

Pattern and clinical profile of children with complex cardiac anomaly at University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu State, Nigeria

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Abstract

Background: Complex congenital cardiac abnormalities are rare among children and contribute to mortality and morbidity. The prevalence and pattern of presentation vary from place to place.

Materials and Methods: The objective of this study was to determine the clinical profile and pattern of presentation of complex congenital cardiac malformations among children attending a tertiary hospital in Enugu State. A cross-sectional retrospective study in which a review of the records of children who attended the children outpatient clinic of University of Nigeria Teaching Hospital (UNTH), Ituku-Ozalla, Enugu State over a 5-year period (January 2007-June 2012) was undertaken.

Results: Thirty one thousand seven hundred and ninety-five (31,795) children attended the outpatient clinic of the hospital over the study period, of these, 65 had cardiac diseases, from which 16 were found to have congenital complex cardiac abnormalities of various types, giving a prevalence of 0.05%.

Complex abnormalities seen in these children are Tricuspid atresia with various associations, cor triatriatum, single ventricle, and large ASD (atrio-septal defect) with complete AVCD, cor triatriatum sinistrum with cardiomyopathy, DORV (double outlet right ventricle) with left sided aorta, hypoplastic tricuspid valve with a PDA (patent ductus arteriosus), TOF (tetralogy of fallot), prolapse of aortic valve, and pulmonary regurgitation. One of these complex cardiac anomalies presented with Turner's syndrome and another with VACTERAL association.

Conclusions: The results of this study show that 0.05% of children who presented at cardiology clinic of a teaching hospital in Enugu State had congenital complex cardiac abnormalities and that the commonest forms seen were those with cor triatriatum and TOF.

Key words: Abnormalities, children, complex congenital cardiac, Enugu, presentation

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Introduction

Congenital heart disease (CHD) is defined as structural abnormality of heart or blood vessels near the heart present either at the time of birth or detected later on.^[1] The incidence of these defects is 0.5-0.8 live birth; it increases to 2-6% if first degree relative is affected.^[2] Complex heart disease is a set of associated malformations involving parts that are necessary for maintenance of the patient's life, each of them being classified

as follows: Total anomalous pulmonary venous drainage, hypoplastic left heart syndrome, single ventricle, mitral atresia, pulmonary atresia with intact ventricular septum, tricuspid atresia, double right ventricular outflow tract, double left ventricular outflow tract, tetralogy of fallot (TOF), truncus arteriosus, and transposition of the great vessels.^[3] The

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incidence of complex forms (moderate and severe forms of CHD) is about 6/1,000 live births.^[4] In 2000, it was estimated that there were 320,000 children with simple conditions, 165,000 with moderately complex conditions, and 138,000 with highly complex conditions, with a total of 623,000.^[4]

Most of the known causes of CHD are sporadic genetic changes, either focal mutations or deletion or addition of segments of DNA.^[4] The genes regulating the complex developmental sequence have only been partly elucidated. Some genes are associated with specific defects. The most common deletion which has extensive symptoms including defects of the cardiac outflow tract including TOF.^[4] Known antenatal environmental factors include maternal infections (Rubella), drugs (alcohol, hydantoin, lithium, and thalidomide), and maternal illness (diabetes mellitus, phenylketonuria, and systemic lupus erythematosus).^[5]

A congenital heart defect (CHD) is a heart problem which is present at birth and is caused by improper development of the heart during fetal development. In the majority of the instances, when a baby is born with CHD, there is no known reason for the heart to have formed improperly. Scientists know that some types of congenital heart defects can be related to an abnormality of an infant's chromosomes (5-6%), single gene defects (3-5%), or environmental factors (2%). In 85-90% of cases, there is no identifiable cause for the heart defect, and they are generally considered to be caused by multifactorial inheritance.^[5] Consanguineous marriages have been noted as an important factor contributing to increase in complex cardiac malformations.^[6] This is influenced by the degree of relatedness between the spouses i.e., first cousins, double first cousins, and second cousins. A consistent positive association has been reported between consanguinity and VSD and atrial septal defects, pulmonary atresia, (TOF) and other CHDs.^[7-10] Consanguinity, however, is not a common practice among the Igbos who are the indigenous and predominant inhabitants of Enugu and environs but is occasionally noted among Hausa-Fulani extraction who migrated to this area with their cattle for grazing.

Three complex congenital malformations commonly reported are TOF, transposition of the great arteries, and single-ventricle physiology =^[11] There are also others that are either classified as moderate or severe in complexity. These are double outlet ventricle, cor triatriatum sinistrum, and dextrum etc.

Congenital complex cardiac abnormality plays a major role in morbidity and mortality of children.^[12] However, the treatment and rehabilitation of these children with congenital abnormality is very costly; hence, the need to identify causative and risk factors and prevent them early,^[12] where possible. The birth of an infant with major malformations whether diagnosed ante-natally or not evokes

an emotional parental response.^[12] Parents are likely to feel anxious and guilt on learning of the existence of a congenital complex cardiac anomaly and require sensitive counseling.^[13]

Prevalent studies of congenital complex anomalies are useful to establish baseline rates, to document changes over time and to identify clues to etiology. They are also important for health services planning and evaluating antenatal screening in populations with high risk. The study is also important as it may help to raise the awareness and make a case for both pediatric cardiac surgery and interventional cardiology. It will also emphasize the loss of babies with congenital complex cardiac abnormalities.

We are not aware of any study of this nature from Enugu or southeast Nigeria in general. In addition, the University of Nigeria Teaching Hospital (UNTH) moved to its permanent site at Ituku-Ozalla 4 years ago, and since then no work has been done on the prevalence and pattern of presentation of complex cardiac anomaly in children in the area. This study was thus designed to bridge this gap with a view to determining the prevalence of complex cardiac anomaly among children attending UNTH, Ituku-Ozalla, and the different types of abnormalities that are prevalent. It is hoped that this will add to the body of knowledge available on these disorders and may stimulate further research in the area on the subject.

Materials and Methods

The aims and objectives of this study were to determine the prevalence of congenital complex cardiac abnormalities among children attending the children outpatient clinic of the UNTH, Ituku-Ozalla, Enugu State; to describe the different forms of abnormalities seen among these children; to determine the various clinical profile, and outcome of congenital complex cardiac abnormality at UNTH.

Purposes of this study, congenital complex cardiac abnormalities are defined as obvious abnormality of structure or form which is present at birth or noticed within a few days after birth involving two or more heart lesions.

The study was conducted at the children outpatient clinic of the UNTH, Ituku-Ozalla, Enugu, Nigeria. The hospital was then located at her temporary site within the city (Enugu) center. In January 2007, the hospital was re-located to its permanent site at Ituku-Ozalla, about 22 km away from Enugu metropolis.

The hospital provides care for children and also receives referrals from different parts of Enugu, the rest of Enugu State and surrounding states. Enugu State of Nigeria has a population of about 3.3 million people according to the national census of 2006; the surrounding states of Abia, Anambra, Benue, Ebonyi, Delta, Imo, and Kogi have populations ranging from 2.2 to 4.2 million people.

Facilities for genetic testing are not available in our center and are thus not offered to babies treated in the unit.

A cross-sectional retrospective study in which a review of the records of all children attending UNTH over a 5-year period (January 2007 and April 2011) was undertaken. The folders (case files) of these children were retrieved from the hospital records department and examined individually by the investigators. Data collection was done with structured forms designed for the study. The diagnosis of congenital complex cardiac abnormality was based on clinical evaluation and 2-D echocardiogram examination (as documented by doctors in the patients' folders). Patient's history, including antenatal history, history of exposure to teratogens, and family history of consanguinity were obtained from these folders. Further information obtained included maternal age and type of congenital complex cardiac abnormality. The prevalence rate was estimated as a percent of the total number of children attending children outpatient within the period of the study (Number of children with congenital complex cardiac abnormalities/total number of children admitted in the hospital for the duration of study).

Data were analyzed using SPSS 13. Rates and proportions were calculated with 95% confidence intervals (CI). The proportions were compared using students *t*-test. Level of significance was set at $P < 0.05$.

Ethical approval for this study was sought from the Ethics and Research Committee of UNTH.

Results

A total of 31,795 children attended the children outpatient clinic of the hospital over the study period, of these, 65 had cardiac diseases, from which 16 were found to have congenital complex cardiac abnormalities of various types, giving a prevalence of 0.05% [Table 1]. Age group ranged from 6 months to 10 years. More than 80% of children presented between the 1st and 6th year of life [Table 1].

Out of the 16 cases 14 (87.5%) were male and 2 (12.5%) female. Male to female ratio was 7:1. The commonest complex cardiac lesion was TOF 6 (37.5%) Table 2, the mean age of presentation was 11.5 months.

Table 2 shows the types of congenital abnormality seen in these children. TOF is the commonest complex cardiac anomaly 6 (37.5%).

Cyanosis 9 (56.3%), finger clubbing 9 (56.3%), failure to thrive 5 (FTT) (31.3%), breathlessness, and easy tiredness 4 (25.0%) occurred mostly among children with congenital complex heart disease [Table 3].

Table 4 shows that complex cardiac anomaly is commonly found in males than females in the ratio of 7:1.

Table 5 shows the outcome and history of consanguinity among children with complex cardiac anomaly. Two children were referred for surgery abroad and these were inoperable, others are been followed up and could not be referred due to financial reasons. There was no history of consanguinity in any of our patient.

Discussion

CHDs are among the more common major malformations at birth.^[12] In developing countries thousands of children

Table 1: Age and sex distribution

Age group (year)	No of cases		Total	Percentage
	M	F		
1 month-<1	1	0	1	6.25
1-<6	11	3	14	87.5
6-12	0	1	1	6.25

Table 2: Frequency of various complex congenital heart defects

Complex cardiac defects	No	Percentage
TOF	6	37.50
Cor triatriatum	2	12.50
DORV	2	12.50
Tricuspid atresia with right atrial cor triatriatum	1	6.25
Tricuspid atresia with patent ductus atriosus	1	6.25
Tricuspid atresia with VSD, ASD, and DORV	1	6.25
Single ventricle with complete AVCD and large ASD	1	6.25
Mitral valvular stenosis with membranous VSD and aortic root prolapse	1	6.25
Dextrocardia	1	6.25
Total	16	100

TOF=Tetralogy of fallot, DORV=Double outlet right ventricle, VSD=Ventricular septal defect

Table 3: Features of presentation of cases of complex cardiac anomaly

Symptoms	No of cases	Percentage (%)
Cyanosis	9	56.3
Finger clubbing	9	56.3
FTT	5	31.3
Breathlessness	4	25.0
Easy tiredness	4	25.0
Cough	4	25.0
Congenital abnormality	2	12.5
CCF	1	6.25
Recurrent chest pains	1	6.25

FTT=Failure to thrive

Table 4: Sex distribution and age of presentation

Type of heart disease	Males	Males%	Females	Females%	Age (Years)
With right CT	1	100	-	0	1.7
TA with PDA	1	100	-	0	1.9
TA with ASD	-	0	1	100	
ASD and DORV					
SV, AVCD, and ASD	-	1	0	100	10
CT	1	50	1	50	1.8
MS and VSD	-	0	1	100	1.3
Dextrocardia	1	100	-	0	2.0
DORV	2	100	-	0	1.8
TOF	6	100	-	0	1.6

PDA=Patent ductus arteriosus, ASD=Atrio-septal defect, DORV=Double outlet right ventricle, VSD=Ventricular septal defect

Table 5: Outcome and history of consanguinity (HS) of complex congenital heart defects

Complex cardiac defects	HS	Outcome
TOF	Nil	Saline phoresis
Cor triatriatum	Nil	Follow up
DORV	Nil	Surgery (but inoperable)
Tricuspid atresia with right atrial cor triatriatum	Nil	Follow up
Tricuspid atresia with patent ductus atriosus	Nil	Follow up
Tricuspid atresia with VSD, ASD and DORV	Nil	Follow up
Single ventricle with complete AVCD and large ASD	Nil	Follow up
Mitral valvular stenosis with membranous VSD and aortic root prolapse	Nil	Follow up
Dextrocardia	Nil	Follow up

TOF=Tetralogy of fallot, DORV=Double outlet right ventricle, VSD=Ventricular septal defect

die due to CHD. One-quarter of all deaths from CHD occur in the 1st month of life, and half to two-third of deaths occur within 1st 7-10 days of life.^[13] Many infants require corrective or palliative surgery and frequent hospitalization during 1st year of life.

Alfred Blalock, in 1945, performed the first surgical connection of the left subclavian artery to the ipsilateral pulmonary artery in cyanotic patient with pulmonary stenosis or atresia.^[14] This was the start of classical Blalock–Taussig shunt creation. Richard Brock carried out the first pulmonary valvulotomy using a closed technique.

The main achievements of the 1950s were the repair of ventricular septal defect (VSD) and TOF.^[1, 15] In the 1960s, atrial physiological correction of transposition of the great vessels (TGV) and the interposition of conduits between the right ventricle and pulmonary artery was done and in the 1970s, the techniques of Fontan and Jatene for the reconstruction of single-ventricle heart and TGV respectively were first initiated.^[16-19]

The prevalence of congenital complex cardiac abnormalities of 0.05% obtained in this study is similar to that in one study.^[15] Other studies reported 2.5, 5.2, and 6.4% respectively as prevalence rates.^[20,21] The reason for this varying prevalence could be due to the fact that they are hospital study and as such, geographical differences may count. The prevalence rate of 0.05% obtained in this study appears lower when compared to the general population. This low value could be due to the fact that it is a hospital based study. A good number of these children do not present to the teaching or specialist hospitals but are seen at other peripheral hospitals and as such this work may not be able to “capture” these other children. Some that are born outside the hospital with congenital abnormalities are not taken to hospitals for care but are taken to traditional healers or other alternative practitioners while some are just left at home to their fate. Some that are brought to peripheral hospitals may not be referred to tertiary or teaching hospitals for care because of the current low level of activity at the national cardiac centre at UNTH. Needless to mention that majority of these children are not well managed and a good number die or are left with avoidable complications.

However, many studies gave account of prevalences of each complex cardiac anomaly. For instance, TOF is the most common cyanotic congenital heart defect.^[22] Tetralogy of Fallot occurs in approximately 400 per million live births.^[22] On the other hand, in Malta, the birth prevalence for TOF between 1980 and 1994 was 0.64 per 1000 live births, prompting speculation of a genetic predisposition toward the condition.^[23] In the same vein, a single ventricle which is defined as a heart with one ventricle receiving inflow from two separate atrioventricular valves or a common atrioventricular valve accounts for about 1% of all cardiac anomalies with an incidence of about 0.05-0.1 per 10,000 live births with a prevalence of between 0.0005 and 0.001%.^[24] On the other hand, cor triatriatum, a rare anomaly is reported to have a prevalence rate of about 0.1% of cases of CHD. These isolated prevalences of tetralogy of Fallot and single ventricle are similar to our study which is 0.018 and 0.003%, respectively. The

observed similarities in prevalences with studies that looked at populations not similar to ours could be due to the fact that both studies were done in a referral institution where major congenital complex cardiac defects are been admitted.

Clinical profile of complex cardiac anomaly depends on the very type, but in general, cyanosis, breathlessness, and early presentation is the key note.^[25] Most of our series presented with cyanosis and breathlessness.

Associations of complex cardiac anomaly with syndromes cannot be overemphasized. For instance, single ventricle could be associated with tricuspid atresia (TA), hypoplastic left heart syndrome (HLHS), mitral valve atresia (usually associated with HLHS), single left ventricle, double outlet right ventricle (DORV), and pulmonary atresia with intact ventricular septum (PA/IVS).^[25] In our study, single ventricles are associated with more than one of the above.

It is important to note that VACTERAL Associations and talipe deformities were seen among two children in our study. VACTERAL Associations and talipe deformity have been reported in some children with complex cardiac anomaly by some workers.^[25,26] Martinez-Frias *et al.*,^[27] in their work noted TOF as the most common complex congenital heart defects seen in the VACTERAL association. Less common defects in the association such as truncus arteriosus, and transposition of the great arteries were also reported.

In our study, majority of our children with complex CHD were between the age of 1 and 12 years. It is noted that most of these patients presented after the 1st year of life. These findings are in accordance with other studies.^[21,22] The reason why more males are affected could be that in Nigeria, more attention and health seeking behavior are given more to male children. Other possible reasons for the male preponderance could be that XY karyotype may confer protection in this case causing the males to survive longer than the females thus making the males more available for studies than the female.

The main focus of investigation is 2-D echocardiography and ECG. Although cross-sectional echocardiography with Doppler has been shown to be of great value in diagnosis of patients with cor triatriatum, biplanar trans esophageal echocardiogram (TEE) provides a more complete and detailed data of the anatomy of cor triatriatum and other complex cardiac anomaly.^[28] In this series, 2-D echocardiography, ECG and chest radiographs were used for the diagnosis of complex cardiac anomaly.

Prenatal diagnosis may help detect this anomaly early and avert numerous morbidity and mortality that follow this disease. Prenatal diagnosis has not yet gained ground in

the management of complex cardiac disease in Nigeria. However, prenatal diagnosis of a major cardiac abnormality tends to precipitate a crisis for the affected parents. In a setting of grief and emotional distress, there is the challenge to provide meaningful information of the abnormality, its need for intervention and likely outcome, so as to enable the parents, if allowed the option, to come to a fully informed decision as to whether to continue with the pregnancy.^[29]

In developed countries, early detection and surgical intervention have provided a high chance of survival in children with CHD but in developing countries like ours, the facilities for diagnosis and treatment of children with complex CHD are limited to larger cities and quite expensive and beyond the reach of poor, so many children die before diagnosis at an early age.

To improve the survival of children with complex CHD there is need to diagnose and treat CHD at earliest age by provision of diagnostic and surgical and other interventional facilities at each corner of the country in order to manage successfully. For instance, we have two inoperable cases referred outside the country as a result of late presentation. Others only ended up receiving saline phoresis and drugs and had been in the waiting list of surgery abroad for years because of financial constraint. The situation may not change until the challenges reported by Eze and Ezemba^[30] in an earlier work at UNTH are addressed. Something is being done in that direction locally but the Federal Ministry of Health needs to do more.

Limitations

A retrospective, cross-sectional study of this nature is bound to be faced with a number of challenges, and expectedly so as the investigators are not in complete control of fully “in-charge” of the processes. Firstly, retrieving patients’ folders from the hospital records department (which is yet to be fully computerized) was a rather Herculean task. Some of the retrieved folders contained inadequate information and this affected the quality of the study. In addition, a hospital-based study of this nature, especially one restricted to only a section of the hospital as is the case in this instance, cannot be said to reflect truly what obtains in the general population. A prospective, community-based study is thus desirable.

Conclusions

The results of this study show that 0.05% of children admitted to cardiology clinic of a teaching hospital in Enugu state had congenital complex cardiac abnormalities and that the commonest forms seen were those with cor triatriatum and TOF. The prevalence rate obtained in this study, however, may not reflect the true situation in the general population for reasons adduced in the discussion above but gives a clue to the existence of the problem and

could serve as a stimulus for further studies on the subject. Centers that provide comprehensive care for these patients receive more patients that do affect the statistical data.

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