



Surgical Treatment of Complex Fractures of the Upper End of the Humerus: Retrospective Studies of 25 Cases

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DOI: 10.36347/gamj.2024.v05i03.002

| Received: 13.06.2024 | Accepted: 20.07.2024 | Published: 30.07.2024

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Abstract

Original Research Article

Fractures of the upper end of the humerus are common, they represent approximately 5% of all fractures, and their frequency of occurrence increases to more than 10% above the age of 65 where they are the third causes of fractures. osteoporosis of the limbs after fractures of the upper extremity of the femur and the wrist. Fractures of the upper end of the humerus pose a therapeutic problem, particularly for complex fractures with 3 and 4 fragments. The aim of our work is to determine the epidemiological -clinical aspect of complex fractures of the upper end of the humerus in adults and to assess the functional and radiological results of our series. This is a series of 25 cases collected in the orthopedics department of the Mohamed V military training hospital (HMIMV) between 2016 and 2021. We identified the epidemiological data of the patients and the circumstances of the trauma. The treatment was surgical in principle, either osteosynthesis using a plate or nail or prosthetic replacement. The reduction was evaluated on postoperative radiographs. At follow-up, the functional results were evaluated by the Constant score. Our series includes 12 men and 13 women. The average age of our patients was 55 years, public road accidents were noted in 48%, 4-part fractures were found in 76% of cases. Screwed plate osteosynthesis was used in 40% of cases and antegrade nailing was performed in 40% of cases. The prosthesis was placed for 5 patients. The average constant score was 65.24 with extremes ranging from 35 to 88. We noted consolidation of fractures without malunion in 68%. In complex fractures of the upper end of the humerus, osteosynthesis well indicated according to the patient and the fracture and early postoperative rehabilitation allow acceptable functional results.

Keywords: Complex fracture of the upper end of the humerus, surgical treatment.

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INTRODUCTION

The FESH sits by definition above the lower edge of the tendon of insertion of the pectoralis major muscle. The aim of this retrospective study is to evaluate the functional results of fractures of the upper end of the humerus treated surgically and to compare the functional results of the different surgical techniques applied in our patients. Fractures of the upper end of the humerus are common, there are many varieties of prognosis and variable treatment; depending on the situation (elderly subject or young adult) of the quality of the fractured bone (osteoporotic, other bone pathologies). They represent approximately 5% of all fractures, and their frequency of occurrence increases to more than 10% above the age of 65 where they are the third causes of osteoporotic fractures of the limbs after fractures of the

upper extremity of the Femur and of the wrist [1]. In addition, there is a significant correlation between the displacement of these fractures and age, this displacement being a decisive factor in their management. Many classifications have been proposed according to the location of the features in relation to the articular surface and the tuberosities, the number of fragments, the displacement, and whether or not it is associated with a glenohumeral dislocation [2]. To this day there is no consensus on a decision-making algorithm for the therapeutic management of these fractures [3] which ranges from simple immobilization to humeral arthroplasty, including numerous osteosynthesis techniques. This treatment must respond mainly to two imperatives: Ensure good consolidation and allow early mobility of the shoulder, shoulder stiffness being the main therapeutic complication.

Citation: Pedro Gomes, Mohamed Boussaidan, Youssef Benyas, Jalal Boukhriss, Driss Benchebba, Bouchaïb Chafry, Moustapha Boussouga. Surgical Treatment of Complex Fractures of the Upper End of the Humerus: Retrospective Studies of 25 Cases. Gha alt Med Jrl, 2024 Jul-Sep 5(3): 51-56.

METHODS

This is a retrospective and descriptive study collected at the Orthopedic Surgery and Traumatology department of the Mohamed V military training hospital, which concerns 25 cases of complex fractures of the upper end of the humerus, on a period of 5 years between January 2016 and December 2021. We identified the clinical data of the patients, namely sex, age at the time of the trauma, medical-surgical history, laterality, affected side, profession, circumstances of trauma, the mechanism of injury and the lesions associated with FESH. The radiological assessment included 2 orthogonal views: a frontal shoulder view and an axillary profile. This radiological study was carried out at 4 standardized times: preoperatively, immediately postoperatively, at the first follow-up: 4 to 6 weeks after intervention and at the final follow-up. A CT scan of the shoulder was requested each time the standard assessment was deemed insufficient (Figure 1). At the end of this assessment, two groups of complex fractures were defined: 3-fragment fracture and 4-fragment fracture. We studied the treatment time, the different approaches and the surgical techniques adopted: osteosynthesis by screwed plate, intramedullary nailing or arthroplasty. At follow-up the functional result was evaluated by the Constant score, the radiological evaluation was studied on each incidence looking for consolidation in good position or a pseudarthrosis or a malunion based on the evaluation of the tilt of the head by measuring the angle alpha, formed by the intersection of a line parallel to the axis of the humeral diaphysis and a line passing through the anatomical neck of the humeral head. When the angle α is between 30° and 60° ($45^\circ \pm 15^\circ$), the head is considered not tilted from the front. Beyond 60° , the movement is valgus, and below 30° , it is varus. Necrosis of the humeral head or osteoarthritis was also looked for.

RESULTS

Our series includes 12 men and 13 women, the average age of our patients was 55 years with extremes ranging from 32 years to 86 years. We noted two frequency peaks in our population, the first peak is between 30 and 39 years old, and the second is between 50 and 69 years old. Public road accidents (AVP) were noted in 48%, followed by domestic accidents in 40% of

cases. The nondominant side was found in 13 cases. The lesions associated with FESH affected the lower limb in 2 cases: 1 case of fracture of the femoral shaft and 1 case of fracture of the 2 bones of the leg. Fractures with 4 fragments were found in 19 patients, or in 76% of cases. We found 3 cases of anterior dislocations associated with fractures. The average time taken for surgical treatment was 14 days. The deltopectoral (anterior) approach was used in 15 patients, or in 60% of cases, the upper - external (lateral) approach was used in 10 patients, or in 40% of cases. Screwed plate osteosynthesis was used in 10 patients, or in 40% of cases, and antegrade nailing was used in 10 patients, or in 40% of cases. The shoulder prosthesis was placed in 5 patients (Figure 2). The analysis of post-operative radiographs showed a satisfactory reduction in 80% cases, i.e. in 20 patients, we noted 4 cases of head tilt (3 cases in valgus and one case in varus) and one case of minimal translation of the head the head. There was 1 case of infection on screwed plate osteosynthesis equipment, 2 cases of nail migration and one case of secondary displacement in patients treated with antegrade nailing and one case of prosthesis dislocation. Rehabilitation was started between D3 and D45 postoperatively. The average constant score was 65.24 with extremes ranging from 35 to 88. For cases treated with a locked plate, it was 68.1 and for prosthetic cases, the average constant score was 60.6. Visible on ultrasound in 62% of cases in the Rochet series, the functional results of which were satisfactory or very satisfactory in 89.6% of cases [17]. The mean constant score following locked plate treatment was 68.1 in our series. This score is comparable to scores cited in the literature as illustrated in Table 2 [6, 18-21]. In cases of severe osteoporosis, our treatment of choice is prosthetic replacement, for which we obtained an average constant score of 60.6. In the literature, functional results are disparate Table 3 [22-25]. This can be explained by the condition of the rotator cuff and the type of arthroplasty used. In our series, we noted 04 cases of malunion, these were low degree extra-articular malunion in varus, valgus or translation, we agree with Südkamp [19] on the fact that malunion is secondary to an imperfect postoperative reduction. Pseudarthrosis was noted in 4% of cases, Boileau [26] and Krishnan [27] found respectively 13% and 21% of cases of pseudarthrosis especially at the tuberosities.

Table 1: Constant score for nailing

| Painting 1: Score of constant for nailing | |
|---|-------------------|
| Authors | Score of constant |
| Cuny <i>et al.</i> , [10] 2008 | 62 |
| Boudard <i>et al.</i> , [11] 2014 | 60.6 |
| Boughebri <i>et al.</i> , [12] 2007 | 62 |
| Doursounian <i>et al.</i> , [13] 2011 | 66 |
| Linhart <i>et al.</i> , [14] 2007 | 82 |
| OUR series | 66.4 |

Table 2: Constant score for locked plate

| Painting 2: Score of constant for plate locked | |
|--|-------------------|
| Authors | Score of constant |
| Konigshausen <i>et al.</i> , [19] 2012 | 66 |
| Solberg <i>et al.</i> , [20] 2009 | 68.6 |
| Sudkamp <i>et al.</i> , [21] 2009 | 70.6 |
| Schliemann <i>et al.</i> , [22] 2015 | 71.3 |
| Brunner <i>et al.</i> , [23] 2009 | 72 |
| OUR series | 68.1 |

Table 3: Constant score for arthroplasty

| Painting 3: Score of constant for arthroplasty | |
|--|---------------------------|
| Authors | Score of constant AVERAGE |
| Gallinet <i>et al.</i> , [22] 2009 | 39 |
| Bufquin <i>et al.</i> , [23] 2007 | 44 |
| Soup <i>et al.</i> , [24] 2015 | 48.4 |
| Boileau <i>et al.</i> , [25] 2002 | 54 |
| OUR series | 60.6 |



Figure 1: CT of the shoulder shows a 4-part fracture of the upper end of the humerus

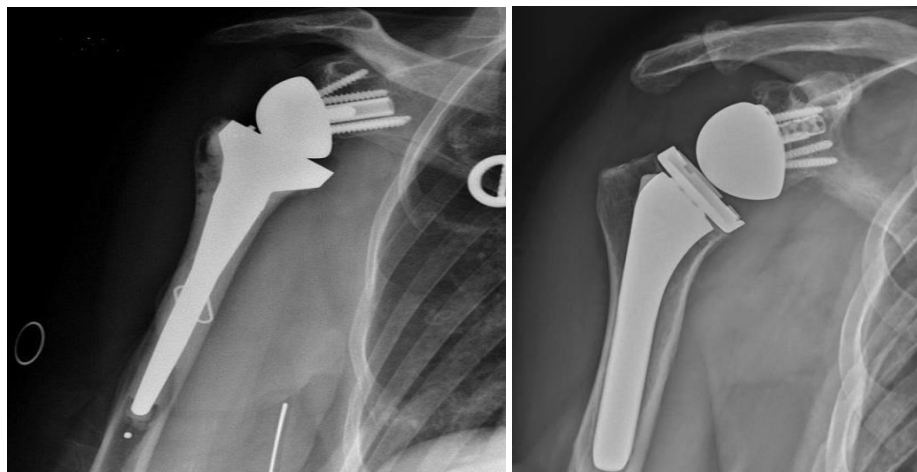


Figure 2: Right shoulder reverse prosthesis

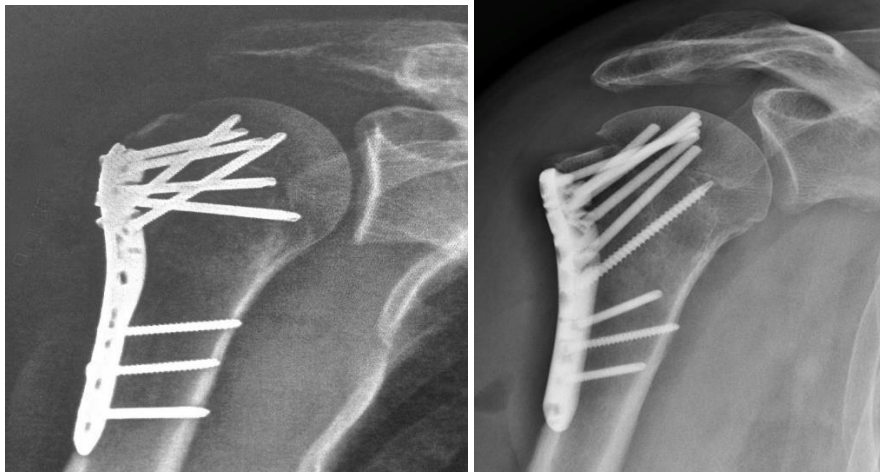


Figure 3: Consolidation after synthesis by screwed plate



Figure 4: Pseudarthrosis of the metaphyseal fracture line

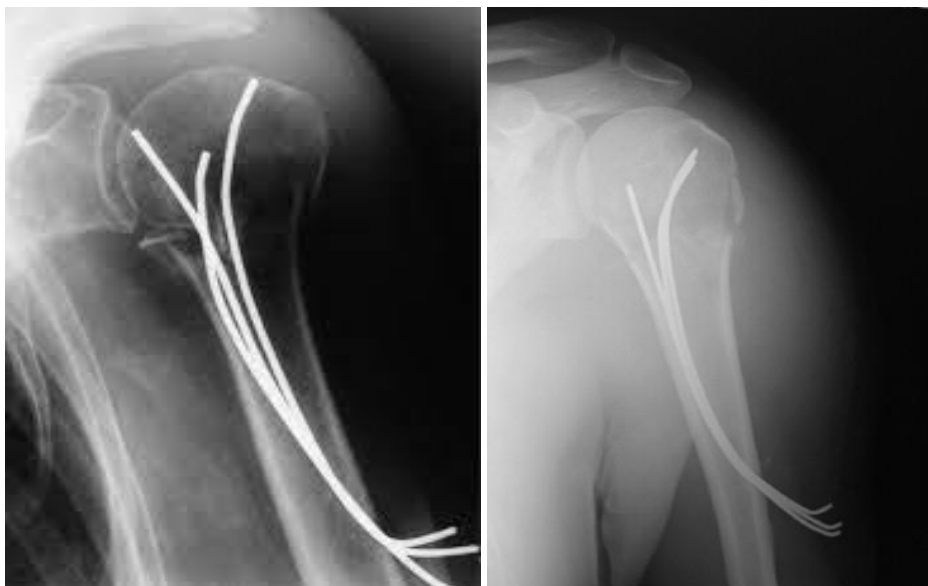


Figure 5: Malunion and minimal Varus consolidation**DISCUSSION**

In our study, FESH occurred at a mean age of 55 years. They remain lower than those reported in European and American series [4-6] in which the average age is between 60 and 72 years. The age-related increase in bone fragility is one of the risk factors predisposing to this type of fracture [7, 8]. In the literature, female predominance has been noted in certain series [9, 10]. In our series, men were affected almost as much as women (12M/13F). Patients treated with antegrade nailing presented a mean constant score of 66.4; these results are comparable to those reported in the literature as shown in Table 1 [11-14]. The good results appear to be linked to the self-stability of the locking screws, making it possible to obtain stability of the osteosynthesis [13, 15, 16]. A scar in the caps crossed by a nail was

In complex fractures of the upper end of the humerus, the treatment is surgical, the main objective of which is the anatomical reduction of these complex fractures, osteosynthesis well indicated depending on the patient and the fracture and early postoperative rehabilitation allow have acceptable functional results.

State of current knowledge on the subject

- Fractures of the upper end of the humerus are increasingly common;
- The treatment of these complex fractures requires anatomical reduction and stable osteosynthesis;
- These joint fractures pose a public health problem due to the functional after-effects that they can have.
- Contribution of our study to knowledge
- Well-indicated osteosynthesis depending on the patient and the fracture allows for acceptable functional results;
- The evaluation of postoperative reduction predicts the radiological results at follow-up;
- Shoulder prosthesis is the treatment of choice in cases of severe osteoporosis.

CONCLUSION

Patients treated with antegrade nailing presented a score of Average constant of 66.4. We noted a consolidation rate in the caps crossed by a nail was a good position in 68% (Figure 3). We noted 1 case of pseudarthrosis, 4 cases of malunion: 3 cases in valgus and 1 case in varus (Figure 4, Figure 5) and 2 cases of aseptic necrosis of the humeral head without having noted a case of osteoarthritis.

Conflicts of Interest: The authors declare no conflict of interest.

Author Contributions

All authors contributed to the design of the article: data collection; patient monitoring; revision and writing of the paper. All authors declare having read and approved the final version of the manuscript.

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