



PATIENT REPORTED OUTCOMES AND ASSOCIATED FACTORS
AFTER ORIF OF DISTAL HUMERUS AT AaBET HOSPITAL: JANUARY
2019 TO 2025

BY: Gachana Moti (MD, 4th Year Orthopedics and Traumatology Surgery
Resident)

ADDIS ABABA, ETHIOPIA

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DEPARTMENT OF ORTHOPEDICS AND TRAUMATOLOGY

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Project summary

Investigator	Gachana Moti (MD, Orthopedics and Trauma Surgery Resident)
Full Title of the Research Project	Patient reported outcomes and associated factors after ORIF of distal humerus at AaBET Hospital: JANUARY 2019 TO 2025
Duration Of the Project	January 2019 To January 2025
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List of Abbreviations and Acronyms

AaBET: Addis Ababa Burn, Emergency and Trauma Hospital

AO: Arbeitsgemeinschaft für Osteosynthesefragen

ASES: American society of Elbow Surgeons

DASH: Disability of the Arm, Shoulder and Hand

DHF: Distal Humerus Fracture

FMOH: Federal Ministry of Health

MEPS: Mayo Elbow Performance Score

ORIF: Open Reduction and Internal Fixation

OTA: Orthopedic Trauma Association

PRO: Patient Reported Outcomes

PROM: Patient Reported Outcome Measures

TEA: Total Elbow Arthroplasty

UE: Upper extremity

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Finally, I would like St. Paul's Hospital Millennium Medical College department of orthopedics and traumatology for creating favorable condition to conduct this research.

ABSTRACT

Background: Distal humerus fractures are common injuries, accounting for a significant proportion of long bone fractures. Open reduction and internal fixation management remains a standard treatment, yet the functional outcomes and associated factors in resource-limited settings like Ethiopia remain underexplored.

Objective: Aim of this study is to assess functional outcomes and associated factors of distal humerus fracture patients treated with open reduction and internal fixation at Addis Ababa Burn, emergency and Trauma Hospital (AaBET) Hospital from January 2019 to January 2025

Method: The study was conducted at Addis Ababa Burn, Trauma and Emergency (AaBET) hospital an affiliate of St. Paul's Millennium Medical College from January 2019 to January 2025. The Study had utilized Hospital based retrospective cross-sectional design by reviewing data on available medical records and interviewing patients on phone call. The study was conducted from October 2025 to December 2025. The data were collected using structured questionnaire, then entered and analyzed using SPSS version 27. Logistic regression (binary and multiple) analyses were used to determine the effect of factors on the outcome variable.

Result: A total of 62 patients were included. Favorable functional outcome (MEPS ≥ 75) was achieved in 41 patients (66.1%; 95% CI: 54%–77%). The mean MEPS was 78.4 ± 15.2 , and the mean DASH score was 34.8 ± 22.5 . Open fractures (AOR = 0.10; 95% CI: 0.02–0.58; $p = 0.010$) and presence of postoperative complications (AOR = 0.18; 95% CI: 0.03–0.94; $p = 0.042$) were independently associated with poorer functional outcomes.

Conclusion: Two thirds of patients achieved good to excellent functional outcomes following ORIF of distal humerus fractures; however, open fracture type and postoperative complications were significant predictors of poor outcome. Strengthening perioperative management, infection prevention, and early rehabilitation is essential to improve functional recovery.

Keyword: Distal humerus, Open Reduction and Internal Fixation, Outcome

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1. INTRODUCTION

1.1 Background of study

The humerus is the longest and the largest bone in the upper limb. It is made up of the proximal end, a shaft and the distal end. It articulates distally with the radius and ulnar to form the elbow joint. The distal end consists of both articular and non-articular parts(1). Anatomically, the distal humerus has a triangular shape, which is built of two columns and a tie arch. The medial column holds at its distal end the non-articular medial epicondyle with the insertion of the flexor muscles and the medial part of the humeral trochlea. The lateral column holds at its distal end the capitellum and more proximally the lateral epicondyle with the insertion of the extensor muscles (mobile wad)(2).

Distal humerus fractures, defined as interruptions of bone continuity below the insertion of the anterior brachial muscle, are relatively rare, representing 1 to 2% of all fractures(3). These fractures display a bimodal distribution, predominantly affecting young men (12-19 years old) due to violent trauma and elderly women (>80 years old) due to low-energy trauma associated with osteoporosis(3). In adults, distal humerus fractures account for about 30% of all humeral fractures(2). There are multiple established classification systems all being based primarily on the involvement of the medial and lateral column of the distal humerus and the presence of sagittal or coronal fracture patterns(2). The initial schemes for the classification of DHF are based on the anatomical location of the fracture line and its appearance(4). The Association of Osteosynthesis (AO) presented the first comparative classification of DHF, which was later adopted by the Orthopedic Trauma Association (OTA) in 1996. This classification divides the fracture into extra-articular (13A), partial articular (13B), and complete articular (13C). Further comminution and specific fracture patterns being defined by numbers. These classifications describe fracture patterns, and joint stability, which can predict patients' prognosis(4).

The management of distal humerus fractures is considered challenging and technically demanding, because of the complexity of the regional anatomy and the multi fragmentary pattern of injury. Achieving rigid internal fixation and anatomical reconstruction by restoring the two columns and the articular surface is essential for allowing early motion, adequate bone healing and avoiding future cartilage degeneration. Therefore, open reduction and internal fixation with plate fixation of both columns is the gold standard(5). However, despite evolution of ORIF techniques for distal humerus fractures, an overall complication rate up to 35% has been reported(5).

To choose the best surgical treatment for distal humerus fractures, the risks and complications of internal fixation need to be evaluated. Complications that can occur after surgery include pain, reduced range of motion, nerve-related sensory and motor issues, damage to the adjacent vascular system, delayed union, non-union, elbow stiffness, re-surgery due to instability, and osteoarthritis(4).

Although several studies have evaluated clinical outcomes of distal humeral fractures, fewer studies have explored the association between clinical and patient-reported outcomes (PROs). Several outcome measures are available to assess progress following treatment of elbow disorders including the Mayo Elbow Performance Index (MEPS), Disabilities of the Arm, Shoulder, and Hand (DASH) score, ASES-elbow score, and the Broberg and Morrey rating system among many others. Other reported outcomes include elbow range of motion, strength, complication rate, and patient satisfaction(6).

In this study, we aim to assess functional outcomes using Mayo scoring systems and DASH score at AaBET Hospital focusing on the rate of functional recovery and the factors influencing patient outcomes.

Finally, I hypothesized that patients with open fractures and those who developed postoperative complications would have significantly poorer functional outcomes following ORIF of distal humerus fractures.

1.2 Statement of problem

The number of distal humerus fractures is increasing, likely due to the growing elderly population(6). Incidence of 5.7-8.3 fractures per 100,000 people per year. Distal humerus fractures can be challenging to treat due to complex anatomy; unique biomechanical forces, poor bone quality in the elderly, and need for early range of motion(7).

Treatment options typically include non-operative management, open reduction internal fixation (ORIF), or total elbow arthroplasty (TEA). ORIF remains the predominant treatment of choice for a majority of these injuries(7).

Distal humerus fractures are complex injuries that often result in significant functional impairment. By evaluating the outcomes of ORIF and identifying associated factors, this study contributes to optimizing treatment strategies that promote early mobilization, reduce complications, and enhance recovery. Understanding which factors—such as fracture type, patient age, surgical approach, and postoperative protocol affect functional outcomes can help orthopedic surgeons tailor interventions to individual patients, improving prognosis and reducing the risk of nonunion, stiffness, or nerve injury

The ideal outcome measures used to evaluate the management of distal humerus fractures are not known. Likewise, there is no one PRO score consistently reported for outcomes after acute distal humerus fractures(6). Insights from this research can inform post-operative care and rehabilitation guidelines, ensuring that patients receive appropriate physiotherapy to regain range of motion and

strength. Through this research, valuable information will be generated to improve functional outcomes and targeted interventions aimed at addressing poor outcomes with distal humerus fractures.

In many low- and middle-income countries, including Ethiopia, there is a lack of sufficient data on functional outcomes and associated factors after ORIF of distal humerus fractures. Most available studies originate from high-income settings, where patient characteristics, surgical expertise, and rehabilitation facilities differ significantly. This knowledge gap makes it difficult for local orthopedic surgeons and healthcare providers to predict outcomes, optimize treatment strategies, and allocate resources effectively.

1.3 Significance of study

This research addresses the critical role of treating physicians and patients to shape the outcomes of patients after operative treatment of distal humerus. By evaluating the current understanding and practices of physicians, patients and physiotherapists, the study seeks to identify gaps and highlight areas for improvement in promoting optimal functional outcomes. The findings will provide actionable plans for physicians, enable them to deliver more tailored and effective counseling and educational programs to enhance improved functional outcome.

In addition, this research will contribute valuable data for physiotherapists to formulate targeted strategies aimed at reducing poor outcomes after surgery. Beyond its immediate impact, this study will serve as an important contribution to the body of literature, offering a foundation for future systematic reviews and providing a clearer understanding of the connection between operative treatment, associated factors and functional outcomes.

2. Literature review

The incidence of distal humerus fractures in adults was 5.7/100000 per year in a 10-year follow up study(8). It accounts for 2% to 6% of all fractures and one third of humerus fractures. According to the study done by Dr. Prakashappa TH in 2020 distal humerus fractures in adults are very difficult and challenging to treat due to intra - articular and inter - condylar involvement, high comminution, reconstruction difficulty of the articular surfaces, maintaining stability and morbidity, if not constructed anatomically(9). Hence, it is important to understand these fractures and their treatment protocol. The main goal of surgical treatment is to obtain fixation that is stable enough to allow immediate postoperative elbow mobilization to prevent it from stiffening, malunion and nonunion, hence open reduction and internal fixation allows early mobilization and good functional outcomes(9).

In comparison to any other joint, the elbow's good anatomical alignment, perfect stability, and early mobilization principles are of utmost significance(10).

1.1 Patient reported Functional Outcomes after open reduction and internal fixations

United states and Europe studies

In the United States, Zarezadeh et al. (2018) conducted a study assessing the functional outcomes of distal humerus fractures treated with open reduction and internal fixation, reviewed commonly used outcome measures and reported that most patients achieved good to excellent functional results, with Mayo Elbow Performance Score (MEPS) and DASH assessment tools. The study found that elbow motion, pain control, and strength were key indicators of successful recovery as well as age, fracture complexity, and early rehabilitation also influence the functional outcomes. Importantly, there are inconsistencies in outcome reporting across studies, advocating for uniform assessment tools in future research. Overall, stable fixation and structured follow-up were identified as essential for favorable long-term function(6).

Another study done in United States by Ek et al. (2008) evaluated the functional outcomes of complex intercondylar distal humerus fractures treated with open reduction and internal fixation. Patients achieved a median elbow flexion–extension arc of 90°, with good recovery of joint mobility. Functionally showed consistently good results on the Mayo Elbow Performance Score and a mean DASH score that indicates mild residual disability. Quality of life was comparable to that of the general population(11).

In Norway, Rosenlund et al. (2022) conducted a study to assess the functional outcomes and complications following open reduction and internal fixation (ORIF) of distal humerus fractures. The study reported a mean Oxford Elbow Score (OES) of 33.3 (out of 48), indicating generally good functional outcomes and 62% of patients achieved an OES of ≥ 32 , which reflects a satisfactory level of elbow function(12).

In Turkey, Özdemir et al. (2002) evaluated the long-term functional outcomes of adult intra-articular distal humerus fractures treated with open reduction and internal fixation. The study assessed outcomes using the Mayo Elbow Performance Score (MEPS), DASH score, and elbow range of motion in which all assessments indicate good to excellent functional recovery in most patients. The authors concluded that open reduction and internal fixation provide reliable long-term elbow function with acceptable complication rates when anatomical reduction and stable fixation are achieved(13).

In the Netherlands, Doornberg et al. (2007) conducted a long-term follow-up study on adults who had undergone open reduction and internal fixation for distal humerus fractures, with outcomes assessed 12

to 30 years postoperatively. The study reported favorable long-term functional outcomes using Mayo Elbow Performance Index and DASH indicating minimal disability and high elbow function. The authors concluded that ORIF of distal humerus fractures offers durable and satisfactory long-term functional results when proper surgical technique is applied(14).

In Greece, Tyllianakis et al. (2022) conducted a retrospective review to evaluate the long-term functional outcomes of adult distal humerus fractures treated with open reduction and internal fixation. The Functional outcomes were assessed using the Mayo Elbow Performance Score (MEPS), with results showing good to excellent outcomes. The authors concluded that ORIF remains a reliable treatment method for achieving favorable long-term elbow function in distal humerus fractures(15).

Asian studies

In India, Sunil et al. (2020) conducted a study to evaluate the functional outcomes of distal humerus fractures treated with open reduction and internal fixation (ORIF), Using the Mayo Elbow Performance Score (MEPS) to assess results, they found that 80% of patients had good to excellent outcomes. The authors concluded that ORIF with anatomical reconstruction and stable fixation leads to satisfactory elbow function in the majority of patients(16).

In India, Mahajan et al. (2020) prospectively evaluated 35 adult patients with distal humerus fractures treated with open reduction and internal fixation. Using the Mayo Elbow Performance Score (MEPS) to assess functional outcomes, indicating 86% of patients attained good to excellent elbow function. The authors concluded that ORIF with bicolumnar plating offers reliable anatomical reconstruction, enhanced stability, early range of motion, and favorable functional recovery in complex distal humerus fractures(8).

African studies

In Morocco, Abaydi et al. (2024) retrospectively reviewed 62 cases of surgically treated distal humerus fractures in patients aged over 65 years treated with open reduction and internal fixation. The functional outcomes assessed by the Mayo Elbow Performance Score showed that 64.5% of patients achieved excellent to good results, accompanied by significant pain relief and satisfactory mobility. The authors concluded that stable fixation, especially parallel dual plating and early rehabilitation, are key to good long-term elbow function despite the anatomical and physiological challenge (2).

In Rabat, Morocco, Lazrek et al. (2022) retrospectively assessed 55 adults with distal humerus fractures treated via open reduction and internal fixation. They found that anatomical reduction and stable fixation enabling early rehabilitation appeared essential for restoring elbow function, even in severely comminuted fractures. The study concluded that early functional recovery depends critically on surgical

precision and implant stability, more than on finer distinctions of patient demographic or fracture type(17).

In Cotonou, Benin, Chigblo et al. (2022) conducted a retrospective study of adults with distal humerus fractures treated via open reduction and internal fixation (ORIF). The Mayo Elbow Performance Score (MEPS), indicating functional outcomes ranging from poor to excellent. The authors concluded that even in resource-limited settings with delayed surgery, acceptable anatomical and functional outcomes are achievable when accurate reduction and stable fixation are prioritized(18).

In Stellenbosch, South Africa, Woyisile N and colleagues (1995) examined long-term functional outcomes in adults with distal humerus fractures managed by open reduction and internal fixation. Functional assessment indicated generally good results across the group, with a majority achieving satisfactory scores on validated measures such as the Mayo Elbow Performance Score and DASH(19).

1.2 Associated Factors Influencing Functional Outcome

Europe studies

In studies evaluating clinical outcomes of distal humerus fractures treated with open reduction and internal fixation, several key factors have been consistently associated with functional outcomes. Early surgical intervention, precise anatomical reduction, and stable internal fixation are crucial for achieving optimal elbow function. Additionally, patient-related factors such as age, bone quality, and early initiation of range of motion exercises have been shown to improve outcomes. Overall, both surgical technique and patient compliance with rehabilitation are vital for successful recovery(20).

In Germany, Kundel et al. (1996) conducted a study to identify factors influencing functional outcomes in patients with distal humerus fractures treated with open reduction and internal fixation. The study evaluated outcomes using clinical scores, range of motion, and found that anatomical reduction, stable internal fixation, and early mobilization were the most critical factors for achieving good functional results. In contrast, delayed surgery, comminuted fractures, advanced patient, ulnar nerve complications and heterotopic ossification were also noted as negative predictors. They concluded that meticulous surgical technique and timely intervention are essential for optimizing long-term elbow function in distal humerus fractures(21).

In Croatia, Daraboš et al. (2012) analyzed factors influencing functional outcomes in patients undergoing open reduction and internal fixation for distal humerus fractures. They emphasized that achieving anatomical joint surface reconstruction, rigid internal fixation, and early rehabilitation were critical for good postoperative function. Patients who underwent stable fixation and initiated early

elbow motion showed significantly better range of motion and lower complication rates. The study concluded that both surgical precision and timely, structured postoperative care are essential for successful long-term elbow function(22).

In Greece, Athanaselis et al. (2022) investigated influencing factors in adult patients with distal humerus fractures treated with open reduction and internal. The study emphasized that early surgical intervention, stable bicolunar fixation, and early initiation of postoperative mobilization were key factors contributing to favorable outcomes. Overall, patients with anatomical reduction and adherence to a structured rehabilitation program achieved better range of motion and functional scores. The study concluded that successful management depends not only on surgical technique but also on patient-related factors and timely rehabilitation(23).

African studies

In Morocco, Abaydi et al. (2024) studied patients over the age of 65 with distal humerus fractures treated by open reduction and internal fixation. The study found patients who underwent stable fixation with early rehabilitation showed acceptable recovery and maintained independence in daily activities. Ultimately, functional recovery was achievable but depended on managing both surgical and patient-related factors effectively (2)

In Cotonou, Benin, Chigblo et al. (2022) conducted a retrospective study of adult patients treated with ORIF for distal humerus fractures. Important factors influencing outcome included anatomical restoration of the joint surface, timely fixation, and early mobilization. The study concludes that even in challenging environments, accurate surgical technique, stable fixation, and rehabilitation can yield acceptable elbow function(18).

2. 3 conceptual Framework

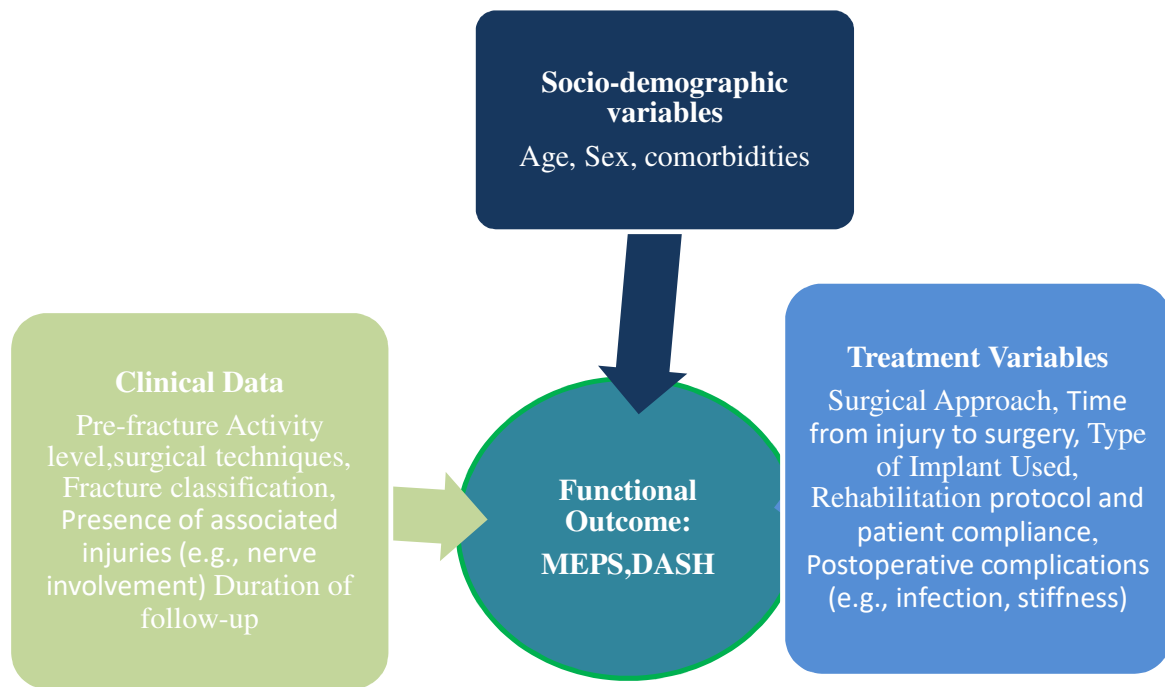


Figure 1: conceptual framework showing relations between dependent and independent variables of distal humerus fracture treated with ORIF at AaBET Hospital from January 2019 to January 2025, Addis Ababa, Ethiopia.

3. OBJECTIVES

3.1 General Objective

- ✓ To assess the functional outcomes and identify associated factors influencing recovery of distal humerus fractures treated with open reduction and internal fixation from January 2019 to January 2025

3.2 Specific Objectives

- ✓ To evaluate the functional outcomes of patients with distal humerus fractures post-ORIF using validated scoring systems from January 2019 to January 2025.
- ✓ To identify demographic factors associated with functional outcomes following ORIF from January 2019 to 2025.
- ✓ To analyze postoperative variables, such as time to mobilization, physiotherapy adherence, and complications (e.g., infection, stiffness), in relation to functional results from January 2019 to January 2025.
- ✓ To determine patient satisfaction and quality of life following surgery for distal humerus fractures from January 2019 to January 2025.

4 METHODS AND MATERIALS

4.1. Study area and period

The study was conducted at Addis Ababa Burn, Emergency and Trauma (AaBET) Hospital, Addis Ababa, Ethiopia, an affiliate of St. Paul's Hospital Millennium Medical College. AaBET Hospital was established in August 2015. It was the first trauma center established by the Federal Ministry of Health (FMOH) in collaboration with SPHMMC. Currently, the hospital is giving service as a tertiary referral center as well as an undergraduate and specialty training center in four major disciplines i.e. neurosurgery, Orthopedic Surgery & traumatology, plastic and reconstruction surgery, and emergency and critical care medicine. It has 190 beds, and one operation theatre with four tables.

Particularly, the orthopedic surgery and traumatology department is amongst the principal departments of St. Paul's Hospital Millennium Medical College. With a total of 16 rooms and 65 beds at its disposal, the department treats a variety of acute and chronic musculoskeletal ailments. The department utilizes one or two operation table(s) per day. The human capital of the department includes seven subspecialists – 4 in orthopedic trauma and Arthroplasty, two in orthopedic sports medicine, one in pediatric orthopedic surgery, and one in physical therapy and rehabilitation, one in foot and ankle subspeciality and seven specialists. The department offers specialty training, with 49 residents currently in training, and conducts research.

All patients who underwent operative fixation for distal humerus after presenting with fracture from January 2019 to January 2025, who fulfill the inclusion criteria were included. The study was conducted from May 2025 to January 2026.

4.2. Study design and Study period

The study utilized hospital based analytical cross-sectional design by reviewing records on available medical records and on phone call interviews of patients at AaBET Hospital Record department of five years from January 2019 to January 2025.

Data Collection Period (Research Activity) were for three months from October 2025 - December 2025.

4.3 Population

4.3.1. Source population

All patients with distal humerus fracture at AaBET hospital from January 2019 to January 2025.

4.3.2. Study population

All patients with distal humerus fracture treated with open reduction and internal fixation at AaBET hospital from January 2019 to January 2025.

4.3.3. Study unit

The study unit was both the patient's medical charts and the patient directly.

4.3.4 Eligibility criteria

4.3.5 Inclusion criteria

- ✓ All patients above 15 years of age
- ✓ Closed and open distal fractures
- ✓ Both extra articular and intraarticular fractures
- ✓ Patients treated with ORIF techniques
- ✓ Minimum of 6 months post-surgery

4.3.6 Exclusion criteria

- ✓ Age below 15 years
- ✓ Pathologic fractures
- ✓ Per prosthetic fractures or prior elbow implants
- ✓ Preexisting deformities
- ✓ Patient who lost to follow up before 6 months
- ✓ Patients unreachable by phone call

4. 4 sample size determination

Given that the total number of patients who underwent ORIF for distal humerus fracture in the hospital from January 2019 to January 2025 was 66, a census approach was employed. All eligible patients meeting inclusion criteria were included in the study to maximize statistical power. No sample size calculation for an infinite population was performed.

4. 5 sampling techniques and procedures

Data was collected via interviewer-administered, structured questionnaire. The data collection tool contains closed questions specifically designed for the study; the socio demographic and clinical characteristics contained in the data collection tool and Patient reported outcome measure (PROM) data

using MEPS and DASH. The source of the data was adult OPD logbook, patient chart and patient him/herself. One trained General practitioner and one junior resident were hired for the purpose of this study under supervision of the principal investigator.

Once the patients who fulfill the inclusion criteria are purposively identified; the questionnaires were filled by data collectors, from the patient's medical charts as well as from in person or telephone interviews.

4. 6 study variables

4.6.1 Dependent variable

- ✓ The primary outcome measure was mayo elbow performance score (MEPS) A score of 90 or more is considered excellent. A score of 75-89 is considered good. A score of 60-74 is considered fair and a score of 0-59 is considered poor. Dichotomously, A score of 75 and above is “Good “or “favorable” and a score below 75 is “Poor”.
- ✓ The secondary outcome measures the DASH a 30-item self-reported questionnaire in which the response options are presented as 5-point Likert scales. Scores range from 0 (no disability) to 100 (most severe disability). This score was designed to be useful in patients with any musculoskeletal disorder of the upper limb.
 - Categorized as
 - 0-10 very satisfied
 - 11-30 satisfied

4.6.2 Independent variable

- ✓ Age
- ✓ Duration of follow-up
- ✓ Fracture type (open or closed)
- ✓ Postoperative complications (e.g., infection, stiffness, nerve injury)
- ✓ Presence of associated injuries (e.g., nerve involvement)
- ✓ Rehabilitation protocol and patient compliance
- ✓ Sex
- ✓ Surgical approach and technique
- ✓ Time from injury to surgery
- ✓ Type of fixation used

4.7 Operational definition

Mayo Elbow performance Score: the most applied elbow-specific outcome measure. It is a score that assesses pain, motion, stability and function. It is widely applied to all elbow pathology including trauma. As a 4-part test that evaluates clinical information on a 100-point scale, where scores categorize performance as poor (60 or less), fair (60 to 74), good (75 to 89), or excellent (90 to 100)(24).

Disability of Arm, shoulder and Hand is a 30-item patient reported region-specific outcome measure. It contains items related to activities of daily living, social activities, work activities, symptoms, sleeping, and confidence. The score is normalized from zero to 100, with a lower score representing better function(25).

Rehabilitation protocol: can be either proper rehabilitation with professional advice or no professional advice.

Distal Humerus Fracture: interruptions of bone continuity below the insertion of the anterior brachial muscle(3)

Good/excellent(favorable) functional outcome: MAYO elbow score of ≥ 75

Major complications: Mechanical Failure, Nerve Palsy Stiffness, Heterotopic Ossification, Infection, and Post-Traumatic Arthritis.

4.8 Data quality control

Training on the optimal use of the questionnaire was given to one orthopedic surgery resident and one general practitioner by the primary investigator for one day. There was daily supervision on data collection. The collected data onto the Epi Info 7.2.7 version and cleaned, checked for completeness by the primary investigator. The cleaned data was exported and stored to SPSS version 27 statistical package for analysis.

4.9 Data analysis

After completing data collection, data were checked by the principal investigator for completeness and coded. The coded data was entered into Epi info and were exported to SPSS Version 27 for further analysis.

Both descriptive and inferential statistical analysis methods were applied. In the descriptive aspect, graphs and tables were used for presentation of results. On the other hand, the binary logistic regression analysis was done to assess the association between the dependent and independent variables. Variables with a p-value of <0.25 in a Bivariate analysis were considered eligible for the multivariable model. Thereafter, multiple variable logistic regression analysis was performed to control potential confounders and identify factors associated with functional outcomes. Adjusted Odds ratio with a 95%

confidence interval and p-value of less than 0.05 were computed to measure the effect size of each independent variable and level of significance, respectively.

4.10 Ethical considerations

The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical clearance was also obtained from the institutional review board (IRB) of Saint Paul Hospital Millennium Medical College. In addition, the administration of AaBET Hospital asked permission to retrieve and review patients' records. Verbal consents were obtained from interviewed patients. Patients' medical data will be kept confidential. Standard of care treatment were provided when such is deemed necessary, particularly, but not limited to, in cases of complication.

4.12 Result dissemination plan

After completion of the study, the report will submit to Department of Orthopedic Surgery and Traumatology at St. Paul's Hospital Millennium Medical College. Correspondingly, the findings were submitted to AaBET Hospital. Lastly, the results of the research will disseminate through publication to reputable journals.

5. RESULT

5.1 Socio – Demographic and Clinical Characteristics of the Study participants

The final study comprised 62 patients (3 not reached on phone, 1 deceased) who had open reduction and internal fixation (ORIF) for distal humerus fractures at AaBET Hospital between January 2019 and January 2024.

The participants ranged in age from 16 to 78 years, with a mean age of 46.5 ($\pm$ 12.8) years. Most patients (64.5%, n=40) were in the middle-aged group (40–64 years), as seen in Table 1. Elderly patients ($\geq$ 65 years) made up the smallest percentage of the study, at 6.5% (n=4), whereas young people (16–39 years) made up 29.0% (n=18). With 58.1% (n=36) of the participants being men and 41.9% (n=26) being women, there was a male majority in terms of sex distribution, resulting in a male-to-female ratio of almost 1.4:1. [Table 1]

Table 1. Frequency and percentage distribution of socio-demographic variables of patients report after ORIF of Distal Humerus in the AaBET Hospital in Addis Ababa city, Ethiopia, 2025

Variable	Category	Frequency	Percent
Age	16 - 39 years	18	29.0
	40 - 64 years	40	64.5
	>= 65 years	4	6.5
Sex	Female	26	41.9
	Male	36	58.1

The most prevalent comorbidity among those reported was alcohol consumption (17.7%, n=11), followed by smoking (4.8%, n=3) and chronic disease (11.3%, n=7). In terms of the surgical strategy, triceps splitting was utilized in 61.3% of instances (n=38), while triceps-preserving procedures were utilized in 38.7% of cases (n=24).

Falls or other mechanisms was the most common causes of injury (46.8%, n=29) followed by road traffic accidents (25.8%, n=16) and sports-related injuries (27.4%, n=17). There were no bilateral instances reported and left-sided injuries were more frequent (58.1%, n=36) than right-sided injuries (41.9%, n=26). 24.2% (n=15) of fractures were open, but the majority (75.8%, n=47) were closed.

42.6% (n=26) of the patients had surgery within the first two weeks following their injury, whereas more than half (57.4%, n=35) had surgery after two weeks or longer. Surgical techniques were split evenly between single posterior incisions (50%, n=31) and dual incisions (50%, n=31). The distribution of implant fixation was comparable, with dual plating utilized in 48.4% (n=30) of cases and single plating in 51.6% (n=32). Range of motion (ROM) exercises and rehabilitation started at different times: 40.3% (n=25) started within a week, 33.9% (n=21) started right away (<48 hours), and 25.8% (n=16) started after a week. Of the patients, 25.8% (n=16) had postoperative problems. Elbow stiffness (17.7%, n=11) was the most frequent consequence, followed by neurological injury (4.8%, n=3) and surgical site infection (3.2%, n=2).

Table 2 Frequency and percentage distribution of clinical and injury-related variables of patients report after ORIF of Distal Humerus in the AaBET Hospital in Addis Ababa city, Ethiopia, 2025

Variable	Category	Frequency	Percent
Comorbidities and approaches	Smoking	3	4.8
	Alcohol	11	17.7
	Chronic Illness	7	11.3
	Triceps Splitting	38	61.3
	Triceps Preserving	24	38.7
Cause of injury	RTA	16	25.8

	Sports	17	27.4
	Others/ Fall	29	46.8
Side of Injury	Right Side	26	41.9
	Left Side	36	58.1
	Both Sides	0	0
Type of Injury	Open	15	24.2
	Closed	47	75.8
Time to Surgery	≥ 2 weeks	35	57.4
	< 2 weeks	26	42.6
Surgical Approach	Dual Incisions	31	50
	Single Posterior incision	31	50
	Other	0	0
Type/No of Implants	Single Plate	32	51.6
	Dual Plate	30	48.4
ROM & Rehabilitations Started	Immediate (< 48 hrs)	21	33.9
	Within 1 wk	25	40.3
	After 1 wk	16	25.8
PO Complications	Infection	2	3.2
	Stiffness	11	17.7
	Neurological Injury	3	4.8
	Others	0	0
	Total Computed	16	25.8

5.2 Functional Outcome after ORIF Characteristics of the Study participants

5.2.1. MAYO Elbow Performance Score (MEPS) Outcomes

The individual components of the Mayo Elbow Performance Score (MEPS), assessed and detailed in Table 3. At their most recent follow-up, most patients 72.6% (n= 45) said they were pain-free. 11.3% (n= 7) of respondents experienced mild discomfort, while 16.1% reported significant pain (n=10). No patients complained of excruciating discomfort. In terms of the elbow flexion arc, (72.6%) 45 individuals had exceptional flexion ($> 100^\circ$), (16.1%) 10 had a functional range ($50^\circ - 100^\circ$), and (11.3%) 7 had limited flexion ($< 50^\circ$). Most patients (72.6%) 45 had adequate elbow stability. No instances of severe instability were noted, while the remaining (27.4%) 17 showed mild instability. In general, performance in everyday tasks was excellent. Combing hair was reported to have the greatest level of function (26.2%, n = 55), followed by personal hygiene and putting on a shirt (25.2%, n = 53). Of the patients, 23.3% (n=49) described eating as totally functional.

Table 3: Distribution of MEPS categories of patients report after ORIF of Distal Humerus in the AaBET Hospital in Addis Ababa city, Ethiopia, 2025

Variable	Category	Frequency	Percent
Pain	No pain	45	72.6
	Mild pain	7	11.3
	Moderate pain	10	16.1
	Severe pain	0	0
Range of Motion	Flexion > 100°	45	72.6
	Flexion 50°–100°	10	16.1
	Flexion < 50°	7	11.3
Stability	Stable elbow	45	72.6
	Mildly unstable elbow	17	27.4
	Unstable elbow	0	0
Daily Function	Combing hair	55	26.2
	Performing personal hygiene	53	25.2
	Eating	49	23.3
	Putting on a shirt	53	25.2

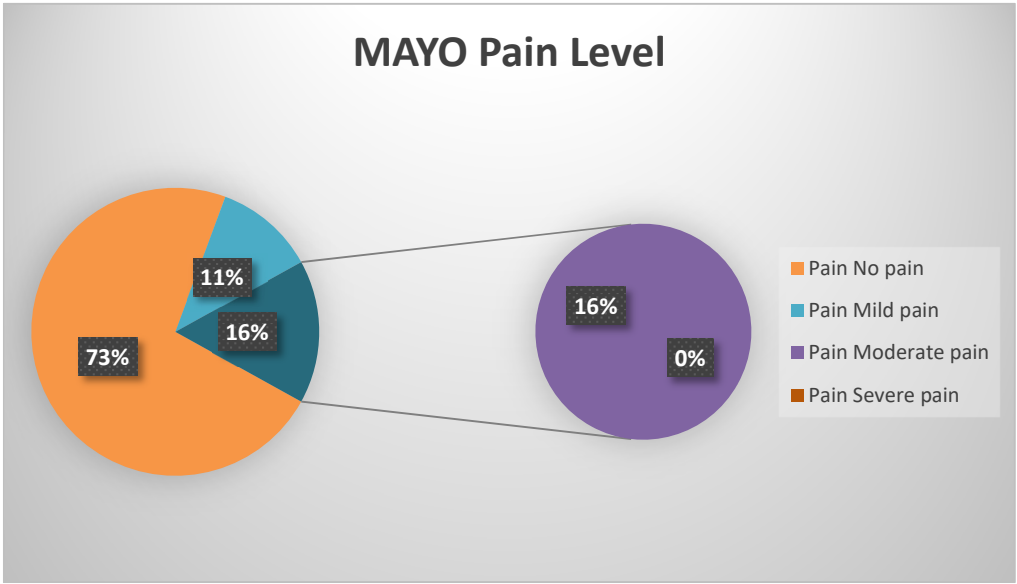


Figure 1: Pie chart showing Pain categories of MEPS Outcomes of Patients report after ORIF of Distal Humerus in the AaBET Hospital in Addis Ababa city, Ethiopia, 2025

5.2.2. DASH Score Outcomes of Patients report after ORIF of Distal Humerus in the AaBET Hospital in Addis Ababa city, Ethiopia, 2025

The 30-item DASH questionnaire was examined using its six predetermined functional areas to better understand the type of impairment that patients experienced after ORIF for distal humerus fractures. Table 4 displays the frequency of patients reporting "No Difficulty" or "Unable" as well as the mean score for each domain item (scored 1–5, where 1 = No Difficulty and 5 = Unable).

Moderate residual impairment was seen in the 16 categories pertaining to instrumental and fundamental ADLs. Putting on a pullover sweater (mean score: 2.55 ± 1.29) and gardening/yard labor (mean score: 2.61 ± 1.21) were the most difficult tasks on average. Interestingly, the greatest percentage of patients ($n=7$, 11.3%) reported being "Unable" to carry a shopping bag. It was somewhat easier to do tasks like pushing open a heavy door and positioning an object overhead.

Six patients (9.7%) were unable to participate in recreational activities that required free arm mobility, such as badminton and frisbee, which had the most impact (mean score: 2.56 ± 1.29). The most challenging social activity was managing transportation (mean score: 2.63 ± 1.24), but interference with regular social activities was rated as moderate (mean score: 2.45 ± 1.34).

No patient reported being totally "Unable" to work; instead, they indicated mild-to-moderate impairments in job activities (mean score: 2.16 ± 1.07). Weaknesses were the most common symptoms (mean score: 2.69 ± 1.28). A moderate amount of pain-related sleep disruption was found (mean score: 2.32 ± 1.23). One patient (1.6%) strongly agreed that they felt less capable, and the impact on confidence was moderate (mean score: 2.26 ± 1.17). (Table -4)

Table 4: Mean, SD and Range of DASH Score of Patients report after ORIF of Distal Humerus in the AaBET Hospital in Addis Ababa city, Ethiopia, 2025

Variable	Category	Mean± SD	Frequency	
			No Score	Percent
Activities of Daily Living	Open a tight or new jar	2.23 ± 1.179	138	44.52
	Write	2.32 ± 1.068	144	46.52
	Turn a key	2.29 ± 1.151	142	45.81
	Prepare meal	2.52 ± 1.238	156	50.32
	Push open a heavy door	2.21 ± 1.118	137	44.19
	Place an object on a shelf above your head	2.29 ± 1.206	142	45.81

	Do heavy house hold chores (e.g. wash walls, wash floors)	2.52 ± 1.225	156	50.32
	Garden or do yard work	2.61 ± 1.206	162	52.26
	Make a bed	2.35 ± 1.256	146	47.09
	Carry a shopping bag or briefcase	2.37 ± 1.358	147	47.42
	Carry heavy objects(over 10lbs)	2.32 ± 1.142	144	46.45
	Change light bulb overhead	2.40 ± 1.260	149	48.06
	Wash or blow dry your hair	2.45 ± 1.141	152	49.03
	Wash your back	2.24 ± 1.126	139	44.84
	Put on a pullover sweater	2.55 ± 1.289	158	50.97
	Use knife to cut food	2.32 ± 1.290	144	46.45
Recreational Activity	Recreational activities which requires little effort (card playing, knitting etc.)	2.44 ± 1.196	151	48.71
	Recreational activities in which you take some force or impact through your arm, shoulder, or hand (golf, hammering, tennis etc.)	2.11 ± 1.175	131	42.26
	Recreational activities in which you move your arm freely (playing frisbee, badminton, etc.)	2.56 ± 1.288	159	51.29
Social Activities	Manage transportation needs(getting from one place to another)	2.63 ± 1.244	163	52.58
	Sexual activities	2.37 ± 1.231	147	47.42
	During past week, to what extent has your arm, shoulder or hand problem interfered with your normal social activities with families, friends, neighbors or groups	2.45 ± 1.339	152	49.03
Work Activity	During past week, were you limited in your work or other regular daily activities as result of your arm, shoulder or hand problem?	2.16 ± 1.074	134	43.23
Symptoms	Arm, shoulder or hand pain	2.44 ± 1.263	151	48.71
	Arm, shoulder or hand pain when you performed any specific activity	2.40 ± 1.234	149	48.06
	Tingling(pins and needle)in your arm, shoulder or hand	2.34 ± 1.214	145	46.77
	Weakness in your arm, shoulder or hand	2.69 ± 1.275	167	53.87
	Stiffness in your arm, shoulder or hand	2.24 ± 1.289	139	44.84
Sleeping	During pat week, how much difficulty have you had sleeping because of pain in your arm, shoulder or hand?	2.32 ± 1.225	144	46.45
Confidence	I feel less capable, less confident or less useful because of my arm, shoulder or hand problem.	2.26 ± 1.173	140	45.16

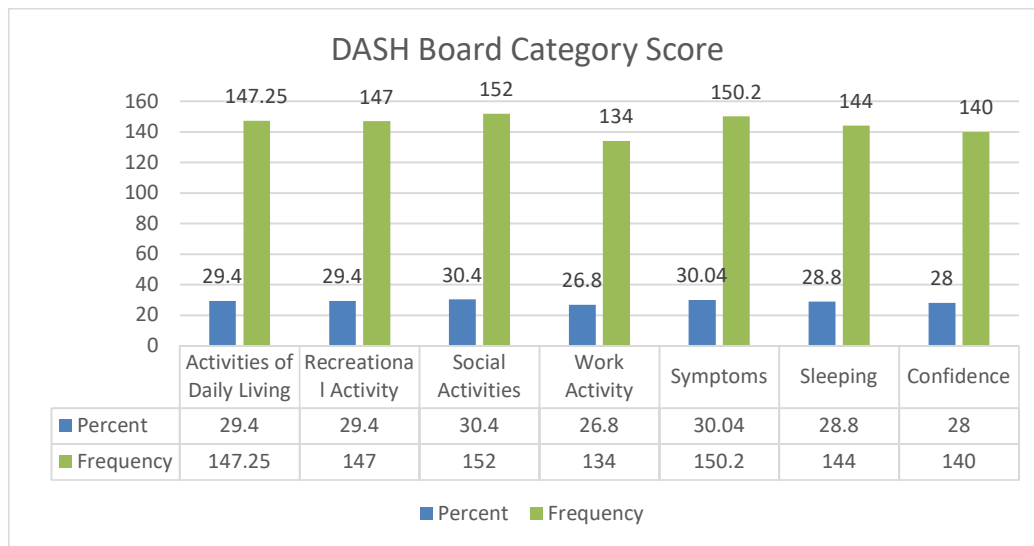


Figure 2: Bar Chart of DASH Score Distribution of Patients report after ORIF of Distal Humerus in the AaBET Hospital in Addis Ababa city, Ethiopia, 2025

5.2.3 Combined Functional Outcome Classification after ORIF of Distal Humerus Fractures

5.2.3.1 Mayo Elbow Performance Score (MEPS) Outcomes

Table 5 displays the total functional result as determined by the Mayo Elbow Performance Score (MEPS). 66.1% (n=41) of patients had a Good or Excellent result (MEPS ≥ 75) according to the conventional MEPS classification. Of them, 33.9% (n=21) were rated as Good (MEPS 75–89) and 32.3% (n=20) as Excellent (MEPS 90–100). With 24.2% (n=15) classified as Fair (MEPS 60–74) and 9.7% (n=6) as Poor (MEPS < 60), the remaining 33.9% (n=21) of patients had a Fair or Poor result. The cohort's average MEPS was 78.4 ± 15.2 (range: 45–100).

The DASH score was used to quantify patient-reported disability; a lower score denotes improved function (Table 5). With a broad range from 5.0 to 86.7, the average DASH score for all patients was 34.8 ± 22.5 . Patients with Excellent results had the lowest impairment (mean DASH: 14.5 ± 5.2) and those with Poor outcomes had the highest disability (mean DASH: 70.2 ± 12.5), according to MEPS category analysis. 43.5% (n=27) of the sample satisfied the clinically meaningful criteria of DASH ≤ 20 , which is used to indicate a favorable patient-reported outcome.

MEPS and DASH ratings showed a substantial negative connection (Pearson's $r^* = -0.82$, $p < 0.001$), indicating that reduced patient-reported disability (lower DASH score) was linked to greater physician-assessed elbow function (higher MEPS).

Table 5 proportion of patients with Good Vs Poor Functional Outcomes

Variable	Category	Frequency	Percent	Mean +- SD	Range
MAYO Score	Good	41	66.1	78.4 ± 15.2	45–100.
	Poor	21	33.9		
DASH Score	Poor	35	66.5	34.8 ± 22.5	11
	Good	27	43.5		

5.3 Factors Associated with functional Outcomes after ORIF Characteristics of the Study participants

Binary logistic regression analysis was employed to discern the predictors for functional outcome after ORIF of distal humerus fractures using the Mayo Elbow Performance Score as the outcome variable. Functional outcome was categorized as favorable for MEPS scores ≥ 75 and poor (unfavorable) for MEPS scores < 75 . Odds ratios were determined by using logistic regression for bivariate analysis; those with p-values ≤ 0.25 were included in the multivariate analysis for identification of predictors for functional outcome.

After adjusting for the confounding variables, there was no association between the gender of the patient and the outcome in relation to function. Even if the odds ratio for male patients to achieve a better function outcome than that of females is 2.84, the result is not statistically significant (AOR = 2.84, 95% CI: 0.62-13.02; $p = 0.179$).

Time from injury to surgery was not a statistically significant independent predictor of functional outcome in the multivariable model. For patients undergoing surgery after 2 weeks or more post-injury, there was a significantly lower likelihood of achieving good functional outcome compared with those undergoing surgery at 2 weeks or less post-injury (Adjusted OR = 0.29, 95% CI: 0.06-1.38; $p = 0.120$).

Functional outcome had no statistical association with the source of injury. Relative to those injured after falling, there was no statistically significant difference in the odds of achieving good functional

outcomes for those injured due to road traffic accidents (AOR = 1.16, 95% CI: 0.20-6.85; p = 0.873) and those injured in sports-related activities (AOR = 0.24, 95% CI: 0.03-2.10; p = 0.197).

Similarly, comorbidities and risk factors, including alcohol consumption, were not independently related to functional outcome. Those with comorbidities had lower odds of having a good functional outcome than those without comorbidities; however, this was not statistically significant (AOR = 0.48, 95% CI: 0.08-2.81, p = 0.418).

However, type of injury was a significant independent predictor of functional outcome. Compared with patients with closed fractures, those with open fractures had lower odds of good functional outcomes (AOR = 0.10, 95% CI: 0.02–0.58; p = 0.010).

Furthermore, the existence of any postoperative complication was independently associated with functional outcome. Patients who developed postoperative complications were significantly less likely to achieve good functional outcomes compared to those without complications, even after adjustment for other variables in the model (AOR = 0.18, 95% CI: 0.03–0.94; p = 0.042. (Table - 6)

Table 6 Bivariate and Multivariate logic regression analysis of associated factors related to the Patients report after ORIF of Distal Humerus in the AaBET Hospital in Addis Ababa city, Ethiopia, 2025 (n=62)

Variables	MAYO Score				
	Good	Poor			
	No (72.6%) 45	No (27.4%) 17	COR(95% CI)	AOR(95% CI)	p value
Sex of Pt					
Male	28 (62.2)	8 (47.1)	1.853 (1.60 - 5.72)	2.84(0.62 - 13.02)	0.179
Female	17 (37.8)	9 (52.9)	1	1	
Time from the Injury to the Surgery					
>=2 Weeks	28 (62.2)	7 (43.8)	2.12 (1.66- 6.73)	0.29(0.061 -1.38)	0.120
< 2 Weeks	17 (37.8)	9 (56.3)	1	1	
Cause of Injury					
RTA	13 (28..9)	3 (17.7)	0.93 (0.25 – 0.94)	1.16 (0.19 - 6.85)	0.873
Sport	12 (26.7)	5 (29.4)	0.10 (0.35 – 0.24)	0.24 (0.03 - 2.10)	0.197
Falling	20 (44.4)	9 (52.9)	1	1	1

Comorbidity/ Risk Factor/ Alcohol					
Yes	6 (13.3)	5 (29.4)	2.7 (2.70 – 10.47)	0.483 (0.083 - 2.805)	0.418
No	39 (86.7)	12 (70.6)	1	1	
Types of Injury					
Open	7 (15.6)	8 (47.1)	0.207 (0.060 – 0.722)	0.101 (0.018 - 0.584)	0.010*
Closed	38 (84.4)	9 (52.9)	1	1	
Existence of Any PO Complications					
Yes	9 (20.0)	7 (41.2)	0.357 (0.106 – 1.199)	0.179 (0.034 0.943)	0.042*
No	36 (80.0)	10 (58.8)	1	1	

***Was assigned to indicate those variables which has association with dependent one.**

6. DISCUSSION

This study evaluated functional outcomes and associated factors among patients who underwent ORIF for distal humerus fractures at AaBET Hospital. Favorable functional outcome (MEPS ≥ 75) was observed in 66.1% of patients, with a mean MEPS of 78.4 ± 15.2 . The mean DASH score was 34.8 ± 22.5 and demonstrated strong inverse correlation with MEPS ($r = -0.82$, $p < 0.001$), confirming internal consistency between physician-assessed and patient-reported measures.

Open fractures were independently associated with poorer functional outcome (AOR = 0.10; 95% CI: 0.02–0.58). Although statistically significant, the wide confidence interval suggests imprecision, likely due to the relatively small number of open fracture cases. These findings align with previous literature indicating that soft tissue injury severity and infection risk negatively influence recovery.

Similarly, postoperative complications significantly reduced the likelihood of favorable functional outcome (AOR = 0.18; 95% CI: 0.03–0.94). Complications such as stiffness and infection may delay rehabilitation and compromise elbow mobility. These findings emphasize the importance of perioperative optimization and early supervised physiotherapy.

Post-operative complications also independently predicted the outcome of function (AOR = 0.18, 95% CI: 0.03-0.94; p-value = 0.042). Patients who experienced complications such as infection, stiffness, and nerve injury had reduced 82% odds of attaining good functional outcome of ORIF the probability of having. This result is in accordance with the general literature that suggests

complications negatively influence the processes of healing and rehabilitation (3,18). For example, Sanchez Sotelo et al. showed that elbow stiffness is the most common 35% sequel seen after ORIF of distal humeral fractures and impacted negatively the range of motion and function (5).

Postoperative complications are a well-recognized concern in ORIF of complex articular fractures, especially in elderly and comorbid populations, where infection and stiffness rates are notably higher. McKee et al. documented that postoperative adverse events significantly influenced clinical results post-ORIF in elderly patients. In low resource environments like many African trauma centers, higher complication rates may also reflect variability in perioperative care, limited access to advanced implants and postoperative rehabilitation services, and delayed presentation (21,22). This combination of factors may amplify the impact of complications on functional outcomes.

6.1 Strength and Limitations of the Study

6.1.1 Limitations

This study has several limitations. First, the analytical cross-sectional design limits causal inference. Second, exclusion of patients unreachable by phone may have introduced non-response bias. If patients with poorer outcomes were less likely to respond, the study may overestimate favorable functional outcomes. Third, the relatively small sample size reduces statistical power and results in wide confidence intervals for some estimates. Finally, detailed fracture classification and radiographic union assessment were not included in the multivariable model, which may result in residual confounding.

6.1.2 Strength

Despite these drawbacks, the study has several noteworthy advantages:

Using both clinician-assessed (MEPS) and patient-reported (DASH) measures, it is one of the first to analyze patient-reported outcomes (PROs) after distal humerus ORIF in an Ethiopian setting.

Multivariable logistic regression is a useful tool for identifying independent outcome predictors and controlling for important confounders. To improve internal consistency, the trial was carried out in a high-volume trauma facility using standardized surgical techniques. The results add to the limited body of knowledge in low- and middle-income nations and can guide future research as well as local therapeutic practice.

7. CONCLUSION & RECOMMENDATION

7.1 Conclusion

Approximately two-thirds of patients achieved favorable functional outcomes following ORIF of distal humerus fractures at AaBET Hospital. Open fracture type and postoperative complications were independently associated with poorer outcomes. Strengthening infection prevention strategies, optimizing surgical technique, and ensuring structured early rehabilitation are critical to improving functional recovery in this setting.

7.2 Recommendation

7.2.1 Recommendations for Addis Ababa Burn, Emergency and Trauma (AaBET) Hospital

Early detection and careful treatment of open distal humerus fractures, such as timely debridement, suitable antibiotic prophylaxis, and stable internal fixation, should be given top priority at AaBET Hospital. The hospital should strengthen standardized perioperative procedures targeted at reducing complications like infection and stiffness since there is a substantial correlation between surgical complications and poor functional results. It is crucial to improve multidisciplinary postoperative treatment, which includes early and supervised physical therapy. Enhancing patient follow-up procedures and documentation would also improve continuity of treatment and enable early problem discovery and management.

7.2.2 Recommendations for Health Care Professionals

For fracture treatment and postoperative care, orthopedic surgeons, residents, nurses, and physiotherapists should closely follow evidence-based guidelines. To enable early mobilization, surgeons should use precise surgical procedures, particularly when treating open fractures, and provide secure fixation. While physiotherapists should prioritize early, guided elbow movement to reduce stiffness, nurses should be crucial in postoperative wound care and infection surveillance. To improve functional results, postoperative complications must be promptly managed and continuously monitored.

7.2.3 Recommendations for Patients, Community, and Other Stakeholders

Road traffic accident prevention is one of the primary causes of high-energy injuries, thus it is important to raise awareness of injury prevention techniques among the community and pertinent stakeholders. Patients and caregivers should be informed about the significance of following up with follow-up visits, adhering to postoperative rehabilitation programs, and presenting to medical facilities as soon as possible after an accident. Programs for raising community awareness should highlight the potential negative effects on recovery and long-term elbow function of postponed care and noncompliance with physiotherapy.

7.2.4 Recommendations for Policy Makers

By providing adequate funding for tertiary trauma hospitals and rehabilitative programs, policymakers should give trauma treatment top priority as a public health issue. The provision of necessary orthopedic implants, antibiotics, and physiotherapy treatments in public hospitals should be encouraged by policy. To standardize treatment and lessen result variability, national and regional guidelines for the management of complicated fractures should be created or reinforced. Reducing the frequency of severe traumatic injuries also requires funding for road safety regulations and enforcement.

7.2.5 Recommendations for Future Research

Prospective and multicenter designs should be considered in future research to further examine causal links and enhance the generalizability of results. To further assess the effects of surgery scheduling, adherence to rehabilitation, and particular postoperative problems on functional results, studies with larger sample numbers are advised. It is also necessary to do comparative research evaluating various treatment techniques, such as complete elbow arthroplasty versus ORIF in certain patient groups. Furthermore, qualitative studies examining patients' compliance with physical therapy and aftercare may offer insightful information for enhancing surgical results.

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9. ASSURANCE OF PRINCIPAL INVESTIGATOR

I the undersigned agree to accept all responsibilities for the scientific and ethical conduct of the research project. I will provide timely progress to my advisor and seek the necessary advice and approval from my primary advisors during the research. I will communicate timely to my advisors all stakeholders involved in the study including any source of funding for the research.

Name of the investigator: -----

Signature: -----

Date: -----

Approval of the Primary Advisor

Name of the primary advisor: -----

Signature: -----

Date: -----

ANNEX I: PARTICIPANT INFORMATION SHEET

Data collection Questionnaire

Part I: Demographic and Injury Information

Name of patient----- MRN-----

1. Age of patients
 - a. <15 yrs
 - b. >15
2. Sex
 - a. Male
 - b. Female
3. Post operative complications (Multiple Response)
 - a. Infection
 - b. Stiffness
 - c. Neurologic injury
 - d. Others_____ (specify)
4. When did ROM and rehabilitations starts
 - a. Immediate post op (<48)
 - b. Within one week
 - c. After 1 week
5. Type of surgical approach used
 - a. Dual incision
 - b. Single posterior incision
 - c. Triceps splitting
 - d. Triceps preserving
6. Comorbidities/ Risk factors/ (Multiple Response)
 - a. Smoking
 - b. Alcohol
 - c. Chronic illness(DM, HTN, HIV, immunologic disease)
 - d. Other __ (specify)
7. Time from injury to surgery
 - a. <1-2 week
 - b. > 2 week
8. Types/number of implant used of implant
 - a. Single plate
 - b. Dual plating %
9. Cause of injury
 - a. RTA
 - b. Sport
 - c. Others_____ (specify)
10. Side injured
 - a. Right side
 - b. Left side
 - c. Both side
11. Type of injury
 - a. Open
 - b. Closed

Part 2: Functional Outcome Measure

2.1 MAYO Score

Patient Name: _____ MRN _____

Date: _____

S no	Components	Criteria	Point
1	Pain	No pain	45
		Mild pain	30
		Moderate pain	15
		Severe pain	0
2	Range of Motion	Flexion > 100°	20
		Flexion 50°–100°	15
		Flexion < 50°	5
3	Stability	Stable elbow	10
		Mildly unstable elbow	5
		Unstable elbow	0
4	Daily Function	Combing hair	5
		Performing personal hygiene	5
		Eating	5
		Putting on a shirt	5

2.1 DASH score

Patient Name: _____ MRN _____

Date: _____

S no	Questionnaires	Responses				
		No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable
1	Open a tight or new jar	1	2	3	4	5
2	Write	1	2	3	4	5
3	Turn a key	1	2	3	4	5
4	Prepare meal	1	2	3	4	5
5	Push open a heavy door	1	2	3	4	5
6	Place an object on a shelf above your head	1	2	3	4	5
7	Do heavy house hold chores (e.g. wash walls, wash floors)	1	2	3	4	5
8	Garden or do yard work	1	2	3	4	5
9	Make a bed	1	2	3	4	5
10	Carry a shopping bag or briefcase	1	2	3	4	5
11	Carry heavy objects(over 10lbs)	1	2	3	4	5
12	Change light bulb overhead	1	2	3	4	5
13	Wash or blow dry your hair	1	2	3	4	5
14	Wash your back	1	2	3	4	5
15	Put on a pullover sweater	1	2	3	4	5
16	Use knife to cut food	1	2	3	4	5
17	Recreational activities which requires little effort (card playing, knitting etc.)	1	2	3	4	5
18	Recreational activities in which you take some force or impact through your arm, shoulder, or hand (golf, hammering, tennis etc.)	1	2	3	4	5
19	Recreational activities in which you move your arm freely (playing frisbee, badminton, etc.)	1	2	3	4	5
20	Manage transportation needs(getting from one place to another)	1	2	3	4	5
21	Sexual activities	1	2	3	4	5
22	During past week, to what extent has your arm, shoulder or hand problem interfered	Not at all	Slightly	Moderately	Quite bit	Extremely
		1	2	3	4	5

	with your normal social activities with families, friends, neighbors or groups					
23	During past week, were you limited in your work or other regular daily activities as result of your arm, shoulder or hand problem?	Not limited at all	Slightly limited	Moderately limited	Very limited	Unable
		1	2	3	4	5
24	Arm, shoulder or hand pain	None	Mild	Moderate	Severe	Extreme
		1	2	3	4	5
25	Arm, shoulder or hand pain when you performed any specific activity	1	2	3	4	5
26	Tingling(pins and needle)in your arm, shoulder or hand	1	2	3	4	5
27	Weakness in your arm, shoulder or hand	1	2	3	4	5
28	Stiffness in your arm, shoulder or hand	1	2	3	4	5
29	During past week, how much difficulty have you had sleeping because of pain in your arm, shoulder or hand?	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	So much difficulty that I can't sleep
		1	2	3	4	5
30	I feel less capable, less confident or less useful because of my arm, shoulder or hand problem.	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
		1	2	3	4	5

Annex II: Consent Form

My name is Dr Gachana Moti I am a final year orthopedics and traumatology surgery resident at SPHMMC. I am currently doing research on functional outcome of distal humerus fracture treated with open reduction and internal fixation and the factors associated with outcomes at Addis Ababa Burn, Emergency and Trauma Hospital, Ethiopia. I would like to assure you that your name will not be mentioned in the study and the information that you gave us will be kept confidential and only for research purposes. The information that you give us is quite useful to achieve the objective of the study. However, you have full right not to participate in the study if you are not interested.

Are you willing to participate in the study? 1) **Yes** 2) **No**