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Results of Open Surgical Treatment of Fractures of The Humeral Paddle

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Abstract: *Fractures of the humeral paddle, a prerogative of young adults, are most often complex, related to violence and the increase in road accidents.The objective of our work is to assess our functional results, in the medium term, correlated with a review of the literature. This is a retrospective study of 45 patients, carried out in the traumatologyorthopedics department 1 of HMIMed.V in Rabat, over a period of six years from January 2014 to December 2020. The mean age of the patients was 39 years (17-68 years), predominantly male. The etiologies are dominated by falls and accidents on the public highway. Fractures are classified according to the Müller and Allgöwer classification where type C is found in 51% of cases. All our patients are operated on with an osteotomy of the olecranon in 71% of cases. Osteosynthesis by Lecestre plate associated with screwing or plugging is used in 84% of cases. The course 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 non-union. 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 bad in 11% of cases. Fractures of the humeral pallet are fractures with a satisfactory functional prognosis, subject to anatomical restoration ad-integrum and solid osteosynthesis allowing early rehabilitation of the elbow. one case of joint callus and one case of non-union. 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 bad in 11% of cases. Fractures of the humeral pallet are fractures with a satisfactory functional prognosis, subject to anatomical restoration ad-integrum and solid osteosynthesis allowing early rehabilitation of the elbow. one case of joint callus and one case of non-union. 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 bad in 11% of cases. Fractures of the humeral pallet are fractures with a satisfactory functional prognosis, subject to anatomical restoration ad-integrum and solid osteosynthesis allowing early rehabilitation of the elbow.*

Keywords: Fracture, humeral pallet, surgical Treatment

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 pathology in adults and a third of elbow fractures [2], they are most often articular, their management must respond to the principle of articular fractures, that is to say i.e. restore a joint space and allow immediate mobilization, allowing 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.

MATERIAL AND METHODS

This is a retrospective study of 50 patients operated on for humeral paddle fractures from January 2014 to December 2020.
The aim of our work is to evaluate the clinical, therapeutic and evolutionary particularities of humeral paddle fractures and to clarify the difficulties of their management as well as to evaluate the results of our series.

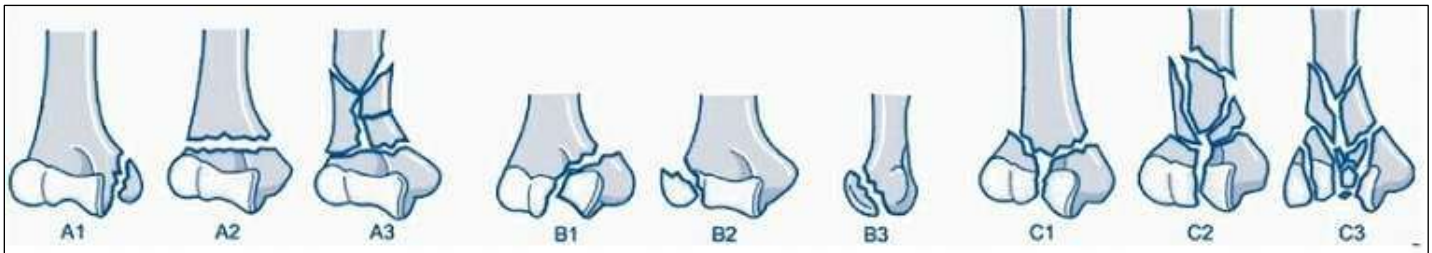
RESULTS

The average age of our patients is 39 years old with a clear male predominance. 30 men against 20 women with a sex ratio of 1.5. Falls are the main cause and are found in 28 patients (56%), followed by road accidents (AVP) in 16 patients (32%) then fractures due to aggression in 6 patients (12%). The right side is affected in 33 patients (66%). Fractures are isolated in 25 patients (50%). Cutaneous opening is associated in ten patients (20%). Nine patients (18%) had an associated fracture of the same limb, three polytraumatized (6%) and three 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 classification of Müller and Allgöwer according to the association of osteosynthesis (AO) (Figure 1). Type C represents a rate of 51% (Figure 2). All patients had surgical treatment; under regional anesthesia in 14 patients (28%) and under general anesthesia in 36 patients (72%). All our patients are placed in the contralateral lateral decubitus position (fractured limb on lateral support). All our patients had antibiotic prophylaxis based on amoxicillin-clavulanic acid or first-generation cephalosporin at induction before inflation of the pneumatic tourniquet. Different approaches are used. The posterior trans-olecranon approach is performed in 32 patients (64%), the external route in ten patients (20%), the internal route in six patients (12%), the transtricipital route and the para-tricipital route are each performed in a single patient. The type of osteosynthesis used is screwing in three patients (6%), screwing and pinning in two patients (4%), a screwed Lecestre type plate or third tube alone or associated with pins;

screw or combination of two plates in 45 patients (90%) . The osteosynthesis of the olecranon is ensured by a pinning-staying with steel wire a Lecestre type screwed plate or tube tier alone or associated with pins; screw or combination of two plates in 45 patients (90%) . The osteosynthesis of the olecranon is ensured by a pinning-staying with steel wire a Lecestre type screwed plate or tube tier alone or associated with pins; screw or combination of two plates in 45 patients (90%) . The osteosynthesis of the olecranon is ensured by a pinning-staying with steel wire
(Figure 3). Aspiration drainage and antibiotic prophylaxis are systematic in all our patients as well.
All our patients had an early, progressive and prolonged rehabilitation. For postoperative complications, we observed two cases of sepsis (4%) (Figure 4 and Figure5); two disassembly cases (4%) (Figure 6); five cases of stiffness (10%), a single case of articular malunion (2%) and one case of septic pseudarthrosis (2%) (Figure 7). We used the mayo-clinic elbow performance score [1] as an evaluation criterion. The performance index includes a pain score (45 points); for mobility (20 points); for stability (10 points) and for daily activity (25 points). Based on this system, the functional results are obtained by adding the points concerning pain, mobility, stability and function, i.e.: excellent (90-100 points), Good (75-89 points), Average (60-74 points) and Poor (<60 points). At an average follow-up of three years, we obtained seven excellent results (14%), 29 good results (58%), nine average results (18%) and five poor results (10%). We note that the cases of poor results were observed in subjects aged over 60 years. Among the five cases of poor results, two presented lesions associated with 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 multiple trauma patient (Table 1). nine average results (18%) and five poor results (10%). We note that the cases of poor results were observed in subjects aged over 60 years. Among the five cases of poor results, two presented lesions associated with 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 multiple trauma patient (Table 1). nine average results (18%) and five poor results (10%). We note that the cases of poor results were observed in subjects aged over 60 years. Among the five cases of poor results, two presented lesions associated with 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 multiple trauma patient (Table 1). 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 multiple trauma patient (Table 1). 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 multiple trauma patient (Table 1).

Table 1: functional results according to the Mayo clinic score according to the anatomical type of the fracture

type of fracture	**Excellent**	**Good**	**Average**	**Bad**
AT	2	7	3	1
B	2	11	3	1
VS	3	11	3	3
Total	7	29	9	5



Type A : fractures extra-articulaires
- A1 : fracture de l'épicondyle médial
- A2 : fracture supracondylienne simple
- A3 : fracture supracondylienne comminutive

Type B : fractures unicondyliennes
- B1 : fracture du condyle médial (incluant la trochlée)
- B2 : fracture du condyle latéral (incluant le capitellum)
- B3 : fractures tangentielles (incluant la trochlée et le capitellum)

Type C : fractures sus et intercondyliennes
- C1 : fracture en « Y » ou en « T », déplacée ou non (sus et intercondylienne simple)
- C2 : comminution supracondylienne
- C3 : comminution articulaire et/ou tassement

Figure 1: classification of Muller and Allgöwer according to the AO

Figure 2: CT image with 3D reconstruction of a supra and intercondylar type C fracture of the right humeral paddle

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 1/3 tube plate with screwing and realization of wire-stayed pinning with steel wire of the osteotomy of the ´olecranon

Figure 4: sepsis on material of a fracture of the right humeral pallet with exteriorization of the tensioning wire of the olecranon

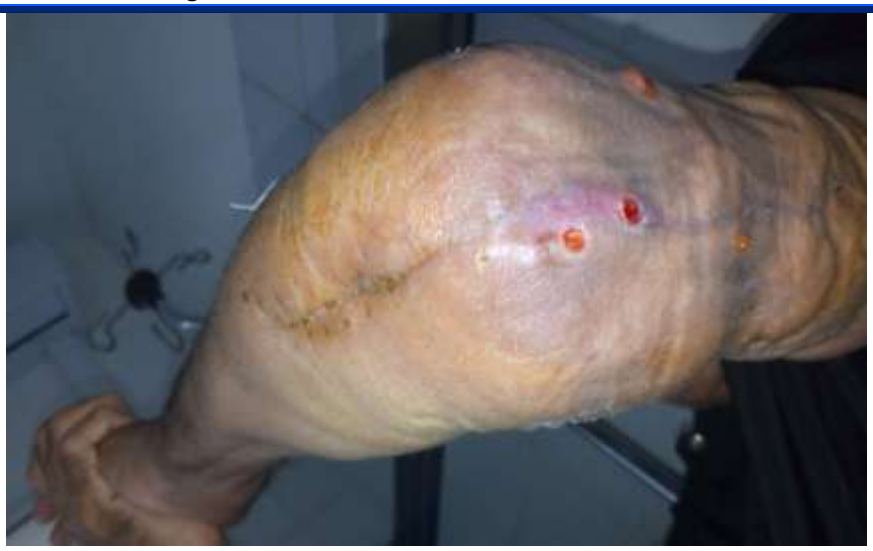
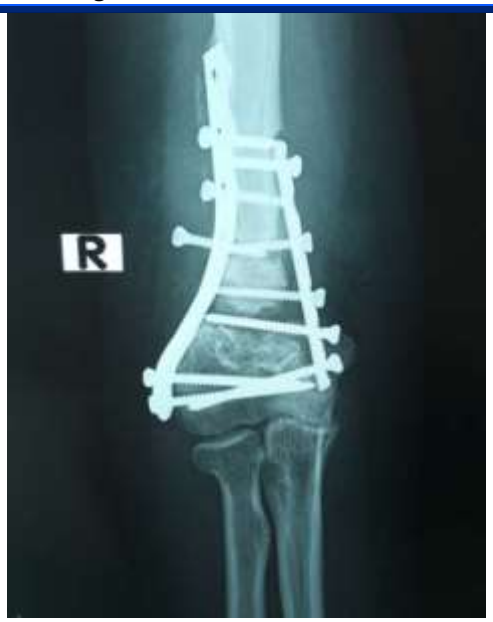


Figure 5: sepsis on material of an osteosynthesis of a fracture of the left humeral pallet with cutaneous fistulas

Figure 6: AP and lateral X-ray of a debricolage of a screwing of the internal pillar of a supra and intercondylar fracture



Picture 7: frontal X-ray of a septic pseudarthrosis of the right humeral pallet with debriefing of the material and bone sequestration

DISCUSSION

Fractures of the distal extremity of the humerus are defined as fractures which typically sit below the distal insertion of the brachialis muscle; the lower limit of this insertion draws an open angle below a finger's breadth above the coronoid fossa [1]. These fractures have been called humeral paddle fractures. There are no real variations in the prevalence of fractures of the humeral paddle according to the age or sex of the patients, however these fractures are differentiated into three populations: child, adult and elderly subject because in each population prognosis and treatment are different [3]. In our series, the average age of the 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 are their main etiology, followed by AVP [4]. In our series 56% are secondary to falls. Cutaneous opening represents 25 to 30% of fractures depending on the series [3]. We report a rate of 20%. Several classifications, none of which manages to synthesize the anatomical, prognostic and therapeutic criteria, we have opted for the classification of Müller and Allgöwer according to the association of osteosynthesis (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 polyfractured patients for LECESTRE [5] and 38.5% for SARAGAGLIA [6]; which will have a great impact on the treatment and on the functional results. In our series, it is 17.6%. The treatment of humeral paddle fractures in adults is mainly based on reconstructive surgery by osteosynthesis. Three general principles must be taken into consideration, namely the exact restoration of joint anatomy and anteversion of the paddle; the stability of the synthesis which must be able to authorize an early rehabilitation and the urgency of the management even outside of the open or complicated lesions because the precocity of the gesture before the appearance of the edema in displaced fractures facilitates the consequences and rehabilitation [5]. It is in fact 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 a mastery of the approaches and a knowledge of the osteosynthesis material and the use to be made of it in each type of fracture [7,8]. All the authors insist on the need for a short immobilization and a prolonged rehabilitation because of the slow recovery of mobility. [3]. The place of treatment other than osteosynthesis, namely orthopedic; functional or by prosthetic replacement remains very limited.

Complications of surgical procedures are not exceptional, sequelae are dominated by stiffness whose prognosis after arthrolysis is all the better as the anatomy has been restored. Consolidation is usually done in 45 to 60 days, this period is often increased, whatever the treatment in case of open fracture or comminuted fracture. Delayed consolidation should not delay rehabilitation in order to avoid stiffness, which is the most frequent and feared complication of the elbow. Fractures of the humeral paddle being 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 according to the authors. Since prono-supination is rarely limited, the majority of authors take into account the amplitude of flexion-extension [3]. The risk of pseudarthrosis is not greater than that of other articular fractures 2 to 10% [3], 7% for LECESTRE [5]. Only one case of delayed consolidation is noted in our series.

There are many quotations available to assess the functional results of fractures of the humeral paddle, they vary from one author to another. MANNEDU [9] specifies that there is no static correlation between the anatomo-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 by 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, ie the anatomo-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 make it possible to explain the results obtained, but it is a set of factors. including age, lesion associations, the time to surgery, the nature of the treatment and the experience of the surgeon [3]. In our series we had 64% of good results regardless of the type of treatment, it should be noted that all our patients are operated, whereas in patients treated orthopedically the result was always bad, which proves the superiority of osteosynthesis.

CONCLUSION

The fractures of the humeral pallet are more and more frequent, this is in connection with the increase of the accidents of the public highway and their violence responsible for an important comminution. Their management is a real challenge that requires a good understanding of the fracture and precise preoperative planning. A stable osteosynthesis allowing an early rehabilitation is the guarantor of an optimal result.

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