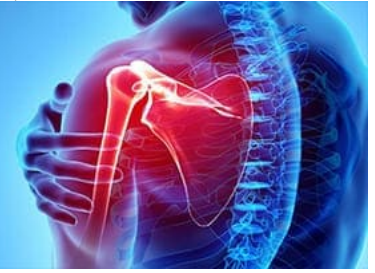


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## Osteomyelitis in children: epidemiological, clinical, biological, radiological and therapeutic aspects at Owendo university teaching hospital of Gabon

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### Abstract

Osteomyelitis is a hematogenous bone infection; it poses therapeutic difficulties because of its evolution towards chronicity. The aim of this work was to determine the frequency, to describe the epidemiological, clinical, biological, radiological aspects and to evaluate the results of the treatments instituted as well as the prognosis after treatment.

This was a prospective descriptive study, over a period of 19 months from June 1, 2021 to December 31, 2022, in the department of traumatology and orthopedics at Owendo University Teaching Hospital (CHUO). The study concerned the analysis of the files of patients from 0 to 15 years old at most, admitted for osteomyelitis, treated and followed up in the department.

The results show that 12 patients made up of 8 men and 4 women took part in the study, with an M/F ratio: 2.0 in favor of men. The average age was 8.5 years. The patients who consulted after 1 month were majority in the series with 41.7% (n=5). Three patients had sickle cell disease with homozygous SS form in 25% (n=3). All patients benefited from samples for bacteriological examinations with antibiogram. The persistence of the infection was the most represented complication with 40% (n=2). The evolution was favorable in 83.3% (n=10), in unfavorable cases, we didn't record any deaths.

In conclusion, osteomyelitis is rare in the department but remains a serious condition when it occurs. It presents a very variable clinical picture; the predominant germ remains *Staphylococcus aureus*. Treated early, osteomyelitis heals without sequelae but the slightest delay can lead to complications affecting the functional future of the child.

**Keywords:** Osteomyelitis, child, Owendo University hospital center

### Introduction

Osteomyelitis is a blood-borne infection of the bone that affects both sexes. In the vast majority of cases, the germ is a *staphylococcus aureus* <sup>[1]</sup>. It mainly affects growing children of school age. It is characteristic by its frequency in children and adolescents with a predisposing factor in sickle cell disease <sup>[2]</sup>. The front door of the germ most often goes unnoticed; elsewhere, it is an infected wound, paronychia, boil, etc. Often the Oto-Rhino-Laryngology and/or urogenital sphere can be incriminated. Osteomyelitis remains common in developing countries despite progress in diagnostic and developments in antibiotic therapy and, in a large number of cases, results in a chronic, disabling evolution, the social cost of which is significant. In diabetics patients, bone infection is likely to start from a perforating lesion or an ulcer <sup>[3]</sup>. The germ's isolation in fragments of bone biopsies is necessary to confirm the diagnosis but the result of simple standard X-rays, ultrasound of the soft tissues and positive blood cultures, in addition to the clinical elements of presumption, most often allow diagnosis. Evoke and anticipate treatment <sup>[4]</sup>. The prognosis of osteomyelitis, which remains linked to early diagnosis and treatment, is constantly threatened by the risk of damage growth plate with major sequelae that entails. Sepsis, septic arthritis, progression to chronicity and pathological fractures occupy the first line of multitude complications likely to occur during osteomyelitis <sup>[5]</sup>.

Osteomyelitis poses diagnostic difficulties in Gabon because of the quality of the patients who are for the most part economically weak and unable to raise the financial means necessary to carry out the basic examinations. The difficulties are also therapeutic due to the late diagnosis in the chronicity phase and which requires real management strategies to control the infection. The aim of this study was to determine the frequency of this pathology in the department, to describe the clinical and radiological signs and to evaluate the results of the medical and surgical treatments instituted as well as the prognosis after treatment.

## Material and Methods

### Study framework

We carried out our study at the CHUO located in the town of Owendo south of Libreville, in the Akournam II district. The CHUO was inaugurated on July 8, 2016 by the presidential couple, with the aim of having a specialized and even hyper-specialized unit in orthopaedics-traumatology for a specialized management of all these pathologies referring to it as well as the maxillofacial, neurosurgery and general surgery.

### Type of study

We carried out a prospective, descriptive study, single-centre study over a period of 19 months from June 1, 2021 to December 31, 2022.

### Inclusion and non-inclusion criteria

Were included in our study all patients, from 0 to 15 years old at most, presenting to the traumatological emergencies of the CHUO for osteomyelitis. Were excluded children over the age of 15 and those who abandoned the initial treatment started in the service.

### Data collection

The data was collected from patients consulting the emergency department of our hospital who met the inclusion criteria of our study, namely osteomyelitis in children aged 0 to 15 years included. The data was recorded on a pre-established sheet, the data could be supplemented by a telephone call thanks to the various contacts mentioned in the medical files. The study variables were: age, sex, reasons for consultation, time interval between illness and date of consultation, etiologies found, segments affected by the lesion, bone's lesion location, the bone affected in the upper and lower limbs, the general condition on admission which was considered good if the patient had a good state of hydration, normal-colored integuments, no fever and no signs of weight loss; the general condition was considered fair if the patient presented some episodes of fever with pallor of teguments sign of iron deficiency anemia, finally, the general condition was considered poor if the patient presented an alteration of general physical in a sepsis chart. The study parameters also included biological examinations carried out, the nature of the hemoglobin, the germs isolated from the specimens, radiological signs observed, the type of treatment instituted, the complications observed and the evolution. The criteria for admission in outpatient department or in emergency were determined by the clinical criteria including pain with lameness or functional impotence depending on the case, fistulization, the presence of an abscess, febrile swelling or not. Admission was also decided in front of radiographic images confirming

sequestration, periosteal apposition, osteolysis and/or pathological fracture. Ultrasound was requested in some patients, if it showed soft tissue abnormalities, periosteal abnormalities or cortical abnormalities, the child was admitted. Biologically, samples from the collections before the intervention were taken with a sterile single-use syringe; intraoperatively, it was the product of curettage sometimes mixed with fragments of bone sequesters, for bacteriological examinations to isolate germs. If the patient had a fever, additional investigations including blood culture, complete blood count (NFS), C-reactive protein (CRP), sedimentation rate (ESR), cytochemical examination of urine (ECBU), and chest X-rays were requested depending on the case. The evolution was good if there was a partial or total regression of the symptoms with the treatment determined by the kinetics of CRP, white blood cells and sedimentation rate. The patients hospitalized during the consultation carried out by the emergency physicians were regularly reviewed to obtain new information and note the elements of their evolution. Patients treated on an outpatient basis received a phone call to note possible post-consultation and treatment events, some of them were reviewed during the last consultation attesting to their recovery.

### Ethical consideration

Authorization for the study was obtained from the competent authorities of the CHUO, as well as the head of the orthopedic-traumatology department of the said hospital. Provisions have been made for the implementation of the study to guarantee confidentiality. The consent of patients or their families in case of incapacity given. Patient anonymity was respected.

### Statistical analyzes

All the data collected was entered and processed with Microsoft Excel version 2019 software. Categorical variables were expressed as percentages the interpretation of the data was made by comparing percentages.

## Results

### Sociodemographic data

We collected a total of 12 patients, namely 8 male participants and 4 female participants, with an M/F ratio: 2.0 in favor of the male sex. Patients in the 6 to 10 age group were the most represented, at 58.3% (n=7). The average age was 8.50 years with extremes between 2 and 15 years included.

### Additional reports

The main reasons for consultation were pain and swelling with 25% (n=3) each, followed by functional impotence, skin fistula and lameness with 16.7% (n=2) each. The patients who consulted after 1 month were the majority in the series with 41.7% (n=5). Fistulized multifocal osteomyelitis was predominant in the series with 66.7% (n=8) of cases (figure 1)



**Fig 1:** 12-year-old patient with fistulized osteomyelitis on the medial aspect of the right distal femur

Trauma was the most frequent etiology with 41.7% (n=5) followed by hemoglobinopathies with 25% (n=3). Out of 15 active outbreaks identified, the femur was the most affected bone segment with 40.0% (n=6). The metaphysis was the preferred choice seat with 41.7% (n=7/17), it was associated with the diaphysis in 29.4% (n=5/17) (Table 1):

**Table 1:** Distribution of patients according to the site of the lesion on the bone

Variable		Effective	%
Site of the lesion	Métaphysis	7	41,2
	Diaphysis	3	17,6
	Epiphysis	2	11,8
	Multifocal	5	29,4

The patients with a fair general condition were predominant in the series with 58.3% (n=7/12). Three patients had sickle cell disease in the series with the homozygous SS form in 25% (n=3). All patients received specimens for bacteriological examinations with antibiogram, the bacteriological characteristics of the series are summarized in Table 2 below:

**Table 2:** Distribution of patients according to the incriminated germs

Variable		Effective	%
Incriminated germs	Staphylococcus aureus	4	33,3
	Enterobacter cloacae	2	16,7
	Gram Bacillus negative	2	16,7
	Streptococcus	2	16,7
	Sterile culture	2	16,7

Staphylococcus aureus was the most incriminated germ in the series with 33.3% (n=4), 16.7% (n=2) of cases of sterile culture were noted. Concerning the radiological signs, the bone sequestrs (33.3%) followed by the periosteal appositions (25%) constituted the most observed radiological signs in the series (table 3):

**Table 3:** Distribution of patients according to the radiological signs observed

Variable		Effective	%
Radiological signs	Bone sequestrs	4	33,3
	Periosteal apposition	3	25
	Brodie's abscess	2	16,7
	Geodes	2	16,7
	osteolysis	1	8,33

The bone sequestrs was the most radiological signs observed in the series with 33,3% (n=4).

All our patients received antibiotic therapy; the different treatments administered in the series are summarized in Table 4 below:

**Table 4:** Distribution of patients according to the type of treatment administered

Variable		Effective	%
Treatments received	Antibiotic therapy	9	75
	Antibiotic therapy + Splint immobilization	3	25
	Sequestrectomy +curettage + drainage	4	33,3
	Incision + drainage Subperiosteal abscess	3	25

In this study, we noted some complications which are summarized in Table 5 below:

**Table 5:** Distribution of patients according to the complications observed

Variable		Effective	%
Complications observed	Persistence of infection	2	40
	Pathological fracture	1	20
	Skeletal deformity	1	20
	Near joint stiffness	1	20

The most represented complication was the persistence of the infection with 40% (n=2). The evolution was favorable in 83.3% (n=10), in the unfavorable cases (16.7%), we didn't record any deaths.

**Discussion**

**Sociodemographic characteristics**

Our study has some limitations due to its retrospective and monocentric characteristics which led to the reduction of the sample size. Osteomyelitis is a hematogenous infection of growing bone; it can occur at any age and in both sexes [6]. In this study devoted to pediatric age, the mean age was 8.5 years with extremes of 2 and 15 years included; the age group of 6 to 10 years was predominant in the series with 58.3% (n=7) and the disease affected more boys than girls. These results are comparable to those of Dellah *et al.* [7] who reported in their series of 47 children, a mean age of 7.05±2.73 years with a male predominance; this could be explained by the fact that boys are by nature more turbulent than girls and therefore more victims of the traumas which constituted the most frequent etiology in this series with 41.7% (n=5).

**Clinical characteristics**

The chronic forms of osteomyelitis (> 1 month) were most frequent in the series with 41.7% (n=5) and the fistulized multifocal form was predominant with 66.7% (n=8). These

results are comparable to those in the literature [8, 9] and could be explained by the delay in consultation; parents preferring to treat their children in less equipped peripheral care units or at bonesetters. The great financial difficulties of the parents would partly explain this therapeutic wandering. In this series, we noted three cases of sickle cell disease (25%), osteomyelitis in sickle cell patients is well known in areas with a high incidence of hemoglobinopathy [10]; it was reported by Souna *et al.* who found 62.26% [11] of sickle cell disease cases in their series. The Sickle cell disease is very common in Africa and particularly in Gabon with a high frequency of 25% [12]. Poor sanitary conditions seem to predispose to acute infectious complications which are more frequent than in other continents [13]. Out of 15 active focus identified, the femur was most affected as bone segment with 40.0% (n=6), followed by the tibia and the humerus with 26.6% (n=4) and 20% (n=3) respectively with the metaphysis as the preferred seat in 41.2% (n=7/17) of cases. These data are consistent with the literature which reports that long bones with fertile metaphysis are the most affected according to a well-known rule: "osteomyelitis is near the knee and far from the elbow" [14]. The Patients with a fair general condition were predominant in the series with 58.3% (n=7/12).

### Biological characteristics

Some children presented episodes of fever and a biological inflammatory syndrome marked by hyperleukocytosis in 41.7% (n=5), iron deficiency anemia in 25% (n=3), an increase in c-reactive protein in 58.3% (n=7/12) and an acceleration of the sedimentation rate in 50% (n=6). These same observations have been made by several authors [15, 16] and could be partly explained by malnutrition and the precarious living conditions in which these Gabonese children live.

*Staphylococcus aureus* was the most encountered germ in the series with 33.3% (n=4). This is consistent with data from the literature which have shown that in the vast majority of cases, osteomyelitis is attributable to *Staphylococcus aureus* [17, 18]. *Salmonella* was responsible for the disease in 25% (n=3) of sickle cell disease cases in our series; it is common in the literature [10-12], it would be a hematogenous graft on the necrotic areas left by vaso-occlusive crises, favored by the immunosuppression that accompanies the hemoglobinopathy. The isolation of the germ in the series with an antibiogram guided the choice of antibiotic therapy.

### Diagnosis, treatment and complications

Morphologically, only standard radiography was performed. Sequesters were the most common radiological signs with 33.3% (n=4), followed by periosteal apposition with 25% (n=3) of cases. These same signs have been reported by several authors of the series [21, 22]. This could be explained by the late nature of the consultation or the diagnosis of osteomyelitis was made in an advanced stage already presenting characteristic radiological signs. A probabilistic treatment was used in the sterile cultures which represented 16.7% (n=2) of the cases, these sterile cultures could be explained by self-medication at home before the consultation. This way of proceeding has been mentioned in the literature [19, 20]. All patients received parenteral antibiotic therapy; the antibiotics used in first intention were those which had a good bone diffusion (ceftriaxone and

fluoroquinolones), then, the antibiotic therapy was readjusted according to the results of the antibiogram. In this series, only 58.3% (n=7) benefited from surgical treatment; the surgery consisted of bone curettage associated with sequestrectomy, trepanation and drainage. Other patients underwent incision drainage of the subperiosteal abscess or Brodie's abscess. There were 41.7% (n=5) of complications cases. These complications were essentially persistence of infection in 40% (n=2/5) of cases, pathological fracture, skeletal deformity, stiffness of the knee joint respectively in 20% (n=1) of each case. After treatments adapted on a case-by-case basis, the results obtained were favorable in 75% (n=9/12), these data are consistent with data from the literature [23, 24] and could be explained by solidarity efforts between family members who often contribute when a relative is hospitalized or undergoes surgery. This rate of favorable results may be revised upwards if the Gabonese state decides to provide full coverage of economically weak people who currently benefit from partial coverage of health insurance.

### Conclusion

With less than two cases per month, osteomyelitis is rare in the department but remains a serious condition in children when it appears. It is the prerogative of older children from 6 to 10 years old with predisposing factors which are trauma and haemoglobinopathies. The predominant germ remains *Staphylococcus aureus*. Osteomyelitis has a very variable clinical picture, the diagnosis is based on clinical, biological and radiological data. The pelvic limb is the most affected, particularly the femur and the tibia, with the fertile metaphysis, which are far from the elbow and near from the knee, as the preferred site. Treated correctly and very early, osteomyelitis heals without sequelae, but the slightest delay or inappropriate treatment can lead to complications that are of several kinds and that affect the functional future of the child.

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