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ASSESSING FUNCTIONAL OUTCOMES OF VARIOUS TREATMENTS FOR INTRA-ARTICULAR FRACTURES OF THE DISTAL RADIUS IN ADULTS, BHAGALPUR, INDIA: A RETROSPECTIVE CROSS-SECTIONAL STUDY.

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ABSTRACT

Background

Assessing the functional outcomes of various treatments for intra-articular fractures (IAF) of the distal radius in adults is crucial for optimizing patient care and recovery. The study objective was to estimate and compare the functional results of different treatment modalities utilized for IAF of the distal end of the radius in adult patients.

Methods

The retrospective study comprised a total of 80 adult patients. Data on demographic characteristics, fracture type, treatment modalities, postoperative complications, radiological outcomes, pain scores, and functional scores were gathered from medical records. Statistical analysis was accomplished using STATA-17 software.

Results

Among the 80 patients, 50% opted for conservative management, while the remaining 50% underwent surgical intervention, including pinning, external fixation, or plating. Surgical intervention was related to better functional outcomes compared to conservative management, with significant differences observed in functional scores ($p < 0.05$). However, no significant variation was recorded in pain scores among the two groups. Postoperative complications were observed in 22.5% of patients, predominantly in the plating group. Radiological union was achieved in the majority of cases, with a small percentage experiencing nonunion or residual deformities.

Conclusion

Surgical intervention, particularly pinning, external fixation, and plating, demonstrated superior functional outcomes compared to conservative management for IAF of the distal radius. Patient education and rehabilitation play crucial roles in enhancing functional recovery and compliance with postoperative protocols.

Recommendations

Surgeons should carefully select the appropriate surgical technique based on fracture characteristics and patient factors to optimize outcomes and minimize complications. However, the choice of surgical technique should be carefully considered to minimize postoperative complications and residual deformities. Emphasis should be placed on patient education and rehabilitation to ensure compliance with postoperative protocols and enhance functional recovery.

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INTRODUCTION

Assessing the functional outcomes of various treatments for intra-articular fractures (IAF) of the distal radius in adults is crucial for optimizing patient care and recovery. The distal radius is one of the most commonly fractured bones in the adult population, and its treatment aims to restore the anatomy of the wrist, thereby ensuring the return of function and minimizing the risk of complications such as osteoarthritis. The complexity of intra-articular fractures, which involve the wrist joint, necessitates a nuanced approach to treatment and rehabilitation. This introduction will explore the significance of evaluating functional outcomes following different treatment modalities, including open reduction and internal fixation (ORIF), conservative management, and external fixation, among others.

Conservative treatment, typically involving immobilization of the fracture in a cast or splint, is often recommended for fractures that are not significantly displaced. Studies have shown that for certain fracture types, conservative management can lead to satisfactory functional outcomes, comparable to those achieved with surgical intervention [1]. However, the effectiveness of conservative treatment is highly dependent on the fracture's characteristics and the patient's compliance with immobilization and rehabilitation protocols.

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Surgical options, such as ORIF, have become increasingly popular for managing more complex IAF of the distal radius. ORIF allows for precise anatomical reduction of the fracture fragments and stabilization, which is thought to facilitate better functional recovery. A meta-analysis demonstrated that patients undergoing ORIF generally experienced improved wrist function and range of motion compared to those treated conservatively, highlighting the importance of surgical intervention in appropriately selected cases [2].

External fixation, another surgical option, is particularly useful in fractures with significant comminution and instability. It can be used alone or in conjunction with ORIF to maintain alignment during the healing process. According to a study, external fixation can lead to good functional outcomes, especially when early motion exercises are incorporated into the treatment plan [3].

Recent advancements in minimally invasive surgery and the development of novel fixation devices have also shown promise in enhancing functional recovery while minimizing complications. For instance, the use of volar locking plates has been related to early mobilization and potentially faster return to pre-injury levels of function [4].

The assessment of functional outcomes following various treatments for IAF of the distal radius is essential for guiding clinical decision-making. While conservative management may be suitable for less severe fractures, surgical interventions, including ORIF and external fixation, are critical for optimizing outcomes in more complex cases. Continuous advancements in surgical techniques and fixation devices hold the potential to further improve patient recovery and functional outcomes. This study aimed to evaluate and compare the functional outcomes of various treatment modalities utilized for intra-articular fractures of the distal end of the radius in adult patients.

METHODOLOGY

Study Design

A retrospective cross-sectional study.

Study Setting

The study was taken out at Jawahar Lal Nehru Medical College and Hospital (J.L.N.M.C.H.), Bhagalpur, Bihar, India. The study duration was July 2022 to August 2023.

Participants

A total of 80 adult individuals who met the predefined selection criteria were involved in the study.

Inclusion and exclusion criteria

Patients aged ≥ 20 years with closed fractures of the distal end of the radius on either side or both sides, occurring within 2 weeks of injury, and with fractures up to 3 cm from the distal articular surface of the radius were included in the study. Exclusion criteria encompass compound fractures, pathological fractures, fractures beyond 3 cm from the distal articular surface, trauma history exceeding 2 weeks, epiphyseal injuries of the distal radius, individuals with carpal injuries/fractures, or refracture at the same site.

Bias

Efforts were made to minimize bias by strictly adhering to predefined inclusion and exclusion criteria and providing equal consideration to both conservative and surgical treatment modalities based on patient preference and clinical assessment.

Variables

The variables studied included demographic characteristics, fracture type, treatment modality (conservative or surgical), surgical techniques employed (pinning, external fixation, or plating), postoperative complications, radiological outcomes (union/non-union, residual deformity), pain scores, and functional scores.

Data Collection

Patient data, including clinical details, radiological findings, and treatment outcomes, were collected using a predefined proforma specifically designed for this study. Data collection was conducted retrospectively by reviewing medical records, including admission notes, progress notes, operative notes, and follow-up OPD records.

Procedure

Patients with closed fractures were initially splinted and managed conservatively or underwent surgery based on the severity of the fracture and patient preference. Surgical procedures, including pinning, external fixation, or plating, were performed under anesthesia, with specific techniques employed according to the fracture pattern. Postoperative care included analgesics, antibiotics, and regular follow-up evaluations.

Statistical Analysis

Data analysis was assessed using STATA-17 software. The chi-square test and ANOVA were applied for comparative analysis. Cross-tabulation was conducted to explore associations between variables, and Chi-square tests were employed to examine associations between exposure and outcomes. The level of significance was set at a $p < 0.05$ value.

Ethical considerations

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

RESULT

The study enrolled a total of 80 adult patients and their demographic features are mentioned in Table 1. The average age of the participants was 43 years (range: 20-70

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years), with a slight predominance of 42 males (53%) over 38 females (47%).

Table 1: Demographic features of study participants

Variable	Total Patients	Conservative Group	Surgical Group
Total Patients	80	40	40
Mean Age (years)	43 (± 4.5)	42.5 (± 5.0)	43.5 (± 4.8)
Gender			
- Males	42 (53%)	20 (50%)	22 (56%)
- Females	38 (47%)	20 (50%)	18 (44%)

The majority of fractures (62%) were sustained on the dominant hand, with 38% occurring on the non-dominant hand. Regarding fracture type, 45% of patients had minimally displaced and comminuted fractures, while 55% had displaced and comminuted fractures. The treatment outcomes are mentioned in Table 2.

Table 2: Treatment Outcome

Outcome measure	Conservative Group	Surgical Group	p-value	95% CI
Postoperative Complications (%)	15%	30%	0.045	0.012, 0.211
Radiological Union (%)	92%	95%	0.287	-0.054, 0.104
Residual Deformity (%)	10%	15%	0.421	-0.065, 0.133
Pain Score (Mean ± SD)	3.5 ± 1.2	2.8 ± 1.0	0.082	-0.014, 0.218
Functional Score (Mean ± SD)	32.5 ± 8.6	27.5 ± 7.3	0.016	0.022, 0.161

Among the 80 patients, 40 (50%) opted for conservative management, while the remaining 40 (50%) underwent surgical intervention. Within the surgical group, 15 patients (37.5%) underwent pinning, 12 (30%) received external fixation, and 13 (32.5%) underwent plating procedures.

Overall, 18 patients (22.5%) experienced postoperative complications, including infection (8 patients), hardware failure (5 patients), and nerve injury (5 patients). The majority of complications occurred in the plating group (10 patients), followed by the external fixation group (5 patients) and the pinning group (3 patients).

At the 12-month follow-up, 75 patients (93.75%) demonstrated radiological evidence of fracture union, while 5 patients (6.25%) experienced nonunion. Additionally, 10 patients (12.5%) exhibited residual deformities, primarily in the form of malalignment.

The mean pain score, assessed on a 10-point Likert scale, was 3.5 (range: 1-8) in the conservative group and 2.8 (range: 1-7) in the surgical group, indicating a slightly lower level of pain in the surgical cohort.

Functional outcomes were assessed using a 10-item Likert scale, with higher scores demonstrating greater difficulty in functioning. The mean functional score was 32.5 (range: 10-70) in the conservative group and 27.5 (range: 10-65) in the surgical group, suggesting better functional outcomes in the surgical cohort.

Statistical analysis revealed a significant variation in functional outcomes between the conservative and surgical groups ($p < 0.05$), with surgical intervention associated with better functional scores. However, no significant variation was observed in pain scores among the two groups ($p > 0.05$).

Among the surgical subgroups, patients who underwent plating demonstrated the highest rates of postoperative complications and residual deformities, followed by those who underwent external fixation and pinning. However, there was no statistically significant variation in radiological outcomes among the surgical subgroups ($p > 0.05$).

DISCUSSION

The study, comprising 80 adult patients with an average age of 43 years and a slight male predominance, found that fractures were most common in the dominant hand, with a higher incidence of displaced and comminuted fractures. While half of the patients opted for conservative management, the remainder underwent various surgical procedures, primarily plating.

Postoperative complications, including infections and hardware failures, affected 22.5% of patients, particularly those who underwent plating. Despite this, the radiological union was achieved in the majority of cases, although a small percentage experienced nonunion or residual deformity. Although pain scores were marginally lower in the surgical group, functional outcomes were significantly better compared to conservative management.

Subgroup analysis highlighted that patients who underwent plating procedures had higher complication rates and residual deformities. In conclusion, surgical intervention yielded superior functional outcomes, underscoring the importance of meticulous surgical techniques to minimize complications and enhance patient recovery.

The management and functional results of distal radius fractures in adults have been extensively studied, revealing varied approaches and results. Locking distal radius plates has been shown to effectively correct distal radius anatomy, offering a superior alternative to other treatments [5]. Comparative studies in Kerala found that percutaneous K-wire fixation after closed reduction provides added stability and improved functional outcomes compared to POP cast treatment for extra-articular distal radius fractures [6].

The use of volar variable-angle locking plates for unstable distal end radius fractures has been correlated with excellent to good functional results with the least complications [7]. Other research indicates that the treatment modality for associated distal ulnar head and neck fractures does not significantly affect outcomes in operatively treated distal radius fractures [8].

Additionally, studies have highlighted that obesity may increase the complexity of distal radius fractures but does not necessarily lead to worse functional outcomes [9], and that non-operative treatment of displaced fractures can lead to adequate results, albeit with a high rate of subsequent surgeries [10]. These findings underscore the importance of individualized treatment plans based on fracture complexity, patient characteristics, and potential for functional recovery.

Generalizability

The findings of this study cannot be generalized for a larger sample population.

CONCLUSION

In conclusion, this study highlights the importance of evaluating functional outcomes following different treatment modalities for IAF of the distal end of the radius in adults. Surgical intervention, particularly pinning, external fixation, and plating, demonstrated superior functional results compared to conservative management. However, the choice of surgical technique should be carefully considered to minimize postoperative complications and residual deformities. While plating showed the highest rates of complications, no significant difference was observed in radiological outcomes among surgical subgroups. These findings underscore the need for individualized treatment approaches based on fracture characteristics and patient factors to optimize outcomes and enhance patient recovery.

Limitations

The limitations of this study include a small sample population who were included in this study. Furthermore, the lack of a comparison group also posed a limitation for this study's findings.

Recommendations

Surgeons should carefully select the appropriate surgical technique based on fracture characteristics and patient factors to optimize outcomes and minimize complications. Emphasis should be placed on patient education and rehabilitation to ensure compliance with postoperative protocols and enhance functional recovery. Further research is warranted to evaluate long-term outcomes and explore the potential benefits of emerging technologies in the management of these fractures.

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List of abbreviations

IAF: intra-articular fractures
ORIF: open reduction and internal fixation

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No funding was received.

Conflict of interest

The authors have no competing interests to declare.

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