Pattern of Congenital Heart Disease Diagnosed by Echocardiogram in Patients Admitted into a Rural Setup Tertiary Hospital

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Abstract

Congenital heart disease is a defect in the structure of heart and great vessels present at birth. Early recognition will help to treat the child and if possible get corrective surgery done. The aim of this study was to observe the pattern of congenital heart disease in our set-up. This descriptive study based on echocardiographic findings over a period of 3 years from January 2013 to December 2015 conducted in Community Based Medical College Bangladesh. Mymensingh. Patient's consent was obtained from patient's parents before echocardiography. A total of 100 children found to have congenital heart disease determined by echocardiography were studied and analysed for frequencies of lesions, sex ratio and mean age. One hundred patients, comprising 55(55%) male and 45(45%) female had congenital heart disease as diagnosed by echocardiogram had, their age ranged from 0.01 to 15 years with a mean age of 6.4 ± 5.3 years and male to female ratio 1.2:1. Sixty six percent of patients were diagnosed as non cyanotic heart defects and rest 34% cyanotic heart defects. Atrial septal defect (35%) was the most frequent form of non-cyanotic congenital heart defect, followed by ventricular septal defect (15%), pulmonary stenosis (6%), patent ductus arteriosus (5%), endocardial cushion defect (3%) and coarctation of aorta (2%). Whereas fallot's tetralogy (17%) followed by transposion of great arteries (10%) and ebstein's anomaly (7%) were the commonest cyanotic congenital heart defects. Congenital heart diseases are common in our set-up. Atrial septal defect is the commonest non-cyanotic and Fallot's tetrology as cyanotic congenital heart disease.

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Introduction

Congenital heart diseases (CHDs) are the malformation of the heart or the large blood vessels associated with the heart, affecting various parts or function. The disease is recognized as one of the leading causes of mortality in the first year of life.[1-3] CHDs are the common single group of abnormalities accounting for about 30% of the total congenital abnormalities.[1] It has been estimated that some types of CHDs can be related to the defects in the chromosome, gene or environmental factors.[4] In ~90% of the CHD cases, there is no identifiable cause that can be attributed to multifactorial defects. The majority of these structural abnormalities occur as isolated malformation in most patients, but about 33% have associated anomalies.[5]

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CHD may be present at different ages from birth to adolescence.[6] The estimated incidence of CHD is 9 per 1,000 live births which corresponds to 1.35 million newborns with CHD every year, representing a major global health burden.[7] The incidence of CHD in Bangladesh is 25/1000 live birth; in India is 8.54 per 1000 live birth;[8] in Pakistani population is 11 per 1000 live birth.[9] Congenital heart defects are the most common type of birth defect in the United States, affecting nearly 1% of about 40,000 births per year.[10] In Europe the average total prevalence of CHD was 8.0 per 1000 births and live birth prevalence was 7.2 per 1000 births.[11]

Pattern of CHD varies from country to country, region to region. According to the Merck Manual of Diagnosis,[12] the different types of CHDs are Atrial Septal Defect (ASD), Ventricular Septal Defect (VSD), Tetralogy of Fallot (TOF), Patent Ductus Arteriosus (PDA), Pulmonary Stenosis (PS), Aortic Stenosis (AS), Coarctation of Aorta (COA) and Atrioventricular Septal Defect (AVSD) which accounts for 85% of all CHDs. The remaining 15% of rare and complex CHDs are Persistent Truncus Arteriosus (PTA), Tricuspid Atresia (TA), Total Anomalous Pulmonary Venous Connection (TAPVC), Hypoplastic Left Heart Syndrome (HLHS), Double Outlet Right Ventricle (DORV), Single Ventricle (SV), Ebstein Anomaly (EA) and Dextrocardia. In developed countries pattern of CHD is well documented. However, there are no epidemiological data available on the pattern of congenital heart disease but a study published on clinical basis in our hospital "case study profile of congenital heart disease" by Professor Mafizur Rahman and Professor M. Karim Khan in Journal of Community Health Medical Research December, 1999;5:19-21.[38]. The present study reports pattern of congenital heart diseases diagnosed by echocardiogram in a rural tertiary hospital in Mymensingh, Bangladesh.

Methods

This descriptive study based on echocardiographic findings over a period of 3 year from January 2013 to December 2015 conducted in Community Based Medical College Bangladesh. Mymensingh. Patients consent was obtained from patient's parents before echocardiography. A total of 100 children (aged from birth to 15 years) found to have congenital heart disease by echocardiography were studied. Transthoracic M-mode, 2D and Doppler echocardiography (pulsed, continuous – wave and color flow mapping) were performed in different views. Standard diagnostic echocardiographic criteria were used to identify the congenital defects according to their structural characteristics and/or hemodynamic effects. Transthoracic echo done by echocardiographiy Machine: Model Tosiba Nemio MX Model SSA-590A (Fig-1) . Transducer 7 MHz PSM-70AT (Child), Transducer 3 MHz PSM-30BT (Adult) (Fig-2). TEE not done.

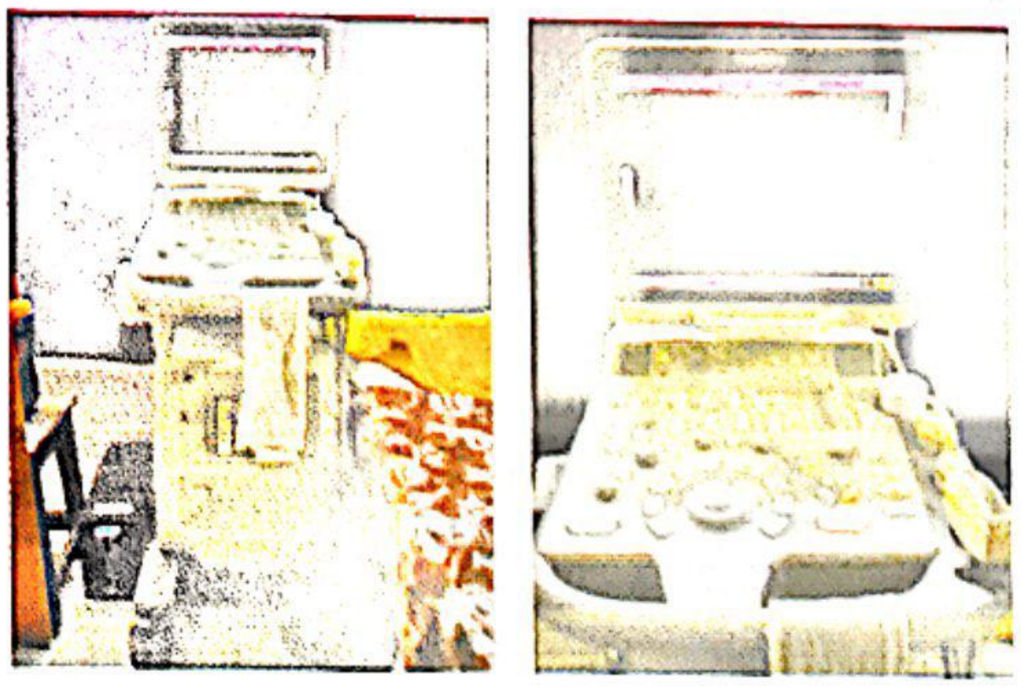

Fig-1: Echocardiographiy Machine: Model Tosiba Nemio MX Model SSA-590A

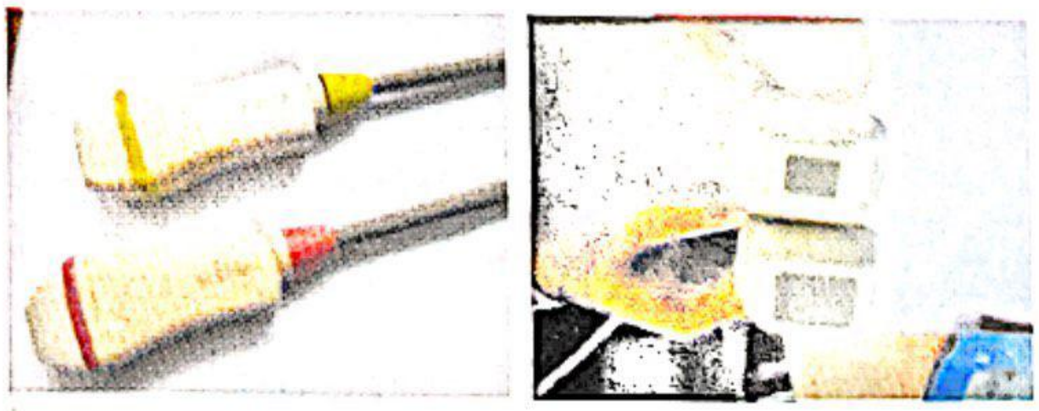

Fig-2: Transducer 7 MHz PSM-70AT (Child), Transducer 3 MHz PSM-30BT (Adult)

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The CHD were classified into cyanotic or non-cyanotic according to the standards established.[13] Patients with more than one heart defect were classified according to the malformation that precipitated the presentation and produced the major hemodynamic disturbance. Severity of CHD was considered 'complex' when a valve or chamber was atretic or hypoplastic, 'significant' when treatment was mandatory and 'minor' when surgical intervention was unnessasary.[14] Patients aged more than 15 years and those that had mitral valve prolapse, minor abnormalities of the great veins or branches of the aortic arch, congenital arrhythmias, hypertrophic or dilated cardiomyopathy, rheumatic heart disease and bicuspid aortic valve without stenosis or regurgitation were excluded. Congenital anomalies were classified according to the International Classification of Disease (ICD – 10).[15] A questionnaire including clinical and laboratory data was completed for all cases. The survey data were checked, coded, computerized and comparing using Statistical Package for Social Sciences (SPSS, Inc., Chicago, IL, USA, Version 11.5). Descriptive statistics was used to report the findings and all these data were analyzed and presented in the form of tables and graphs as frequencies and percentages.

Results

One hundred patients, comprising 55(55%) male and 45(45%) female had congenital heart disease diagnosed by echocardiogram, their age ranged from 0.01 to 15 years with a mean age of 6.4 ± 5.3 years and male to female ratio 1.2:1. Over one third (34%) of the patients were between 1 – 5 years of age, 27% between 11 – 15 years, 21% below 1 years and rest 18% between 6 – 10 years (Table I). Major clinical presentations were dyspnoea (92%), fatigue (90%), recurrent chest infection (72%), delayed development (68%), congenital abnormalities (60%), found on R.E (59%) and FTT (53%). Other symptoms were CCF (42%), cyanosis (37%), hypoxic spells (23%) (Table II). Sixty six (66%) of the total cases had non-cyanotic heart defects. Cyanotic heart defects were seen in 34 patients (34%) (Figure-3). Atrial septal defect (35%) was the most frequent form of non-cyanotic congenital heart defects, followed by ventricular septal defect (15%), pulmonary stenosis (6%), patent ductus arteriosus (5%), endocardial cushion defect (3%) and coarctation of aorta (2%). Whereas fallot's tetralogy (17%) followed by transposion of great arteries (10%) and ebstein's anomaly (7%) were the commonest cyanotic congenital heart defects as shown in Table III. The frequencies of specific form of CHD are presented in table IV. Patients with ventricular septal defect, pulmonary stenosis, patent ductus arteriosus, endocardial cushion defect, coarctation of aorta and ebstein's anomaly had male predominance compared to female (53.3% vs. 46.7%; 66.7% vs. 33.3%; 100% vs. 0%; 66.7% vs. 33.3%; 100% vs.0%; 71.4% vs. 28.6% respectively). Atrial septal defect was the common CHD. It was found in 17(48.6%) male and 18(51.5%) female with male to female ratio 0.9:1. The mean age at diagnosis was 9.3 ± 0.9 years. Ventricular septal defect was the second most frequent CHD, seen in 8(53.3%) male and 7(46.7%) female with male to female ratio of 1.1:1 and mean age at diagnosis of 5.5 ± 1.2 years. Fallot's tetralogy a cyanotic heart disease was diagnosed in 7(41.2%) male and 10(58.8%) female with male to female ratio 0.7:1 and mean age 3.9 ± 0.6 years. Transposition of great arteries and ebstein's anomaly were diagnosed in 10 patients (5(50%) male and 5(50%) female and male to female ratio 1:1 with mean age 2.5 ± 0.9 years) and in 7 patients (5(71.4%) male and 2(28.6%) female and male to female ratio 2.5:1 with mean age 7.2 ± 2.5 years) respectively.

Table-I: Age and sex distribution of patients of congenital heart disease (n = 100)

Age (years)	No. of male	No. of female	Total (percentage)
<1	11	10	21(21.0)
1 – 5	18	16	34(34.0)
6 – 10	11	07	18(18.0)
11 – 15	15	12	27(27.0)

* Mean age = (6.4 ± 5.3) years; range = (0.01 – 15) years.

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Table II: Symptoms/signs of patients of congenital heart disease (n = 100)

Symptoms	Frequency	percentage
Recurrent chest infection	72	72.0
Dyspnoea	92	92.0
Found on R.E.	59	59.0
Hypoxic spells	23	23.0
CCF	42	42.0
Delayed development	68	68.0
Cyanosis	37	37.0
Congenital abnormalities	60	60.0
FTT	53	53.0
Fatigue	90	90.0

* Total will not correspond to 100% for multiple responses.

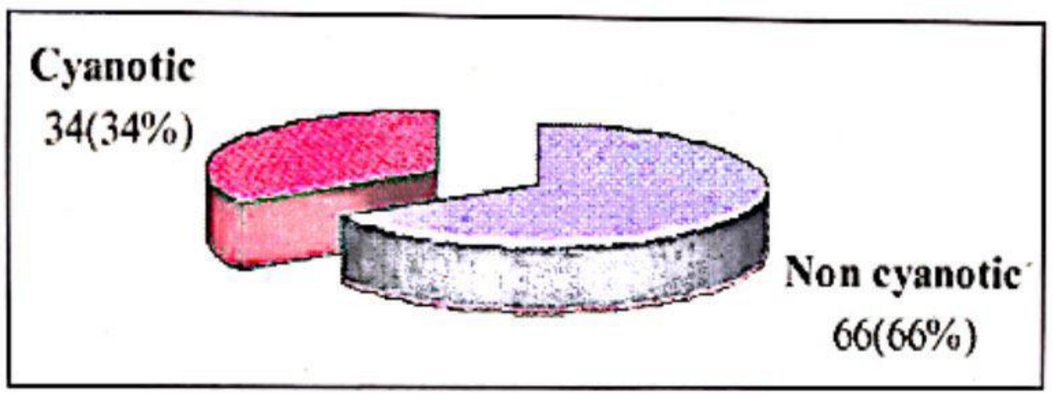

Fig. 3: Type of congenital heart disease (n = 100)

Table III: Relative frequency of congenital heart disease (n = 100)

Heart defects	Frequency	Percentage
Non-cyanotic		
Ventricular septal defect	15	15.0
Pulmonary stenosis	06	6.0
Patent ductus arteriosus	05	5.0
Atrial septal defect	35	35.0
Endocardial cushion defect	03	3.0
Coarctation of aorta	02	2.0
Cyanotic		
Fallot's tetralogy	17	
Transposion of great arteries	10	
Ebstein's anomaly	07	

Table IV: Distribution of specific type of congenital heart disease.

Lesion	Male	Female	Male : Female	Mean age at diagnosis (yrs)
Ventricular septal defect	8(53.3)	7(46.7)	1.1:1	5.5 ± 1.2
Pulmonary stenosis	4(66.7)	2(33.3)	2:1	5.4 ± 1.6
Patent ductus arteriosus	5(100.0)	00	Male	9.3 ± 3.1
Atrial septal defect	17(48.6)	18(51.4)	0.9:1	9.3 ± 0.9
Endocardial cushion defect	2(66.7)	1(33.3)	2:1	1.5 ± 1.2
Coarctation of aorta	2(100.0)	00	Male	2.8 ± 0.7
Fallot's tetralogy	7(41.2)	10(58.8)	0.7:1	3.9 ± 0.6
Transposion of great arteries	5(50.0)	5(50.0)	1:1	2.5 ± 0.9
Ebstein's anomaly	5(71.4)	2(28.6)	2.5:1	7.2 ± 2.5

Figures in the parentheses denote corresponding percentage.

Discussion

Congenital heart diseases are among the more common major malformations at birth.[16] In developing countries thousands of children die due to CHD.[17] One quarter of all deaths from CHD occur in the 1st month of life and half to two third of deaths occur within 1st seven to ten days of life.[18,19] The pattern of CHD varies depending upon patient's age and country development. Studies on patients of different ages reveal that complex defects (hypoplastic left heart syndrome, mittral and aortic atresia) are common in the autopsy of fetus and neonates;[14] significant defects (transposition of great arteries, Fallot's Tetralogy and so forth) predominant in neonates and infants.[20,21] and minor defects (ventricular septal defect, patent ductus arteriosus, atrial septal defect and so forth) in older children. In developed countries, this pattern has been modified in such a way that nowadays, CHD is considered a disease of adults as well as children.[22] The use of echocardiography and routine clinical

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screening of neonates and infants allow the detection of heart defects at a very early stage, which make the decision on therapeutic abortion or early surgical correction easier.[23,24] In the developing countries, where there is a shortage of health services, however, the pattern still resembles that of the presurgical era.[25] The majority of patients are never diagnosed, those in critical stages die and survivors are diagnosed too late. Up till now in our country childbirth occurs at home and necropsy has not been included within the medical practice yet. Therefore, it is difficult to ascertain the true pattern of CHD.

The result of our study shows that although 73% of patients with congenital heart disease were diagnosed before age of 10 years, only 21% were diagnosed before age of 1 year. The peak age of diagnosis of our patients was between 1 – 5 years. This is relatively late compared with developed countries in which most cases are detected during the neonatal period. Early diagnosis of these lesions in the Western world may be due to the fact that routine foetal echocardiographic examination forms part of ante-natal care.[26] Males were affected predominantly in our study with a mean age of 6.4 ± 5.3 years and male to female ratio 1.2:1 which differ from findings of Marelli et al. (2007)[22] & Baspinar et al. (2006)[27] but accordance with other studies of Sani et al.[28] & Kolo et al. (2012).[29] Whereas, ventricular septal defect, pulmonary stenosis, patent ductus arteriosus, endocardial cushion defect, coarctation of aorta and ebstein's anomaly were commoner in males and atrial septal defect and fallot's tetralogy were commoner in females. The major clinical presentation of patients were dyspnoea, fatigue, recurrent chest infection, delayed development and congenital abnormalities. These findings are almost similar in the study of Memon et al[30] demonstrated that dyspnoea, recurrent chest infection, delayed development, congenital abnormalities and hypoxic spells were the main symptoms of the patients.

The pattern of distribution of types of CHD encountered in this study was very different from other studies, whether conducted in our country or in other countries. The most common CHD in this study was atrial septal defect (35%), which is consistent with the findings of previous studies from Nigeria[28,31] and from other parts of the world,[32-36] but different to a report from South Africa.[37] Also the studies in Bangladesh Rahman et al.,[38] Siddique et al.[39] and Begum et al.[40] found ASD the commonest lesion. The second most common CHD in this study was ventricular septal defect (15%). This is less compare to the worldwide incidence (25–30%)[41] and others reported by Masood et al.[42] (25%) and Abbag[32] (32.5%) and Burki & Babar[43] (29%) and Shann (43.4%).[44] Pulmonary stenosis is the next common CHD (6%) in this study, followed by patent ductus arteriosus (5%) and endocardial cushion defect (3%). Almost similar study in Jordan reported by Amro[45] showed that pulmonary stenosis in 6.2%, patent ductus arteriosus in 8.3% and endocardial cushion defect in 4.1% of patients. This observation is contrary to the study of Sharmin et al.[46] in Bangladesh found that pulmonary stenosis in 1.7%, patent ductus arteriosus in 7.8% and coarctation of aorta in 1.7% of patients. There is a significant difference in the incidence of Coarctation of aorta in the developing countries as compared to that of developed countries. It is reported to be 2% in our study as compared to 10.2% in Sweden.[47] Among the cyanotic lesions Tetralogy of Fallot was the commonest congenital heart lesion followed by transposition of the great arteries and ebstein's anomaly. This is comparable with the study in Taiwan where the commonest cyanotic cardiac lesion was Tetralogy of Fallot and then transposition of the great arteries.[48] In another study Tetralogy of Fallot was most common but transposition of the great arteries was earlier to present.[49] This variation could be due to either a genetic or an environmental factor, such as the higher incidence of congenital infections and consanguineous marriages in some parts of the developing countries compared to the developed countries.[50]

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In developed countries early detection and surgical intervention have provided a high chance of survival in children with CHD but in developing countries like Bangladesh the facilities for diagnosis and treatment of children with 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 CHD there is need to diagnose and treat CHD at earliest age by provision of diagnostic and surgical facilities at each corner of the country in order to intervene successfully.

Conclusion

Congenital heart diseases are still common in our society and constituting a big health problem. Majority of patients with CHD detected noncyanotic congenital heart disease. Atrial septal defect is the commonest non-cyanotic and Fallot's tetrology as cyanotic congenital heart disease. In order to avoid complications, early detection of congenital heart disease is of utmost importance for proper management.

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