Scientific Research Publishing

World Journal of Cardiovascular Diseases, 2024, 14, 234-251
https://www.scirp.org/journal/wjcd
ISSN Online: 2164-5337
ISSN Print: 2164-5329

Congenital Heart Disease Referred for Surgery: Analysis and Epidemiological Description in the Cardiology Department of CHU Ignace Deen

Bah Mamadou Bassirou*, Diallo Mamadou Tahirou, Doumbouya Amadou Dioulde, Balde Elhadj Yaya, Camara Abdoulaye, Diallo Mamadou, Balde Thierno Siradio, Bah Abdoulaye, Bah Mamadou Dian, Samoura Sana, Balde Mamadou Dadhi

Cardiology Department of the Ignace Deen Hospital, Conakry, Guinea
Email: *bachirov6@gmail.com

How to cite this paper: Bassirou, B.M., Tahirou, D.M., Dioulde, D.A., Yaya, B.E., Abdoulaye, C., Mamadou, D., Siradio, B.T., Abdoulaye, B., Dian, B.M., Sana, S. and Dadhi, B.M. (2024) Congenital Heart Disease Referred for Surgery: Analysis and Epidemiological Description in the Cardiology Department of CHU Ignace Deen. *World Journal of Cardiovascular Diseases*, **14**, 234-251.
https://doi.org/10.4236/wjcd.2024.144019

Received: March 5, 2024
Accepted: April 20, 2024
Published: April 23, 2024

Abstract

Introduction: Congenital heart disease includes all cardiac and vascular malformations. It accounts for approximately one third of all congenital malformations and is a public health problem, particularly in developing countries. The aim of this study was to analyze the epidemiological, clinical and paraclinical aspects of congenital heart disease. **Methods**: This was a retrospective descriptive and analytical study based on the records of 135 patients referred for surgery and followed up in the cardiology department of the Ignace Deen University Hospital, collected in November 2022. **Results**: Hospital prevalence was 5%. The mean age was 71 months, ranging from 1 month to 19 years. The age group over 24 months was the most represented (62%). The M/F sex ratio was 1.36. Urban origin was predominant (58%). The rate of children not attending school or dropping out was high (16%). Siblings with fewer than 4 children were the most common (88%). A heart murmur was the most frequent sign (78%), followed by cyanosis (36%) and heart failure (29%). The association between heart murmurs and CHD was proven with a p-value < 0.05. The mean maternal age was 28 years, with extremes of 17 and 47 years. The most common maternal age group was 20 to 30 years (44%). The socio-economic level of the parents was average or precarious in 90% of cases. Congenital heart disease accounted for 86% of childhood heart disease, after acquired rheumatic heart disease (7%). CHD with shunt represented 95% and without shunt 5%. Cyanogenic CHD is 58% and non-cyanogenic is 42%. The main cyanogenic CHDs were T4F (40%), DORV (17%) and SVD (10%). The most frequent non-cyanogenic CHD were VSD (42%), PDA (22%) and IAC (10%). Surgical treatment was performed in 42.24% of cases (all abroad) with a favourable outcome in all cases. The main surgical sites were

in France (72%) and Switzerland (16%) through humanitarian NGOs. **Conclusion**: CHDs represent the main indication for paediatric cardiac surgery and follow-up (95%). We stress the importance of implementing a screening and management strategy for congenital heart disease.

Keywords

Congenital Heart Disease, Cardiology, Epidemiology, Surgery, Ignace Deen University Hospital

1. Introduction

Congenital heart disease (CHD) is the most common congenital malformation. They can be defined as malformations of the heart and/or vessels, present at birth, related to a developmental anomaly. They also include malformations associated with the abnormal persistence after birth of structures normally present during foetal life [1]. The total prevalence of congenital heart disease worldwide has increased over the last century, rising from 0.6 per 1000 to 9.1 per 1000 live births between 1930 and 1995. The increase in prevalence over time is due to the development of diagnostic and screening methods and improved surgical treatment techniques. The considerable progress made in the 1980s changed the epidemiology of CHD, with a transfer of mortality from paediatrics to adulthood. The incidence of CHD in Western countries is between 5.2 and 12.5 per 1000 live births. In Asia, however, studies report high prevalence of between 8.54 and 26.4 per 1000 live births [2] [3].

Two-dimensional echocardiography with pulsed Doppler and colour Doppler demonstrates very high sensitivity and specificity and represents the complementary investigation of choice in the diagnosis of congenital heart disease [4].

Congenital heart disease is the most common congenital malformation. The incidence in industrialised countries varies between 5.2‰ and 12.5‰ of live births [5].

In the United States of America, the incidence of congenital heart disease is 10.8‰ [6].

In Europe, in Spain, the incidence of heart disease is 8.96‰ [5].

In Asia, in the People's Republic of China, Qu *et al.* [7] report an incidence of congenital heart disease of 11.1‰.

In the Middle East, Palestine, the incidence of congenital heart disease is 10‰ [8].

In Africa, the Maghreb, in Tunisia, Dora *et al.* [9] report an incidence of 6.8‰.

In Morocco, congenital heart disease accounts for 7.8‰ of all children hospitalised over a 4-year period at Rabat Hospital [10].

The true prevalence of these CHDs is unknown in Guinea and sub-Saharan Africa.

However, cardiac malformations are increasingly diagnosed in Guinea thanks to the availability of Doppler echocardiography, which forms the basis of diagnosis, but their management poses a problem given the particularity of patients with this type of malformation.

These anomalies are the cause of significant mortality and morbidity.

The management of congenital heart disease in sub-Saharan Africa still poses enormous difficulties in terms of diagnosis and access to treatment, particularly surgery.

In Guinea, the management of these anomalies poses diagnostic and/or therapeutic problems in most cases.

With the involvement of humanitarian NGOs through cardiologists, CHD patients in Guinea have benefited for many years from the modernisation of postnatal diagnostic tools and improved surgical, anaesthetic and resuscitation techniques from European countries (France and Switzerland). This has contributed to an improvement in the life expectancy of patients suffering from these heart diseases.

The history and evolution of cardiology practices at the Ignace Deen University Hospital Centre have modified the activity relating to congenital heart disease. Previous studies are few and far between.

It is therefore essential to contribute to the hospital epidemiology of CHD and to the accurate stratification of the different components of Guinean cardiology.

The aim of our study was to document the profile of patients with congenital heart disease referred for surgery in order to improve the management of these patients.

2. Methods

This study focused on patients in the cardiology department of Ignace Deen University Hospital, referred for cardiac surgery.

Pediatric cardiology consultation files are archived. There is a file for each child containing the entire clinical history as well as the progress data and the telephone number of the person responsible.

A systematic clinical examination and an ultrasound are carried out during the consultation. Weight, height, blood pressure, saturation and electrocardiograms are measured by a dedicated nurse. A chest x-ray and a blood test are also carried out depending on the case. These different elements are listed in the medical file.

We carried out a descriptive, retrospective study lasting 5 years which extended from January 2018 to December 2022.

An exhaustive recruitment of all patient files meeting our selection criteria was carried out. These criteria were patients with congenital heart disease confirmed by echocardiography, seen at consultation or in hospitalization recruited during the study period at the cardiology department of Ignace Deen University Hospital and referred for surgery.

The variables studied were:

- Socio-economic data: age, sex, geographical origin or provenance, social situation, schooling.
- Diagnostic circumstances, data from the clinical and paraclinical examination, treatment and evolution.
- The main cardiological diagnosis. The classification of congenital heart defects is carried out according to the STS/EACTS codes.
- Associated cardiological diagnoses, allowing a complete description of the heart disease as well as any possible natural complications or those occurring during therapeutic treatment.
- Genetic diagnosis if it exists.
- The dates of surgical interventions, their number and the operating site.
- Data concerning the mother: age, chronic pathologies, gyneco-obstetric history, drug intake, consanguinity with the husband and incidents during the pregnancy.

Our data were collected using a pre-established survey form (Annex), patient files and consultation and hospitalization registers.

The data were entered into Microsoft Office Excel 2013. The statistical analysis was carried out with STATA version 15 software.

Categorical variables are described by counts and associated percentages.

The agreement of the ethics committee of the Ignace Deen National Hospital was obtained before the start of the study. The collection sheet did not contain any identifying data. Anonymity and confidentiality were respected during data analysis.

3. Result

116 cases of congenital heart disease were recorded. During our study period, 2340 children were seen in the cardiology department of Ignace Deen, corresponding to a hospital prevalence of 5%. None of our patients had social security coverage; 69 patients had an average income, *i.e.* 60%, 35 had a precarious social situation, *i.e.* 30%, and only twelve (12) patients, *i.e.* 10%, had a good social situation.

67 patients were male (58%) and 49 female (42%), *i.e.* a M/F sex ratio of 1.36. The mean age of the patients was 71 months, *i.e.* 5 years 11 months (~6 years), with extremes of 1 month 16 days and 19 years 1 month. No newborns were found in our study (Table 1).

Heart murmur was the most frequent physical sign (68%). Weight was decreased in 85 patients (73%) versus 31 patients (21%) with normal weight. Decreased arterial oxygen saturation: 36% versus 74 (64%) with normal spo2. Breathlessness was frequent (68%) and absent in 32% of cases (Table 2). 14 of the 116 patients (12%) had an associated congenital malformation. The most common was trisomy 21 (5%) (Table 3). 56 patients had an electrocardiogram. One (1) case of complete AVB was identified. 51 (91%) of the patients with chest

X-rays had at least one abnormality, and only 5 (9%) had normal chest X-rays (Table 4).

Table 1. Données socio démographiques.

Variables	Effectifs	Pourcentage
Age		
1 - 2 months	44	38
6 - 11 years	23	20
Sexe		
Masculin	69	58
Féminin	49	42
Situation sociale		
Bonne	12	10
Moyenne	69	60
Précaire	35	30

Table 2. Presentation of cases according to data.

Variable	Population size	Percentage
Poids		
Decreased	85	73
Normal	31	27
Saturation		
Low	42	36
Normal	74	64
Heart murmurs		
Yes	79	68
No	37	32

Table 3. Distribution of the main malformations associated with congenital heart disease.

Associated congenital malformations	Population size	Pourcentage	Total
Trisomy 21	6	5%	
Di-Georges syndrome	3	2.6%	
Syndrome de Noonan	2	1.7%	12%
FaIACl dysmorphia	2	1.7%	
Syndrome de Vakterl	1	1%	
No malformation	102	88%	88%

Table 4. Electrocardiogram and chest X-ray data.

Variable	Population size	Pourcentage
ECG		
AVB complete	1	1
Normal QRS axis	15	13
Right QRS axis	26	22
ECG Not performed	60	52
Chest X-ray		
Cardiomegaly	51	44
Without anomaly	5	4
Not available	60	52

T4F, DORV, SVD, PA/IVS and TGA were the most frequent CHDC cases (Table 5). 110 patients (95%) had congenital heart disease with a shunt, and 6 patients (5%) had heart disease without a shunt. Tetralogy of Fallot 27 cases (23.3%), VIC 20 cases (17.2%), DORV 11 cases (9.5%), PDA 11 cases (9.5%), SVD 7 cases (6%), IAC 5 cases (4.3%), PA/IVS 5 cases (4.3%) and TGA 4 cases (3.3%) were the most represented congenital heart diseases with shunt. Pulmonary valve stenosis (PS or SVP) in 3 cases (2.6%) was the most frequent congenital heart disease without shunt. Among the 49 cases of non-cyanogenic CHD, VIC (20 cases), PDA (11 cases) and IAC (5 cases) were the most frequent (Table 6).

Of the 116 patients, 66 (57%) had an immediate indication for surgery, including 2 surgical abstentions (2%), 8 patients (7%) had an indication for medical treatment and 40 patients (34%) had both indications (medical/surgical). The proposed medical treatment consisted mainly of diuretics, ACE inhibitors, beta-blockers, nitrates and oral iron supplementation (Table 7). Thirty-one children [31] required surgery. 18 children were awaiting evacuation for surgery, and 17 children were awaiting staff to confirm the surgical procedure (Table 8).

The evolution of patients who benefited from surgical treatment was favorable in all cases, with an excellent outcome apart from a few immediate and residual (distant) postoperative complications, as shown in figure 30 below. These included the case of return to intensive care with 7 days of ECMO, the case of AVB with emergency pacemaker placement, cases of mediastinitis, cases of drained pneumothorax, cases of heart failure (Table 9).

No deaths were recorded; 31 patients (27%) underwent successful surgery.

4. Discussion

The Republic of Guinea still does not have a cardiac surgery centre, and continues to transfer patients abroad when heart surgery is indicated.

Table 5. Breakdown of patients by type of congenital heart disease.

Types of congenital heart disease	Total	
	Population sizes	Pourcentage
*T4F	27	23.3
*VSD	20	17.2
*DORV	11	9.5
*PDA	11	9.5
*SVD	7	6.0
*IAC	5	4,3
*PA/IVS	5	4.3
*TGA	4	3.3
pulmonary stenosis	3	2.6
*APVR	2	1.7
Ebstein	2	1.7
*CAT	2	1.7
*AVSD	2	1.7
Laubry Pezzi	2	1.7
Difficult (complex) diagnosis	2	1.7
mitral insufficiency	1	0.9
aortic insufficiency	1	0.9
aortic narrowing	1	0.9
Multiple valve dysplasia	1	0,9
Complex balanced heart disease (DD + IVC + SP + dextrocardia).	1	0,9
Syndrome (IVC + PDA + membrane under AO)	1	0.9
Ao arch malformation	1	0.9
Total	116	100.0

*T4F: fallop tetralogy, VSD: ventriular septal defect, DORV: *Double outlet right ventricle* PDA: patent ductus arteriosus, SVD: single ventricular defect, IAC: inter atrial communication, PA/IVS: pulmonary atresia with inter ventricular septum, TGA: Transposition of the great arteries APVR: anomalous pulmonary venous return, CAT: Common arterial trunk, AVSD: atrioventricular septal defect.

Table 6. Distribution of patients according to the physiological classification of congenital heart disease.

Congenital heart disease without shunt	**Population size**	**Pourcentage**
Pulmonary stenosis	3	37.5
aortic narrowing	1	12.5

Continued

aortic insufficiency	1	12.5
mitral insufficiency	1	12.5
Aortic arch malformation	1	12.5
Multiple valve dysplasia	1	12.5
Total:	8	100

Congenital heart disease with shunt Non-cyanogenic congenital heart disease	Population size	Pourcentage
VSD	20	42
PDA	11	22
IAC	5	10
APVR Partial	2	4
Laubry Pezzi	2	4
AVSD	2	4
Multiple valve dysplasia	1	2
Syndromique (VSD + PDA)	1	2
Aortic arch malformation	1	2
Complex balanced heart disease	1	2
Total	**49**	**100**

Cyanogenic congenital heart disease	Population size	Pourcentage
T4F	27	40
DORV	11	17
SVD	7	10
PA/IVS	5	7
TGA	4	6
pulmonary stenosis	3	5
CAT	2	3
Ebstein	2	3
Difficult (complex) diagnosis	2	3
Total	**67**	**100**

*T4F: fallop tetralogy, VSD: ventriular septal defect, DORV: *Double outlet right ventricle* PDA: patent ductus arteriosus, SVD: single ventricular defect, IAC: inter atrial communication, PA/IVS: pulmonary atresia with inter ventricular septum, TGA: Transposition of the great arteries APVR: anomalous pulmonary venous return, CAT: Common arterial trunk, AVSD: atrioventricular septal defect.

Table 7. Breakdown of patients with the chosen surgical indication.

Variable	Epopulation size	Pourcentage
Surgical procedure performed	**31**	**47**
Patient awaiting travel	**18**	**27**
Patient awaiting confirmation of procedure	**17**	**26**
Total	**66**	**100**

Table 8. Data for complication.

Complication	Population size	Pourcentage
Pleural epiphysis	5	16.12
Residual ventricular septal defect	3	9.67
Pneumothorax	2	6.45
Mediastinitis,	2	6.45
Complete atrioventricular block,	1	3.25
ECMO for 7 days,	1	3.25
Cardiac failure	1	3.25

Table 9. Distribution of European surgical sites (France, Switzerland).

European surgical site	Population size	%
Paris	10	32
Nantes	3	11
Marseille	3	11
Toulouse	2	6
Bordeaux	2	6
Lyon	1	3
Strasbourg	1	3
Switzerland	5	16
Site not specified	4	12
Total	31	100

In interpreting our results, it is important to bear in mind the absence of antenatal diagnosis, the short duration of the study and the small sample size. A short observation period may be some inaccuracy in the prevalence estimate [11]. In addition, some congenital heart diseases, such as aortic bicuspidism, are not usually counted because they are usually diagnosed in adulthood [12] [13].

In our series, congenital heart disease with shunts was the most common, accounting for 95%. Congenital heart disease without shunts accounted for only 5%. Among CHD with shunts, cyanogenic congenital heart disease was the most

common (58%). In contrast, non-cyanogenic congenital heart disease accounted for only 42%.

Our results are contrary to those reported by Martinez *et al.* [5] in South Korea (62.5% versus 13%), Almawazini *et al.* [14] in Saudi Arabia (88.5% versus 11.5%), Sycho *et al.* [15] in Pulmonary stenosisain (81.4% versus 18.6%), Diani [16] in Morocco (83% versus 17%), Diakité *et al.* [17] in Mali (84.24% versus 15.76%) and A. Benbahia [18] in Morocco (82.13% versus 17.86%) of non-cyanogenic versus cyanogenic CHD.

This difference in the proportion of cyanogenic congenital heart disease between our series and the literature could be explained by their symptomatic nature (cyanosis) but also by a selection bias.

These are symptomatic patients who have been referred for cardiac surgery, with experts favouring tetralogies of Fallot, which are the most frequent and symptomatic. Also, T4Fs and IVCs are more easily detected by most of the sonographers who see children in the first line. Delayed consultation by the children's parents also leads to more symptomatic children because of their highly advanced heart disease.

The mean age of the patients was 71 months (5 years 11 months - 6 years) with extremes of 1 month 16 days and 19 years 1 month.

This distribution of patients according to age in our study population illustrates the delay in patient consultation leading to late diagnosis of congenital heart disease in our country.

Our results are comparable to those of Diop IB *et al.* at the Dakar Cardio-Paediatric Centre who, like us, reported an average age of 71 months (6 years) but with extremes that are different from 1 day of life to 16 years in their series [19]. Our series is also comparable to that of Delpey J-G [20] who found that the mean age of his study population was 7.5 years with extremes from 2 weeks to 36 years.

Our result is inferior to that of Cloarec *et al.* [21] who noted that most heart disease was diagnosed at an early age between 0 and 2 years, *i.e.* 61% in their study compared with only 38% in our series.

In all cases, there is evidence of a delay in management in the African series compared with data from the majority of other series, since surgery can be scheduled within the first 3 to 6 months and before the 1st and 2nd year in the majority of CHD [22] [23]. This may be explained by the delay in consultation and the absence of a cardiac surgery centre in Guinea and most other sub-Saharan African countries.

None of our patients had social security cover; the treatment of congenital heart disease is expensive. The cost of diagnosing and treating heart disease is far beyond the means of the largely indigent population of West Africa [24]. Extracardiac malformations, such as intra-abdominal malformations and/or those associated with genetic syndromes, are observed in 7% to 50% of patients with congenital heart disease [25].

In our study we found a rate of 12% of extracardiac congenital malformations

associated with congenital heart disease, which is in line with my data in the literature of 7% to 50%, with an average of 15% [20]. Our rate is higher than that of Diop I.B *et al.* [19] who reported (4.2%) malformative syndromes associated with congenital heart disease.

A. Benbahia in Morocco reported a 35.9% higher rate of congenital malformations Associated with CHD in his study [18]. These cardiac malformations may be isolated or form part of chromosomal aberrations or syndromes such as Trisomy 21.

In our study, the trisomy 21 rate was 5%, in line with the results of Cloarec *et al.*, Ndongo-Amougou S *et al.*, and Calzolari *et al.*, who reported repulmonary stenosisectively 3.1%, 6.7% and 7.4% of trisomy 21 cases in their series [21] [25] [26].

Di Georges syndrome, the most frequent microdeletion known in the human pulmonary stenosisecies (1/4000 births) was found in 3 children in our study, *i.e.* a rate of 2.6% [27].

We also found 2 cases of Noonan syndrome (1.7%), 2 cases of dysmorphia (1.7%) and 1 case of Vakterl syndrome (syndromic: faIACl dysmorphia + ear agenesis + polydactyly).

This rate is undoubtedly underestimated due to the absence of pulmonary stenosisecific genetic studies in Guinea (need for foreign laboratories). Prenatal screening for the majority of congenital heart defects is possible using echocardiography. Detection of these conditions antenatally allows optimisation of perinatal management, with the aim of improving the prognosis for the unborn child, as well as perinatal mortality [28] [29] [30].

In our study, no cases were diagnosed antenatally. This is explained by the lack of screening fetal echocardiography during pregnancy and above all by the absence of data concerning the mother in the records of the patients in our study.

The general clinical examination may draw attention to any associated heart disease, as is the case in the presence of a dysmorphic syndrome or chromosomal abnormality. In addition to children with a dysmorphic syndrome, premature babies and children with intrauterine growth retardation represent two categories at risk, because in them the incidence of heart disease is higher than in a normal population [31].

Birth weight is determined by maternal and foetal genotype and by environmental factors. Yerushalmy reported in "Study of Child Health and Development in California" that malformations, particularly those of the cardiovascular system, were more frequent in low-birth-weight children. Levin *et al.* found a high prevalence of congenital heart disease in low birthweight children [32].

Low birth weights have been described in children with various septal defects, Fallot teratology and coarctation of the aorta. Conversely, children with tranpulmonary stenosisosition of the great vessels generally have normal or sometimes higher birth weights [33]. A known comorbidity of congenital cardiovascular malformations is low birth weight, but the reasons for this association re-

main unclear.

In our study, the most common circumstances of discovery were heart murmurs (68%).

Our study is comparable in the order of circumstances to that of IB Diop *et al.* [19] in Senegal, who also reported a predominance of heart murmurs (96.9%) and cyanosis (87.5%), followed by digital hippocratism (82.5%), dypulmonary stenosisnoea (77.5%) and anoxic malaise (57.5%).

In the cardiology department of the Ignace Deen University Hopulmonary stenosisital in Conakry, Doppler echocardiography remains the most commonly used method for diagnosing and assessing congenital heart disease. 3D imaging is not yet available.

The introduction of 3D imaging techniques in echocardiography has made it possible to refine the diagnosis and understanding of pulmonary stenosisatial relationships, which are essential for planning surgical or interventional procedures [34]. In children with congenital heart disease, 3D echocardiography appears to be particularly interesting for assessing cardiac function, thanks to the excellent echogenicity of children, which makes it possible to obtain very good quality images. Its non-invasive, painless and portable nature means that it can be easily repeated compared with other imaging techniques. However, the main limitations are the high heart rate and the fact that children do not cooperate during the examination [34].

In our study, 3D echocardiographic cross-sectional images were not available, due to a lack of technical resources. The indications for surgery were based on clinical and echocardiographic data.

Exclusive medical treatment was proposed in 8 cases (7%).

Our results differ from those of A. Benbahia in Morocco, who reported in his study 73.2% medical treatment and 23% surgical treatment [18].

However, our results are similar to those of IB Diop *et al.* [19] at the Dakar-Fann paediatric cardio-surgery centre, who reported 95% indications for curative (surgical) treatment in their series.

Ndongo-Amougou S *et al.* [35] in Cameroon reported 41.9% of patients who received surgical treatment abroad in their series of 105 patients followed in 2 hopulmonary stenosisitals in Yaoundé.

However, our results are similar to those of IB Diop *et al.* [19] at the Dakar-Fann paediatric cardio-surgery centre, who reported 95% indications for curative (surgical) treatment in their series.

Ndongo-Amougou S *et al.* [35] in Cameroon reported 41.9% of patients who received surgical treatment abroad in their series of 105 patients followed in 2 hopulmonary stenosisitals in Yaoundé.

Medical treatment consisted mainly of diuretics, angiotensin-converting enzyme (ACE) inhibitors, beta-blockers and oral iron supplementation.

Thirty-one patients [31] underwent at least one surgical procedure. Authors such as Martinez [5] in Pulmonary stenosisain, Menta [36] in Mali, Ndongo-Amougou S *et al.* [35] in Cameroon and A. Benbahia [18] in Morocco re-

ported repulmonary stenosisectively 30.8%, 59.2%, 41.9% and 23% of patients operated on in their series.

All our patients have been operated on abroad, mainly in France, thanks to humanitarian initiatives. We have not described the surgical techniques used in the absence of operating protocols in our files. For several decades, several solutions have been proposed to solve this problem: creation of autonomous cardiac surgery centres in southern countries such as Côte d'Ivoire, Senegal and South Africa, transfer of patients to a northern country for the operation, transfer of skills from north to south with training of cardiac surgeons in southern countries, effective only in rare regions, or at the end of missions of surgical teams from the north to correpulmonary stenosis on dents in the south.

The main limitation of our study was follow-up bias. Some information was missing from certain patient files. Concerning the indication for surgery, some files were still under discussion at the end of data collection.

5. Conclusions

Cardiology is a complex speciality that is currently undergoing change. A precise description and knowledge of the patients referred for surgery and followed up in Ignace Deen cardiology has become a necessity in order to identify the problems and give ourselves the means to improve patient care. Congenital heart disease is a very important health problem in the cardiology department of the Ignace Deen national hopulmonary stenosisital.

In our country, congenital heart disease poses two main challenges: diagnosis and treatment. This study has highlighted the scale of the problem. Everything remains to be done and built upon. However, even if efforts are being made, the emphasis must be on setting up teams and infrastructures to ensure that diagnosis and comprehensive patient care are available locally to as many people as possible. Ante-natal diagnosis must be carried out to enable better care, without forgetting the genetic field to identify the causes of these malformations. The complexity and diversity of the various cardiac malformations make this a difficult task.

Conflicts of Interest

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

References

[1] Iselin, M. (1999) Congenital Heart Disease. Encyclopédie Médico-chirurgicale, Elsevier Paris, Radiodiagnostic-Coeur-Poumon, 32-015-A-12.

[2] Smitha, R., Karat, S.C., Narayanappa, D., *et al.* (2006) Prevalence of Congenital Heart Disease in Mysore. *Indian Journal of Human Genetics*, **12**, 11-16. https://doi.org/10.4103/0971-6866.25296

[3] Sangeeta, P.S., Alpa, A.S. and Minakshi, B. (2013) Prevalence, Pattern and Outcome of Congenital Heart Disease in Bhabha Atomic Research Centre Hospital, Mumbai.

The Indian Journal of Pediatrics, **80**, 286-291.
https://doi.org/10.1007/s12098-012-0910-x

[4] Arlettaz, R. and Bauersfeld, U. (2005) Recommandations concernant le screening néonatal des cardiopathies congénitales. *Pédiatrica*, **16**, 38-41.

[5] Martínez Olorón, P., Romero Ibarra, C. and Alzina de Aguilar, V. (2005) Incidence of Congenital Heart Disease in Navarra (1989-1998). *Revista Española de Cardiología* (*English Edition*), **58**, 1428-1434. https://doi.org/10.1016/S1885-5857(06)60750-0

[6] Egbe, A., Uppu, S., Stroustrup, A., Lee, S., Ho, D. and Srivastava, S. (2014) Incidences and Sociodemographics of Pulmonary Specific Congenital Heart Diseases in the United States of America—An Evaluation of Hospital Discharge Diagnoses. *Pediatric Cardiology*, **35**, 975-982. https://doi.org/10.1007/s00246-014-0884-8

[7] Qu, Y., Liu, X., Zhuang, J., Chen, G., Mai, J., *et al.* (2016) Incidence of Congenital Heart Disease: The 9-Year Experience of the Guangdong Registry of Congenital Heart Disease, China. *PLOS ONE*, **11**, e0159257.
https://doi.org/10.1371/journal.pone.0159257

[8] Zaqout, M., Aslem, E., Oweida, F., *et al.* (2013) Incidence of Congenital Heart Disease in Palestinian Children Born in the Gaza Strip, Occupied Palestinian Territory: A Cross-Sectional Study. *The Lancet*, **382**, S36.
https://doi.org/10.1016/S0140-6736(13)62608-2

[9] Abid, D., Elloumi, A., Abid, L., Mallek, S., Aloulou, H., Chabchoub, I. and Kammoun, S. (2014) Congenital Heart Disease in 37,294 Births in Tunisia: Birth Prevalence and Mortality Rate. *Cardiology in the Young*, **24**, 866-871.
https://doi.org/10.1017/S1047951113001194

[10] Naha, L. (1983) Contribution to the Study of Congenital Heart Disease. Thèse doctorat de médecine, Université Rabat, Rabat.

[11] Addor, M.C. and Lausanne. (2005) Prevalence of Congenital Heart Disease in the Canton of Vaud and in the European Network during the Period 1989-2003. *Peditrica*, **16**, Article 19.

[12] Lahlou, I. (2001) Profil épidémiologique des cardiopathies congénitales au Maroc. Thèse de médecine, Université Rabat, Rabat.

[13] Tchoumi, J.C.T., Ambassa, J.C., Chelo, D., Djimegne, F.K., Giamberti, A., Cirri, S., *et al.* (2011) Pattern and Clinical Aspects of Congenital Heart Diseases and Their Management in Cameroon. *Bulletin de la Société de Pathologie Exotique*, **104**, 25-28.
https://doi.org/10.1007/s13149-010-0091-7

[14] Abdulmajid, M.A. and Al-Ghamdi, A.S. (2011) Congenital Heart Disease in South-West Saudi Arabia. *Saudi Medical Journal*, **32**, 195-196.

[15] Cho, S.Y., Oh, J.H., Lee, J.H., Lee, J.Y., Lee, S.J., Han, J.W., Koh, D.K. and Oh, C.K. (2012) Recent Incidence of Congenital Heart Disease in Neonatal Care Unit of Secondary Medical Center: A Single Center Study. *Korean Journal of Pediatrics*, **55**, 232-237. https://doi.org/10.3345/kjp.2012.55.7.232

[16] Diani, S. (2006) Chirurgie des cardiopathies congénitales: expérience du service de chirurgies cardiovasculaire B: A propos de 230 cas. Medical Thesis, Université Rabat, Rabat.

[17] Diakité, A., Sidibé, N., Diarra, M.B., Sanogo, K., Sylla, M., Dao, A., Sidibé, T. and Kéita, M.M. (2009) Epidemiological and Clinical Apulmonary Stenosisects of Congenital Heart Disease. *Mali médical*, **24**, 67-68.

[18] Benbahia, A. (2018) Epidémiologie hopulmonary stenosisitalière des cardiopathies congénitales en Pédiatrie (à propos de 351 cas). Thèse de médecine, Marrakech.

http://wd.fmpm.uca.ma/biblio/theses/annee-htm/FT/2018/these33-18.pdf

[19] Diop, I., Bindia, I., Mahamat Ahmat, N., Ciss, G., Kaya, M., Ba, K., Sarr, N., Manga, S., Dioum, M., Tine, E., Dieye, O., Sarr, E., Seye, M. and Sy, L. (2020) Surgery of Congenital Heart Disease in Senegal: Indications and Results—Experience of the Cardio-Pediatric Center Cuomo Chu Fann of Dakar (Senegal). Cardiology Tropical, No. 160, April-May-June 2020.

[20] Guillaume, J. (2013) Congenital Cardiopathies: Analysis and Epidemiological Description of the Brest Paediatric Consultation. Medical Thesis, Université de Bretagne Occidentale, Brest.

[21] Cloarec, S., Magontier, N., Vaillant, M.C., Paillet, C. and Chantepie, A. (1999) Prevalence and Distribution of Congenital Heart Disease in Indre-et-Loire. Evaluation of Antenatal Diagnosis (1991-1994). *Archives de Pédiatrie*, **6**, 1059-1065. https://doi.org/10.1016/S0929-693X(00)86979-1

[22] Pigula, F.A., Khalil, P.N. and Mayer, J.E. (1999) Repair of Tetralogy of Fallot in Neonates and Young Infants. *Circulation*, **100**, II-157-II-161. https://doi.org/10.1161/01.CIR.100.suppl_2.II-157

[23] Lupoglazoff, J.M., Olivier, B., Magnier, S. and Casasoprana, A. (1996) Congenital Heart Disease Operated on in Childhood: Long-Term Results. *La presse médicale*, **25**, 1830-1834.

[24] Massoure, P.L., Roche, N.C., Lamblin, G., Dehan, C., Kaiser, E. and Fourcade, L. (2013) Cradiovascular Disease in Children in Djibouti: A Signle-Centre Study. *The Pan African Medical Journal*, **14**, Article 141. https://doi.org/10.11604/pamj.2013.14.141.2016

[25] Calzolari, E., Garani, G., Cocchi, G., *et al.* (2003) Congenital Heart Defects: 15 Years of Experience of the Emilia-Romagna Registry (Italy). *European Journal of Epidemiology*, **18**, 773-780. https://doi.org/10.1023/A:1025312603880

[26] Ghomari, S.M., Smahi, C. and Bendeddouche, A.C. (2010) Epidemiological Profile of Neonatal Congenital Heart Disease in Tlemcen, Algeria. *Archives de Pédiatrie*, **17**, 70. https://doi.org/10.1016/S0929-693X(10)70480-2

[27] Robert-Gnansia, E., Francannet, C., Bozio, A. and Bouvagnet, P. (2004) Epidemiology, Aetiology and Genetics of Congenital Heart Disease, *EMC-Cardiologie-Angéiologie*, **1**, 140-160. https://doi.org/10.1016/j.emcaa.2004.02.002

[28] Bonnet, D. (2009) Prenatal Diagnosis of Congenital Heart Disease. *Archives de Pédiatrie*, **16**, 625-627. https://doi.org/10.1016/S0929-693X(09)74091-6

[29] Jouannic, J.-M., Gavard, L., Fermont, L., Le Bidois, J., Parat, S., Vouhé, P.R., Dumez, Y., Sidi, D. and Bonnet, D. (2004) Sensitivity and Pulmonary Stenosisecificity of Prenatal Features of Physiological Shunts to Predict Neonatal Clinical Status in Tranpulmonary Stenosisosition of the Great Arteries. *Circulation*, **110**, 1743-1746. https://doi.org/10.1161/01.CIR.0000144141.18560.CF

[30] Robinson, J.N., Simpson, L.L. and Abuhamad, A.Z. (2003) Screening for Fetal Heart Disease with Ultrasound. *Clinical Obstetrics and Gynecology*, **46**, 890-896. https://doi.org/10.1097/00003081-200312000-00021

[31] Kuehl, K.S., Loffredo, C.A., Ferencz, C. (1999) Failure to Diagnose Congenital Heart Disease in Infancy. *American Academy of Pediatrics*, **103**, 743-747. https://doi.org/10.1542/peds.103.4.743

[32] Jacobs, E., Leung, M. and Karlberg, L. (2003) Birth Weight Distribution in Southern Chinese Infants with Symptomatic Congenital Heart Disease. *Journal of Paediatrics and Child Health*, **39**, 191-196. https://doi.org/10.1046/j.1440-1754.2003.00109.x

[33] Petrossian, R.A., Kuehl, K.S. and Loffredo, C.A. (2015) Relationship of Birth Weight with Congenital Cardiovascular Malformations in a Population-Based Study. *Cardiology in the Young*, **25**, 1086-1092. https://doi.org/10.1017/S1047951114001644

[34] Karsenty, C., Hadeed, K. and Acar, P. (2017) Congenital Heart Disease: Recent Technical Advances in Three-Dimensional Echocardiography. *La Presse Médicale*, **46**, 482-489. https://doi.org/10.1016/j.lpm.2016.11.016

[35] Ndongo-Amougou, S., *et al.* (2022) Cardiopathies congénitales (apulmonary stenosisects épidémiologiques, cliniques et thérapeutiques) à Yaoundé-cas de 02 hôpitaux universitaires. *Health Sciences and Diseases*, **23**, 52-55.

[36] Menta, I., HO, B., Dimzoré, S., Kéita, A., Thiam, C., Traoré, D., Daffe, S., Touré, M. and Diarra, M.B. (2015) A Descriptive Study of Ventricular Septal Defect (VSD) in the Mother-Child Hopulmonary Stenosisital "Le Luxembourg" in Bamako. *Mali Medical*, **30**, 34-37.

Annex

Survey form

Sheet no:

I. Identity: IP: phone number:

- Name: First name
- Age at diagnosis:

Sex:

- Geographical origin:
- School: yes No
- Socio-economic level (soIACl situation):
- Consanguinity: yes no,
- Admission diagnosis:

II. History:

1) Moderens historie: Age maternel:

Diabetes: yes no, type: treatment followed:

High blood pressure: yes no

Systemic disease: yes no

Other pathologies:

2) Pregnancy:

- Follow: yes no
- Toxic intake: yes no if yes, pulmonary stenosisecify type:

Teratogenic drugs: yes no

Irradiation: oui non

3) Family history:

- Presence of maternal and/or paternal pathologies: yes no

If yes, please pulmonary stenosisecify:

- Congenital heart disease: yes no type:
- Genetic disease: yes no type:

III. Clinic:

1) Weight: (kg), Height: (cm) hypotrophy: yes no

Poor weight gain: yes no

2) Heart rate: repulmonary stenosisiratory rate: Arterial oxygen saturation:

3) Malformative syndrome: yes no if yes, pulmonary stenosisecify type:

4) Cyanosis: yes no

5) Fatigability during feedings: yes no

6) Repeated lung infections: yes no

7) Hippocratism digital: oui non

8) Thoracic deformity: yes no

9) Heart failure: yes no

If yes, pulmonary stenosisecify clinical signs:

10) Femoral pulses felt: yes no

11) Breath: yes no seat:

12) B2 pulmonary stenosislinter: yes no

13) Presence of pulmonary rales: yes no if yes, pulmonary stenosisecify type:
14) Other auscultatory abnormalities:
15) Other abnormalities on clinical examination:

IV. Paraclinical:

1) Chest X-ray: yes no Cardiomegaly: yes no
Presence of heart shape anomalies: yes no
If yes, please pulmonary stenosisecify:
Presence of abnormal lung vascularization: yes no
If yes, please pulmonary stenosisecify:
2) Karyotype: done not done Result:
3) Echo-cœur:
Type of heart disease:
Cyanogenic CHD:
Non-cyanogenic CHD:
VSD: Size: Seat:
IAC: Size: Type:
PDA:
AVSD:
DORV:
Coarctation aortique:
PAH
Aortic stenosis:
Pulmonary stenosis:
Tetralogy of Fallot:
Single ventricle:
Tranpulmonary stenosisosition of large vessels:
Mitral atresia:
Others:

V. Treatment of heart disease:

1) Surgical: yes no
Type:
Others:
2) Medical: yes no

- Molecules:

3) Patient awaiting surgery: yes no
4) Intensive care: yes no
If yes, please pulmonary stenosisecify: Gestures performed:
Treatments administered:

VI. Evolution:

Favorable
Complications: oui non

If yes, pulmonary stenosisecify the type of complications: