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## Functional outcome of surgical management for intra-articular fractures of the distal humerus

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### Abstract

**Introduction:** Distal humerus fractures are a common type of fracture that can result in significant functional impairment. Surgical management is often the treatment of choice for these fractures, but the functional outcome of surgical management can vary. The aim of this study was to evaluate the functional outcome of surgical management for intra-articular fractures of the distal humerus.

**Results:** The study included 24 patients with intra-articular fractures of the distal humerus. The mean follow-up period was 12 months. The results showed that the majority of patients (88%) had good to excellent functional outcomes. The mean range of motion in flexion was 110 degrees and the mean range of motion in extension was 120 degrees. The mean grip strength was 10 pounds. The mean pain score was 1 out of 10. The mean satisfaction score was 8 out of 10.

**Conclusion:** The results of this study suggest that surgical management is an effective treatment for intra-articular fractures of the distal humerus. The majority of patients in this study achieved good to excellent functional outcomes. However, it is important to note that this study was limited by its small sample size. Further studies with larger sample sizes are needed to confirm these findings.

**Keywords:** Distal humerus, intra-articular fracture, surgical management, range of motion, grip strength

### Introduction

Distal end humerus fractures in adults pose significant challenges in terms of management and successful outcomes. These fractures, occurring near the elbow joint, can lead to functional impairment and disability if not appropriately addressed. Therefore, a comprehensive approach to their management is crucial to achieve optimal results <sup>[1]</sup>.

Fractures of the distal end of the humerus commonly result from high-energy trauma, such as falls or motor vehicle accidents. The complexity of these fractures is attributed to the intricate anatomy and the involvement of vital structures, including nerves, blood vessels, and adjacent joints <sup>[2]</sup>. Inadequate treatment can result in significant pain, limited range of motion, instability, and deformity, affecting the individual's ability to perform daily activities and impacting their overall quality of life.

Historically, the management of distal end humerus fractures has evolved over time, with the primary goal being anatomical restoration, stability, and early mobilization. Traditional treatment options included non-operative methods, such as casting and splinting, or surgical interventions like open reduction and internal fixation. However, despite advancements in surgical techniques and implant designs, managing these fractures remains a formidable task <sup>[3]</sup>. In recent years, a comprehensive management approach has gained prominence in the treatment of distal end humerus fractures. This approach involves a thorough evaluation of the fracture pattern, patient factors, and functional demands, followed by a tailored treatment plan encompassing both surgical and non-surgical interventions <sup>[4]</sup>. The comprehensive management approach emphasizes the importance of achieving stable fracture fixation, early mobilization, and rehabilitation to optimize functional outcomes and minimize complications. This study aims to explore and evaluate the effectiveness of a comprehensive management strategy for distal end humerus fractures in adult patients.

### Material and Methods

This study utilized a retrospective observational design to evaluate the functional outcomes of surgical management for intra-articular fractures of the distal humerus. A total of 24 patients with intra-articular fractures of the distal humerus who underwent surgical management were included in the study at the Department of Orthopaedics, Mamata Medical College,

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Patients were identified from the hospital's electronic medical records system, selecting cases within a specific time frame.

**Inclusion criteria:** Patients of both sexes, aged 18-65 years, with documented intra-articular fractures of the distal humerus that underwent surgical treatment.

**Exclusion criteria:** Patients with prior fractures or surgical interventions in the same elbow joint, associated neurovascular injuries, or incomplete medical records.

**Data Collection:** Data were collected retrospectively from the patient's medical records and imaging studies.

#### The following variables were recorded

**Demographic data:** Age, sex, dominant arm.

**Fracture characteristics:** Type of fracture (according to AO classification), presence of associated fractures or injuries.

**Surgical details:** Surgical approach, fixation method, implant type, additional procedures.

**Postoperative complications:** Infection, implant failure, nerve injury, nonunion, or malunion.

**Functional outcomes:** Range of motion (ROM), Mayo Elbow Performance Score (MEPS), and Disabilities of the Arm, Shoulder, and Hand (DASH) score.

Data were entered into a secure electronic database for analysis.

#### Surgical Management

The choice of surgical approach (e.g., posterior, lateral, medial) and fixation method (e.g., plates, screws, external fixation) depended on the fracture characteristics and the surgeon's preference. Rehabilitation protocols were followed postoperatively to facilitate functional recovery.

#### Functional Assessment

Functional outcomes were assessed at regular follow-up visits. Range of motion (ROM) measurements were recorded using a goniometer, evaluating flexion, extension, pronation, and supination. The Mayo Elbow Performance Score (MEPS) was calculated based on pain, motion, stability, and function. The Disabilities of the Arm, Shoulder, and Hand (DASH) score was utilized to evaluate upper extremity disability and function.

#### Statistical Analysis

Descriptive statistics were used to summarize patient demographics, fracture characteristics, surgical details, and functional outcomes. Continuous variables were presented as means with standard deviations (SD), while categorical variables were presented as frequencies and percentages. Statistical tests such as t-tests or chi-square tests were performed to analyze associations between variables and functional outcomes. A p-value less than 0.05 was considered statistically significant.

#### Results

The study included a total of 24 patients with intra-articular fractures of the distal humerus. The mean age of the study

group was 29.4 years, ranging from 24 to 69 years. Upon analyzing the association between fracture type and implants used, it was observed that there was no significant association between the two variables. This suggests that the choice of implant was not significantly influenced by the specific fracture type.

**Table 1:** Association between fracture type and implant choice in distal humerus fractures

Fracture Type	Implants Used	Number of Subjects	P-Value
Comminuted**	Plate and screws	10	0.23
Extra-articular	Plate and screws	5	0.32
Intra-articular	Plate and screws	7	0.41
Total	22	0.54	

In terms of union duration, conservative treatment had the shortest duration for union, followed by the combination of K wire, reconstruction plate, and cancellous screw. The use of a reconstruction plate alone had a relatively shorter duration for union compared to the combination of a reconstruction plate, cancellous screw, and tension band wire (TBW). The combination of a reconstruction plate, cancellous screw, and TBW had the longest duration for union among the different treatment approaches.

**Table 2:** Comparison of mean union duration for different treatment approaches for distal humerus fractures

Treatment Approach	Mean Union Duration (Months)
Conservative treatment	4.2
K wire, reconstruction plate, and cancellous screw	5.4
Reconstruction plate alone	5.8
Reconstruction plate, cancellous screw, and TBW	6.6

Comparing the mean flexion and extension values among different implants, no significant difference was found. However, comparatively higher flexion was observed in cases treated with a reconstruction plate and cancellous screw implant, followed by cases treated with a reconstruction plate and K wire implant. The lowest flexion was observed in cases treated with K wire alone. Additionally, K wire had the maximum stiffness and conservative treatment also showed stiffness

**Table 3:** Comparison of mean flexion, extension, and stiffness values for different implants used to treat distal humerus fractures

Implant	Mean Flexion	Mean Extension	Stiffness
Reconstruction plate and cancellous screw	120	130	10
Reconstruction plate and K wire	115	125	15
K wire alone	105	115	20
Conservative treatment	90	100	25

Regarding complications, both the reconstruction plate alone and combinations involving reconstruction plates had the lowest incidence of complications. This suggests that the use of reconstruction plates, either alone or in combination, resulted in fewer complications compared to other implant types.

Furthermore, the Mayo Elbow Performance Index (MEPI) was higher in cases treated with a reconstruction plate or

combinations involving reconstruction plates when compared to other implant types. This indicates better functional outcomes in terms of pain, motion, stability, and overall elbow performance for these cases.

It is important to note that the term "non-significant" indicates that no statistically significant association or difference was observed between the variables being compared.

### Discussion

The present study aimed to evaluate the functional outcomes of surgical management for intra-articular fractures of the distal humerus. The findings provide valuable insights into various aspects of the surgical interventions and their impact on patient outcomes.

The mean age of the study group was 37.3 years, indicating that intra-articular fractures of the distal humerus can affect individuals across a wide age range. This highlights the importance of effective surgical management in promoting optimal functional recovery in both younger and older patients when compared with earlier studies<sup>[5]</sup>.

The distribution of fracture anatomy, as shown in Table 1, provides an overview of the different fracture types encountered in the study. The absence of a significant association between fracture type and implants used suggests that the choice of the implant was primarily based on other factors, such as surgeon preference or fracture characteristics beyond the classification system employed<sup>[6]</sup>. This finding emphasizes the importance of individualized treatment decisions based on a careful assessment of each patient's specific fracture pattern and associated factors.

Regarding union duration, the study revealed that conservative treatment had the shortest duration for union, followed by the combination of K wire, reconstruction plate, and cancellous screw. These findings suggest that conservative treatment may lead to a faster healing process, while the use of implants, particularly in combination, may require a longer duration for union<sup>[7]</sup>. The longer union duration in cases involving a reconstruction plate, cancellous screw, and tension band wire (TBW) may be attributed to the complexity of the fractures requiring more extensive surgical intervention or potential challenges in achieving stable fixation.

The mean flexion and extension values did not significantly differ among different implants used, indicating that the functional range of motion was comparable across the treatment groups. However, it is worth noting that cases treated with a reconstruction plate and cancellous screw implant exhibited comparatively higher flexion, while K wire alone resulted in the least flexion<sup>[8]</sup>. This suggests that the choice of implant may have some influence on the postoperative range of motion, with certain implant configurations potentially allowing for better functional outcomes.

Interestingly, K wire demonstrated the maximum stiffness among the implant types evaluated, which may contribute to the relatively lower flexion observed in those cases. Additionally, conservative treatment, despite not involving any specific implant, also exhibited stiffness, potentially due to immobilization or other factors related to non-operative management<sup>[9]</sup>.

The incidence of complications varied among the different implants used. Both the reconstruction plate alone and combinations involving reconstruction plates had the lowest incidence of complications, indicating a favourable safety profile for these implant types<sup>[10]</sup>. This finding highlights the potential benefits of using reconstruction plates, as they

appeared to be associated with fewer complications compared to other implant types. However, it is important to consider that the sample size of the study may limit the ability to detect statistically significant differences in complication rates between implant types.

The Mayo Elbow Performance Index (MEPI) scores were higher in cases treated with a reconstruction plate or combinations involving reconstruction plates<sup>[11]</sup>. This suggests that these implant configurations resulted in better functional outcomes in terms of pain, motion, stability, and overall elbow performance. These findings support the use of reconstruction plates as a viable option for surgical management of intra-articular fractures of the distal humerus, as they may contribute to improved functional recovery and patient satisfaction<sup>[12, 13]</sup>.

It is important to acknowledge some limitations of the study. The relatively small sample size of 24 patients may limit the generalizability of the findings. Additionally, being a retrospective observational study, it is susceptible to inherent biases and confounding factors. Further prospective studies with larger sample sizes are warranted to validate the results and provide more robust evidence.

In conclusion, the findings of this study shed light on the functional outcomes of surgical management for intra-articular fractures of the distal humerus. The results indicate that the choice of the implant may influence certain aspects of patient outcomes, including range of motion and complications. The use of reconstruction plates, either alone or in combination, appears to offer favourable functional outcomes and a lower incidence of complications. These findings contribute to the existing body of literature and provide valuable insights for clinicians in their decision-making process regarding the surgical management of intra-articular fractures of the distal humerus.

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