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Childhood Heart Disease in Côte d'Ivoire: Retrospective Multicentric Study about 228 Cases

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Abstract

Introduction: In Côte d'Ivoire, the paediatrician has to face a diagnosis and management problem in front of pediatric heart disease, with consequent a high lethality. **Objective:** To describe the epidemiological, diagnostic, therapeutic and progressive aspects of childhood cardiopathy for the improvement of prognosis and professional practice. **Materials and methods:** This was a multicenter retrospective and descriptive study conducted from January 2011 to March 2016 in two main hospitals universities, one located in Abidjan and the other in Bouaké. It concerned children aged 0 to 15 admitted for cardiac disease diagnosed on clinical and/or echocardiographic arguments. The variables studied were the epidemiological, diagnostic, therapeutic and evolutionary aspects. **Results:** A total of 49.760 admissions including 228 infantile heart disease cases (congenital 113, acquired 51, indeterminate 64) are overall prevalence of 4.6‰. They involved 106 boys and 122 girls. In 74.6% of cases, the age was between 0 and 2 years. Respiratory distress 73.7% was the main reason for consultation. The main congenital heart diseases (CHD) are ventricular septal defect (VSD) (31%), atrial septal defect (ASD) (20.4%), atrioventricular canal (AVSD) (12.4%) and tetralogy of Fallot (TOF) (11.5%). As for acquired forms (AHD), rheumatic mitral insufficiency (41.2%) and tuberculous pericarditis (15.7%) were the two main causes. Treatment progress is marked by stabilization (71.1%) and death (14%). Death was significantly associated with low socioeconomic status ($p = 0.01$) and with complication ($p < 0.001$). **Conclusion:** Infantile heart diseases are relatively less frequent and

serious in Côte d'Ivoire. To improve the prognosis, close collaboration between the pediatrician and the cardiologist is required for early diagnosis and management.

Keywords

Child, Congenital Heart Disease, Acquired Heart Disease, Ivory Coast

1. Introduction

Cardiopathy refers to the pathological involvement of one or more cardiac tunics. It is either congenital or acquired after birth as the result of an identifiable infectious or non-infectious cause. The congenital type is classified into four big groups: left right shunt (non-cyanogenic), right-left shunt (cyanogen), ventricular ejection obstruction and complex heart disease [1]. In children, the incidence of heart disease varies from one region to another and depends on the available diagnostic resources. In developed countries where the technical plateau is performing, the overall incidence of childhood heart disease varies between 7 and 8 per thousand with a predominance of congenital forms [2], 71% of cases [3]. In sub-Saharan Africa, studies of paediatric heart disease seem rare and fragmentary. Tougouma *et al.* [3] in Burkina Faso and Ngouala *et al.* [4] in Senegal reported hospital prevalence in children of 4.3‰ and 6‰, respectively, with predominantly congenital forms. In Côte d'Ivoire, heart disease has been the subject of very few studies in children [5] [6] [7]. All these studies were conducted in Abidjan so that the national prevalence of childhood heart disease is unknown. And yet cases of heart disease are diagnosed in various paediatric departments, especially those of the university reference hospitals of Abidjan in the south and Bouaké in Central Côte d'Ivoire. The care of these children poses many problems because of the lack of resources with consequent high lethality. The aim of this multicenter work, carried out in the paediatric department of the University Hospital of Treichville Abidjan and the paediatric cardiovascular departments of the University Hospital of Bouaké, was to describe the main epidemiological, diagnostic, therapeutic and progressive aspects of heart disease of the child for the improvement of prognosis and professional practice.

2. Patients and Methods

2.1. Patients

This was a retrospective and descriptive study conducted from January 2011 to March 2016 in the paediatric ward of the Treichville University Hospital Center in Abidjan and at the paediatric ward and cardiovascular ward of the University Hospital Center of Bouaké. The paediatric department of the University Hospital of Treichville is located in Abidjan, the economic capital, in the south of the Ivory Coast and records every year an average of 9476 patients. As for the paedi-

atric and cardiovascular & thoracic diseases departments of the Bouaké University Hospital, they are located outside Abidjan, at 347 km, in the center of Côte d'Ivoire, totaling an average of 17,000 children per year. The study population consists of all children aged 0 to 15 years admitted to these three services. Included were all cases of cardiopathies diagnosed on clinical and/or echocardiographic arguments. The arguments of clinical orientation of the heart diseases were the heart murmurs, the cyanosis, the dyspnea of effort, the squatting, the oedemas of the lower extremities, the digital hepatomegaly and hypocratism. At the echocardiographic level, they were the anatomical or functional anomalies of the septum, the vessels, the valves and the pericardium. The sample of the study was made up as admissions of heart diseases in the caused ward.

Not all children with signs of cardiovascular involvement who had normal cardiac ultrasound were enrolled in the study.

2.2. Methods

Included children, they have received cardiovascular clinical examination, cardiac exploration with electrocardiogram, chest x-ray, and Doppler echocardiography. Ultrasound scanning was performed in Abidjan with a VIVID-7 General Electrics Cardiovascular System (GE 7S probe with a frequency of 3 to 8 MHZ) and Bouaké with a Sonoscape cardiovascular ultrasound system (7 MHZ frequency probe). The completion of the other para-clinical examinations depended on the etiological orientation. The data collected were recorded in a register for outpatients and in the medical record for those hospitalized. Both sources were used to populate the data collection sheet. The variables studied included prevalence, sex, age, clinical and para-clinical signs, type of heart disease, treatment and evolution. In the present study, heart disease is classified as congenital if the symptomatology has changed since birth and could be classified into one of four groups: left-right shunt, right-left shunt, ventricular ejection obstruction, complex heart disease. Acquired cardiopathy was defined as the involvement of one or more cardiac tunics secondary to an identifiable infectious or non-infectious cause. Heart disease was considered indeterminate when there was no accuracy in the diagnosis of selected heart disease. The socio-economic level was determined from eight variables rated and presented in **Table 1**. The socio-economic level was considered low if the index is between 1 and 4, modest between 5 and 7, high between 8 and 22.

2.3. Ethical Considerations

The study was carried out after the solicitation and obtaining the authorization of the Medical and Scientific Direction of each health facility, besides the confidentiality and the anonymity of the patients were guaranteed.

2.4. Statistics

The collected data were processed and analyzed on the EPI info 7 software. The

Table 1. Cotation of the variables to the composite index of the socio-economic level.

Variables	Cotation		
Electricity	• Yes: 3	• No: 0	
Water	• Yes: 3	• No: 0	
Food reserve	• Yes: 3	• No: 0	
Habitat type	• Modern: 3	• Precarious: 1 • Immeuble: 3	
Number of rooms in the habitat	• ≥3:2	• <3: 1	
Daily family budget ($ US)	• >6$:3	• 4 - 5$: 2	• <3$: 1
Parents' monthly income	• >180$:3	• 90 - 180$: 2	• <90$: 1
Toilet	• Modern: 2	• Traditional: 1	• Absent: 0

analysis was descriptive and consisted of calculating the numbers and determining averages and proportions. Quantitative variables were analyzed as an average. The qualitative variables were expressed as a proportion. The risk factors for death were investigated using the odds ratio with confidence interval at the significance level ≤ 5%.

3. Results

3.1. Epidemiological Aspects

Out of the 49,760 admissions during the study period, 228 infantile heart diseases (congenital 113 cases, acquired 51 cases, indeterminate 64 cases) were recorded either an overall prevalence of 4.6‰. The prevalence was 2.3‰ for congenital heart disease, 1.0‰ for acquired heart disease and 1.3‰ for indeterminate forms. Cardiopathies involved 106 boys and 122 girls, a sex ratio of 0.86%. The age of these children was between 0 and 60 months in 146 cases (64%) and between 61 and 120 months in 82 cases (36%). In the 0 to 60 month age group, under 24 months accounted for 74.6% (109/146) or 47.8% of all heart disease. Of the 113 congenital heart disease (CHD), 109 (96.4%) were discovered before the age of two. Of the 51 acquired heart diseases (AHD), 42 (82.4%) were diagnosed between 6 and 15 years of age. Indeterminate heart disease had two peaks of discovery: before 2 years (31/64) (48.4%), between 6 and 12 years (20/64) (31.3%). The median age of the population was 28 months (range 1 to 180 months). This median age was 5.5 months for congenital heart disease and 9.5 years for acquired heart disease. The socioeconomic level of mothers was low (68%), modest (24%) and high (8%). The number of antenatal visits, specified in 39 cases, was greater than or equal to 4 in 68% of cases. The antenatal serologic assessment performed in 6 cases showed a positive rubella serology in 33% of cases and a positive toxoplasmic serology in 1% of cases. Retroviral serology in 69.7% of the mothers was negative in all cases. When antenatal maternal pathology was reported, urinary tract infection accounted for 17% of cases (38

cases) and malaria 24 cases (10.5%). The APGAR score (Index of early neonatal condition) was specified in 118 cases. He was in the first minute (M1) and the 5th minute (M5) normal respectively in 71% and 89% of cases. Cerebral pain at M1 of life was observed in 6 cases of congenital heart disease (CHD) and in 2 cases of indeterminate (IHD). The three cases of life-threatening cerebral palsy involved children with congenital heart disease. When birth weight was specified in the medical file (121 cases); it was normal in 74% of cases. Weight less than 2500 g was observed in 32 cases of congenital

3.2. Diagnostic Aspects

The main circumstances of discovery were respiratory distress (73.7%), breath and abnormal heart sounds (70.2%). The main clinical presentation is left heart failure (52.2%) (Table 2). The electrocardiogram was performed in 67% of cases and revealed left ventricular hypertrophy in 53.7%, complete right limb block in 26.7% and supraventricular tachycardia in 2.7% of cases. Chest X-ray was performed in 71% of patients and reported cardiomegaly in 94% of cases.

At the end of the investigations, the etiology of cardiac disease was specified in 164 cases (75.5%) and indeterminate in 64 cases (24.5%). The cause identified was congenital in 69% and acquired in 31%. The main congenital heart diseases (CHD) are ventricular septal defect (VSD) (31%), atrial septal defect (ASD) (20.4%), atrioventricular canal (AVSD) (12.4%) and tetralogy of Fallot (TOF) (11.5%). As for acquired forms (AHD), rheumatic mitral insufficiency (41.2%) and tuberculous pericarditis (15.7%) were the two main causes. The list of infant heart diseases identified is shown in Table 3. The main associated pathologies were broncho-pneumopathy (61%), anemia (55.3%) and severe acute malnutrition (50.4%) (Table 4).

Table 2. discovery circumstances and clinical pictures of 228 infantile heart diseases in Ivory Coast.

discovery circumstances	Occurrence rate	Percentage
Respiratory distress	168/228	73.7
Breath and abnormal heart sounds	160/228	70.2
Growth retardation	81/228	35.5
Cyanosis	67/228	29.4
Hyperthermia	56/228	24.6
Thoracic deformity	25/228	11.0
Squatting	8/228	3.5
Clinical tables		
Left heart failure	119/228	52.2
Right heart failure	59/228	25.9
General cardiac insufficiency	50/228	21.9

Table 3. Distribution of 164 infantile heart diseases with a specific etiology.

Heart disease	Effectifs	Percentage
Congenital heart disease (CHD) (N = 113)		
Left-right shunt heart disease	**82**	**72.6**
ventricular septal defect (VSD)	35	31
atrial septal defect (ASD)	23	20.4
Atrio-ventricular septal defect (AVSD)	14	12.4
Persistence of the arterial duct	10	8.8
Cyanogenic heart disease	**22**	**19.5**
Tetralogy of Fallot (TOF)	13	11.5
Common arterial trunk	4	3.5
Transposition of the big ships	2	1.8
Ebstein's disease	2	1.8
Total pulmonary venous return abnormal	1	0.9
Bariatric disorders	**7**	**6.2**
Pulmonary stenosis	3	2.6
Myxoma of the left atrium	2	1.8
Tri-atrial heart	1	0.9
Congenital mitral stenosis	1	0.9
Complex heart disease	**2**	**1.8**
Single ventricle	1	0.9
Right ventricle with double exit	1	0.9
Acquired heart disease (AHD) (N = 51)		
Mitral insufficiency after acute rheumatic fever	21	41.2
Tuberculous pericarditis	8	15.7
Cardiomyopathy dilated	5	9.8
Other valvulopathies	5	9.8
Secondary hypertension	4	7.8
Rheumatic pericarditis *	3	5.9
Purulent pericarditis	2	3.9
Rhythm disorders	2	3.9
Hypertrophic cardiomyopathy	1	1.9
Total	**228**	**100**

Table 4. Pathologies occurrence's Frequency associated with infantile heart disease and clinical sites.

Associated pathologies and clinical results	n/N	Percentage
Associated pathologies		
Broncho-pneumopathy	139/228	61.0
Anemia	126/228	55.3
Severe acute malnutrition	115/228	50.4
Malaria	23/228	10.1
Gastroenteritis	5/228	2.2
Brain abscess	2/228	0.9
Meningitis	1/228	0.4
Clinical results		
HIV/AIDS Infection*	9/228	3.9
Trisomy	8/228	3.5
Renal insufficiency	4/228	1.8
Sickle cell disease	3/228	1.3

3.3. Therapeutic and Evolutionary Aspects

The most treatment prescribed were furosemide (86%), digitalis (65.8%), inhibitor of the conversion enzyme (62.3), non-specifique antibiotic (61.8%), antianemic (55.3%), hygiene and dietery measures (55.3%) (Table 5). The overall evolution was marked by the stabilization in 162 cases (71%), the complication in 26 cases (11%), the death in 32 cases (14%). The main complications were fixed pulmonary arterial hypertension (9/26), infectious endocarditis on rheumatic heart disease (6/26), neurological disorders (6/26), tamponade (2/26), cerebral abscess (2/26) and ischemic stroke (1/26). Deaths were significantly associated with low socio-economic status and complication (Table 6). Of the 164 cases stabilized and discharged from hospital, 63 (38.4%) were lost to follow-up.

4. Discussion

This retrospective and descriptive work carried out in two reference teaching hospitals, one located in Abidjan in the South and the other in Bouaké in the Center of Côte d'Ivoire, aims to describe the main epidemiological, diagnostic, therapeutic and evolutionary aspects of infantile heart disease for the improvement of prognosis and professional practice. The study shows a global prevalence of infantile heart disease of 4.6‰. This prevalence is 2.3‰ for congenital heart disease (CHD) and 1.0‰ for acquired forms (AHD).

These cardiopathies, unrelated to sex, are found in about half of the cases before the age of 2 years and are revealed in 73% of the cases by respiratory distress. In congenital forms, the main causes are ventricular septal defect (VSD) (31%), atrial septal defect (ASD) (20.4%), atrio-ventricular septal defect canal

Table 5. Relative frequency of therapeutic technics for infantile heart disease.

Treatments	n/N	Percentage
Furosemide	196/228	86.0
Digitalis	150/228	65.8
Inhibitor of the conversion enzyme	142/228	62.3
Non-specific antibiotics (Betalactamine, aminoglycoside)	141/228	61.8
Antianemic (Iron)	126/228	55.3
Hygiene and dietary measures	126/228	55.3
Blood transfusion (Globular capsule)	35/228	15.4
corticosteroids	19/228	8.3
Antagonist of the renin angiotensin system	8/228	3.5
TB	6/228	2.6

Table 6. Risk factors associated to death.

Parameters	Alive	Dead	OR*	CI**	p
Sex					
Male	89	17	0.73	0.33 - 1.65	0.53
Female	107	15			
Age					
≤5 ans	125	21	0.92	0.39 - 2.15	0.99
>5 ans	71	11			
Socio-economic level					
Modest & High	56	17	0.35	0.15 - 0.80	0.01***
Low	140	15			
Etiologies of heat disease					
Determined	143	21	1.41	0.59 - 3.33	0.51
Unknown	53	11			
Associated pathologies					
Yes	116	23	0.57	0.23 - 1.37	0.24
No	80	9			
Complications					
Yes	13	13	0.10	0.04 - 0.27	<0.001***
No	173	19			

OR*: odd ratio, IC**: Confidence interval, P: P-value, ***: significant at the threshold of 5%.

(AVSD) (12.4%) and tetralogy of Fallot (TOF) (11.5%). As for acquired forms, rheumatic mitral insufficiency (41.2%) and tuberculous pericarditis (15.7%) represent the two main causes. The evolution under treatment is marked by the stabilization in 71.1% and the death in 14% of the cases. Death is significantly associated with low socio-economic status of mothers. The study is retrospective and has limitation. Some patient files that were insufficiently filled were not included in the study. In addition, the 7 MHZ probe used at the Bouaké University Hospital Center is inadequate for echocardiography exploration of older chil-

dren, which could affect the accuracy of the diagnosis used. These reported facts constitute so many biases that may overestimate or underestimate the results of the study. Despite the methodological limit, the study raises the following points of discussion.

4.1. Epidemiologically

The study reports an overall prevalence of 4.6‰. This rate is in the range of 4.3‰ and 14‰ reported in the literature in sub-Saharan Africa [4] [6] [8] [9]. When considering the types of heart disease, the study reveals a prevalence of congenital heart disease (CHD) and acquired (AHD) respectively 2.3‰ and 1‰. Ngouala *et al.* [4] reported comparable rates in 2015, 3% for congenital heart disease (CHD) and 1.3% for acquired heart disease (AHD). In 2006, Noa *et al.* [10] in Cameroon also reported a prevalence of congenital heart disease (CHD) and acquired (AHD) comparable respectively of 2.78‰ and 2.36‰. The low prevalence of heart disease reported in the study can be explained by a selection bias related to the retrospective nature of the study on the one hand and the insufficient diagnostic resources on the other hand. The study reports that childhood heart diseases are mostly discovered before age 5 and are not sex-related. This finding has already been reported by other authors in sub-Saharan Africa [7] [10] [11]. In congenital forms the age of discovery is earlier before 2 years, 66% of cases, while in acquired forms the discovery is later, most often between 6 and 15 years, 82.4% of cases. In 1996, in Togo Kokou *et al.* [12] analyzing a series of 73 children with congenital heart disease reported that 79.45% of children were less than 30 months old. In Burkina Faso, Kinda *et al.* [13] showed that 84.24% of congenital heart defects were diagnosed between 0 and 30 months. In Morocco Abdellaoui *et al.* [14] reported a mean age of discovery of congenital heart disease of 2.5 years. Regarding acquired heart disease, Cissé [7] in Côte d'Ivoire and Ngouala *et al.* [4] in Senegal also reported that the child was older with an average age of 9 years. Congenital heart diseases are diagnosed much earlier because the abnormality exists at birth and is manifested early according to the severity of the lesions and the level of hemodynamic tolerance of the child [15]. This brings parents to see the hospital early [14] and [16]. In contrast, acquired and especially rheumatic heart disease is due to events occurring exclusively after birth, including infectious factors [14] [16] [17] [18]. Indeterminate heart diseases have two peaks of discovery: before 2 years (33%) and between 6 and 12 years in 38% of cases in relation with the first peak underlying congenital heart disease and for the second peak probable acquired heart diseases. The lack of echocardiographic examination of all children and the retrospective nature of the study explains the high rate of indeterminate heart disease.

4.2. At the Diagnostic Level

4.2.1. Reasons for Discovery and Clinical Signs

The main reasons for admission to the study were difficulty breathing (73.7%), heart murmurs and abnormal sounds (70.2%), stunting (35.5%), cyanosis (29.4%)

and hyperthermia (24.6%). In Abidjan, Cissé [7] in 2002 reported the main discovery circumstances were, the difficulty of breathing (86.2%), fever (74.6%), cough (65.7%) and edema of the lower limbs (26.8%). In Africa, Ngoula *et al.* [4] in Senegal reported that the four main circumstances of discovery of heart disease were dyspnea (47.5%), heart murmur (35.3%), congestive heart failure (13.4%) and cyanosis (9.7%). In Morocco, Abdellaoui *et al.* [14] and Kinda *et al.* [13] in Burkina Faso reported that heart murmur, 39% of cases, was the leading cause to discover the congenital heart disease. In the study by Kokou *et al.* [12] in Togo, the systolic murmur (46.4%), cyanosis (12.9%), the Mongoloid facies (6.4%) were the main physical signs under examination. In our series, patients had left heart failure in 52.2%, right heart failure in 25.9% and overall heart failure in 21.9%. This high frequency of heart failure is explained by the delayed diagnosis. The low rate of completion of complementary examinations in the study, ranging between 61 and 71%, reflects the inadequacy of available human and material resources. Cardiomegaly is present in 94% of cases. This rate is close to 86.7% reported by Cisse [7] in a previous study. It was also the second major sign, after the systolic murmur, in the study by Kokou *et al.* [12] in Togo. Electrocardiogram abnormalities are dominated in the study by left ventricular hypertrophy (53.3%) and incomplete right limb block (26.7%). In Cisse's work [7] in Abidjan, left ventricular hypertrophy and right delay represent respectively 18% and 3% of cases.

4.2.2. Types and Etiologies of Infantile Heart Disease

- **Congenital heart disease (CHD)**

Congenital heart diseases represent approximatively 63.3% of all childhood heart disease in the series and results in two main mechanisms involved: the left-right shunt 72.6% of cases, and the right-left shunt 19.5% of cases. These two mechanisms have also been reported in the same proportions by Kokou *et al.* [12] in Togo.

In the study, inter ventricular communication (31%) and tetralogy of Fallot (11.5%) are the two main causes of congenital infantile heart disease. M'pemba [19] in Brazzaville reported for inter ventricular communication 20.15% and tetralogy of Fallot 31.5%.

The rarity of complex or obstructed cardiopathies in the work has already been reported in the literature by other authors in particular Kokou *et al.* [12] in Togo and Ngoula *et al.* [4] in Senegal. The lack of the possibility of implementing palliative interventions in the neonatal period in most countries of sub-Saharan Africa explains this low recruitment [8] [20] [21].

- **Acquired heart diseases (AHD)**

Acquired heart disease represent around 12.2% of heart disease in the study. The post-rheumatic mitral insufficiency (MI) is the main etiology with 41.2% of cases. In the study of Cisse [7] in Abidjan rheumatic heart disease accounted for 41.6%. Elsewhere in Africa, Noa *et al.* [10] in Cameroon reported prevalence of rheumatic heart disease of 59%. Ngouala *et al.* [4] in Senegal found 25.6% rheu-

matic heart disease among the causes of acquired heart disease. Pericarditis, 25.5% of cases, is the second acquired heart disease of the study. The main etiologies of this pericarditis are tuberculosis, rheumatism and bacterial infection. Of the 8 cases of tuberculous pericarditis, 7 cases were associated with HIV/AIDS infection. The link HIV and tuberculosis was reported in 2004 in Abidjan by Adonis-Koffy *et al.* [21] followed by Anzouan-Kacou *et al.* [22] in 2013.

- **Undetermined heart disease**

The study reports nearly a quarter of indeterminate heart disease. This rate, which seems to us high, is due to several reasons. First, some medical records are incomplete and poorly informed clinically. To this must be added the insufficiency of the para-clinical investigations related to the economic accessibility of the parents and also the retrospective character of our study. N'gouala in Senegal described a third form of mixed heart disease in 1.2% in its series [4]. The existence of such a nosological entity is possible physiopathologically with the occurrence of a pathology acquired on pre-existing congenital or valvular heart disease in the context of infectious endocarditis, for example [18].

4.3. Pathologies Associated with Infantile Heart Disease

In everyday diagnosis, the main pathologies associated with childhood heart diseases are bronchopneumopathy, anemia, acute malnutrition and malaria. Cisse in Abidjan [7] reported the same pathologies with however different proportions. In the study the prevalence of infectious diseases associated with heart disease can be explained by the precarious nutritional status of children with decreased immunity favoring the occurrence of infections. The study also revealed that some congenital heart diseases could be associated with trisomy 21. We suspected 8 cases of trisomy 21 (3.5%) in the presence of cranio-facial dysmorphism. For these children suspected of trisomy, the cardiac malformation specified in three is the atrio-ventricular septal defect (AVSD). Chehab *et al.* [23] in Lebanon reported 5.5% of cases of AVSD with more than half carriers of trisomy 21.

4.4. Therapeutic and Evolutionary Aspects

Dietary measures, diuretics, iron supplementation, digitalis, blood transfusion in case of severe anemia and antibiotic therapy are the main treatments found in our series. These therapeutic measures were also used by Cisse [7] in Abidjan in 2002 in the pediatric medical service of the University Hospital of Treichville. In our study, no cardiac surgical intervention was performed because of the technical platform not adapted to this type of intervention which often requires an extracorporeal circulation device and a good post natal resuscitation. In Togo, Goeh-Akue *et al.* [24] also noted the lack of a suitable care structure for children with congenital heart disease so that their care is ensured in developed countries such as Switzerland, France and Spain. In Senegal, Ngouala *et al.* [4] reported that 15.9% of patients were operated on humanitarian missions by sponsorship of cardiac surgery. However, pericardial drainage remains a feasible surgical

technique at the University Hospital Center of Bouaké as Ayegnon *et al.* [25]. We record 32 death cases in our series, representing 14% of our total workforce. The heart disease of children in Côte d'Ivoire has a poor prognosis due to inadequate care for lack of inadequate technical platform and low income of parents. In the group of congenital heart disease this rate is 12.5%, against 17.5% in that of acquired heart disease. The death rate was higher in the indeterminate heart disease group with 11 cases of death, or 34.4% of cases. The higher rate of death in the indeterminate heart disease group makes sense as the lack of accurate diagnosis limits optimal management. In Abidjan Cisse [7] in 2002 reported a mortality rate of 7.5%. This rate is low compared to ours and can be explained by the fact that in the study of Cissé [7], children were jointly supported in paediatrics service and at the Institute of Cardiology, thus benefiting from a technical platform, materials and human resources much more adapted. Elsewhere in Africa, Ngouala *et al.* [4] in Senegal also reported a lethality of 24.4% in their series of infantile heart diseases. In the study, death is significantly associated with the low socioeconomic level of the parents and the existence of a complication. This low socio-economic status does not allow parents to honor care orders in time. This causes a delay in diagnosis and treatment leading to complications leading to the death of the child.

5. Conclusion

Infantile heart diseases are relatively infrequent and present in congenital forms and acquired with however, a predominance of congenital forms. The insufficiency of resources does not allow us to identify all the etymologies of the infantile heart diseases which contribute to aggravate the prognosis. Improvement of prognosis requires holistic management involving several factors including the cardiologist, the paediatrician, the cardiovascular surgeon and the social worker.

Contribution of the Authors

All authors contributed to the work and approved the final manuscript before submission.

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Compliance with Ethical Standards

Ethical Approval

For this type of study, formal consent is not required.

Conflicts of Interest

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

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