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## Benefit of the external fixator in the management of open fractures of the leg skeleton: About 31 cases at Owendo University Teaching Hospital (CHUO)

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### Abstract

Open fractures of the leg skeleton represent 8 to 10% of traumatic injuries to the musculoskeletal system. Their stabilization methods remain controversial and the external fixator is one of them. The objective of this study was to show the benefit of the external fixator in the management of these fractures. This was a retrospective study carried out between January 2017 and December 2020 at Owendo University Teaching Hospital. The study concerned all patients admitted for open leg fractures, treated and followed up in the department. We collected 31 patients including 22 men and 9 women. Their average age was 34.2 years (range 18-62 years). The age group from 31 to 50 was the most represented with 54.8% (n=17). Field workers constituted the socio-professional group most affected with 25.8% (n=8). Road traffic accidents (RTA) were the main sources of trauma with 83.9% (n=26). According to the Gustilo and Anderson classification, the type IIIa lesions were the most frequent with 61.2% (n=19). The majority of patients were treated on the 6th day (58.1%, n=18). Occurring in 38.7% (n=12), the complications encountered were infection and delayed union in 16.2% (n=5) each. The average time to consolidation was 23.6 weeks (range 15 -52 weeks). With an average follow-up of 10 months, the results evaluated, according to Ketenjian criteria, were excellent in 19.4% (n=6), very good in 41.9% (n=13), good in 22.6% (n=7) and bad in 6.4% (n=2), in others words 83.9% satisfactory results. the results obtained are generally satisfactory but can be improved if we simplify the methods of providing the external fixator to needy patients.

**Keywords:** Open fracture, leg skeleton, external fixator, CHUO

### Introduction

Open fractures of the leg skeleton are extra-articular fractures, mainly diaphyseal, of one or both bones of the leg, located between three fingers below the knee joint at the top and a horizontal passing through three fingers. of fingers above the tibio-tarsal space below in contact with a breach in the overlying cutaneous-muscular covering and bringing the bone fragments into contact with the ambient environment <sup>[1]</sup>. This is a formal therapeutic emergency because these fractures can generate significant morbidity <sup>[2]</sup>. When they occur in the context of high energy trauma as is the case in this series. their frequency continues to increase with the increase in road traffic accidents (RTA) in our country. Open fractures of the leg segment are the most common of long bones and represent 20 to 30% in Europe <sup>[3]</sup> and 39% in Africa <sup>[4]</sup>. they are characterized by complex lesions of bones and soft tissues <sup>[5]</sup> and pose a real public health problem because they mainly affect the active population. Their therapeutic management still poses problems in our context. This is mainly due to the emergency unavailability of osteosynthesis equipment, in this case the external fixator, the acquisition formalities of which are still complex in our structure. Consequently, the processing time is sometimes delayed by several days. The skin opening complicates one in four leg fractures. Indeed, the superficial location of the tibia under a skin covering makes it vulnerable and exposes it to infection and delayed union <sup>[6, 7]</sup>. Open leg fractures still pose, in our context, management problems which must include not only the bony side which requires

initial stabilization but also the soft parts which must be treated by careful trimming. Therapeutic methods for bone stabilization are numerous and the external fixator is one of them. In our context, the formalities of its acquisition are still complex, the patient must deposit a deposit of 768 euros for its availability, which is not always obvious if we consider the fact that the majority of patients are economically weak with a health insurance which does not cover them 100%, which, de facto, extends treatment times by several days [8]. Despite this, the external fixator remains the first choice in the management of open leg fractures and it is the method chosen in this series. Open leg fractures have been the subject of some studies in the department. In this study, we propose to show the benefit of the external fixator in the management of open fractures of the leg skeleton.

## 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 study with a descriptive purpose which took place over a period of 4 years: from January 2017 to December 2020 at Owendo University Teaching Hospital.

### Inclusion and non-inclusion criteria

The study concerned all patients who suffered trauma leading to an open leg fracture, treated with an external fixator and followed in the department for at least six (6) months. Patients who abandoned the initial treatment started in the department to the detriment of traditional treatment and those who presented incomplete medical records or were lost to follow-up constituted the non-inclusion criteria.

### Collection of data

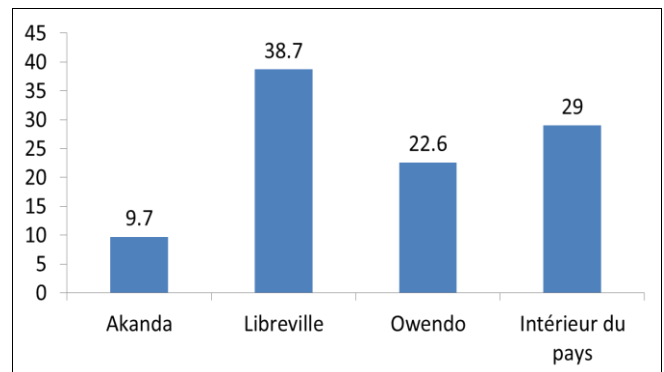
Data collection was based on a survey form designed for the study and which recorded the following study variables from the department's medical files and for each patient meeting our selection criteria: sociodemographic data: sex, age; clinical and paraclinical parameters: functional signs, physical signs, radiological and biological signs and data and treatment parameters: the treatment time, the type of anesthesia, the type of external fixator used and the associated procedures and the radiographic and functional results. Bone consolidation was assessed by the absence of pain, mobility of the fracture site, with the presence of a unitive bone callus between the bone fragments. Pseudarthrosis was retained due to a lack of bone union more than six months after treatment and requiring surgical revision. Postoperative infection was suspected in the presence of cardinal signs of inflammation with purulent discharge from the wound and a positive cytobacteriological examination of the pus. For the evaluation of anatomical and functional results, the modified Ketenjian AY criteria were used [9].

### 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

We collected 31 patients including 22 men and 9 women, either a sex ratio (M/F) of 2.44. Their average age was 34.2 years (range 18 – 62 years). The age group from 31 to 50 was the most represented with 54.8% (n=17). Field workers constituted the socio-professional group most affected with 25.8% (n=8). Road traffic accidents (RTA) were the main sources of trauma with 83.9% (n=26). Patients from Libreville were the most numerous with 38.7% (n=12) (see figure 1).



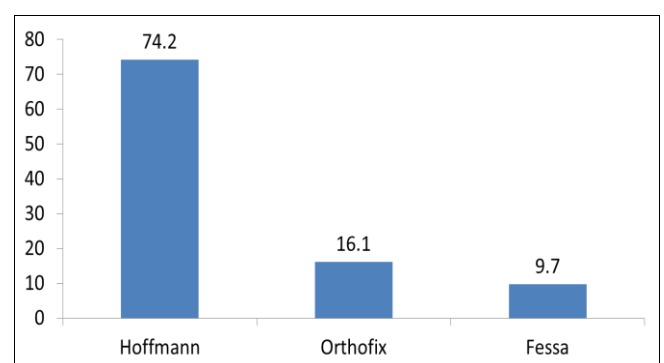
**Fig 1:** Distribution of patients according to origin

The auto-auto mechanism was the most frequent with 53.9% (n=17) followed by the pedestrian-auto mechanism. Transport by ambulance was the most used means of evacuating patients to our structure with 51.6% (n=16). The majority of patients were treated around the 6th day (table 1)

**Table 1:** Distribution of patients according to treatment times

Time limit	Effective	%
0 – 6 hours	0	0
6 – 24 hours	1	3,2
24 – 72 hours	4	12,9
4 <sup>th</sup> Day	2	6,4
6 <sup>th</sup> Day	18	58,1
10 <sup>th</sup> Day	3	9,7
14 <sup>th</sup> Day	2	6,4
21 <sup>th</sup> Day	1	3,2
Total	31	100

Patients covered by insurance were numerous with 41.9% (n=13). According to the Gustilo and Anderson classification, type IIIa lesions were the most frequent with 61.2% (n=19). The patients who benefited from tibio-tibial exofixation using the Hoffmann fixator were the most numerous with 74.2% (n=23) (figure 2 and figure 3)



**Fig 2:** Distribution of patients according to the type of external fixation



**Fig 3:** A: open fracture of the left leg, classified gustilo anderson type IIIa, taken care of by hoffmann fixative; B: first descent from the bed of a patient on D2 post-operative osteosynthesis using Hoffmann external fixator; C: patient seen in outpatient consultation at 7 months, presenting with bony consolidation of the leg bones.

The average time to consolidation was 23.6 weeks (range 15 - 52 weeks). Some benefited from a flap of coverage during the same operation when local conditions were favorable but sometimes at a distance. Directed healing followed by a thin skin graft was done in cases where loss of skin substance persisted without bone exposure. Functional rehabilitation was practiced in all patients immediately postoperatively. The evaluation was clinical and radiological and carried out immediately post-operatively and at various outpatient consultations until the definitive removal of the osteosynthesis material. Occurring in 38.7% (n=12), the complications encountered were infection and delayed union respectively in 16.2% (n=5). One patient (3.2%) presented an axial varum-type deformation and another (3.2%) an axial and sagittal varum-type deformation associated with the recurvatum. For the evaluation of anatomical and functional results, the Ketenjian criteria were used [9]. With an average follow-up of 10 months, the results were excellent in 19.4% (n=6), very good in 41.9% (n=13), good in 22.6% (n=7) and poor in 6.4% (n=2) or 83.9% satisfactory results.

### Discussions

Open fractures of the leg segment represent an important part of the service's activity. Out of 304 cases of hospitalization for leg trauma, 31 cases presented an open leg fracture, representing a frequency of 10.2%. This result is comparable to that of Camara *et al.* [10] in Conakry who found in their series a frequency of 9.6% of open leg fracture. This result could be explained by the increase in road traffic accidents. In the department, the surgical site infection rate remains high (11.8%), the environment in which the patients were operating does not allow us to perform internal osteosynthesis for open leg fractures, especially when these are support beyond 6 hours, which is the case for most people. Exofixation remains the method of first choice which allows both to stabilize the fracture site and to minimize the risk of infection if early and careful debridement has been carried out beforehand. Our structure has Hoffmann fixators, orthofixes and Fessas. The choice of each of them depends on the morphological characteristics of the patient but also on the habits of the surgeon.

In this work, open leg fractures concerned young adult males whose average age was 34.2 years with a predominant age group between 31 years and 50 years (54.8%), these data are comparable to those of Coulibaly NT *et al.* [11] in Dakar in 2013 who reported an average age of 38 years with a male predominance. This could be explained by the fact that young people constituted the most active social layer of society, the male predominance found could be explained by the fact that

men are the most exposed to trauma due to their risky activities. All socio-professional strata were affected by open fractures of the leg segment, while those whose professional activities commonly required travel were the most exposed, in this case field workers as in the present study. Our results are consistent with those in the literature [12-14]. Road traffic accidents (RTA) were the most frequent etiology with 83.9% (n=26). These results are consistent with data from the literature [15, 16] and could be explained by the large number of vehicles which become essential for travel in the urban center. Patients from Libreville were the most numerous, this could be explained by the fact that the population of the country is more concentrated in Libreville which is the capital of the country, the greatest professional activity takes place there, people move around with their personal vehicles and therefore are victims of RTAs. This same observation was made by several authors of the series [17, 18] who noted more accidents in the large urban centers of their respective countries. The majority of our patients were referred or evacuated, the mode of evacuation was transport by ambulance in 51.6% (n=16), these evacuations to our hospital center clearly demonstrate that we are the reference center in the management of charge of trauma emergencies. The majority of patients were treated around the 6th day, this late treatment was mainly due to two reasons: the complex procedure for acquiring the external fixator which requires a deposit of around 768 euros and the financial precariousness of the economically weak patients whose health insurance requires a contribution of 20% for their care. We used the Gustilo-Anderson classification to classify the open fractures in the series, it emerged that type IIIa lesions were the most frequent with 61.2% (n=19), this result differs from those of several authors of the series [10, 15], who found the majority of type II lesions in their respective series; the poor coverage of the antero-internal aspect of the leg, the violence of the trauma and the mechanism of injury lead to the vulnerability of the middle third and the skin lesions observed in the series. Radiologically, the fracture line was simple in 71.0% (n=21) and complex in 29.0% (n=9). He sat in the middle third in 80.6% (n=25). The fracture of both bones of the leg was the most represented with 77.4% (n=24). Our results are consistent with literature data [10, 16, 21]. Therapeutically, we carried out both medical and surgical treatment. Concerning medical treatment, all our patients benefited from tetanus sero vaccination, antibiotic prophylaxis, analgesics and anticoagulants based on low molecular weight heparin therapy. Concerning the surgical treatment, all our patients benefited from careful trimming before bone fixation using a Hoffmann type external fixator in the vast majority of cases and within an average time of 6

days. This therapeutic approach is also that described in the literature with approximately the same time frames [10, 13, 16]. For Dubrana [22], the external fixator constitutes the method of choice for stabilizing open fractures of the leg due to the subcutaneous location of the tibia. On the other hand, for Melvin's team [23], Centro medullary nailing was used exclusively. For the latter, the external fixator increases the risk of infectious complications occurring. The average time to bone union was 23.6 weeks with extremes of 15 and 52 weeks. Some of them benefited from a covering flap during the same operation when the local conditions were favorable, others on the other hand, benefited from a remote flap. Directed healing followed by a thin skin graft was done in cases where loss of skin substance persisted without bone exposure. Our results and our therapeutic approach are consistent with the data in the literature [10, 15, 24].

The evaluation of the anatomical and functional results was made at a mean follow-up of 10 months, according to the Ketenjian criteria, these results were excellent in 19.4% (n=6), very good in 41.9% (n=13), good in 22.6% (n=7) and bad in 6.4% (n=2) which is an overall satisfactory result with 83.9% (n=26). The complications were mainly infection of the surgical site and delayed bone union with respectively 16.2 (n=5) each. These results are comparable to those of Camara *et al.* [10] who found 76.5% favorable results in their series with a fairly low rate of postoperative complications, mainly soft tissue infection (9.5%) and pseudarthrosis (7.5%). These satisfactory results, overall, could be explained by the choice made for exo fixation, which, by not allowing internal fixation, de facto reduces the occurrence of postoperative complications.

### Conclusion

Open fractures of the leg segment are frequent injuries in our daily practice. They have a socio-economic impact because they occur most often in young adult males and following an ACR and affecting the middle third of the leg. There is a predominance of Gustilo-Anderson type IIIa fractures. The therapeutic time includes careful trimming and immobilization of the leg segment using external fixators. The prognosis depends on the extent of the trauma and the treatment time; if treatment is taken early, the risk of complications decreases. Although our series does not represent a large number of patients, this retrospective work, in view of the results obtained, still demonstrates that the external fixator constitutes an interesting therapeutic alternative in the management of open leg fractures.

### Declarations

**Funding:** This work received no specific grant from public, commercial, or association funding agencies.

**Conflict of interest:** The authors have no conflicts of interest to declare in relation to the writing of this article.

**Ethical approval:** authorization for the study was obtained from the competent authorities of the CHUO. Arrangements have been made to guarantee confidentiality and anonymity. Consent from patients or their families in the event of their incapacity was given.

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