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Epidemiological profile and results of the management of diaphyseal fractures of the forearm bones in adults at Owendo University teaching Hospital (Gabon)

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Abstract

Introduction: Forearm bone fractures are serious fractures that often affect pronosupination. Their treatment remains controversial. The aim of this work was to describe the epidemiological profile and evaluate the results obtained after their surgical treatment in the department.

Patients and Methods: This was a retrospective study conducted from May 2016 to May 2018, at the Owendo University Teaching Hospital. The study included all patients admitted to the department for diaphyseal fracture of one or both bones of the forearm, treated surgically and regularly followed in outpatient consultation.

Results: A total of 52 patients were collected. There were 39 men (75%) and 13 women (25%). The average age was 38.0 years with extremes of 16 and 60 years. Road traffic accidents constituted the most frequent etiology with 73.1% (n = 38). Fractures were closed in 78% (n = 41). Simultaneous damage to both bones of the forearm was noted in 78.8% (n = 41). The fracture line was transverse in 78.8% (n = 41). The middle third was the most common site with 78.8% (n = 41). The average intervention duration varied between 65 and 120 minutes. Fractures operated by screw plate consolidated at the 12th post-operative week. The anatomical and functional result was generally satisfactory at 96.1%.

Conclusion: diaphyseal fractures of the forearm bones are common in the department and are the prerogative of young adult males. Support by screwed plate or intramedullary pinning gave generally satisfactory results.

Keywords: Epidemiology, results, treatment, fracture, bone, diaphysis, forearm, adult

Introduction

Diaphyseal fractures of both bones of the forearm in adults are common trauma injuries. Their frequency, in adults, varies from 1 to 3% of all limb fractures [1]. They generally occur during a road traffic accident, fights and falls [2] and disrupt pronosupination. These fractures are serious and can lead to complications such as non-unions, repeat fractures, radioulnar synostosis, compartment syndrome and malunions which can be responsible for functional impairment of the thoracic limb [3].

These fractures pose, in our context, therapeutic problems; the treatment is not unanimous [4] and numerous studies [5-7] have demonstrated that osteosynthesis by screwed plate on the two bones makes it possible to best restore the anatomy and therefore to restore the function of the thoracic limb. A precise diagnosis of these lesions is therefore important in order to establish appropriate and urgent treatment to restore normal anatomy of the forearm [8]. Screening and treatment of associated lesions of the proximal and distal radioulnar joints are mandatory, because they make it possible to obtain a correct functional result while knowing from the outset that the treatment of these lesions, in adults, remains almost exclusively surgical [9].

In Gabon, few studies are available on diaphyseal fractures of the forearm bones in adults. Through this study, we wanted to determine the epidemiological profile and evaluate the results of the management of these fractures in our department.

Patients and Methods

Study framework: Our study took place at Owendo University Teaching Hospital, located in south of Libreville after NOMBA bridge, in AKOURNAM II district.

Type and period of study

This was a retrospective descriptive study which took place from May 2016 to May 2018, either two years in Owendo University Teaching Hospital (CHUO).

Inclusion criteria

Were included in this study, adults patients, admitted and treated at department for a fracture of one or both bones of the forearm with traumatic origin, confirmed by an x-ray examination. The patients with complete clinical files with pre-operative radiological assessment and post-operative control until consolidation followed in outpatient consultation for at least of twelve months.

Non-inclusion criteria

Were not included in this study any patient who has not been treated in the department or who has signed a waiver to undergo treatment of another nature outside. All incomplete files (absence of pre- or post-operative x-ray, absence of medical observation, or treatment sheet, or operating protocol sheet).

Collection of data

The study parameters were: frequency, age, sex, profession, etiology, mechanism, affected side, skin condition, anatomopathological type, additional examinations, therapeutic methods used, radiographic results and functional results. The results were evaluated with a minimum follow-up of 12 months. Data were collected from medical records and operating room registers.

The results were evaluated according to Western Orthopedic Society Score (WOSS) (Table 1).

Table 1: Western orthopedic society score

Mobility	Force clamping in % relative to the opposite side	Pain
No stiffness FE >140°/PS>150° (3 points)	Symmetrical (100%) (2 points)	None (3 points)
Moderate stiffness Deficit FE < 40°/ deficit PS < 30° (2 points)	Diminished (50-80%) (1 point)	Moderate or episodic (2 points)
Medium stiffness: deficit FE De 40 à 80° / deficit PS de 30 à 80 (1 point)	Greatly diminished (< 50%) (0 point)	Regular exercise (1 point)
Major stiffness: deficit FE > 80° / deicit PS >80° (0 point)		Permanent or intense (0 point)

FE: flexion extension; PS: Pronation – Supination

Results analysis

The evaluation of the result of functional rehabilitation is measured by the extent of the amplitude of each main joint movement according to the score of the Western Orthopedic Society (SOO) (Table 2).

Table 2: Results after evaluation according to SOO score

Results	Points
Excellent	10 à 11
Good	8 à 9
Poor	5 à 7
Bad	< 5

Statistical analyzes

All data collected were entered and processed with Microsoft

Excel version 2016 software. Categorical variables were expressed as percentages.

The interpretation of the data was made by comparing percentages.

Results

940 patients consulted for trauma of the thoracic limb, among them, 52 patients presented a fracture of the bones of the forearm, an incidence of 5.5% of all fractures of the thoracic limb. There were 39 men (75%) and 13 women (25%), i.e. a sex ratio (M/F) of 3.0 in favor of men. The average age was 38.0 years with extremes of 16 and 60 years. The peak frequency of fractures concerned the age group between 16 and 20 years (Fig 1).

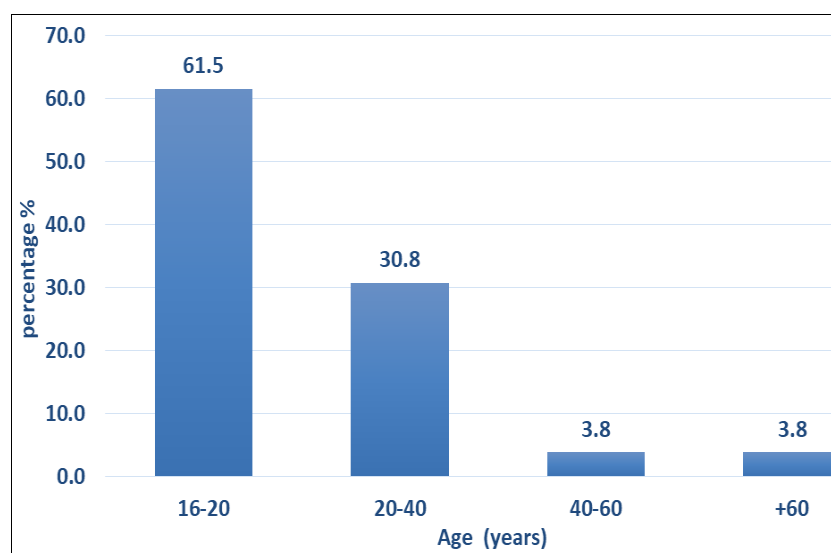


Fig 1: Distribution of patients according to age groups

Students predominated in the series with 71.1% (n = 37). Road traffic accidents (RTA) constituted the most frequent etiology with 73.1% (n = 38). The left side was affected in 61.5% (n = 32) and fractures by direct mechanisms represented 84.6 (n = 44). Clinically, pain and functional impotence were the main reason for consultation in all patients (100%), swelling and

deformation of the forearm were found in 94.2% (n = 49). The fractures were closed in 78% (n = 41) and were accompanied by a frank skin opening creating an open fracture in 21.2% (n = 11). Para clinically, all patients received a full-face and profile forearm x-ray taking the elbow and wrist joints before and after the surgical procedure (figure 2).



Fig 2: Fracture of the 2 bones of the right forearm classified 22RA3 and 22UA3, A, before the intervention, B, after osteosynthesis by screwed plate of the radius and the ulna checked on D10 post-operative

Simultaneous damage to both bones of the forearm was noted in 78.8% (n = 41), isolated damage to the radius represented 13.5% (n = 7) while the ulna was affected. Isolation in 7.7% (n = 4). The fracture line was transverse in 78.8% (n = 41), oblique in 11.5% (n = 6) and spiral in 9.6% (n = 5). The middle third was the preferred site of fracture with 78.8% (n = 41). The fracture was associated with polytrauma in two patients with a case of severe head trauma and a case of blunt trauma to the pelvis, with

a fracture of the ipsilateral humerus (Floating elbow) in one case. The average time before surgery was 4 days with a range of 1 to 9 days. The average operating time varied between 65 minutes (Intramedullary pinning) and 120 minutes (Plate osteosynthesis). For the simultaneous diaphyseal fracture of the two bones of the forearm, the screw plate was the most used treatment method in the series and the plate-plate assembly was the most performed with 59.6% (n = 31) (Figure 3)

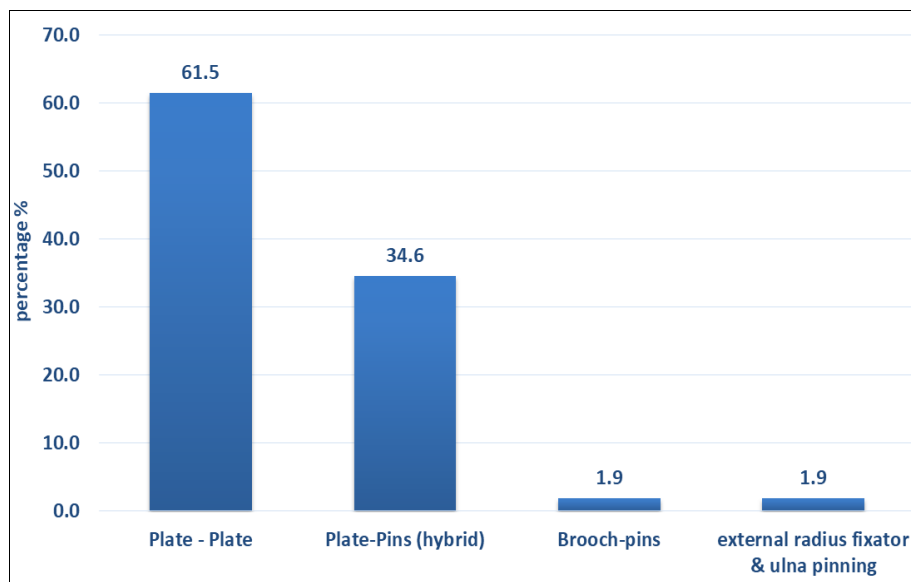


Fig 3: Distribution of patients according to the montages carried out on simultaneous diaphyseal fractures of the two bones of the forearm

The length of hospitalization varied between two to three weeks. The only secondary complication noted in the series was surgical site infection which occurred in two patients with an open fracture (3.84%). All fractures operated with an open screw plate were consolidated at the 12th post-operative week. The times to union were a little longer for the other treatment methods (Plate-wire, pin-wire and exo fixation-wire) with an average time to union of 16 weeks with intervals of 14 weeks and 22 weeks. The overall anatomical and functional result is summarized in Table 3 below:

Table 3: Distribution of patients according to functional result

Résultats	Points	Effective	Percentage (%)
Excellent	11	9	17,3
Good	9	41	78,8
Average	7	2	3,8
Bad	<5	0	0

Discussion

Our study has limitations linked to the retrospective nature of the study which did not allow us to have all the data previously

collected. Some patients seen in the emergency department were no longer seen in an outpatient clinic for scheduled therapeutic follow-up; this contributed to the reduction in our number and certainly introduced certain biases into our results; nevertheless, the results obtained are questionable. Out of 940 patients consulted for trauma of the thoracic limb, 52 patients among them presented a fracture of the bones of the forearm, an incidence of 5.5%; this result is comparable to that of Bombah FM *et al.* [10] who found an incidence of 5.8% in their series in Douala. The average age of this study was 38.0 years with a male predominance. This result is comparable to those of several series authors whose average age is between 35 and 40 years [11-13] with a male predominance. This could be explained by the fact that young adults, especially males, constitute the most active social segment and the most exposed to trauma due to certain risky professions reserved for men. Students predominated in the series with 71.1% (n = 37), this result is comparable to that of Youssef R *et al.* [14] who found a predominance of students in their study with 78% of cases. Road traffic accidents (RTA) constituted the most frequent etiology with 73.1% (n = 38), this result is consistent with literature data [13,15,16] and could be explained by the constant increase in the number of vehicles in the city and bad traffic habits that do not respect the highway code, added to this is the poor state of road infrastructure. This increased rate of ACR also partly explains the direct shock mechanisms recorded in this study. Pain and functional impotence were present in all our patients, this is due to the consequences of the direct shock on the forearm causing the fracture responsible for the pain and impotence. On the other hand, deformation is only evident if the fracture is displaced. These observations are consistent with literature data [17-19]. Paraclinically, the standard x-ray of the forearm, full face and profile, taking the elbow and wrist, was sufficient to confirm the diagnosis in all our patients; thus, simultaneous damage to both bones of the forearm was noted in 78.8% (n = 41), the fracture line was simple and transverse in the majority of cases (78.8%), whereas in the Azboy series [15], the line detaching a third fragment represented 40.6% (n = 13). This predominance of the transverse line could be explained by the fact that during ACR, the direct impact mechanism was the most frequent, the bone breaks at the point of impact, the preferred site of the middle third is due to the exposure of the middle part of the forearm to direct impact. In our study, simultaneous fractures of the diaphysis of the two bones of the forearm were predominant than other clinical forms; this is consistent with literature data [8, 20].

Therapeutically, the open plate-plate osteosynthesis technique was the most widely used treatment method. The goal of treatment being to obtain consolidation of the fracture and good function of the thoracic limb, this therapeutic attitude was also that of several authors of the series [8, 20, 21]. The functional results are correlated with the anatomical results, for this, anatomical reduction and reestablishment of the imperatives of pronosupination are necessary. In this series, 96.2% (n = 50) had an overall satisfactory result according to the evaluation of the Western Orthopedic Society. This result is consistent with literature data [22, 23]. Although several treatment methods have been described, there is unanimity since the work of Anderson [24] that osteosynthesis by open compression plate on each bone is the best technique offering better results. It is this method which was mainly used in this study, hence the good results obtained. On the evolutionary level, the vast majority of patients found a cure without sequelae except two patients who presented a malunion late. This could be explained by the fact that an

anatomical reduction was the objective to be achieved during our interventions and that the instructions for early rehabilitation were respected, which agrees well with the data in the literature [25, 26].

Conclusion

With an incidence of 5.5%, fractures of the forearm bones remain frequent in the service and are the prerogative of young, male subjects and victims of ACR. Direct shock remains the main mechanism. Pain and functional impotence were the main reasons for consultation. Swelling of the thoracic limb is constant within our study population. Radiologically, the simultaneous fracture of the radius and the ulna was the most common, the middle third of the diaphysis was the preferred site of these fractures. Simple line fractures are the most common. Osteosynthesis using a screwed plate with dynamic compression and in certain cases a hybrid plate-wire or pin-wire assembly gave generally satisfactory anatomical and functional results.

Conflict of interest

The authors have reported no conflict of interest.

Data availability

All data are included in the article content.

Funding Disclosure

The authors received no funding for this research.

Human studies

The study obtained approvals from the ethics committee of the Faculty of Health Sciences of Kara University, and the principles of the Declaration of Helsinki were respected.

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