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Prevalence, Pattern and Risk Factors of Congenital Heart Disease in Children ≤ 2 Years of Age: A study in a tertiary Hospital, Pabna, Bangladesh

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Abstract | **Original Research Article**

Congenital heart disease means the malformation of the heart, aorta, or other large blood vessels that is the most frequent form of major birth defect in newborns. In recent neonatologists and paediatricians are more conscious about early detection and treatment of children with congenital heart diseases. Now a day, diagnostic facilities are also available in many places. A prospective study was carried out in Pabna Sadar Hospital, Pabna, Bangladesh during the period from January 2017 to December 2018. The total number of participants, only peadiatric patients within 2 years of age who were admitted with any health problem and/or born in this hospital was 17200. Among these patients 7772 were born in this hospital and rest 9428 were taken from hospital admission register who were admitted in this hospital during the study period because of any health problems. Only the patients/ respondents who were agreed without any pressure and continued the total tanner of the study are mentioned only in this study. The suspected patients to have any form of congenital heart disease (CHD) were followed up every 4-6 wks for a period of 12 months. The aim of the study was to assess the prevalence, pattern and risk factors of congenital heart disease in children < 2 years of age in Pabna, Bangladesh. Echocardiography with color Doppler was performed in all these patients including those who reported late but were delivered in Obstetrics department of Pabna Sadar Hospital, Pabna, Bangladesh. In this study we found, out of total 17200 paediatric patients (Both admitted and born) 137 had CHD. Some of the patients 3152 (18.33%) had other associated somatic anomalies among which Down's syndrome was commonest (10.44%). Among CHD patients we found most common congenital heart lesions were Atrial Septal Defect/ASD in 37 (27.01%), Ventricular Septal Defect/VSD in 23 (16.79%), Patent Ductus Arteriosus/PDA in 17 (12.41%), Tetralogy of Fallot/TOF in 13 (9.49%) and Pulmonary Stenosis/PS in 10 (7.30%). Those who were found to have congenital heart disease were managed accordingly. Some patients had spontaneous closure of defects in first year follow up period. The incidence of Congenital Heart Disease (CHD) found upon various factors like nature of the samples or on the spot examination by a Paediatric cardiologist. A hospital which has Obstetric, Neonatal and Paediatric cardiology unit can carry out this kind of study successfully. In this study screening of asymptomatic high risk neonates and children also contribute in early detection of many trivial lesions. Severe lesions were also detected by the paediatric cardiologist who usually expires before being referred from other hospitals and before being diagnosed. So a higher incidence rate is recorded in this study. All data were collected through a pre designed questioner by trained stuffs.

Keywords: Congenital Heart Disease, Children, Incidence.

INTRODUCTION

Congenital heart disease or congenital heart defect (CHD) is a problem of the heart's structure and function present at birth, affecting the heart or adjacent great blood vessels, detected either at the time of birth or detected later in life. This was a prospective study and carried out in Pabna Sadar Hospital, Pabna, Bangladesh during the period from January 2017 to December 2018. The total number of participants, only peadiatric patients within 2 years of age who were admitted with any health problem and/or born in this hospital was 17200. Among these patients 7772 were born in this hospital and rest 9428 were taken from hospital admission register who were admitted in this hospital during the study period because of any health problem. The aim of the study was to observe the situation of congenital heart disease in children <2 years of age in Pabna, Bangladesh. The incidence of congenital heart disease is the rate of new cases of congenital heart disease, usually expressed as the

number of babies born with congenital heart disease per 1,000 live births. Data from the Northern Region Pediatric Cardiology database showed that between 1985 to 1999 there were 5.2 cases of congenital heart disease diagnosed in infancy for every 1,000 live births [1]. Further data from the same database suggests around 1 in 4 cases of congenital heart disease in UK are diagnosed later in childhood. Based on these figures incidence in the UK is 6.9/1000 or one in every 145 babies born. The incidence of congenital heart disease (CHD) depends on many factors – the nature of the sample, the source of information, spot examination by pediatric cardiologist, nature of center where study is carried out (hospital based, whether it is a tertiary referral hospital where obstetrics department deal with complex referral women), whether screening echocardiography is done for all suspected newborn or those who has risk of having CHD (all Down's syndrome baby, all baby of diabetic mother, all baby with other congenital malformation) *et al.* [2,3]. Until 1930, it was believed that rheumatic heart disease was by far the most common form of cardiac disease in children [4]. In recent years it has become evident that, in most cardiac centers CHD is the more common of the two. Most cases of congenital heart disease die in early infancy and some conditions do not manifest in the first few years of life, this emphasizing the need to establish incidence and prevalence of this condition[5]. Prevalence rate of congenital heart disease in Bangladeshi population is not known due to insignificant population surveys. There is no incidence study in Bangladesh so far. Some study suggested that, a majority of congenital heart disease in children may remain undetected unless specific efforts are made to diagnose them [2, 3]. In the present prospective study specific efforts were made to detect all possible cases of CHD in infancy by examining all live births delivered in *Pabna Sadar Hospital, Pabna, Bangladesh*. All high risk cases of newborn were also sent for echocardiography though there was no audible murmur. As this *Pabna Sadar Hospital, Pabna, Bangladesh* is a tertiary referral hospital, all high risk pregnancies were admitted here for delivery.

Objectives

General Objective

To assess the prevalence, pattern and risk factors of congenital heart disease in children < 2 years of age in Pabna, Bangladesh

Specific Objectives

To observe the pattern of congenital heart disease in children < 2 years of age in Pabna, Bangladesh

MATERIALS AND METHODS

This was a prospective study conducted in Pabna Sadar Hospital, Pabna, Bangladesh during the period from January 2017 to December 2018. The total number of participants, only paediatric patients from birth to 2 years of age who were admitted with any health problem and/or born in this hospital was 17200. Those suspected to have any form of congenital heart disease (CHD) were followed up every 4-6 wks for a period of 12 months. The aim of the study was to assess the prevalence, pattern and risk factors of congestive heart diseases in children ≤ 2 years of age. The new born were more than 1500 gm and were more than 32 weeks gestational age. A through clinical examination was carried out within first 72 hours of birth and for admitted patient it was ensured at an earliest convenience. Presence of congenital heart disease (CHD) was suspected on the basis of following findings defined by Mitchell *et al*. [6]. These are: a) Presence of a cardiac murmur. b) Presence of cyanosis or feeding difficulty only. c) Cyanosis associated with feeding difficulty and d) Feature of congestive heart failure or failure to thrive.

Detailed information was collected with special reference to family history of congenital heart disease in siblings, parents or in first-degree relatives. Significant antenatal history like- a) Radiation exposure b) Drug intake c) Hormone ingestion d) Rubella like condition in first six months prior to conception or in first trimester of pregnancy, maternal age, parity & f) Babies birth weight, sex, gestational age were recorded.

All suspected patients were investigated with chest X-ray, electrocardiogram and 2D, M- mode echocardiography with color Doppler. Patients who had some form of congenital heart disease were followed up for minimum one year at 6 weeks interval. Patent foramen ovale, persistent left superior vena cava, Azygos vein continuation to superior vena cava, anomalies of systemic artery branches and arrhythmias associated with structural malformations were excluded. Baby of diabetic mothers, all Down's syndrome baby and baby with other congenital malformation like cleft lip, palate, syndactyly, polydactyly, imperforated anus, renal or cerebral malformations were screened additionally though no significant symptoms or signs were present. Innocent murmur or patient with transient systolic murmur was excluded from study after ruling out of structural cardiac malformation by echocardiography.

RESULTS

This was a prospective study and carried out in Pabna Sadar Hospital, Pabna, Bangladesh during the period from January 2017 to December 2018. The total number of participants, only peadiatric patients within 2 years of age who were admitted with any health problem and/or born in this hospital was 17200. Among these patients 7772 were born in this hospital and rest 9428 were taken from hospital admission register who were admitted in this hospital during the study period because of any health problem. The aim of the study was to assess the prevalence, pattern and risk factors of

congenital heart disease in children < 2 years of age in Pabna, Bangladesh. Table-I showed frequency of congenital heart disease among study patients. Total patients were 17200 in number. Positive cases for congenital heart lesions were 137 which means incidence was 7.965/1000 baby. Table II shows the ratio of positive Echocardiographic finding in suspected newborn and patients for screening patients for screening. Among 17200 patients we suspected were 1113 which was 6.47% of the total patients. Among suspected patient only 137 (7.97 per thousand) were found CHD positive through screening. Rest 976 was found normal in condition.

Table-II showed percentage of positive Echocardiographic findings in suspected patients also. Patients who had high risk for congenital heart disease were also screened for exclusion of congenital heart disease. Total patients sent for echocardiography were among which were selected for screening. One hundred and thirty seen had various kinds of congenital (0.797%) heart lesions. Among this, we found 27 and 29 patients with transient and innocent murmur (Table III). Table IV Showed associated non-cardiac anomalies. Down's syndrome was noticed in 14 (10.22%) patients, gastrointestinal abnormalities were detected in 3 (2.23%) cases, genitourinary in 3 (2.23%) cases, cleft lip/palate in 3 (2.23%) cases, congenital rubella syndrome in 2 (1.5%) cases, polydactyly in 2 (1.5%) cases and Turners syndrome in 1 (0.75%) case. Table-V showed the types of congenital malformation in newborn. ASD was noticed in 27.01% cases, VSD in 16.79% cases, PDA in 12.41% cases, TOF in 9.49% cases, D-TGA in 3.65% cases, Tricuspid Atresia in 2.92% cases, pulmonary stenosis in 7.30% cases, coarctation in 1.46% cases, TAPVD in 2.19% cases, Aortic stenosis in 2.19% cases, pulmonary atresia in 2.92% cases, Mitral atresia in 1.46% cases and some other malformations. Table-VI showed pattern of risk factors in suspected cases of congenital heart diseases. High maternal age was noticed in 6.56% cases, Gestation diabetes mellitus in 3.23% cases, drug intake like hormone, anticonvulsants, homeopathic or herbal medicine was noted in 3.23% cases. Patient with some other congenital malformations were also screened. Family history of CHD was noticed in 1.26%. Table-VII showed spontaneous closure percentage of some lesions in first year. Out of 23 VSD cases, 9 were closed spontaneously. Sixteen cases of ASD and 7 cases of PDA were also closed spontaneously by first year of life.

Table-I: Frequency of congenital heart disease among participants (n=17200)

Subject	Male	Female	Total	%
Baby without CHD	9046	8017	17063	99.203
Baby with CHD	89	48	137	0.797
Grand Total	9135	8065	17200	100

Incidence 8.26/1000 (n=17200)

Table II: Findings of Echocardiogram (n=17200)

Component	n	%
Total Participants	17200	100
Suspected	1113	6.47
Screening (Echo.)	1113	6.47
Not suspected	16087	93.53
Suspected but normal	976	5.67
Baby with CHD	137	0.797

Table-III: **Noticable outcome among study patients (n=17200)**

Outcome	n	%	Per K
Definite CHD	137	0.797	7.97
Transient murmur	27	0.16	1.57
Innocent murmur	29	0.17	1.69

NB: Per K means out of 1000

Table-IV: Associated non-cardiac anomalies in CHD Patients (n=137)

Non-cardiac Anomaly	n	%	Type
Down's syndrome	14	10.44	ASD:4
			VSD:3
			AV canal:6
			TOF:1
Gastrointestinal abnormalities	3	2.23	VSD:1
			ASD:1
			PDA:1

Genitourinary abnormalities	3	2.23	DORV:2 VSD:1
Cleft palate/lip	3	2.23	ASD:3
Cataract with congenital Rubella syndrome	2	1.5	PDA:1 PS:1
Polydactyly	2	1.5	Tricuspid Atresia:2
Turners syndrome	1	0.75	PS:1
Total	28		

Table-V: Types of congenital malformation in CHD Patients (n=137)

Congenital Heart Disease	n	%
Ventricular Septal Defect (VSD)	37	27.01
Atrial Septal Defect (ASD)	23	16.79
Patent Ductus Arteriosus (PDA)	17	12.41
Tetralogy of Fallot (TOF)	13	9.49
D-Transposition of Great Arteries (D-TGA)	5	3.65
C-Transposition of Great Arteries (C-TGA)	3	2.19
Atrioventricular Septal Defect (AV canal)	6	4.38
Pulmonary Atresia	4	2.92
Mitral Atresia	2	1.46
Tricuspid Atresia	4	2.92
Pulmonary Stenosis	10	7.30
Aortic Stenosis	3	2.19
Single Ventricle	2	1.46
Coarctation of Aorta	2	1.46
Peripheral pulmonary stenosis	2	1.46
Truncus Arteriosus	1	0.73
Total anomalous pulmonary venous drainage	3	2.19
Others	3	2.19

Table-VI: Risk factors of CHD in suspected cases (n=1113)

Risk factors	n	%
High maternal age (beyond 30 years)	73	6.56
Drugs intake (Including Homeopathy, Herbal)	36	3.23
Antenatal infection	16	1.44
Family history of CHD (sibs affected)	14	1.26
Gestational Diabetes Mellitus	36	3.23
Down's syndrome	16	1.44
Mother having systemic lupus erythematosus	2	0.18
Patient with other congenital malformation	22	1.98
Total	215	19.32

Table-VII: Spontaneous closure of some defects in first Year follow up period (n=137)

Disease	n	Spontaneous (%)
Ventricular Septal Defect	23	9 (39)
Atrial Septal Defect	36	16 (44)
Patent Ductus Arteriosus	19	7 (37)

DISCUSSION

This was a prospective study and carried out in Pabna Sadar Hospital, Pabna, Bangladesh during the period from January 2017 to December 2018. Congenital heart disease (CHD) has already been recognized as one of the important cause of neonatal mortality and morbidity. The reported incidence of CHD in live newborns tends to vary a lot due to various unrecognizable lesions at birth and lack of technical expertise [7]. Ferenez *et al*. [8] reviewed several major studies from Europe and north America and concluded that confirmed CHD incidence had been remarkably constant at 4/1000 live births over 40 years time span from 1940 to 1980[8]. The incidence reported in the present study is 25/1000 live births, which is much higher than any other study conducted so far. Possible reasons are a) study was conducted by a pediatric cardiology unit of a tertiary hospital where all specialty

units like obstetrics and gynecology, neonatology, cardiac center, intensive care units were available (b). All live births were examined by neonatologist/pediatrician and suspected cases were referred to pediatric cardiologist. c) There was a screening program existing in pediatric cardiology unit where all newborn having following conditions are screened for congenital heart lesions: i) baby of elderly mother Down's syndrome iii) Baby with other congenital malformations iv) Mother who had history of ingestion of hormone or anticonvulsant or other teratogens during pregnancy or exposure to radiation. v) Baby of mother with systemic lupus erythematosus vi) Those who had affected siblings Baby of diabetic mother complicated pregnancies were referred to this centre from other military hospitals. So various unrecognized lesions at birth were picked up by echocardiography which were not included in other study. Again some lesions had chance of spontaneous closure within first few weeks/months of life, eg, atrial septal defects (ASD) or patent ductus arteriosus (PDA) or ventricular septal defect (VSD). These were picked up in this study as all patients were examined in first week of life. Again many newborn with complex lesions die before being examined by pediatric cardiologist which decreases the incidence in some study. Screening program existing in the unit also increases the incidence as some asymptomatic newborns were examined and few of them were found to have congenital heart lesions. Studies of the incidence of CHD usually estimate the total incidence and the proportions of different CHD, but present study also tried to find out other non cardiac anomalies present in this newborn, presence of any risk factors in them and then placing them under screening program (if there is no evident clinical features). Gestational age and birth weight of the patients were also studied. The medical equivalent of Heisenberg's uncertainly principle is involved, inasmuch as very large studies of huge population give sufficiently large live births at the expense of not being able to detect all those with CHD, where as very intensive study that find virtually all those with CHD in a region cannot be done on very large populations. The former studies were passive in that diagnosis is made in a large regional high-quality pediatric cardiology center but relies on referral of patients from local doctors. Finally some neonate with critical heart lesions may die in neonatal period before being visited by a pediatric cardiologist. On the other hand, more intensive studies of all neonates in a nursery will detect all forms of CHD and allow for early deaths. This study was an intensive one, hospital based, so detection rate was much higher. CHD in neonates is increasingly reorganized in India now days [9]. This is perhaps due to increasing awareness in pediatricians who are the primary health care provider. This trend may also be related to widely available Echocardiographic machines and trained personnel, since echo forms the mainstay of diagnosis of CHD in neonates. So, screening of the newborn with CHD is important. A study showed pulse oxymetry can effectively screen CHD in asymptomatic children. An Autopsy study on 270 cases were conducted to find out pattern of CHD in first years of life.[10] First years of life is very critical for CHD patient as nearly one third of patients succumb to death during this period. D-TGA was found in 8.7% cases DORV in (5.8%), TAPVC in (4.8%), TOF in 15.5% cases, Tricuspid atresia in 9.6% cases, Fibroelastosis in 6.8% cases, VSD, PDA in 3.8% cases, ASD in 1.9% cases *et al.*[11]. Associated non-cardiac anomaly and somatic anomaly was noticed in 18.30% cases. Among those Down's syndrome were noticed in 9.15% newborn with congenital heart disease which correlates with other study [3, 7]. The incidence of CHD in association with Down's syndrome was 9.3% in one study which was independent of maternal age [3]. ASD was noticed in 27.01% cases, VSD in 16.79% cases, PDA in 12.41% cases, TOF in 9.49% cases, D-TGA in 3.65% cases, Tricuspid Atresia in 2.92% cases, pulmonary stenosis in 7.30% cases, coarctation in 1.46% cases, TAPVD in 2.19% cases, Aortic stenosis in 2.19% cases, pulmonary atresia in 2.92% cases, Mitral atresia in 1.46% cases and some other malformations which was highest in this study which do not correlates with other study. In Bangladeshi population ASD is commoner which was established in another study [12]. Other reason is that ASD is a common finding in newborn most of which closes spontaneously by 2 years of age [13]. A study was conducted on Delhi school children to find out prevalence of congenital heart disease [14].This study showed lesions in order of frequency are VSD 30%, ASD 23%, Aortic stenosis 16%, PDA 11%, PS 10%, TOF 4% etc. This study finding is almost similar to other studies. Clinical profile of congenital heart disease was studied by few workers in Bangladesh previously [15-17]. ASD was the commonest lesion found in study conducted by Sufia Rahman *et al.* [15]. VSD was the commonest in other two studies. Report of New England Regional Infant Cardiac Program showed VSD as the commonest lesion [18]. Hypoplastic left heart syndrome was found as commonest lesion among those who had no intervention before birth [18] Reducing the prevalence of these diseases is urgent and requires a real inventory of the premises of the problem that would clarify the issue for more effective prevention strategies and improved management. So we will have to arrange more study regarding this issue to know more.

Limitations of the study

This was a single centre study with small sample size. So, the study results may not reflect he scenarios of the whole country.

Conclusion and Recommendations

Congenital heart disease (CHD) has already been recognized as one of the important cause of neonatal mortality and morbidity. This was a prospective study and carried out in Pabna Sadar

Hospital, Pabna, Bangladesh during the period from January 2017 to December 2018. The aim of the study was to observe the situation of congenital heart disease in children < 2 years. But Congenital Heart Disease (CHD) is a burning issue. Our findings may help in further study we think. But at the end of the study we would like to recommend for more study, workshops and awareness building intervention to conduct in different places across the globe. As, a patient of CHD take birth with that disease so previous awareness about this disease may save a lot of life.

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