Incidence of Congenital Heart Disease among Hospital Live Birth in a Tertiary Hospital of Bangladesh

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Abstract:

Background: *Incidence of congenital heart disease is 8-10/1000 live birth which is established by many studies carried out in many centers worldwide. In Bangladesh no incidence study was carried out so far. Newborn children presenting with various forms of congenital heart disease is a common problem now a days. Neonatologists and paediatricians are now more conscious about early detection and treatment of newborn with congenital heart diseases. Diagnostic facilities are also available in many places. So an individual incidence record from an ideal center of our country is a demand of the time which led carrying out this study.*

Methods: *This prospective study was carried out in Combined Military Hospital (CMH) Dhaka over a period of three years (2004 – 2006). All five thousand six hundred and sixty eight live births weighing more than 500 gm and more than 28 weeks gestational period were subjected to a thorough clinical examination within 72 hours of birth. Those suspected to have any form of congenital heart disease (CHD) were followed up every 4-6 wks for a period of 12 months. Echocardiography with color Doppler was performed in all these newborn including those who reported late but were delivered in obstetrics department of Combined Military Hospital Dhaka.*

Result: *One hundred forty two babies out of 5668 live birth had CHD, ie, 25/1000 live births. Incidence of CHD was higher in pre terms as compared to full term live birth. Some of the patients (18.30%) has other associated somatic anomalies among which Down's syndrome was commonest (9.15%). Most common congenital heart lesions were Atrial Septal Defect (ASD-26%), Ventricular Septal Defect (VSD-16.9%), Patent Ductus Arteriosus (PDA-18%), Tetralogy of Fallot (TOF-14%), Pulmonary Stenosis (PS-7.75%) etc. 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.*

Conclusion: *The incidence of Congenital Heart Disease (CHD) depends upon various factors like nature of the samples (all live birth or all birth) or on the spot examination by a Paediatric cardiologist. A hospital which has Obstetric, Neonatal and Paediatric cardiology unit can carried out this kind of study successfully. In this study screening of asymptomatic high risk neonates also contributes in early detection of many trivial lesions. Severe lesions were also detected by the paediatric cardiologist who usually expire before being referred from other hospitals and before being diagnosis is established. So a higher incidence rate is recorded in this study.*

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Introduction:

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 show 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 (all live births or all births), the source of information, spot examination by pediatric cardiologist, nature of

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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) etc.[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 CMH Dhaka. All high risk cases of newborn were also sent for echocardiography though there was no audible murmur. As this hospital (CMH Dhaka) is a tertiary referral hospital, all high risk pregnancies were admitted here for delivery. As only pediatric cardiology unit in the country with all kind of facility is situated in this center, it also increase the load of patient which ultimately increase the incidence of CHD in infancy in this center.

Materials and Methods:

This is a prospective hospital based study conducted over a period of three years (January 2004 to December 2006) in pediatric cardiology unit of CMH Dhaka. All five thousand six hundred and sixty eight live birth delivered in Combined Military Hospital (CMH) Dhaka from January 2006 to December 2008 constituted the material of the study. These new born were more than 500 gm and were more than 28 weeks gestational age. A through clinical examination was carried out within first 72 hours of birth. 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. 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 e) Maternal age, parity f) Babies birth weigh, 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, Azygoes 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 were excluded from study after ruling out of structural cardiac malformation by echocardiography.

Results:

Table-I

Frequency of congenital heart disease among hospital live birth (2004-2006).

Subject	Male	Female	Total	Percentage
Live birth	3117	2551	5668	100%
Neonates with congenital heart disease	92	50	142	2.5%

* Incidence 25/1000 Live birth.

Table-I showed frequency of congenital heart disease among hospital live birth. Total live births over a period of three years (2004 – 2006) were 5668 (100%). Positive cases for congenital heart lesions were 142 which means incidence was 25/1000 live birth.

Table-II
Percentage of positive Echocardiographic findings in suspected newborn and newborn for screening.

Subject	No (Screening)	Percentage (Screening)
Total suspected newborn CHD	658 (207)	100% (31.45%)
Newborn with CHD	142 (58)	21.58% (8.81%)

(* Newborn for screening of CHD are within parenthesis).

Table-II showed percentage of positive Echocardiographic findings in suspected newborn. Newborn who had high risk for congenital heart disease were also screened for exclusion of congenital heart disease. Total newborn sent for echocardiography were 658 (100%) among which 207 (31.45%) were selected for screening. One hundred forty two had various kind of congenital (21.58%) heart lesions among which 58 cases (8.81%) were from screening program.

Table-III
*Out come of suspected cases of heart diseases. n=65*8

Out come	No of cases	Percentage of suspected cases	Incidence per thousand
Definite CHD	142	21.58%	25
Transient murmur	30	4.56%	5.29
Innocent murmur	35	5.32%	6.18

Table-III showed outcome of suspected cases of congenital heart diseases. Definitive CHD was noticed in 142 (21.58%) cases. Thirty (4.56%) cases had transient murmur which disappeared after 7-10 days. Thirty five (5.32%) patient had innocent murmur and echocardiography showed no congenital heart lesions.

Table-IV
Distribution of CHD by birth weight and gestation.

Gestational age (wks)	No of children (per thousand live birth)	Birth weight		
		<1500	1500 -2500	>2500
<37 weeks>	63 (11)	46	17	15
37 weeks	79 (13)	9	55	
Total	142 (25)	55	72	15

Table-IV showed distribution of congenital heart disease (CHD) by birth weight and gestational period. Sixty-three newborn had gestational ages of less than 37 completed weeks. Seventy-nine children had gestational age >37 completed weeks. Birth weight of 55 newborn was less than 1.5 kg. Seventy-two newborn had birth weight between 1.5 – 2.5 kg and fifteen newborn had birth weight of more than 2.5 kg.

Table-V
Associated non-cardiac anomalies. n=142.

Non-cardiac Anomaly	No of patient (%)	Congenital heart lesions
Down's syndrome	13 (9015%)	ASD (04) VSD (02) AV canal (06) TOF (01)
Gastrointestinal abnormalities	4 (2.82%)	VSD (02) ASD (01) PDA (01)
Genitourinary abnormalities	2 (1.41%)	DORV (01) VSD (01)
Cleft palate/lip	2 (1.41%)	ASD (02)
Cataract with congenital Rubella syndrome	3 (2.11%)	PDA (02) PS (01)
Polydactyly	1 (0.70%)	Tricuspid Atresia (01)
Turners syndrome	1 (0.70%)	PS (01)
Total	26 (18.30%)	

Table-VI

Types of congenital malformation in newborn. n=142.

S. No	Congenital Heart Disease	Newborn	Percentage
1.	Atrial Septal Defect (ASD)	37	26%
2.	Ventricular Septal Defect (VSD)	24	16.9%
3.	Patent Ductus Arteriosus (PDA)	18	12.68%
4.	Tetralogy of Fallot (TOF)	14	9.86%
5.	D-Transposition of Great Arteries (D-TGA)	6	4.23%
6.	C-Transposition of Great Arteries (C-TGA)	2	1.41%
7.	Atrioventricular Septal Defect (AV canal)	5	3.52%
8.	Pulmonary Atresia	4	2.82%
9.	Mitral Atresia	2	1.41%
10.	Tricuspid Atresia	5	3.52%
11.	Pulmonary Stenosis	11	7.75%
12.	Aortic Stenosis	2	1.41%
13.	Single Ventricle	2	1.41%
14.	Coarctation of Aorta	3	2.1%
15.	Peripheral pulmonary stenosis	1	0.70%
16.	Truncus Arteriosus	1	0.70%
17.	Total anomalous pulmonary venous drainage	2	1.41%
18.	Others	3	2.1%

Table-VII

Risk factors of CHD in suspected cases. n=658.

S. No	Risk factors	No	Percentage
1.	High maternal age (beyond 30 years)	62 (6)	9.42% (0.91%)
2.	Drugs intake (Including homeopathy, Herbal)	39 (4)	5.93% (0.61%)
3.	Antenatal infection	14 (3)	2.13% (0.46%)
4.	Family history of CHD (sibs affected)	13 (6)	1.98% (0.91%)
5.	Gestational Diabetes Mellitus	45 (16)	6.84% (2.74)
6.	Down's syndrome	15 (13)	2.28% (1.98%)
7.	Mother having systemic lupus erythematosus	1 (0)	0.15% (0)
8.	Patient with other congenital malformation	18 (10)	2.74% (1.52%)
9.	Total	207 (58)	31.45% (8.81%)

* Figure within parenthesis indicates positive cases of congenital heart disease and its percentage to total.

Table-V Showed associated non-cardiac anomalies. Down's syndrome was noticed in 13 (9.15%) newborn, gastrointestinal abnormalities were detected in 4 (2.8%) cases, genitourinary in 2 (1.4%) cases, cleft lip/palate in 2 (1.41%) cases, congenital rubella syndrome in 3 (2.11%) cases, polydactyly in 1 (0.7%) cases and Turners syndrome in 1 (0.7%) case.

Table-VI Showed types of congenital malformation in newborn. ASD was noticed in 26% cases, VSD in 16.9% cases, PDA in 12.68% cases, TOF in 9.86% cases, D-TGA in 4.23% cases, AVSD and tricuspid Atresia in 3.52% cases each, pulmonary stenosis in 7.75% cases, coarctation in 2.1% cases, TAPVD in 1.4% cases, Aortic stenosis in 1.41% cases, pulmonary atresia in 2.82% cases, Mitral atresia in 1.41% cases and others in 2.1% cases.

Table-VII Showed pattern of risk factors in suspected cases of congenital heart diseases. High maternal age was noticed in 9.42% cases, Gestation diabetes mellitus in 6.84% cases, drug intake like hormone, anticonvulsants, homeopathic or herbal medicine was noted in 5.93% cases. Patient with other congenital malformations (2.74%) were also

screened. History of antenatal infection and family history of CHD was noticed in 2.13% and 1.98% cases respectively.

Table-VIII

Spontaneous closure of some defects in first year follow up period.

Disease	Total no	Spontaneous
Ventricular Septal Defect	24 (100%)	7 (29.16%)
Atrial Septal Defect	37 (100%)	17 (45.94%)
Patent Ductus Arteriosus (PDA closed with Indomethacine were not included)	18 (100%)	6 (33.33%)

Table-VIII showed spontaneous closure percentage of some lesions in first year. Out of 24 VSD cases, 7 were closed spontaneously. Seventeen cases of ASD and six cases of PDA were also closed spontaneously by first year of life.

Discussion:

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 unit 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 ii) 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 vii) Baby of diabetic mother,d)complicated pregnancies were referred to this centre from other miliraty 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 than 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 can not be done on very large populations.[8] 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.

Thus, a local doctor may not refer simple cases of ASD, mild PS to cardiologists. Again some lesions with subtle physical findings (such as ASD) might not be detected until adult life.[8] 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 a

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.[9] 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 etc.[11] Associated non-cardiac anomaly and somatic anomaly was noticed in 18.30% cases (table V). 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] In our study the lesions in order of frequency were; ASD (26%), VSD (16.9%), PDA (12.68%), TOF (9.86%), D-TGE (4.73%), C-TGA (1.41%), AVSD (3.52%), Pulmonary atresia (2.82%), Mitral atresia (1.41%), Tricuspid atresia (3.52%) and pulmonary stenosis 7.75% (table VI). ASD 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.[12] This study finding is almost similar to other studies.[4,5]

Clinical profile of congenital heart disease were studied by few workers in Bangladesh previously [15,16,17]. ASD was the commonest lesion found in study conducted by Sufia Rahman et al[15]. VSD was the commonest in other two study. 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]

The incidence of PDA was higher in this study (12.68%) which was possibly because of increased number of preterm deliveries in our settings.

High maternal age was found as an important risk factor for CHD in this study(table vii). Women are prone to various environmental hazards with increasing age. This might increase the risk of occurrence of CHD in their babies. Another study in Bangladesh also showed similar findings.[17] Among drugs phenytoin, alcohol, smoking, homeopathy and herbal medicines have all been implicated in teratogenesis in at least few cases(table vii).Role of antitubercular drug in CHD is not yet documented[3].Three mothers who were getting antitubercular drugs has babies with normal heart. There is always concern about CHD among siblings of patient with CHD.[19,20,21] In this study six newborn(1.98%) has history of CHD in siblings.

This is a single hospital based study to find out the incidence of CHD. Apart from size of the sample studied, to find out the incidence among live births, more emphasis should be given on comprehensive examination of newborns at frequent intervals and the mode of diagnostic technique. Echocardiography with color Doppler should be performed on all suspected newborn to avoid missing of apparently healthy newborn.

Conclusion:

The incidence of Congenital Heart Disease (CHD) depends upon various factors like nature of the samples (all live birth or all birth) or on the spot examination by a Paediatric cardiologist. A hospital which has Obstetric, Neonatal and Paediatric cardiology unit can carried out this kind of study successfully. The variations in the reported incidence of CHD are primarily due to variations in the ability to detect trivial lesions like small muscular VSDs, tiny VSDs, ASDs and the small PDAs that may either close spontaneously or never cause medical problems. In this study screening of asymptomatic high risk neonates also contributes in early detection of many trivial lesions. Severe lesions were also detected by the paediatric cardiologist who usually expire before being referred from other hospitals and before being diagnosis is established. So a higher incidence rate is recorded in this study.

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