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Etiological Factors of Infective Endocarditis in Children Aged 1 Month to 15 Years Hospitalised in the Paediatric Department of CHU Gabriel Touré of Bamako (Mali)

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Abstract

Introduction: In emerging countries where studies are rarer, the epidemiological profile of infective endocarditis resembles that of developed countries at the beginning of the antibiotic era. There is little data available in Mali on this subject, motivating this study, the aim of which was to study the etiological factors of infective endocarditis in children aged between 1 month and 15 years hospitalised in the paediatric department of the CHU Gabriel Touré. **Patients and Methods:** We conducted a cross-sectional and descriptive study, which took place from August 2018 to August 2019 (13 months), in children aged between 1 month and 15 years hospitalised in the paediatric department of the Gabriel Touré University Hospital with an ultrasound-confirmed cardiac disease and a temperature above 38°C. **Results:** The hospitalization rate was 0.4%. The average age was 11 months, the sex ratio was 1.35. Respiratory distress (63.6%) and fever (30.3%) were the most common reasons for referral. Congenital heart disease (87.9%) and dyspnoea on feeding (24.2%) were the most common medical histories. IVC was the most frequent congenital heart disease (36.4%). The mean temperature was 39.1°C. Blood cultures were taken in 24 patients (72.7%) and were positive in 27.3%. *Staphylococcus aureus* was found in 55.6% of cases. Trans-thoracic ultrasound found vegetations in 03 cases. According to the modified DUKE criteria, the diagnosis of endocarditis was retained in 27.30%. The evolution was marked by a high case fatality rate (45.45%). **Conclusion:** Endocarditis is an uncommon disease in children with a pulmonary portal of entry and *Staphy-*

lococcus aureus as the main germ. Its mortality remains high.

1. Introduction

Infective endocarditis (IE) is an inflammation of the endocardium of microbial origin. It may involve the cardiac valvular endothelium, prosthetic valves and any other intra-cardiac prosthetic material [1]. It is rare in children with 0.78 per 1000 admissions per year [2], but its frequency is not decreasing despite the introduction of new antibiotics [3]. The germs responsible for infective endocarditis have not changed over time. Streptococci and staphylococci are the most common causative organisms [3]. Infective endocarditis in children has been on the increase for several decades, with a prevalence in healthy hearts ranging from 0.42 to 1.35 per 1000 admissions to paediatric wards [4]. In emerging countries, where studies are scarcer, the epidemiological profile resembles that of developed countries at the beginning of the antibiotic era [5]. Infective endocarditis is considered rare in the African literature [6] [7].

Interest in this condition has increased with the considerable development of echocardiographic exploration techniques that allow the detection of increasingly discrete lesions, but also with the contribution of immunological and molecular techniques that have begun to unravel the mystery of microbial infective endocarditis [1].

In Africa south of the Sahara, very few studies have focused on endocarditis. The objectives of this study were: to determine the socio-demographic profile, the hospital frequency, and the short-term outcome of infective endocarditis in children hospitalised in the paediatric department of the Gabriel Touré University Hospital.

2. Patients and Methods

We conducted a cross-sectional and descriptive study, which took place from August 2018 to August 2019 (thirteen months), in children aged between 1 month and 15 years hospitalised in the paediatric department of the CHU Gabriel Touré. The Center Hospitalier Universitaire Gabriel TOURE is a third reference hospital, located in commune III of the District of Bamako, capital of the Republic of Mali. Located in the city center it is easily accessible for the majority of the population. It has four (04) main missions: It comprises nine (9) departments including the department of pediatrics. All patients aged between 1 month and 15 years hospitalised and having a confirmed heart disease on ultrasound and a temperature higher than 38˚C were included, regardless of the origin or the treatment received, with the parents/guardians having given their

consent. Blood cultures and cardiac ultrasound were systematically requested in all included patients. On admission, we took a temperature reading, questioned the parents, and then carried out a thorough clinical examination of all the patients included in the study in search of an infectious focus. A form was developed for data collection. The variables studied were epidemiological (sex, ethnicity, residence, age, period of admission, history, death, etc.), clinical (questioning, ENT, pulmonary and meningeal signs, etc.) and paraclinical (echo-cardiography, frontal chest X-ray, blood culture, CBC) characteristics.

The data were collected in Excel 2016, then inserted into an Epi Info version 7 database for analysis. Quantitative variables were presented as means and categorical variables as % proportions. The Chi-square test was used for statistical analysis with a significance level of 0.05. The confidentiality of the data was respected.

3. Results

Limit of the study: Mali does not have an adequate technical platform for the surgical management of endocarditis and is responsible for the high mortality of this pathology.

3.1. Epidemiological Characteristics

During the study period, we included 33 suspected cases of endocarditis out of 8462 hospitalisations in the paediatric department of the CHU Gabriel Touré, *i.e.* a hospital frequency of 0.4%. The 1 - 24 month age group was the most represented with 84.85% (Table 1) and the mean age was 11 months with extremes of 2 and 72 months (Table 1).

The sex ratio was 1.35 and the majority of patients (90%) resided in Bamako (Table 1).

Table 1. Socio-demographic characteristics of children seen for acute fever.

Features	Numbers (n = 33)	%
Age range (months)		
1 - 24	28	84.8
25 - 36	02	06.1
37 - 72	03	09.1
Sex		
Male	19	58
Feminine	14	
Sex ratio	1.35	42
Residence		
Bamako	30	90
Outside Bamako	03	10

3.2. Clinical and Paraclinical Characteristics

On admission the majority of patients had a temperature between 38.5˚C and 39˚C (63.8%), and the mean temperature was 39.1˚C with extremes of 38.5˚C and 40˚C. Respiratory distress with 21 cases (63.6%) and fever with 10 cases (30.3%) were the most frequent referral reasons (Table 2). Personal medical history was dominated by congenital heart disease (87.9%) and dyspnoea during feedings (24.2%). More than a third of our sample (36.4%) had severe acute malnutrition. The physical examination revealed a murmur in all cases, respiratory distress in 93.9% and crepitus in 57.6%. The pulmonary portal of entry was the most common (57.6%), and was oral in 9.1% of patients (Table 2, Table 3).

Interventricular communication (IVC) was the most frequent congenital heart disease (36.4%) (Table 4).

Table 2. Distribution of patients by reason for referral.

Reference ground	Number (N = 33)	(%)
Respiratory distress	**21**	**63.6**
Fever	10	30.3
Altered general condition	9	27.3
Cough	2	6.1
Rheumatic heart disease	2	6.1
Convulsion	1	3
Abdominal pain	1	3
Endocarditis	1	3
Undernutrition	1	3

Table 3. Distribution of patients by examination at entry.

Physical examination		Number (N: 33)	(%)
Skin examination	Digital Hippocratism	**6**	**18.2**
	Cyanosis	3	9.1
	Purpura	5	15.2
Abdominal examination	Splenomegaly	**11**	**33.3**
	Hepatomegaly	5	15.6
ENT examination	Pharyngitis	**7**	**21.2**
	Dental Carrie	3	9.1
	Angina	5	15.2
Examination Cardiovascular	Breath	**33**	**100**
	Hepato-jugular reflux	6	18.2
Lung examination	Respiratory distress	**31**	**93.9**
	Sizzling	19	57.6
	Sibilants	3	9.1

Table 4. Distribution of patients according to echocardiogram result.

Echo-core result	Number	(%)
Not achieved	5	15.2
Interventricular communication	**9**	**27.3**
Atrioventricular communication	4	12.2
Interauricular communication + Expansion of cavities	3	9
Complex Congenital Heart Disease	3	9
Transposition of the great vessels	2	6.1
Mitral insuffisance rheumatic + vegetation	2	6.1
Mitral insuffisance rheumatic + Pericardial detachment	2	6.1
Interventricular communication with vegetation	1	3
Tetralogy of Fallot	1	3
Common artery	1	3
Total	33	100

More than three quarters of the sample had anaemia (78.8%), leukocytosis was present in 63.6% of patients and C reactive protein was elevated in 72.72%. Blood cultures were taken in 24 patients (72.7%) and positive in 27.3% of cases. The most frequently found germs were: *Staphylococcus aureus* (55.6%), *Streptococcus pneumoniae* (33.3%) and *Klebsiella pneumoniae* (11.1%) (Figure 1). The signs on the frontal chest X-ray were dominated by cardiomegaly associated with hilobasal pneumonia (15.15%) and isolated cardiomegaly (9.1%). Transthoracic ultrasound revealed vegetations in 03 cases (9.1%).

According to the modified DUKE classification, the diagnosis of endocarditis was retained in 9 patients (27.3%). The etiological treatment consisted of intravenous administration of amoxicillin/clavulanic acid in 54.54% of cases. The average duration of treatment was 14 days with an extreme range of 1 to 49 days.

3.3. Evolutionary Characteristics

The evolution was marked by the death of 15 patients (45.45%) (Figure 2).

4. Discussion

In our study we recorded a hospital incidence of 0.4%. In Africa data on endocarditis are poor. Yamego *et al.* [2] and N'Diaye MB [6] recorded a higher frequency with respectively 1.7% and 1.04%. The reasons for referral are dominated by respiratory distress and fever. Some authors confirm the predominance of respiratory distress [6]. All patients had underlying heart disease, and congenital heart disease was in the majority.

Weli M *et al.* [3] found similar results. In developed countries, most infective endocarditis in children complicates congenital heart disease [7]. Yamego *et al.* [2] recorded the presence of rheumatic heart disease. This situation is common
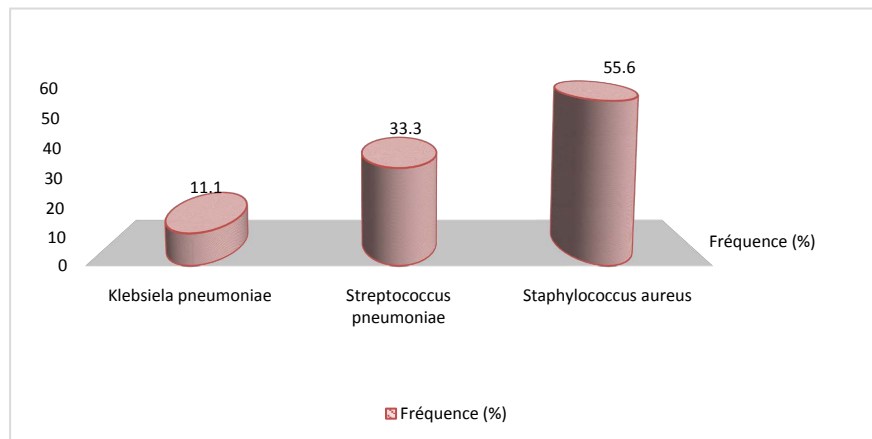
Figure 1. Distribution of patients according to the germ isolated (N: 33).
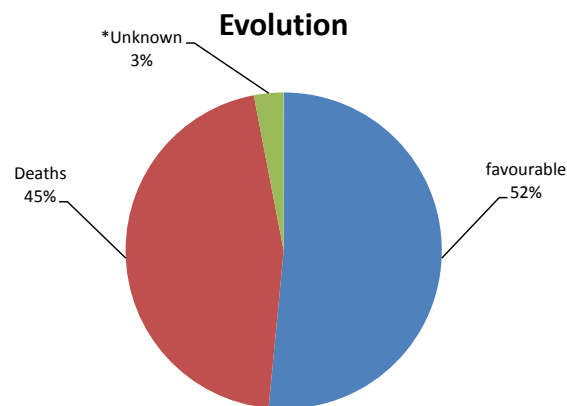

Figure 2. Distribution of hospital developments (N: 33).
*Exit against medical advice.

to developing countries where we observe a regression of rheumatic heart disease and a recrudescence of congenital heart disease secondary to an improvement in diagnostic means contrasting with the low level of the technical platform for better management by surgical or interventional procedures.

Cardiac auscultation is only suggestive when it confirms the appearance of a heart murmur or a change in the intensity of a known murmur. The presence of a murmur is a major criterion of DUKES, often considered a classic clinical sign of infective endocarditis [8]. A murmur was found in all our patients.

The portal of entry is rarely found, it was pulmonary in 19 patients (57.6%), oral in 3 patients (9.1%). Yamego *et al.* [2] and Weli *et al.* [3] reported a predominance of the oral portal of entry. Infectious entry points are increasingly suspected and identified [9]. Systematic transcardiac ultrasound performed in all patients showed vegetations in 9.1%. This is significantly lower than the results of Weli *et al.* [3] and Yamego *et al.* [2] who recorded the presence of vegetations in 97% and 94.7%.

It should be remembered that a normal cardiac ultrasound does not rule out the diagnosis of infective endocarditis, and it is advisable to repeat the examina-

tion a few days later if the diagnostic doubt persists [9]. However, in our context, it was only performed once on admission because most of the parents have a modest income. According to the literature, staphylococcus and streptococcus are the most frequent germs of bacterial infective endocarditis.

Our work has shown the same observation. *Staphylococcus aureus* was found in 55.6%, *Streptococcus pneumoniae* in 33.3%, and *Klebsiella pneumoniae* in 11.1%. Ferrieri *et al.* found that streptococcus and staphylococcus were predominant [10]. This finding is shared by Yamego *et al.* [2].

The presence of a large number of negative blood cultures has been reported by several authors [3] [6]. According to the literature, no germ is identified in 6 to 11% of infective endocarditis [11] [12]. Indeed, the majority of our patients had received antibiotics before admission to hospital, as they were referred by lower level health facilities. Indeed, antibiotics prescribed unexpectedly and indiscriminately can delay the diagnosis and make it difficult to identify the causative germ.

Delayed diagnosis, unfavourable nutritional status and, above all, inadequate technical facilities for appropriate treatment (lack of surgical/interventional management) could be an explanation for our high mortality.

5. Conclusion

Infective endocarditis is a relatively rare condition in our context. Mortality is high. Early detection of congenital heart disease and improvement of the technical platform will help to reduce this very high lethality.

Conflicts of Interest

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

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