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Spectrum of structural heart disease among adolescents in a tertiary health facility in Enugu, South East Nigeria.

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Abstract

Background: Structural cardiac anomalies are neglected area of research among adolescents.
Objectives: The objective of this study was to determine the pattern of presentation and clinical manifestations of structural cardiac diseases among adolescents attending UNTH, Enugu, Nigeria.
Methods: An analysis of structural heart defects (congenital and acquired) seen among adolescents attending both the children outpatient clinic and cardiology clinic of the University of Nigeria Teaching Hospital (UNTH), Enugu was undertaken over a five-year period.
Results: A total of 778 echocardiography was done among children from day 1 to 24 years. Of these, 51 adolescents had echo confirmed structural heart disease. Forty-two (42/51) 82.4% had congenital heart disease. Their age ranged between 120 and 242 months with a mean age of presentation as 168 (36.5) months. The overall prevalence rates of structural heart diseases among these adolescents was (51/14,849) 0.34%; while that for congenital was (42/14849) 0.28% and that for acquired was (9/14849) 0.06%. The commonest congenital heart disease observed in these adolescents was ventricular septal defect (16/51) 31.4%, and Tetralogy of Fallot (TOF) (12/51) 23.5%, followed by AV canal defect (6/51) 11.8%. The commonest acquired heart disease is Rheumatic Heart Disease (RHD), and observed in 9.8% followed by cardiomyopathy seen in 7.8% of cases. Among those with congenital heart disease, surgery was performed in 31.8% of the subjects. However, following surgery, 78.6% (11/14) still has residual heart defect.
Conclusions: The results of this study show that 0.34% per cent of adolescents who attended UNTH in Enugu State had cardiac abnormalities. The prevalence of congenital and acquired heart diseases was 0.28% and 0.06% respectively. The commonest forms seen were those with VSD and RHD.

Keywords: Pattern, Structural heart diseases, Adolescents, Enugu.

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Introduction

Structural Heart Disease (SHD) is the commonest form of congenital anomalies in children, with a reported incidence of 7.1 per 1000 births [1-3]. Following advances in the field of paediatric cardiology, cardiac surgery, and critical care, most children born with CHD survive to adolescents [2,3]. One of the major issues among adolescents with congenital heart disease is the transition from paediatric to adult care, which should be optimized and well-structured to avoid interruption of care [4]. It is important to note that adolescents with congenital heart disease have different features and psychological attributes from that of children [5].

In fact, in developed countries, specialized centres have been developed to care for adolescents with congenital heart diseases [5]. Moreover, since some of the surgical interventions are not definitive or curative, the adolescents with congenital heart disease are not without long-term complications including arrhythmias, infective endocarditis, stroke, pulmonary hypertension, and heart failure, some needing cardiac transplantation [6,7].

Acquired Heart Diseases (AHDs), which are variant of structural heart disease, are a complex group of disease entities affecting the heart and great vessels of children. This is responsible for a significant morbidity and mortality in children especially adolescents [8,9]. The array of acquired heart diseases includes Rheumatic Heart Disease (RHD), Kawasaki disease, cardiomyopathies, infective endocarditis, and pericarditis. The prevalence of the acquired heart diseases in children varies from region to region. In Nigeria, the rates are between 28.1% and 68% [8-11]. However the actual prevalent rates among adolescents is not well known especially in this environment.The commonest type of acquired heart disease in our environment is rheumatic heart disease, however due to improvement in living conditions and access to health facility, there has been a reversal in that trend in developed countries [8]. For Instance, in the United States of America, Kawasaki disease has replaced Rheumatic heart disease as the most common Acquired heart diseases [10].

Currently there is paucity of data on the spectrum of structural heart disease in adolescents in Nigeria. In the absence of proper care, adolescents and adults with structural heart disease could

face serious mental and physical health consequences [13]. Less than 30% of young adults with congenital heart disease have health care providers who are trained in this specialty [9]. Structural cardiac anomalies are often discussed among children, however many cardiac diseases including both congenital and acquired variety are seen in adolescents and are often neglected. The study is thus focused on determining the pattern of structural cardiac disease in general and those of congenital and acquired in particular, among adolescents.

Methods

Adolescents with structural heart diseases seen between 2015 and 2019 were consecutively recruited. The hospital receives referral within the state and from other states in south east Nigeria, but receives referred cardiac cases from all over the country. All the adolescents had a detailed history taking with physical examination done. Subsequently chest radiograph, electrocardiography, and echocardiography were conducted. Transthoracic echocardiography was performed on all the subjects using a GE Vivid Q echocardiography machine. This machine had the facility for 2D, M-mode, and color-flow Doppler imaging. The echocardiographic diagnoses of the various congenital heart diseases and acquired heart diseases were based on the standard diagnostic criteria. The diagnosis of rheumatic heart disease, Kawasaki, and cardiomyopathies was also made based on the standard definitions.

Nature of cardiovascular services in institution of study

The institution is endowed with a paediatric cardiology firm consisting of 5 paediatric cardiologists with most of them trained in foreign countries. Diagnosis of all structural cardiac disease was by means of Echocardiography over the past 5 years. However, open heart surgery is still at the primordial phase. Majority of surgical cases were handled by foreign missions.

Ethical consideration

Ethical clearance for this study was obtained from the Research and Ethics Committee of the University of Nigeria Teaching hospital Ituku Ozalla Enugu.

Data analysis

Data were analysed using Epi Info and SPSS, version 20. Test of normality was assessed using the Kolmogorov–Smirnov tool for normality. Mean and standard deviation were used to summarize the details of the data that were normally distributed. Comparisons of the categorical data were made using the X^2 test, while the Student t test was used to compare means.

Definition of terms

Adolescent period is the interval between childhood and adulthood. It comprises of biological growth and major social role transitions. A definition of 10-24 years is used in this study to cover adolescent growth and function [14].

Hospital policy for cut off point for age/transition in the paediatric outpatient clinic

Transition from paediatric to adult care should be a well-planned and knitted process. It requires a pre-informed participation of the adolescent, their caregivers, and the health system. Adolescents with cardiac diseases should undergo transition. Eventual transfer to adult cardiology is done in the hospital of study between 18-20 years.

Diagnostic criteria for case selection

Clinical features of dyspnoea on exertion, tachycardia and tender hepatomegaly, with a clinical murmur and echocardiography confirmation of structural heart disease. Most of the adolescents were either diagnosed for the first time in the hospital facility or referred with a diagnosis of heart disease from another facility.

Results

Between 2015 and 2019, a total of 14,849 adolescents were seen in the children outpatient clinic. Seven hundred and seventy-eight echocardiography was among children from day 0 to 22 years (no adolescents presented with any cardiac disease at 23 and 24 years). Of these 51 adolescents had echo confirmed structural heart defects. Nine (9/51) 17.6% had acquired heart disease while 42 (45/51) 82.4% had congenital heart disease. This consisted of 28 (54.9%) males and 23 (45.1%) females giving a male: female ratio of 1.21:1 for those with structural heart defect (Table 1).

They presented with symptoms and/or signs attributable to the cardiovascular system. Their age ranged between 120 and 242 months with a mean age of presentation as 168 (36.5 SD) months. Table 2 showed extra cardiac correlates of adolescents with cardiac disease. They were commonly seen among adolescents with congenital heart disease.

Variable	N	%
Sex		
Male	28	54.9
Female	23	45.1
Age group		
120-144	20	39.2
145-180	15	29.4
181-216	12	23.5
>216	4	7.8

Table 1. Sex and age distribution of adolescents with cardiac disease.

The overall prevalence rates of structural heart diseases among these adolescents were (51/14,849) 0.34%; while that for

congenital was (42/14849) 0.28% and that for acquired was (9/14849) 0.06%.

Most patients belong to the middle and low socio-economic class. Social classes 1 and 5 are least represented. The prevalence rate of those with extra-cardiac association is 3/51(5.9%) and all seen in children with congenital heart disease.

The commonest congenital heart disease observed in these adolescents was ventricular septal defect (16/51) 29.5%, Tetralogy of Fallot (TOF) (12/51) 23.5%, followed by AV canal defect (6/51) 11.8%.

The commonest acquired heart disease is Rheumatic Heart Disease (RHD), and observed in 9.8% followed by cardiomyopathy seen in 7.8% of cases. Other cardiac defects such as double outlet right ventricle constituted 2% of the cases (Table 2).

The frequency of various symptoms is presented in Table 3 and Table 4. The commonest symptom was easy fatigability, observed in 97.3% of the patients. The second and third commonest were fast breathing and cough respectively while cyanosis was observed in only 2.3% of these patients. Among those with congenital heart disease, surgery was performed in 31.8% of the subjects. However, following surgery, 78.6% (11/14) still has residual heart defect.

Disease	N	%
Downs	1	33.34
Marfans	1	33.33
Anorectal	1	33.33
Total	3	100

Table 2. Extra cardiac feature of adolescents with structural heart disease.

Disease	N	%
TOF	12	23.5
PDA	4	7.8
ASD	4	7.8
VSD	15	29.5
AV canal	6	11.8
Cardiomyopathy	4	7.8
RHD	5	9.8
DORV	1	2
Total	51	100

Table 3. Common types of cardiac disease in the adolescents of cardiac disease. TOF: Tetralogy of Fallot; RHD: Rheumatic Heart Disease; ASD: Atrial Septal Defect; VSD: Ventricular Septal Defect; PDA: Patent Ductus Arteriosus; AVC: Atrio-Ventriclo Septal Defect; DORV: Double Outlet Right Ventricle.

Feature	n (N)	% (n/N) × 100
Cough	28 (35)	80
Fast breathing	36 (37)	97.3
Failure to thrive	31 (36)	86.1
Cyanosis	27 (40)	67.5
Pulmonary Hypertension	31 (40)	77.5
Excessive sweating	13 (29)	44.8
Easy fatigability	17 (29)	58.6
Down syndrome	14 (38)	36.8

Table 4. Frequency of various clinical features observed in the patients with AV canal defect. n (number of patients with clinical feature); N (number of patients complete data on clinical feature); P. Hypertension: Pulmonary Hypertension.

Discussion

From our study, we noted varying prevalence rates among adolescents with both congenital and acquired heart disease to be 0.28% and 0.06% respectively. Studies on cardiac diseases among Adolescents are rare. However, the prevalence of congenital heart disease among adolescents obtained in his study is higher than prevalence obtained in children as seen in a study by Chinawa et al. who obtained a prevalence of 0.22%. The work of Chinawa et al. was done over 8 years ago, and not on adolescents [13].

A further reason for this rising prevalence in this study is that open heart surgery is not routinely accessible to children in the study locality. Hence most of the children with congenital heart disease tend to grow to adulthood with some complications and several hospital admissions. Again there is no laid down program of transitioning among these children when they get to adolescents age. One of the first challenges in adults is the transition from paediatric to adult care, which should be optimized and well-structured to avoid interruption of care [13]. Regrettably, adolescents with cardiac disease presented very late in this study as shown by their mean age of first presentation to the hospital.

This shows the fact that health education and serious campaign on congenital heart disease in the rural areas and community is very important to enhance early diagnosis and intervention to avert the numerous complications that follow this anomaly. Furthermore, in developed country, the profile of adolescents with congenital heart disease is largely among those operated for congenital heart disease [15]. It is pertinent to note that as a result of advances in the field of paediatric cardiology, cardiothoracic surgery, and critical care, most children born with congenital heart disease survive to adolescents and adulthood with the adult population with congenital heart disease exceeding the number in the paediatric population [15].

The mean age of the adolescents with congenital heart disease in this study was 15 (3) years. This is far lower than that obtained in an Oman study where a mean age of 24 years was

obtained and that reported in Europe where the median age is 27 years [15,16]. The low mean age obtained in our study when compared to others simply showed that those with high mean age probably survived to that point because of timely and routine surgical intervention which is lacking in our setting. Whether the adolescents beyond the age of 15 with congenital heart disease had died due to poor intervention in our country or that they are lost to follow up remains conjectural.

This study showed a male preponderance among the adolescents with congenital heart disease. This is worrisome because it varied with the normal female preponderance among both children and adolescents with congenital heart disease [15]. However, the study by Chinawa et al. showed a male: female ambivalence. We could not explain this male predominance obtained in our study but geographical variations, sample size issues and cultural correlates may be implicated [17]. It is necessary to point out here that the commonest congenital heart disease among adolescents in this study is Ventricular septal defects. This is in tandem with most studies where VSD is the commonest congenital heart disease. However, majority of children in our setting with Ventricular-septal defect had undergone surgical closure with very good outcomes.

We noted with interest in this study, that of about 167 adolescents with clinical murmurs and/or other features of cardiac anomalies, only 51 had confirmed cardiac lesions by means of echocardiography with error of 68%. Some cardiac lesions may not show clinical murmurs such us transposition of great artery with intact septum, some single ventricle physiology etc. This may explain this clinical features echo mismatch. Chinawa et al. in his study noted that more than a third of clinical diagnosis of cardiac disease did not conform to echocardiography findings [17]. Though echocardiography is well accepted for evaluation of cardiac function. The efficacy of echocardiographic findings in confirming congenital cardiac disease is not to be entirely depended on. This has been proven in some studies [18-20]. Among the few reasons for which clinical diagnosis may not be in tandem with echocardiographic results, is some cardiac anomalies like cotritriatum sinistrum which may be mistaken for a Ventricular septal defect because of the typical pan-systolic murmur seen in this anomaly which also presents exactly like ventricular septal defect clinically [21].

Acquired heart diseases are aggregate of disease entities that affect the heart and great vessels of children [22]. This group of heart disease are responsible for significant morbidity and mortality in children [22,23]. We obtained a prevalence of 0.04% in our study. This is different from that obtained in other centres in Nigeria where prevalence rates vary from 28.1% and 68% with Rheumatic heart disease ranking the highest [23,24]. The very low prevalence rate seen in adolescents compared to that in children with acquired heart disease could be due to the fact that many of our subjects were lost to follow up.

Cardiomyopathy is the second acquired heart disease seen among adolescents in the year of study with a prevalence of 7.8%. Paediatric cardiomyopathies are heterogeneous group of myocardial disease affecting children and a leading indication for heart transplants in adolescents. It has a prevalence of 1.13 per 100,000. The aetiology is not known [25]. It is important to note that the prevalence of the various types of acquired heart disease differs among geographical regions and even within similar geographic regions. For example, in the United States of America, Kawasaki disease has replaced Rheumatic heart disease as the most common acquired heart disease [26]. In developing countries, rheumatic heart disease was also the most common a few decades ago, but the trend seems to be changing as reported by some authors [22,26]. For instance, in South Western Nigeria, Okoromah et al. noted that pericardial effusion was the most predominant type while Sadoh and his group also reported myocarditis and cardiomyopathies as the commonest. However, in keeping with our study, Sani et al. in North Western Nigeria, Nkoke et al. from Cameroon reported RHD as the commonest acquired heart disease [22-24,26].

Extra cardiac associations were seen mostly in adolescents with congenital heart disease but the prevalence is very low. Mortality of children with Downs or any extra cardiac correlates in adolescents with congenital heart disease is very high compared with children without these associations. So most of them may have died before getting to adolescents. When we looked at the surgical clinical profile of adolescents with congenital heart disease, we noted that the commonest symptom was easy fatigability. Among those with congenital heart disease, surgery was performed in less than a third and over half still have a residual lesion

A study by Carole et al stated that majority of his patients who had cardiac surgery always consider themselves as cured.". In reality, it is important to note that there is almost no complete surgical cure for congenital heart disease, probably only perhaps with the exception of a successfully ligated and divided ductus arteriosus. All other repaired lesions have the potential for residual lesion and sequelae. The misperception of "cure" poses worrisome consequences. For instance, adolescents who had cardiac surgery and who believe in total cure may forget to use antibiotic prophylaxis or even anti-failure regimen and may not even continue to follow up on medical advice. Consequently, this residual lesions and sequelae which is frequently overlooked may evolve with attendant symptoms [24].

It is pertinent to point out those adolescents with congenital heart disease who had surgery present differently from those with acquired heart disease. For instance, we have experienced various forms of arrhythmias post operation among our patient, one may surreptitiously focus so much on electrophysiological aspects without paying attention to the underlying clinical and hemodynamic problems so commonly associated with the onset of arrhythmias. A good example of this is our patient with Teratology of Fallot who had surgical closure, but with pulmonary regurgitation which is indeed expected but this may be neglected without knowing that the arrhythmias may stem from these surgical complications. The foregoing therefore makes it paramount that cardiologist and cardiac surgeons should major on these challenges and reiterate the importance of clarifying on the patients, their families, and their physicians

that all cardiac surgery is palliative rather than curative and that patients with congenital heart disease require lifelong follow-up at centres where expertise is available to deal with their complex problems [24].

Conclusion

Adolescents present with various forms of cardiac diseases, with ventricular septal defect and Rheumatic heart disease presenting as the commonest congenital and acquired variety respectively. Residual lesions among adolescents with congenital heart disease who had surgery can occur and surgery does not necessarily mean total cure.

Recommendations

Care of these adolescents will continue beyond this stage of life and into adulthood. It is thus recommended that appropriate programme be put in place to ensure a smooth transition of these adolescents into adult care.

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