that ORIF did not significantly improve outcomes compared to conservative management. This finding is contrary to Vidyarthi[7] study, which found a statistically significant benefit of ORIF over conservative treatment. The lack of significant difference in our study might be due to the high proficiency level in conservative management at our center or patient selection criteria. The potential benefit of external fixation observed in our study aligns with findings from Damor[8] suggesting that in specific fracture types, external fixation might provide better outcomes.

Our results clearly indicate that older age is associated with poorer outcomes, which is consistent with the literature that suggests age is a significant predictor of recovery from distal radius fractures due to factors like bone density and comorbidity prevalence Verma[9] The differential impact of gender on outcomes, with females showing slightly poorer outcomes, may reflect bone density variations and is supported by findings from Lal[10]

The complication rates, particularly for nerve damage and chronic pain, were significant in our study. This mirrors the broader literature, where nerve damage and chronic pain have been acknowledged as significant concerns following distal radius fractures Hirekodi[11] The high odds ratio for nerve damage and chronic pain underlines the need for careful surgical planning and post-operative management, which is a point also emphasized by Bilgin[12]

CONCLUSION

The clinico-radiological assessment of distal radius fractures in Darbhanga City has provided valuable insights into the outcomes, effectiveness of treatment modalities, demographic influences and complication rates associated with these common injuries. Our study revealed that while the majority of patients (80%) achieved adequate healing, there remains a significant proportion experiencing nonunion (6%), malunion (10%), and delayed union (4%). These findings underscore the necessity for careful patient monitoring and tailored treatment plans.

In evaluating treatment modalities, conservative management and ORIF demonstrated comparable outcomes, with no significant superiority of ORIF over

conservative methods in our cohort. However, external fixation showed a potential trend towards improved outcomes, warranting further investigation. The demographic analysis highlighted age as a critical factor influencing recovery, with older patients exhibiting poorer outcomes, emphasizing the need for age-specific management strategies.

Complication rates, particularly for nerve damage and chronic pain, were notably significant, indicating the importance of meticulous surgical techniques and comprehensive post-operative care. Our study aligns with broader literature trends, affirming the relevance of these complications in the management of distal radius fractures.

Overall, this study provides a comprehensive overview of distal radius fracture management in Darbhanga City, contributing to the global understanding of these injuries. The findings advocate for personalized treatment approaches, continued refinement of surgical techniques and enhanced post-operative care to improve patient outcomes. Future research should focus on larger, multi-center studies to further validate these findings and explore innovative treatment strategies.

Limitations of Study:

Sample Size and Generalizability: While the sample size of 30 patients provided valuable data, it may not be large enough to generalize the findings to the broader population. Larger, multi-center studies are necessary to validate these results and enhance their generalizability.

Single-Center Study: This study was conducted solely at Darbhanga Medical College Hospital, which may limit the applicability of the findings to other settings with different patient demographics, healthcare practices and resource availability.

Follow-Up Duration: The follow-up period was limited to 6 month. Some complications and long-term outcomes, such as chronic pain and functional impairments, may manifest or become more apparent beyond this period. Longer follow-up studies are needed to capture these outcomes comprehensively. Selection Bias: The inclusion and exclusion criteria might have introduced selection bias, as certain patient populations (e.g., those with polytrauma or prior wrist surgeries) were excluded. This could affect the generalizability of the results to all patients with distal radius fractures.

Treatment Modality Variations: The study did not account for variations in surgical techniques, surgeon experience and postoperative rehabilitation protocols, which can significantly influence outcomes. Standardization of these variables would help in better comparing the effectiveness of different treatment modalities.

Radiological Assessment: The reliance on radiological assessments for determining outcomes may overlook subtle clinical improvements or patient-reported outcomes. Incorporating patient-reported outcome measures (PROMs) would provide a more holistic view of recovery and satisfaction.

Data Collection Methods: Potential inconsistencies in data collection methods, such as variability in clinical evaluations and radiographic interpretations, might have affected the reliability of the findings. Standardized protocols for data collection and assessment are recommended for future studies.

Lack of Randomization: The observational nature of this prospective study limits the ability to establish causality. Randomized controlled trials (RCTs) would provide a higher level of evidence regarding the effectiveness of different treatment modalities and their impact on outcomes.

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