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Spectrum of Paediatric Cardiac Diseases Recorded in a Private Echocardiography Centre in Makurdi, Nigeria

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Abstract

Background: Cardiac diseases contribute significantly to childhood morbidity and mortality with varying patterns across the globe.

Objective: To determine the spectrum and pattern of cardiac diseases among children in Makurdi, Nigeria.

Methods: A retrospective study of 206 children who had echocardiography over 57 months (October 2020-July 2025) was conducted.

Results: Almost three-quarters (71.8%) had abnormal findings, with 85.8% being congenital heart diseases (CHD). Atrial Septal Defect, Patent Ductus Arteriosus and Ventricular Septal Defect were the leading defects. Acquired heart diseases constituted 12.8% with rheumatic heart disease and dilated cardiomyopathy being the most prevalent.

Conclusion: Congenital heart disease remains predominant in this setting, and there is an urgent need for improved paediatric cardiac services.

Keywords: Cardiac diseases, Congenital Heart Diseases, Dilated cardiomyopathy, Rheumatic Heart Disease.

Introduction

Cardiac disease is a major cause of morbidity and mortality among children. It has varying patterns in different regions of the world. [1] Congenital heart disease (CHD) constitutes the highest percentage of cardiac diseases among children, with a global incidence of 4-12 per 1000 live births. [2] Acquired heart disease (AHD) is a heterogeneous entity with a much lower prevalence. [2 - 4] In developed countries, Kawasaki disease tops the lists of AHD. In contrast, in sub-Saharan Africa and other low-income countries, rheumatic heart disease and dilated cardiomyopathy remain the major AHD encountered among children. [3 - 5]

In high-income countries (HICs), survival for children with CHD has become the norm, with up to 85% of all children with CHD surviving into adulthood. The scenario is, however, different in Africa, with a relatively higher mortality from CHD due to poverty and limited access to appropriate care. Congenital heart disease is the seventh most common cause of childhood mortality on the continent. Yet, it receives very little priority compared to communicable diseases, with only a mean of 18 open heart surgeries per million people being performed in Africa as compared to 169 per million people worldwide. [6] In Nigeria, a

remarkable proportion of children with CHD are undiagnosed; those who get diagnosed may die without access to corrective surgical intervention. [2,7] The major reasons for this observation are inadequately trained personnel as well as limited infrastructure for specialised paediatric cardiac services in the country. [7, 8] This study is an audit of the echocardiographic records of a private paediatric echocardiography centre in Makurdi, Nigeria, over a period of 57 months to determine the spectrum and pattern of cardiac diseases seen. The private facility is the only place providing paediatric echocardiographic services in the environment.

Method

Study design

It was a single-centre, retrospective study of 206 echocardiographic examinations performed over 57 months (October 2020 to July 2025).

Study setting

A privately-owned paediatric echocardiography facility located in Makurdi, the capital of Benue State. It receives patient referrals from across the whole state for echocardiographic examinations and reviews.

Ethical consideration

The data was anonymised, and ethical clearance was obtained from the Federal University of Health Sciences, Otukpo Health Research Ethics Committee (FUHSO-HREC/02/05/2023-27/05/2025).

Study procedure

Cardiac consultation and echocardiography examinations were performed for each child by a paediatric cardiologist using the portable GE Vivid iq ultrasound machine with a 3Sc-RS probe. This includes two-dimensional, Doppler, pulse-wave, and continuous-wave imaging. All findings were documented in a register, and the diagnoses were based on ICD-10 classifications.

Data collection

The following information was retrieved from the register: age, sex, weight, indication for referral for an echocardiogram, and diagnosis. The data were extracted using the KoboToolbox. Records with incomplete data were excluded from the final analysis.

Data analysis

The data were cleaned and entered into SPSS version 25, and analysed using simple descriptive statistics; the results were presented as frequencies and percentages.

Results

General characteristics

Two hundred and eleven children underwent echocardiographic examinations during the period; five had incomplete data and were excluded from analysis. Of the 206 data analysed, the ages ranged from 1 day to 15 years, with a median of 12 months and a mean of 36.73±44.06 months. The mean weight was 10.63±9.38 kg, and the males predominated (57.8%) with a male-to-female ratio of 1.4:1. Infants were in the majority (77; 37.4%), followed by those in the age bracket of 12-59 months (45; 21.8%). There were 33 neonates (16.0%) with a median age of 0.5 months and a mean age of 0.44±0.25 months. Table I shows the demographic characteristics of the children studied.

The children were referred mainly with a presumptive diagnosis of CHD in 26.7%, heart murmur (9.2%), Down syndrome (8.7%), heart failure (7.3%), chest infection (5.8%), cyanosis (4.9%), presence of other congenital malformations (4.4%), adenotonsillar hypertrophy (2.9%), those with no indication stated on their request forms (11.2%) as well as others (18.9%).

Cardiac diseases

Fifty-eight (28.2%) children had normal cardiac anatomy, while 148 (71.8%) had abnormal echocardiographic findings.

Congenital heart disease was the most common, 127 (85.8%), while acquired heart disease accounted for 12.8%. Two (1.4%) children had persistent pulmonary hypertension of the newborn. The mean age of those with CHD was much lower than that of those with AHD, 29.94±36.91 months *vs.* 91.47±59.09 months. The CHD ranged from minor solitary defects to complex multiple defects, while the AHD were mainly single lesions.

Table I: Demographic characteristics

Variables	Frequency (n = 206)	Percentage (%)
Age (months)		
<1	33	16.0
1-11	77	37.4
12-59	45	21.8
60-120	40	19.4
>120	11	5.3
Gender		
Female	87	42.2
Male	119	57.8

Congenital Heart Diseases

The isolated/solitary CHD was more common (77/127, 60.6%), while multiple defects accounted for 39.4%. The commonest CHD in this cohort was ASD with a prevalence of 25.9% (33/127), followed by PDA 23.6% (30/127) and VSD in the third place, 22.8% (29/127). The majority of the ASDs were Ostium Secundum type, one case of Sinus Venosus ASD with partial anomalous pulmonary venous connection (PAPVC), and one case of Ostium Primum ASD. Tetralogy of Fallot (17.3%; 22/127) was the most common cyanotic CHD, followed by DORV (3.1%; 4/127) and Truncus arteriosus (2.3%; 3/127). As an isolated/solitary defect, VSD (13.2%) is the most prevalent acyanotic CHD, followed by ASD (10.1%). Two children had Eisenmenger complex: a 60-month-old girl with a very large VSD (13mm) and a 156-month-old boy also with a large VSD, dextrocardia and multiple vegetations (combination of CHD and AHD). Table II shows the spectrum of all the congenital heart diseases seen.

Among neonates, only CHD was encountered, mostly multiple and complex defects. The isolated defects seen were mainly ASD and PFO. This is shown in Table III. For children with Down syndrome, the prevalence of CHD was 12.4% (n = 16); there were only five isolated defects, while AVSD was the most prevalent. The rest were multiple defects.

Acquired Heart Diseases

Acquired heart disease (AHD) accounted for only 19 (12.8%) of the total heart diseases identified. The mean age of the children was 91.4±59.2 months, which is much higher than that of those with CHD. Rheumatic heart disease and dilated cardiomyopathy had equal occurrence at 8 (42.1%), respectively. One of the children with rheumatic heart disease had an associated pericardial effusion. There was a case each (5.3%) of hypertrophic cardiomyopathy, pericardial effusion and coronary artery aneurysms.

Discussion

This audit of echocardiographic records of children has shown the occurrence of cardiac diseases across all the paediatric age groups, with infants bearing the greatest burden. This is consistent with findings from other studies. [2-4] It reflects late presentation, which may be due to delayed recognition of the features, poor health-seeking behaviour, and limited personnel/infrastructure for proper diagnosis. There was a slight male preponderance, similar to the findings of Daniels *et al.* [2] and Chinawa

and Chinawa, [4] but in contrast to what was earlier reported by Abah *et al.* [9] from Makurdi. While there is no clear explanation for this observation, literature has shown that more severe CHD, like conotruncal abnormalities, tend to occur more among males and cardiac septation defects more in females. [10]

Table II: Spectrum of Congenital Heart Diseases

Variables	Frequency (n = 127)	Percentage
Isolated defects	**(n = 77)**	**(60.6%)**
TOF	19	15.0
VSD	17	13.4
ASD	13	10.2
PFO	9	7.1
AVSD	6	4.7
PDA	5	3.9
PS	2	1.6
Eisenmenger complex*	1	0.8
Others**	5	3.9
Multiple defects	**(n=50)**	**(39.4%)**
ASD+PDA	10	7.8
AVSD+PDA	4	3.1
PDA+PFO	4	3.1
ASD+AVSD	3	2.3
VSD+PDA	3	2.3
ASD+VSD	2	1.6
VSD+PFO	2	1.6
TRUNCUS ARTERIOSUS+CONGENITAL DMV	2	1.6
DORV+AVSD	1	0.8
DORV+AVSD+COMMON ATRIUM	1	0.8
ASD+TA+VSD	1	0.8
DORV+ASD+PDA+BAV+Diminutive PA	1	0.8
DORV+COMMON ATRIUM+VSD	1	0.8
HLHS+PDA+COMMON ATRIUM	1	0.8
PDA+PS	1	0.8
TGA+ASD+PDA	1	0.8
TOF+ASD(PoF)	1	0.8
TOF+COR-TRIATRIATUM	1	0.8
TOF+PDA	1	0.8
TRUNCUS ARTERIOSUS+PFO+MAPCAs	1	0.8
VSD+DIMINUTIVE TV+MAPCAs+Aorta rising from RV	1	0.8
Absent PV+MPA ANURYSM	1	0.8
VSD+ROVOTO	1	0.8
VSD+MVP	1	0.8
DEXTROCARDIA+VSD***	1	0.8
DEXTROCARDIA+AVSD	1	0.8
AVSD+BAV	1	0.8
ASD+PAPVC	1	0.8

Eisenmenger complex*: A very large VSD with shunt reversal; Others: congenital dysplastic mitral valve, cleft tricuspid valve, mitral valve prolapse, common/single atrium & hypoplastic left heart syndrome. *** Eisenmenger complex with multiple vegetations. ASD-atrial septal defect; AVSD-atrioventricular septal defect; BAV-bicuspid aortic valve; DORV-double outlet right ventricle; DMV-dysplastic mitral valve; HLHS-hypoplastic left heart syndrome; MAPCAs-multiple aortopulmonary collaterals; PDA-patent ductus arteriosus; PFO-persistent foramen ovale; PA-pulmonary artery; PoF-Pentalogy of Fallot; PS-pulmonary stenosis; TA-tricuspid atresia; TGA-transposition of great arteries; TOF-tetralogy of Fallot; TV-tricuspid valve; VSD-ventricular septal defect.**

Table III: Spectrum of congenital heart disease among neonates

Congenital heart defects	Frequency (n = 25)	Percentage (%)	Percentage of CHD (n = 127)
PFO	7	28.0	5.5
ASD	6	24.0	4.7
PDA+PFO	3	12.0	2.4
ASD+PDA	2	8.0	1.6
COMMON ATRIUM	1	4.0	0.8
PDA	1	4.0	0.8
VSD+PFO	1	4.0	0.8
Situs Inversus+HLHS	1	4.0	0.8
AVSD+PDA+BAV	1	4.0	0.8
AVSD+BAV	1	4.0	0.8
TOF+PDA	1	4.0	0.8
Total		**100.0%**	**19.8%**

ASD-atrial septal defect; AVSD-atrioventricular septal defect; BAV-bicuspid aortic valve; HLHS-hypoplastic left heart syndrome; PDA-patent ductus arteriosus; PFO-persistent foramen ovale; TOF-tetralogy of Fallot; VSD-ventricular septal defect

Table IV: Spectrum of CHD among children with Down Syndrome

Congenital heart defects	Frequency (n = 16)	Percentage	Percent of CHD (n=127)
AVSD	3	18.7	2.4
ASD+PDA	3	18.7	2.4
ASD+VSD	3	18.7	2.4
AVSD+ASD	2	12.4	1.6
AVSD+PDA	1	6.3	0.8
DORV+AVSD	1	6.3	0.8
PDA+PFO	1	6.3	0.8
VSD	1	6.3	0.8
PDA	1	6.3	0.8
		100.0	**12.8%**

ASD-Atrial Septal Defect; AVSD-Atrioventricular Septal Defect; DORV-Double Outlet Right Ventricle; PDA- Patent Ductus Arteriosus; PFO - Persistent Foramen Ovale; VSD - Ventricular Septal Defect.

Congenital heart diseases was the most prevalent cardiac abnormality and acyanotic CHD was the most common form of congenital disease in this cohort, just as previously documented in the literature. [2 -4, 11] The occurrence of isolated (solitary) defects were more frequent in both the congenital heart and acquired heart disease groups in similar rates as documented from Niger-Delta region of the country by Daniels *et al.* [2] The most prevalent congenital heart disease was ASD at a frequency of 25.9%, followed by PDA (23.6%) in second place and VSD (22.8%) at a distance third placement. This disagrees with the preliminary report of the National Pediatric Cardiac Registry and other studies that showed VSD to be the most prevalent. [2 -4,13,14] It is not readily evident why there is this variation. Still,

perhaps the fact that more than half of the cohort were under 12 months of age could be a possible explanation, since a significant number of ASD cases tend to close spontaneously after the first year of life. The findings, however, are similar to those of Amaewhule *et al.* [15] from Rivers State, Southern Nigeria, who studied congenital heart defects among neonates. Tetralogy of Fallot, being the most common cyanotic CHD, is in tandem with earlier reports.[2 - 12,13] The fact that paediatric cardiac services are scarce within the country, coupled with the high rate of home delivery, [7,8,13] may imply a high possibility of missing children with more severe and complex cyanotic CHD.

Among the children with Down syndrome, the frequency of multiple CHD was higher than solitary defects, and AVSD was the most common single defect noted at a rate of 18.8%. The top three multiple defects were ASD+PDA, ASD+VSD and AVSD+ASD, respectively. The report of AVSD being the most common single defect among children with Down syndrome has been documented by other authors. [4,16,17] They also found multiple CHD in various combinations among children with Down syndrome, such as VSD+ASD, AVSD+ASD, ASD+PDA and VSD+PDA. Since Down syndrome is known to be associated with a higher risk of CHD than the general population, it is not surprising to see multiple and complex CHD in children with Down syndrome.

The development of Eisenmenger complex/syndrome in two children (a 5-year-old girl and a 13-year-old boy) with VSD is a reflection of the lack of timely access to paediatric cardiac services in the country, as well as the lack of resources to seek care outside the country due to the high cost involved for cardiac interventions. The older of the two children also had multiple vegetations (on mitral and tricuspid valves). The presence of an uncorrected CHD is a risk factor for the development of infective endocarditis, as seen in this child. The development of complications like the reversal of shunts and vegetations further reduces the quality of life of children with uncorrected CHD. These two are classic examples of late presentation of CHD [18] with its attendant complications.

The frequency of acquired heart diseases (AHD) in this study is similar to earlier reports. [2-4,14,19,20] While both RHD and DCM had a frequency of 42.1% in the present study, earlier works from different parts of the country showed that RHD was more common.[2,4,19,20] In all, RHD remains a major cause of childhood morbidity and mortality from acquired heart disease in our environment. Given its association with poor living conditions, the finding is not surprising, as the 2022 National Bureau of Statistics Multidimensional Poverty Index (MPI) shows that 63% of Nigerians are multidimensionally poor, and children are more affected than adults. There is therefore a need to intensify efforts of prevent RHD at both primary and secondary levels. Dilated cardiomyopathy is the most common type of cardiomyopathy among children, as documented in literature, [21] and the present finding agrees with it. Two of the children with DCM had a clear history of prior viral exanthem, suggesting the likelihood of viral myocarditis being responsible for their DCM. And viral myocarditis is known as a top rank among the acquired causes of DCM. [21]

The preliminary report of the National Paediatric Cardiac Registry [8] had no data from this part of the country, and an earlier report from a tertiary health facility in Benue State had a record of only a few cardiac diseases [9] compared to the present study. The recent availability of paediatric echocardiography services, previously unavailable in Benue State, has probably made the difference. The documentation of various less common but complex congenital heart diseases in this audit shows that until there is more widespread availability of trained personnel and infrastructures, it will be challenging to know

the actual burden of cardiac diseases among children in our environment.

Limitations

This was a retrospective single-centre study; therefore, it may not reflect the actual pattern and burden at the community level. Hence, the findings may not be generalisable.

Conclusion

Congenital heart diseases remain the major contributor to the burden of cardiac disease in this study, but with a different pattern of incidences of the most common ones, viz, ASD, PDA and VSD in that order. Availability and accessibility of timely paediatric cardiac services remain a problem. Therefore, there is a need for continuous advocacy for the establishment of a regional paediatric cardiac care centre to provide accessible paediatric cardiac services, as well as the training of personnel to mitigate the menace.

Authors' Contributions: ARO conceived and designed the study, curated, analysed and interpreted the data, while ARJ conducted the literature review. ARO drafted the manuscript, and OMO and ARJ revised it for sound intellectual content. All the authors approved the final version of the manuscript.

Conflicts of Interest: None declared.

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