

# Evaluation of Surgical Treatment of Distal Humeral Fractures in Adults

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## Abstract

**Introduction:** Fractures of the distal end of the humerus are becoming increasingly frequent in young subjects because of the increase in road traffic accidents, and in elderly subjects because of osteoporosis related to aging populations. **Materials and Methods:** It was a prospective, monocentric study from January 2018 to December 2020 involving 14 patients who received and were treated surgically for distal humeral fractures and followed up. **Results:** We collected 14 patients, including 11 men (78.57%) and 3 women (21.43%), with a sex ratio of 3.7. The mean age was 36.41 years. The circumstances of onset were dominated by road traffic accidents, with 12 cases (85.71%). The dominant side was right-handed, with 11 cases (78.57%). Standard elbow radiography revealed 8 cases of type A fractures (57.14%), 4 cases of type B and 2 cases of type C fractures of the AO. We performed Lecestre plate osteosynthesis in 12 patients and external fixator in 2 others, using the trans-olecranal and transtricipital approaches. Elbow stiffness was the most frequent complication, with 6 cases (42.86%). After six months' follow-up, our results were excellent and good in 78.57% of cases (MEPS). **Conclusion:** Surgical treatment with posterior approaches enabled us to achieve restitution of the articular surfaces, solid restraint and early mobilization of the elbow with satisfactory functional results.

## Keywords

Fracture, Distal Humerus, Lecestre Plate, External Fixator, Trans-Olecranal, Transtricipital

## 1. Introduction

Fractures of the distal end of the humerus are relatively rare, with a frequency of

less than 2% [1]-[3]. They affect an increasingly elderly population, with a high female predominance [4] [5]. In adults, they account for around 30% of all humeral fractures [6].

Fractures of the distal end of the humerus are less frequent than fractures of the proximal humerus, but account for 5% of osteoporotic fractures in subjects over 60 [7].

In correlation with the bimodal age distribution, two main fracture mechanisms can be distinguished: low-energy trauma in the elderly with direct impact on the elbow or indirect impact resulting from a fall on the outstretched hand, and high-energy trauma in the younger patient, mainly resulting from road or sports accidents [8].

They occur in younger men, with 2 peaks in frequency, and in older women, with incidence increasing over the age of 60 [9].

Clinical diagnosis is straightforward in the case of total fractures, but may be unrecognized in the case of frontal partial joint fractures. Clinical examination should look for ulnar nerve damage and skin opening. Radiological findings, including traction films, are used to diagnose total fractures. Parcel fractures require a CT scan. The AO/OTA classification is useful for identifying lesions and choosing treatment [10].

Fractures of the distal end of the humerus should be treated surgically to ensure perfect reduction, stable fixation and early mobilization. Results are good in young patients. In elderly patients with comminuted fractures, anatomical reconstruction of the joint and stable primary osteosynthesis may be difficult due to poor bone quality. The new self-stabilizing screw plates offer improved primary osteosynthesis stability, and would be a major advantage in treating comminuted fractures in patients with bone demineralization. For these patients, first-line arthroplasty is increasingly being proposed as an alternative [11].

We have adopted surgical treatment with a Lecestre screw-plate combined with pinning and/or screw fixation, whatever the type of fracture, in all our patients.

The aim of our study was to evaluate the results of osteosynthesis using the trans-olecranal and transtricipital approaches.

## 2. Materials and Methods

We conducted this study at the Donka University Hospital, Conakry (Republic of Guinea). It was a prospective, descriptive, monocentric study lasting three years from January 2018 to December 2020.

The study included 14 patients who met the following inclusion criteria: patients received for elbow trauma, in whom the diagnosis of fractures of the distal end of the humerus was made and classified as types A, B and C according to the AO classification (association for osteosynthesis) and treated surgically by fracture reduction, Lecestre plate osteosynthesis, associated with either screw fixation or pinning and completed by olecranon bracing in trans-olecranal approaches.

All orthopedically treated patients with distal humeral fractures, as well as patients with incomplete medical records and those lost to follow-up, were not included in our study. General anesthesia was used in all patients. The patient was positioned in the lateral decubitus position, with the limb to be operated on supported by an arm, with a tourniquet at the root of the arm. The approach was transolecranial and transtricipital. We used the Mayo-clinic Elbow Performance Score to evaluate our patients (**Table 1**).

**Table 1.** Mayo-clinic Elbow Performance Score (MEPS).

Criteria	Description	Score
<b>Pain (45 points)</b>	None	45
	Disceet	30
	Moderate	15
	Severe	0
<b>Amplitude (20 points)</b>	>100°	20
	50° - 100°	15
	<50°	5
<b>Stability (10 points)</b>	Stable	10
	Moderate instability	5 (<10° of varus/valgus)
	Definite instability	0 (>10° of varus/valgus)
<b>Function (25 points)</b>	Styling	5
	Eating	5
	Go to toilet	5
	Put on shirt	5
	Putting on shoes	5

Note: Maximum possible: 100 points (>90 = excellent, 75 - 89 = good, 60 - 74 = fair, <60 = poor).

The following variables were studied: epidemiological variables (age, sex, occupation, etiological circumstances), clinical variables (lesion mechanisms, affected side, dominant or non-dominant, associated lesions), radiological variables (AO classification was used to classify fractures), therapeutic variables (set-up, approach, type of osteosynthesis, length of stay), and evolutionary variables (time to consolidation, complications, MEPS assessment score).

The study was conducted in compliance with medical ethics.

Our data sources were patients' medical records, hospitalization and consultation registers, and operative report registers. Our data were entered using Word and analyzed using Epi info version 7.2.

### 3. Results

We enrolled 14 patients, 11 men (78.57%) and 3 women (21.43%), with a sex ratio of 3.7. The mean age of our patients was 36.41 years, with extremes of 19 and

62 years. The most affected age group was 20 to 40, with 8 cases (57.14%). The circumstances of occurrence were road traffic accidents with 12 cases (85.71%) and accidents at work with 2 cases (14.29%). Direct impact was the most frequent injury mechanism, with 10 cases (71.43%). Manual workers were the most frequent victims, with 7 cases (50%), followed by graduates and police officers, with 2 cases each (14.29%) (**Table 2**).

**Table 2.** Distribution of patients by socio-professional strata.

Socio-professional strata	Numbers	Percentage (%)
Farmer	1	7.14
Mason	3	21.42
Carpenter	2	14.29
Welder	2	14.29
Retailer	1	7.14
Police officer	2	14.29
Housewife	1	7.14
Unemployed graduate	2	14.29
Total	14	100

Right-sided involvement was the most common, with 9 cases (64.29%). The dominant side was right-handed, with 11 cases (78.57%). Fractures were closed in 12 cases (85.71%). All our patients underwent a standard X-ray of the elbow, antero-posterior and lateral view; only one patient underwent a CT scan of the elbow for which the standard X-ray was unable to clarify the diagnosis; we found 8 cases of type A fractures (57.14%), 4 cases of type B and 2 cases of type C of the AO. Associated lesions were dominated by proximal ulnar fractures, with 4 cases (28.57%). We did not record any vascular-nervous lesions. Reduction and fixation with a Lecestre screw-plate combined with screw fixation or pinning were indicated in 12 patients as first-line treatment (**Figure 1** and **Figure 2**).

The other two underwent debridement and external humero-ulnar fixation (**Table 3**). General anesthesia was used in all patients (100%). The approach was transolecranial in 8 patients (57.14%) and transtricipital in 4. Average length of stay was 5 days, with extremes of 3 days and 23 days.



**Figure 1.** C1-type fracture of the AO, treated with a Lecestre plate and pinning (CHU de Donka).



**Figure 2.** Fracture of the distal humerus associated with a fracture of the ulna treated with a Lecestre plate and pinning and bracing of the olecranon and ulna (CHU de Donka).

**Table 3.** Distribution of patients according to surgical treatment.

Surgical treatment	Numbers	Percentage (%)
Reduction + Lecestre screw-plate + Pinning	9	64.29
Reduction + Lecestre screw-plate + Screwing	3	21.42
External fixator	2	14.29
Total	14	100

Elbow stiffness was the most frequent complication with 6 cases (42.86%), for which we proceeded to mobilize the elbow under general anesthesia; followed by 3 cases of elbow osteoarthritis (21.43%), one case of infection. After six months, we assessed our patients using the Mayo-clinic Elbow Performance Score (Table 4).

**Table 4.** Patient assessment using the Mayo-clinic Elbow Performance Score (MEPS).

Score	Numbers	Percentage (%)
Excellent	5	35.71
Good	6	42.86
Fair	2	14.29
Poor	1	7.14
Total	14	100

## 4. Discussion

There was a clear male predominance, with a sex ratio of 3.7 and a mean age of 36.41 years. The circumstances of onset were dominated by road traffic accidents, with the working class clearly more represented. Our results match with literature data, which note a predominance of young males and road traffic accidents. Bah *et al.* [12] found a socio-professional stratum dominated by pupils/students. Chamseddine *et al.* [13] found a slight female predominance, with a sex ratio of 0.71 (M = 5, F = 7). On the other hand, in the elderly, fractures of the distal end of the humerus occur in women because of osteoporosis-related to both menopause and senility, with complex fractures whose management sometimes requires recourse to total elbow arthroplasty [1] [7].

In our series, the reasons for the frequency of fractures of the distal end of the

humerus would be the use by young people of two-wheeled machines as a means of both individual and public transport, with a consequent increase in the rate of road traffic accidents, but also the under-equipment of tradesmen on building sites, leading to falls from high places.

All our patients underwent open-focus surgery, using posterior approaches (trans-olecranal and transtricipital), with reduction and Lecestre plate osteosynthesis associated with either screw fixation or pinning, and two others with debridement and an external fixator because of infection. The trans-olecranal approach allowed better exposure of the fracture site; after osteosynthesis of the distal humerus, the olecranon was reconstructed by reduction plus bracing. However, we did not record any complications (pseudarthrosis, disassembly or material rupture) associated with this approach. The transtricipital approach was mainly used for supracondylar fractures, but also for simple articular fractures.

The classic treatment for distal humerus fractures is open-focus osteosynthesis [11] [14]. Lemsanni *et al.* [14] used the trans-olecranal approach for all their patients, *i.e.* 100%.

In the young patient, the material is securely held in place. In osteoporotic elderly patients, fractures are often complex and comminuted, and the fit of the osteosynthesis material may therefore be precarious. Additional support may be required, which may have a negative impact on functional prognosis, at the cost of a high complication rate. This is explained by the high incidence of stiffness in our series, necessitating mobilization of the elbow under general anesthesia.

Our results were excellent and good in 78.57% of the Mayo-clinic Elbow Performance Score.

Saragaglia *et al.* [15] reported 67 excellent results, five good results, two average results and one poor result.

These results in our series can be explained by the use of the external fixator bridging the elbow joint in cases of infected open fractures and immobilization of the limb after the transtricipital approach, resulting in stiffness with pain.

The limitations of our work were the low capacity of the department due to its relocation for hospital renovation works; some patients were lost from follow-up at the time of results evaluation and did not come up to the department despite telephone calls we made.

## 5. Conclusion

Fractures of the distal end of the humerus used to be the preserve of young subjects, whose circumstances were dominated by road traffic accidents. Surgical treatment with posterior approaches enabled restitution of the articular surfaces, solid restraint and early mobilization of the elbow, with satisfactory functional results.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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