

A Prospective Study on Optimizing Surgical Outcomes in Adults with intercondylar Fractures of the Distal Humerus

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Abstract:

Background: Intercondylar fractures of the distal humerus in adults present significant orthopaedic challenges due to their complexity and the intricacy of the elbow joint. These injuries significantly impact patients' quality of life, requiring precise surgical intervention and rehabilitation for successful management. The aim of the study is to evaluate the functional outcomes of surgical management in adults with intercondylar fractures of the distal humerus.

Methods: This prospective observational study included 30 adults aged 20-65 years with intercondylar fractures of the distal humerus. Data collection involved clinical examinations, radiographic studies, and postoperative follow-up. Surgical procedures primarily used a posterior approach, and functional outcomes were evaluated using the Mayo Elbow Performance Score (MEPS).

Results: The patient cohort had a mean age of 46.7 years with equal gender representation. The average follow-up period was 15.1 months. The average time to bony union was 14.8 weeks, with a complication rate of 23%. Functional outcomes varied with fracture types, but the overall MEPS score was favourable at 85. The satisfactory rate of surgical outcomes was 80%.

Conclusion: The study demonstrates the effectiveness of tailored surgical approaches in managing intercondylar fractures of the distal humerus in adults. Despite the high complexity of these injuries, most patients achieved satisfactory functional recovery.

Recommendations: Further research is recommended to optimize surgical techniques and rehabilitation protocols, focusing on reducing complications and enhancing functional recovery.

Keywords: Intercondylar Fractures, Distal Humerus, Surgical Management, Functional Outcomes.

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Introduction

The management of intercondylar fractures of the distal humerus in adults presents a significant challenge in orthopaedic surgery, demanding a careful balance between restoring joint function and minimizing complications [1]. These fractures, occurring at the lower end of the upper arm bone where it splits into two parts (the condyles) to join the forearm, are complex injuries that can significantly impact a patient's quality of life. The intricacy of the elbow joint, coupled with the proximity of vital neurovascular structures, makes surgical intervention a delicate and demanding process.

Optimizing surgical outcomes in these cases is paramount, as the elbow is a critical joint for the

functional use of the arm. Successful management hinges on several key factors: accurate diagnosis, understanding the biomechanics of the elbow, meticulous surgical technique, and postoperative rehabilitation [2]. The goal is to achieve stable fixation, allowing for early mobilization while minimizing the risk of complications such as non-union, malunion, infection, and post-traumatic arthritis [3].

Recent advancements in surgical techniques and implant technology have significantly improved outcomes [4, 5]. However, the complexity of these fractures, variability in patient anatomy, and the potential for associated injuries make each case unique. This necessitates a tailored approach,

considering patient-specific factors such as age, bone quality, and activity level.

The aim of the study is to evaluate the functional outcomes of surgical management in adults with intercondylar fractures of the distal humerus. This includes assessing the effectiveness of various surgical techniques and their impact on post-operative recovery, mobility, and overall quality of life in patients.

Methodology

Study Design: A prospective observational study.

Study Setting: The study was carried out at NRI Institute of Medical Sciences, Sangivalasa, between January 2022 to January 2024.

Study Population: The study included 30 cases of intercondylar fractures of the distal humerus.

Inclusion Criteria: People who were adults aged 20-65 years, medically fit for surgery, with Grade 1&2 compound fractures (Gustilo & Anderson classification) and associated fractures around the elbow were included in the study.

Exclusion Criteria: Individuals who were medically unfit patients, Grade 3 & 4 compound fractures, pathological fractures, neuromuscular disorders like polio or cerebral palsy, injuries following post-contractures around the elbow, children, and patients with inflammatory conditions like rheumatoid arthritis and ankylosing spondylitis were excluded.

Bias: Bias was avoided by giving all participants the identical information and hiding the group allocation from the nurses who collected the data.

Variables: Key variables encompass independent factors like surgical techniques and patient demographics, dependent factors like postoperative functional outcomes and complications, and confounding variables such as patient health and lifestyle.

Data Collection: Data were collected from patients presenting at the Casualty or OPD level, and

thorough clinical examinations and histories were taken. Investigations included radiographic studies, Haemoglobin and Complete Blood Count, Urine for Sugar, Fasting Blood Sugar, Blood Urea, Serum Creatinine, HIV, HBsAg, and Electrocardiogram.

Surgical Procedure: The surgical approach was predominantly posterior, using the trans-olecranon approach. General anaesthesia was used in 18 cases and brachial block in 12 cases. Techniques included isolation of the ulnar nerve, olecranon osteotomy, assembly of humerus fragments, and fixation using AO cannulated cancellous screws and pre-contoured bicolumnar LCP. The stability of fixation was tested by putting the elbow through a range of motion.

Postoperative Care and Follow-up: Postoperative care included elevation of the limb, movement of fingers and shoulder joint, removal of the suction drain within 24-48 hours, and postoperative wound examination. Follow-up was scheduled at 4 weeks, 3 months, 6 months, and 1 year post-discharge. During follow-up, patients performed physiotherapy including active flexion-extension and pronation-supination movements without loading, and outcomes were evaluated using the Mayo Elbow Performance Score (MEPS).

Statistical Analysis: The results were expressed as Mean and range values for continuous data.

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

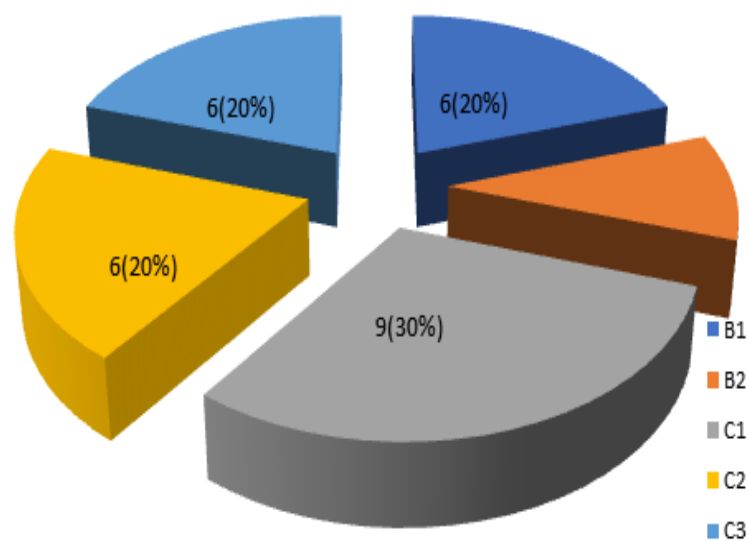
Result

The study involved a diverse group of patients, with the mean age calculated to be 46.7 years, showing a standard deviation of ± 11.88 years. This indicates a wide age range among the participants. The gender distribution was evenly balanced, with a male to female ratio of 1:1. This equitable representation of genders provides a comprehensive perspective on the surgical outcomes for both men and women.

Table 1: Study population demographics

Parameters	Number of cases (%)
<i>Age (Yrs.)</i>	
21 - 30	3 (10.0)
31 - 40	6 (20.0)
41 - 50	9 (30.0)
51 - 60	10 (33.3)
61 - 65	2 (6.7)
<i>Gender</i>	
Male	15 (50.0)
Female	15 (50.0)
<i>Type of Fracture</i>	
B1	6 (20.0)

B2	3 (10.0)
C1	9 (30.0)
C2	6 (20.0)
C3	6 (20.0)
<i>Complications</i>	
Implant Failure	1 (3.3)
Sup. Infection	2 (6.7)
Non-Union	1 (3.3)
Ulnar Neuropathy	1 (3.3)
Elbow Stiffness	2 (6.7)
None	23 (76.7)



Graph 1: Distribution of Fracture Types

The follow-up duration for the study was substantial, with a mean of 15.1 months and a standard deviation of ± 5.35 months. This extended period allowed for a thorough evaluation of the long-term outcomes of the surgical interventions. Fracture types, classified according to the AO system, showed a varied distribution: 9 cases were classified as C1, 6 as C2, 3 as C3, another 3 as B2, and 6 as B1. This variety in fracture types provided a broad spectrum for assessing the effectiveness of the surgical techniques employed.

A notable finding was the average time to bony union, which was 14.8 weeks with a standard deviation of ± 2.86 weeks. This metric is crucial in understanding the healing process post-surgery. The complication rate stood at 23%, a significant figure that highlights the challenges and risks associated with the surgical management of these fractures.

In terms of functional outcomes, the study reported a mean arc of motion of 122 degrees, indicating the degree of mobility achieved post-surgery. The MEPS, a critical measure of functional outcome, varied among different fracture types. The total mean MEPS across all cases was 85, with a standard deviation of ± 11.35 . Specifically, B1 fractures

scored an average of 94.1 ± 2.04 , B2 fractures 90 ± 5 , C1 fractures 90.5 ± 4.08 , C2 fractures 77.3 ± 33 , and C3 fractures 78.3 ± 12.1 . These scores reflect the varying degrees of recovery and functionality based on the type of fracture.

Finally, the overall satisfactory rate for the surgical outcomes was reported to be 80%, a significant figure that underscores the effectiveness of the surgical interventions for most patients in this study.

Discussion

The results of the study on surgical management of intercondylar fractures of the distal humerus in adults reveal a broad age range among the diverse patient group, averaging 46.7 years, with an equal gender distribution. The follow-up period, averaging over 15 months, enabled a comprehensive assessment of long-term surgical outcomes. The variety in fracture types, as classified by the AO system, offered a wide spectrum for evaluating surgical effectiveness. A notable aspect was the average 14.8-week period for bony union, highlighting the healing process post-surgery. The study reported a 23% complication rate, underscoring the inherent challenges in managing such fractures. Functionally, the patients achieved a

mean arc of motion of 122 degrees post-surgery, with the MEPS varying across fracture types, reflecting different recovery levels. The overall satisfactory rate of 80% for surgical outcomes indicates a high level of effectiveness in these interventions for most patients, demonstrating the success of the surgical approaches used in the study.

Intercondylar fractures of the distal humerus are challenging due to their nature and the required surgical expertise [6]. Successful treatment depends on anatomical reduction, stable fixation, and early elbow motion. Previous methods like closed reduction with immobilization often led to significant functional impairment. Current best practices favor surgical reconstruction, especially using the posterior approach through an olecranon osteotomy, which provides excellent visualization of the distal articular fragments [7, 8].

The study at hand presents an older average patient age of 46.7 years compared to similar studies by [9-14], where average ages ranged from 35 to 41.5 years. This suggests a higher occurrence of such fractures in an older demographic in the study. When comparing surgical outcomes, [10] found 14.8% excellent and 48% good outcomes, whereas [11] saw 20% good and 10% fair outcomes. [12] reported 88% excellent/good outcomes, and [13] observed 48% excellent outcomes. [14] achieved an impressive 84.5% excellent outcomes, showcasing variability in results across different studies. Gender distribution also varied, with [9] reporting a nearly even split, while [10, 11] had a male dominance. [13] presented a more balanced gender distribution. Fracture type focus differed among studies: [9, 11, 14] focused solely on AO type C fractures, while [12] included 16% of AO type B and 84% of AO type C fractures, indicating a common research emphasis on the complex AO type C fractures.

Conclusion

The study concludes that surgical management of intercondylar fractures of the distal humerus in adults is effective, with an 80% satisfaction rate indicating positive outcomes. Despite the challenges highlighted by a 23% complication rate and varied healing times, the overall favourable functional outcomes, including a good range of motion and Mayo Elbow Performance Scores, demonstrate the efficacy of tailored surgical approaches and diligent postoperative care in achieving satisfactory recovery in these complex orthopaedic cases.

Limitations: The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

Recommendation: Further research is recommended to optimize surgical techniques and rehabilitation protocols, focusing on reducing complications and enhancing functional recovery.

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List of abbreviations: MEPS- Mayo Elbow Performance Score

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