

Results of Open Surgical Treatment of Humeral Paddle Fractures about 63 Cases

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Abstract

Fractures of the humeral paddle, common to young adults, are most often complex, linked to violence and an increase in road accidents. The objective of our work is to evaluate our functional results, in the medium term, correlated with a review of the literature. This is a retrospective study of 63 patients, carried out in the traumatology-orthopedics department 1 of the IBN EL JAZZAR hospital in KAIROUAN, over a period of 7 years from January 2015 to December 2021. The average age of patients was 39 years (17 - 68 years). Predominantly male. The etiologies are dominated by falls and accidents on public roads. Fractures are classified according to the Müller and Allgöwer classification where type C is found in 51% of cases. All our patients undergo an olecranon osteotomy in 71% of cases. Osteosynthesis using a Lestece plate combined with screwing or plugging is used in 84% of cases. The evolution is marked by complications observed in eight patients (16%), including two cases of sepsis, four cases of elbow stiffness (8%), one case of joint callus and one case of pseudarthrosis. Our results are evaluated according to the Mayo Elbow Performance Score, they are excellent and good in 71% of cases, average in 18% of cases and poor in 11% of cases. Fractures of the humeral paddle are fractures with a satisfactory functional prognosis, requiring ad integrum anatomical restoration and solid osteosynthesis allowing early rehabilitation of the elbow. One case of joint callus and one case of pseudarthrosis.

Keywords

Fracture, Humeral Paddle, Surgical Treatment

1. Introduction

Humeral paddle fractures are defined as fractures that typically occur below the distal insertion of the brachialis muscle [1]. They represent 1% of all traumatic pathologies in adults and a third of elbow fractures [2], which are most often joint and their management must respond to the principle of joint fractures, *i.e.* restore joint space and allow immediate mobilization, making it possible to fight against stiffness which is the most frequent and feared complication. Their usual anatomical complexity has long conditioned the diversity of their treatments and their management still remains very difficult.

2. Material and Methods

This is a retrospective study of 63 patients operated on for a humeral paddle fracture from January 2015 to December 2021.

The aim of our work is to evaluate the clinical, therapeutic and progressive characteristics of humeral paddle fractures and to clarify the difficulties of their management as well as to evaluate the results of our series.

3. Results

The average age of our patients is 39 years with a clear male predominance. 38 men against 25 women with a sex ratio of 1.5. Falls are the main cause and are found in 35 patients (56%), followed by road accidents in 20 patients (32%) then fractures due to aggression in 8 patients (12%). The right side is affected in 41 patients (66%). Fractures are isolated in 32 patients (50%). A skin opening was associated in 12 patients (20%). 11 patients (18%) had an associated fracture of the same limb, four polytraumatized (6%) and four cases (6%) of associated elbow dislocation. All our patients had a standard radiological assessment and a CT scan of the fractured elbow. We opted for the Müller and Allgöwer classification according to the osteosynthesis association (AO) (Figure 1) [3]. Type C represents a rate of 51% (Figure 2). All patients underwent surgical treatment; under regional anesthesia in 18 patients (28%) and under general anesthesia in 45 patients (72%). All our patients are placed in contralateral lateral decubitus (fractured limb on lateral support). All our patients had antibiotic therapy with amoxicillin-clavulanate or first-generation cephalosporin during induction before inflation of the pneumatic tourniquet. Different approaches are used. The posterior trans-olecranon approach is performed in 40 patients (64%), the external approach in 12 patients (20%), the internal approach in 8 patients (12%), the transtricipital approach and the para-tricipital approach are performed. each in a single patient. The type of osteosynthesis used is screwing in four patients (6%), screwing and pinning in two patients (4%), a plate or third screwed tube of the Lecestre type alone or associated with pins; screw or combination of two plates in 56 patients (90%). Osteosynthesis of the olecranon is ensured by a steel wire pinning-retaining of a plate or a stage of Lecestre-type screwed tubes alone or associated with pins; screw or combination of two plates in 56 patients (90%).

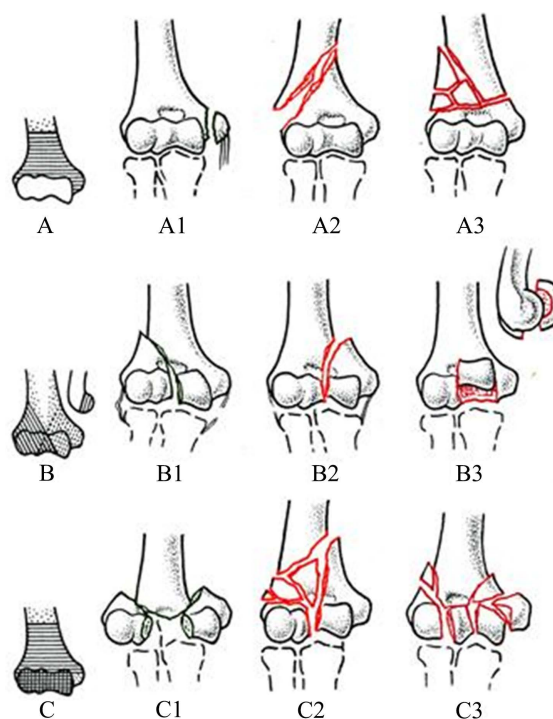


Figure 1. Classification of Müller and Allgöwer according to the AO.



Figure 2. X-ray of a type C supra and intercondylar fracture of the humeral paddle.

Osteosynthesis of the olecranon is ensured by a steel wire pinning-retaining of a plate or a stage of Lecestre-type screwed tubes alone or associated with pins; screw or combination of two plates in 56 patients (90%). Osteosynthesis of the olecranon is ensured by pinning and retention with steel wire (**Figure 3**). Suction drainage and antibiotic prophylaxis are also systematic in all our patients.

All our patients benefited from early, progressive and prolonged rehabilitation. For postoperative complications, we observed two cases of sepsis (4%) (**Figure 4**); two cases of dismantling (4%) (**Figure 5**); six cases of stiffness (10%), a single case of joint malunion (2%) and one case of septic nonunion (2%) (**Figure 6**). We used the Mayo Clinic Elbow Performance Score [1] as the endpoint. The performance index includes a pain score (45 points); mobility (20 points); stability (10 points) and daily activity (25 points). Based on this system, functional results are obtained by adding the points for pain, mobility, stability and function, namely: excellent (90 - 100 points), Good (75 - 89 points), Average (60 - 74 points) and Bad (<60 points). With an average follow-up of three years, we obtained eight excellent results (14%), 36 good results (58%), eleven average results (18%), and six poor results (10%). We note that cases of poor results have been observed in subjects aged over 60 years. Among the five cases of poor results, two presented injuries associated with a type I skin opening for one patient, one case of elbow dislocation and two cases of forearm fracture. The five poor results were respectively: two cases of fracture complicated by infections, two cases of type C1 fracture and one case of type C2 fracture in a polytrauma patient (**Table 1**).



Figure 3. Intraoperative scopic control of a supra and intercondylar fracture of the right humeral paddle treated with an external Lecestre plate and an internal plate with screwing and realization of the guyed steel wire pinning of the osteotomy of the olecranon.



Figure 4. Sepsis on material of a fracture of the right humeral paddle.



Figure 5. Frontal and lateral radiography of plate failure a loosening of the internal pillar of a supra and intercondylar fracture.

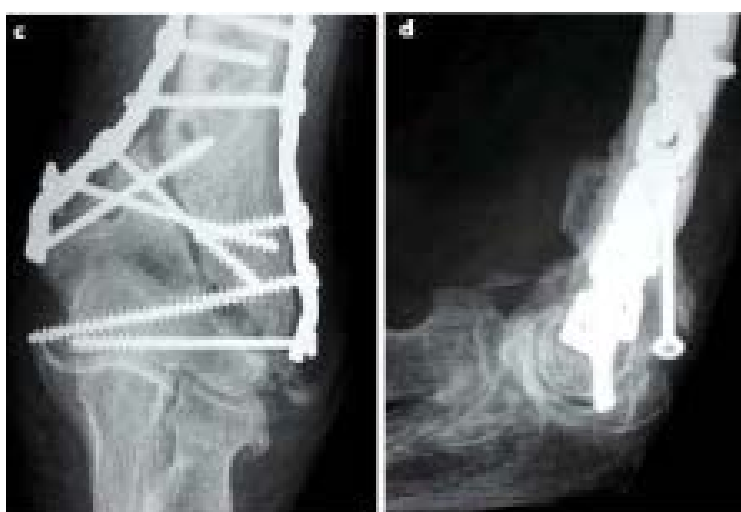


Figure 6. Frontal x-ray of a septic pseudarthrosis humeral paddle.

Table 1. Functional results according to the Mayo clinical score according to the anatomical type of the fracture.

Type of fracture	Excellent	GOOD	Average	Bad
A	3	7	4	1
B	2	11	4	1
C	3	11	4	4
Total	8	37	12	6

4. Discussion

Fractures of the distal end of the humerus are defined as fractures that are generally located below the distal insertion of the brachialis muscle; the lower limit of this insertion draws an open angle below the width of a finger above the coronoid fossa [1]. These fractures are called humeral paddle fractures. There are no real variations in the prevalence of fractures of the humeral paddle depending on the age or sex of the patients, however these fractures are differentiated into

three populations: children, adults and elderly people because in each population the prognosis and treatment are different [3]. In our series, the average age of patients is 39 years. There is also no predominance of one side over the other according to the literature [1], in our series the right side is affected in 66% of cases. Falls constitute their main etiology, followed by AVP [4]. In our series 56% are secondary to falls. The skin opening represents 25% to 30% of fractures depending on the series [3]. We report a rate of 20%. Several classifications, none of which manage to summarize the anatomical, prognostic and therapeutic criteria, we opted for the Müller and Allgöwer classification according to the osteosynthesis association (AO) which is currently the most indicated [3]. We note a predominance of supra and intercondylar lesions depending on the series with extreme percentages of 70% to 92%. This rate is 51% in our series. Bone lesions represent 9% of cases in multiple fracture patients for LECESTRE [5] and 38.5% for SARAGAGLIA [6]; which will have a great impact on the treatment and functional results. In our series, it is 17.6%. The treatment of humeral paddle fractures in adults is mainly based on reconstructive surgery using osteosynthesis. Three general principles must be considered, namely the exact restoration of joint anatomy and anteversion of the paddle; the stability of the synthesis which must be able to authorize early rehabilitation and the urgency of the treatment even outside of open or complicated lesions because the precocity of the procedure before the appearance of edema in displaced fractures facilitates the consequences and rehabilitation [5].

Osteotomy of the olecranon is one of the techniques for exposure of the articular surface during the reconstruction of fractures of the distal humerus. A rigorous technique allows one to avoid complications [7].

The most common surgical techniques used in treating distal humerus intercondylar fractures were olecranon osteotomy and triceps-sparing. The pooled analysis indicated that patients treated using olecranon osteotomy had better functional outcomes than patients treated with triceps-sparing [8].

Other studies have shown that the results of the triceps-sparing paratricipital approach were better than that of olecranotomy [9].

These approaches are associated with several complications, such as triceps weakness, nonunion or delayed union of osteotomy, implant prominence, and delayed mobilization of the elbow. On the other hand, fixation using a triceps-sparing paratricipital approach which allows early elbow mobilization and preserves triceps strength [9].

There are authors who consider that three clinical settings can be more favorable to use this approach: those cases in which a total elbow prosthesis might be needed, cases of ipsilateral diaphyseal fracture, or the presence of previous hardware in the olecranon [10].

It is indeed a difficult surgery where the experience of the operator must be based on a good understanding of the lesions already described; a good choice and mastery of approaches and knowledge of osteosynthesis equipment and its

use in each type of fracture [11] [12]. All authors emphasize the need for short immobilization and prolonged rehabilitation due to the slow recovery of mobility [3]. The place of treatment other than osteosynthesis, namely orthopedic; functional or by prosthetic replacement remains very limited.

The complications of surgical interventions are not exceptional, the after-effects are dominated by stiffness, the prognosis of which after arthrolysis is all the better as the anatomy has been restored. Consolidation generally occurs in 45 to 60 days; this time is often increased, regardless of the treatment in the event of an open or comminuted fracture. Delayed consolidation should not delay rehabilitation in order to avoid stiffness, which is the most common and feared elbow complication. Fractures of the humeral paddle are by far the leading cause of elbow stiffness, 23% for LECESTRE [5], 12.5% for SARAGALIA [6] and 10% in our series.

However, the definition of stiffness varies between authors. As pronosupination is rarely limited, the majority of authors take into account the amplitude of flexion-extension [3]. The risk of pseudarthrosis is not higher than that of other joint fractures by 2% to 10% [3], and 7% for LECESTRE [5]. Only one case of late consolidation was noted in our series.

There are many citations available to evaluate the functional outcomes of humeral paddle fractures, they vary from one author to another. MANNEDU [9] specifies that there is no static correlation between the anatomic-radiological type; mobility; strengths and satisfaction index. In other words, all these parameters cannot independently explain the final result.

We opted for the evaluation criteria following the Mayo Clinic score [1]. In our series, we obtained 56% good results. Several authors [5] [6] agree on the fact that the final result depends on the severity of the fracture, that is to say on the anatomic-radiological classification.

However, in our series, many type C fractures gave good results, which explains why the study of a single factor separately does not explain the results obtained, but it is a set of factors. Including age, lesion associations, time to surgical intervention, nature of treatment and experience of the surgeon [3]. In our series we had 64% good results whatever the type of treatment, it should be noted that all our patients are operated on, while in patients treated orthopedically the result was always poor, which proves the superiority of the osteosynthesis.

5. Conclusions

Fractures of the humeral paddle are more and more frequent, which is linked to the increase in public road accidents and the violence responsible for significant comminution. Their management is a real challenge which requires a good understanding of the fracture and precise preoperative planning. Stable osteosynthesis allowing early rehabilitation is the guarantee of an optimal result.

Several studies have shown the effectiveness of paratricipital approaches preserving the olecranon. Others have shown the superiority of olecranon osteoto-

my which remains a subject of discussion and depends on the experience of the surgeon who must perform stable osteosynthesis to start early rehabilitation which will guarantee the best results.

Conflicts of Interest

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

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