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A 4-year review of echocardiographic findings in a Paediatric Cardiology unit in a tertiary health facility, Calabar, Nigeria

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Abstract

Context: Echocardiography is the gold standard for diagnosing structural heart diseases which is the commonest reason for referral to Paediatric Cardiology Clinic.
Objective: This study was to determine the various indications for paediatric echocardiography and the pattern of cardiovascular abnormalities among children undergoing echocardiography in our facility.
Materials and Methods: This was a retrospective descriptive cross -sectional study where the echocardiographic register of patients over a 4-year period was reviewed. The echo findings were described and classified based on the lesions.
Results: Of the 285 children that underwent echocardiography, 35.8% had normal findings, 34.7% had acyanotic congenital heart defects, 8.1% had cyanotic congenital heart defects and 18.9% had various acquired heart lesions. Ventricular septal defect (12.6%) and atrial septal defect (8.4%) were the commonest acyanotic congenital heart defects while tetralogy of Fallot (4.2%) was the commonest cyanotic congenital heart defect. The commonest acquired heart diseases were pericardial effusion and rheumatic heart disease constituting 6.5% and 5.6% respectively.
Conclusion: Structural heart diseases are significant causes of morbidity in children. There is a pressing need for institutional and national allocation of resources to develop facilities to support and care for children with structural heart diseases.

Key words: echocardiography, congenital heart defects, acquired heart diseases

Introduction

Echocardiography is a non- invasive diagnostic tool used in Paediatric cardiology.[1] It helps in the evaluation and determination of both morphologic and functional architecture of cardiac diseases, be it congenital or acquired.[2] It is also more convenient when compared with cardiac catheterization. Echocardiography has been shown to give a sufficient and comprehensive diagnostic information with regards to structural and functional cardiac lesions.[1] It also allows for follow up and review of cardiac diseases with a high degree of sensitivity.[2] The diagnosis of cardiac lesions has been greatly revolutionized with Paediatric echocardiography which has been shown to have high sensitivity and specificity in the diagnosis of both congenital and acquired cardiac diseases.[1,3] Echocardiography has become an essential technology and has found application in almost every Paediatric cardiology setting. It is an indispensable tool in the diagnosis

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and treatment of both congenital and acquired heart diseases and also provides valuable data to inform pre-operative care.[4] Kandapalli et al[5] stated that clinical assessment, radiographic and electrocardiographic evaluations are essential tools in the diagnosis of congenital heart diseases, however echocardiography remains the gold standard in confirming a diagnosis and preoperative evaluation of children with cardiac disease. Adebayo, et al[6] in Ibadan, evaluated 240 children aged one week to 14 years, 87.5% had structural heart diseases. Abah, et al[7] reported the echo findings among 206 children. 71.8% had abnormal findings, 85.8% had congenital heart disease, while 12.8% had acquired heart disease. Paediatric echocardiography typically uses ultrasound frequency in the range of 3.0 to 8.0 MHz.[8] The most commonly used approach is trans-thoracic. Standard acoustic windows are parasternal long and short axis views, apical view, subcostal view and suprasternal view.[8] This study aimed to identify various indications for Paediatric echocardiography and to describe the findings therefrom. Findings from this study should help health care providers to understand the profile of cardiac diseases among children in our environment and improve practice .In addition, it will avail policy makers with information to make policies to improve the health of our children and also enrich existing literature.

Methods and Materials;

Study Design: This was a retrospective descriptive cross-sectional study.

Study Setting: This study was carried out in the department of Paediatrics, University of Calabar Teaching Hospital, among patients primarily managed by the Paediatric Cardiology unit or referred to the unit for evaluation from any of the Paediatric subspecialties or general Paediatric clinic or from the Ear/nose/throat clinic or eye clinic during work up for surgeries. Occasionally, patients are referred from other health facilities in and around Calabar for echocardiography.

The UCTH, serves as a main tertiary health care facility and reference hospital in Cross River State and also receives patients from the neighbouring states of Akwa-Ibom and Abia states as well as from Cameroun our neigbouring country.

Methods: The echocardiagraphy register of patients, aged 7 days to 17 years seen at the Paediatric Cardiology unit between September 2021 and August 2025 served as the source of information. Each patient was fully examined, chest X-ray and electrocardiography done. Echocardiography was done with Vivid 8 Echo machine using ultra-sound frequencies from 3.5 to 6.0 MHz according to the American Society of Echocardiography guidelines for Peadiatrics.[9] Data obtained were, biodata, indication for echo and findings

Ethical approval: Ethical approval was obtained from the University of Calabar Teaching Hospital Ethics Committee

Data analysis: Data collected was entered into Statistical Package for Social Sciences (SPSS) for Window (version 20, SPSS Inc. Chicago, IL, USA). Data was analysed using simple descriptive statistics.

Result

Sociodemographic and clinical characteristics

A total of 285 children underwent echocardiography in the Paediatrics Cardiology Unit of the University of Calabar Teaching Hospital, Calabar during the period under review, from September 2021 to August 2025. The age range of the children was between 7 days and 17 years with the mean age being 6.30 ± 5.88 years. More than half of the patients (148, 51.9%) were females while (137, 48.1%) were males. Almost half of them were less than 5 years of age (Table 1).

Table 1: Age and sex distribution

Variables	Frequency	Percentage
Age group (years)		
0 – 4.9	139	48.8
5.0 – 9.9	51	17.9
10.0 – 14.9	58	20.3
≥ 15.0	37	13.0
Sex		
Male	137	48.1
Female	148	51.9

Clinical indications for echocardiography

The clinical indications for echocardiography are as shown in Table 2. The commonest clinical indication in the patients studied were suspected congenital heart diseases (91, 31.9%), eye surgery (50, 17.5%), murmur (27, 9.4%), chest pain (25,

8.8), cyanosis (15, 5.3), down syndrome (13, 4.6%), dyspnoea (9, 3.1%) and others (55, 19.4%).

Table 2: Clinical indications for echocardiography

Clinical indications	Frequency	Percentages
Suspected congenital Heart Disease	91	31.9
Eye surgery	50	17.5
Murmur	27	9.4
Chest pain	25	8.8
Cyanosis	15	5.3
Down syndrome	13	4.6
Dyspnoea	9	3.1
Arrhythmia	4	1.4
Hypertension	4	1.4
Infant of a diabetic	4	1.4
Rheumatic Heart Disease	3	1.1
Congestive Cardiac Failure	3	1.1
Others	37	13.0

Echocardiographic findings based on broad classification

Table 3 shows the echocardiographic findings of the patients who had echocardiography done. One hundred and two (35.8%) of the investigations came out to be normal finding. Ninety-nine (34.7%) had acyanotic congenital heart defects, (23, 8.1%) had cyanotic congenital heart defects, (54,18.9%) had acquired heart defects, (7, 2.5%) were other forms of heart defects.

Table 3: Echocardiographic findings based on broad classification

Findings	Frequency*	Percentages
Acyanotic CHD	99	34.7
Cyanotic CHD	23	8.1
Acquired heart diseases	54	18.9
Others	7	2.5

Distribution of echocardiographic findings by age and sex

The distributions of the echocardiographic findings by age and sex of the patients reviewed were described as shown in Table 4 below. The result showed that congenital heart diseases, (acyanotic and cyanotic) were relatively commoner among younger patients while acquired heart diseases were commoner among older patients. With regards to sex distributions of the cardiac conditions, acyanotic lesions were commoner among females than males, on the other hand, cyanotic congenital heart diseases were relatively commoner among the males compared to the females (14.3% versus 6.2%).

Table 4: Distribution of echocardiographic findings by age and sex

Variables	Echocardiographic findings			
	ACHD(%)	CCHD(%)	AHD(%)	Others
Age group (years)				
0–4.9	67 (66.3)	14 (13.9)	17 (16.8)	3 (3.0)
5.0–9.9	16 (69.5)	1 (4.4)	6 (26.1)	0 (0.0)
10.0–14.9	9 (31.0)	2 (6.9)	16 (55.1)	2 (6.9)
≥ 15.0	4 (17.4)	2 (8.7)	15(65.2)	2 (8.7)
Sex				
Male	38 (49.3)	11 (14.3)	25 (32.5)	3(3.9)
Female	58 (59.8)	6 (6.2)	29 (29.9)	4 (4.1)

ACHD – Acyanotic Congenital Heart Disease, CCHD – Cyanotic Congenital Heart Disease, AHD – Acquired Heart Disease

Echocardiographic diagnosis (Congenital heart diseases)

Table 5 shows the distribution of congenital cardiac defects, (36,12.6%) had isolated ventricular septal defect (VSD), (24, 8.4%), had isolated atrial septal defect(ASD), (14,4.9%) had isolated patent ductus arteriosus (PDA), (8,2.7%) were atrioventricular canal defect, (8, 2.7%) were hypertrophic cardiomyopathy (HCM), (12, 4.2%) were tetralogy of Fallot (TOF), (6, 2.1%) were transposition of great arteries(TGA), (5, 1.7%) were patent foramen ovale, (3, 1.0%) were tricuspid atresia while, (3,

Table 5: Echocardiographic diagnosis (Congenital heart diseases)

Diagnoses	Frequency	Percentages	Male, n (%)	Female, n (%)
Normal	102	35.8	52(18.2)	50(17.5)
Ventricular septal defect	36	12.6	16(5.6)	20(7.0)
Atrial septal defect	24	8.4	10(3.5)	14(4.9)
Patent ductus arteriosus	14	4.9	6(2.1)	8(2.8)
Atrioventricular septal defect	8	2.7	3(1.0)	5(1.7)
Hypertrophic cardiomyopathy	8	2.7	4(1.3)	4(1.3)
Tetralogy of Fallot	12	4.2	7(2.5)	5(1.7)
Transposition of great artery	6	2.1	4(1.4)	2(0.7)
Patent foramen ovale	5	1.7	3(1.0)	2(0.7)
Tricuspid atresia	3	1.0	2(0.7)	1(0.3)
VSD+ASD	3	1.0	0(0)	3(1.0)
VSD+PDA	1	0.3	0(0)	1(0.3)
Single Atrium with VSD	1	0.3	1(0.3)	0(0)
Single Ventricle with ASD	1	0.3	1(0.3)	0(0)
Others	7	2.5	3(1.0)	4(1.4)

VSD=Ventricular septal defects, ASD= Atrial septal defects, PDA=Patent ductus arteriousus

1.0%) had a combination of VSD+ASD, also (3, 1%) had combination of ASD+PDA, while (1,0.3%) had VSD+PDA, also, (1, 0.3%) had single atrium and VSD, while (1,0.3%) had single ventricle and ASD, while (7, 2.5%), had other findings.

Echocardiographic diagnosis (Acquired heart diseases)

Table 6 shows the distribution of acquired heart defects, (19, 6.5%) were pericardial effusion, (16, 5.6%) were rheumatic heart disease (RHD), (6, 2.0%) were pulmonary hypertension, (5, 1.7%) were left ventricular hypertrophy, (4, 1.4%) were infective endocarditis, (3, 1.0%) were dilated cardiomyopathy (DCM), (1,0.3%) was endomyocardial fibrosis (EMF).

Table 6: Echocardiographic diagnosis (Acquired heart diseases)

Diagnoses	Frequency	Percentages	Male, n (%)	Female, n (%)
Pericardial effusion	19	6.5	8(2.7)	11(3.8)
Rheumatic heart disease	16	5.6	10(3.5)	6(2.1)
Pulmonary hypertension	6	2.0	3(1.0)	3(1.0)
Left ventricular hypertrophy	5	1.7	3 (1.0)	2(0.7)
Infective endocarditis	4	1.4	2(0.7	2(0.7)
Dilated cardiomyopathy	3	1.0	2(0.7)	1(0.3)
EMF	1	0.3	0(0)	1(0.3)

EMF=Endomyocardial Fibrosis

Discussion

Echocardiography as a noninvasive diagnostic tool has become a ready and most commonly used procedure in the diagnosis of structural heart diseases.[10] This review is the first report on echocardiographic finding among children in our facility. The finding from this study agrees closely with findings from most Nigerian and African studies.[6,11-13] VSD occurring singly or in combination has been reported as the commonest CHD. Adebayo et al[6] in Ibadan, Chinawa et al[11] in Enugu, Sadoh et al[12] in Benin, Kennedy and Miller[13] in Malawi , Kapoor and Gupta[14] in India all reported VSD as the commonest ACHD in their studies. On the other hand, Rahim et al[15] in Iran, reported ASD as the commonest ACHD in their study. ASD was the second commonest among our subjects. The variation in the pattern of congenital heart defects among the populations has been attributed to several factors including environmental, racial and cultural differences.[16,17] The higher prevalence of VSD and ASD among females in this study is supported by the hypothesis that left -to-right CHDs are commoner among females than in males.[18,19] This is at variance with the reports by Adebayo et al[6] in Ibadan and Sani et al[20] in Kano, were VSD was commoner among the male subjects. The reason for this finding is not clearly understood. Atrioventricular canal defect was predominantly found among children with Down syndrome. Similar findings were reported by Adebayo et al[6] in Ibadan and Abah et al[7] in Makurdi. Hypertrophic cardiomyopathy (HCM) is commonly reported as an acquired heart condition. It is an autosomal genetic disorder with incomplete penetrance involving the cardiac sarcomere. Maron et al[21] and Richard et al[22] separately reported HCM as congenital heart disease, the condition usually presents later in life. Among the subjects with HCM, two of them were infants of diabetic mothers with obstructive symptoms with respiratory distress, from systolic anterior motion of the anterior mitral leaflet. Hypertrophic cardiomyopathy is a known cardiac manifestation in infants of diabetic mothers, especially when poorly controlled[21].Patients are at risk of sudden infant death syndrome. Among patients with CCHD, tetralogy of Fallot's (TOF) was the commonest lesion, commoner among the males than females. Earlier studies by Chinawa et al[11] in Enugu, Animasahun et al[23] in Lagos, Kennedy and Miller[13] in Malawi, Kapoor and Gupta[14] in India, reported TOF as the commonest CCHD among their subjects. Three of the patients had a combination of VSD and ASD while one had VSD and PDA. Rare conditions like single atrium with VSD and single ventricle with ASD were seen in two patients.Some Nigerian studies[6,7,11,28] have reported the finding of multiple cardiac defects among their subjects. The reason why certain cardiac defects occur together has not been clearly understood. Among patients with acquired heart diseases, pericardial effusion was found in 6.5% of the patients. Majority of the patients were children with Down syndrome with associated sub-clinical hypothyroidism. Pericardial effusion has been reported` among Down syndrome patients, often in association with hypothyroidism. Anah et al[24], Bhardwaj et al[25] and Pramod et al[26] had reported massive pericardial effusion in their subjects with Down syndrome and hypothyroidism. None of our subjects had cardiac tamponade. One of

the patients with pericardial effusion was managed for systemic lupus erythematosus complicated with ureamic pericarditis and moderate to severe pericardial effusion. Moderate pericardial effusion was also found in a patient with tuberculous pericarditis. Sani et al[20] in Sokoto had also reported cases of pericardial effusion in association with tuberculous and ureamic pericarditis. Rheumatic heart disease was the second most common acquired heart disease in this study. Rheumatic heart disease still presents a high burden of acquired heart disease in sub-saharan Africa sub-region. Wilson et al[27] reported RHD as the third commonest AHD in their study, Sani et al[20] in Sokoto, Arodiwe et al[28] in Enugu, Kennedy and Miller[13] in Malawi reported RHD as the highest AHD in their studies. However, some studies[6,29] in Nigeria had shown a decline in the incidence of RHD. Pulmonary hypertension was found among patients with left to right shunts from large VSDs and/or those with atrioventricular canal defects (AVCD). However, none of them had Eisenmenger's syndrome. Arodiwe et al[28] reported a case of Eisenmenger's syndrome among their subjects. Pulmonary hypertension and subsequent development of Eisenmenger's syndrome is often a complication of left -to-right cardiac shunts with late or no surgical closure of defects. Only 1% of our subjects had dilated cardiomyopathy (DCM) and 0.3% had endomyocardial fibrosis (EMF). Several studies[6,27,30,31] both in Nigeria and elsewhere have consistently demonstrated a decline in the incidence of EMF. This has been attributed to the relative improvement in socio-economic and nutritional status.[6,31] Only a small fraction of our patients with structural heart diseases had surgeries as our centre currently does not have facilities for such treatment. This has been a recurrent dilemma in many centers in Africa as reported by previous studies.[6,7,13] A few of them were referred to some centers in Nigeria and a small number were able to afford surgery outside the country due to the high cost.

Conclusion; In conclusion this study shows that structural heart diseases remain significant causes of paediatric morbidity and mortality in our country. The advent of echocardiography has tremendously improved diagnosis. The major challenge has remained the limited opportunity available for cardiac surgery for the majority of our patients. Improvement in existing facilities should be encouraged while establishing accessible surgical facilities for treatment especially at the tertiary health care levels.

ACHD; Acyanotic congenital heart disease
AHD; Acquired heart disease
ASD; Atrial septal defect
AVCD; atrioventricular canal defect
DCM; Dilated cardiomyopathy
EMF; Endomyocardial fibrosis
HCM; Hypertrophic cardiomyopathy
PFO; Patent foramen ovale
PDA; Patent ductus arteriosus
TGA; Transposition of great arteries
TOF; Tetralogy of Falott

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Conflict of interest: Not applicable

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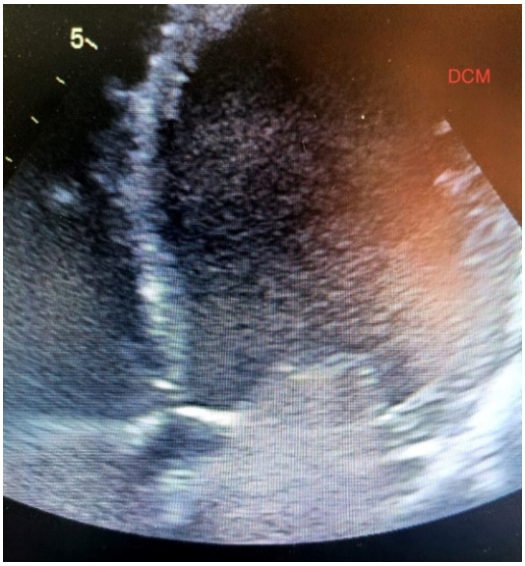
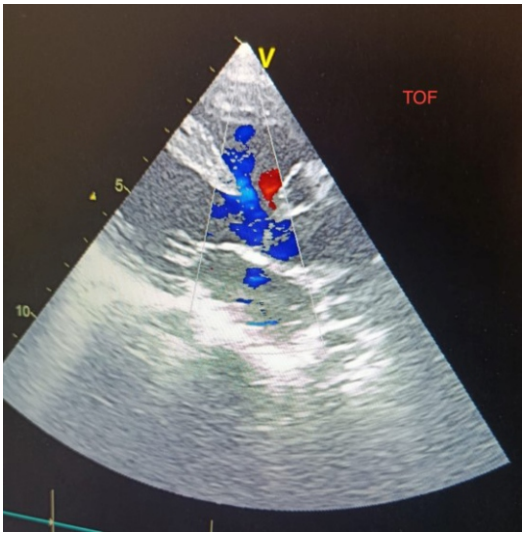
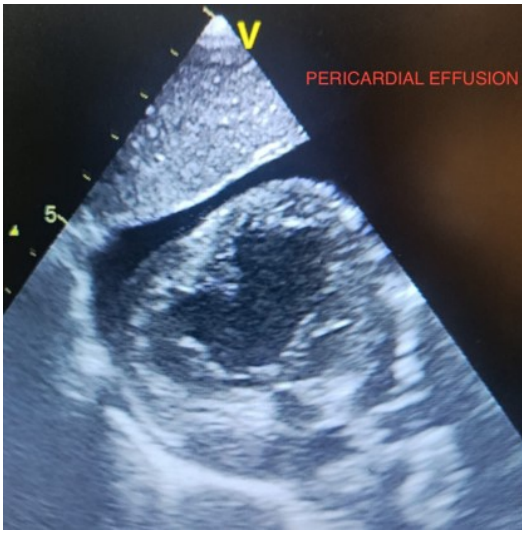


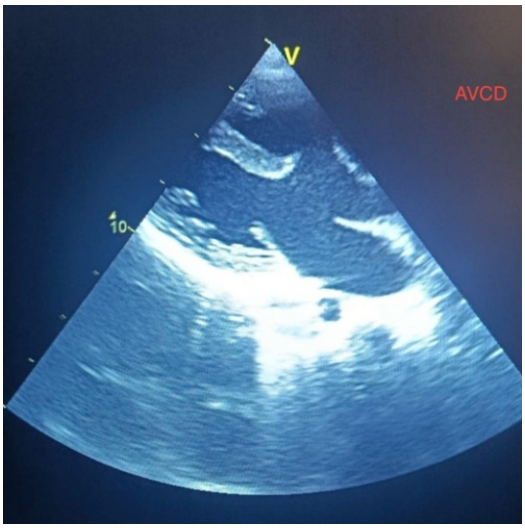
A Patient with dilated cardiomyopathy with left ventricular chamber dilatation



A patient with tetralogy of Fallot, showing overriding of the aorta



A patient with pericardial effusion with moderate pericardial fluid in the pericardium.



A patient with atrioventricular canal defect (AVCD) showing a defect involving the ventricular and atrial septums