STUDY OF RISK FACTORS FOR CONEGNITAL HEART DEFECT IN A TERTIARY LEVEL HOSPITAL

FH POLY[1],S AFROZA[2], H RAHMAN[3],MI HASSAN[4]

Abstract:

A congenital heart defect is a heart problem which is present at birth, caused by improper development of the heart during fetal development. In majority of cases there is no known reason for the heart to develop improperly. Some type of congenital heart defects are related to chromosomal abnormality(5-6%), some are to single gene defect(3-5%) or environmental factors(2%). In 85-90% of cases there is no identifiable cause and are generally considered to be caused by multifactorial inheritance. There are some maternal factors which have some role in cardiovascular malformations. These include high maternal age(above 30 years), maternal obesity, consanguinity among the parents, fever during pregnancy, gestational diabetes mellitus, smoking, alcohol consumption, ingestion of any teratogenic drug including homeopathy and herbal medicine.

Objective of the study: *To evaluate the risk factors associated with congenital heart disease.*

Methodology: *A case control study was conducted at paediatric department of Sir Salimullah Medical College & Mitford Hospital following approval of the protocol from 1st January 2013 to 30th June 2014. Children fulfilling the inclusion criteria-(0-5 year old children of both sexes admitted in paediatric units of Mitford Hospital with any type of congenital heart disease confirmed by echocardiography) were considered as cases. A similar number of age and sex matched children admitted in Mitford Hospital without any cardiac defect were considered as controls. Data were collected by questionnaire.*

Results: *The results show that majority of the cases are male. Maternal age (27.09 ± 4.63) and BMI (24.10 ± 2.28) both are significantly higher in cases than those of controls. Among the cases 31.8% mothers had consanguineous marriage (p=0.001) and 27.1% mothers had history of fever during pregnancy whereas it was present in 9.3% mothers of controls, the difference is significant statistically (p=0.001). Among the cases 34.6% mothers had history of gestational diabetes mellitus and only 18.9% controls had so and the difference is significant statistically (p=0.014).*

Conclusion: *Relatively old age and more weight during pregnancy, consanguinity between parents, fever during pregnancy, history of gestational diabetes mellitus are the main risk factors of congenital heart defects in children.*

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Introduction

Congenital heart disease is the commonest of all congenital lesions and is the most common type heart disease in the children.[1] In a definition proposed by Mitchell et al, congenital heart disease is a" gross structural abnormality of heart and intrathoracic great vessels that is actually or of functional significance".[2] Congenital heart disease occurs in approximately 0.8% of live births.[3] The incidence is higher in stillborns(3%-4%), spontaneous abortuses(10%-25%) & premature infants(2%) excluding patent ductus arteriosus.[4] Congenital heart disease remains the leading cause of death in children among congenital malformations.[5]

The cause of most congenital heart defects is unknown.[1, 4-6] Most cases of CHD were thought to be multifactorial and result from a combination of genetic predisposition and

1. Dr. Ferdousi Hossain Poly, Assistant Registrar, Department of Paediatrics, Sir Salimullah Medical College & Mitford Hospital.
2. Professor Dr. Syeda Afroza, Professsor & Head, Department of Paediatrics, Sir Salimullah Medical College & Mitford Hospital.
3. Dr. Hasanur Rahman, Assistant Professor, Department of Pharmacology, Dhaka Medical College.
4. Dr. Md. Imran Hassan,Resident,Phase B, Department of Pathology, Bangabandhu Sheikh Mujib Medical University.

Correspondence: Dr. Ferdousi Hossain Poly, Medical Officer, Personal Division, Presidents Office, Bongobhabon, Dhaka.email: dr.polyk55@gmail.com, mobile-01718119811

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environmental stimulus. [1 , 4-6] Multifactorial inheritance means that 'many factors" are involved in causing a birth defect. The factors are usually both genetic and environmental, where a combination of genes from both parents in addition to unknown environmental factors produce the trait or condition. A small percentage of congenital heart lesions are related to Chromosomal abnormalities, in particular, trisomy 21,13 & 18 & Turner syndrome.[5] Other genetic factor may have a role in CHD; certain types of VSDs (supracristal) are more common in Asian children.[5] The risk of recurrence of CHD increases if a 1st degree relative(parent or sibling) is affected.[4,5,7] Scientists know that some types of congenital heart defects can be related to an abnormality of an infant's chromosomes(5%-6%), single gene defect(3%-5%) or environmental factors(2%).[5] 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.[1,4,5]

However some types of CHD are known to occur more often when the mother comes in contact with certain substances during the first few weeks pregnancy.[4,7] Some maternal illness and medications taken for these illnesses have been shown to affect the heart's development. [4,7]Women who have seizure disorders and need to take anti-seizure medications may have a higher risk for having a child with CHD, as do women who take lithium to treat depression.[4] Mothers who have phenylketonuria (PKU) who do not adhere to the special diet necessary to manage the disease during pregnancy have higher risk of having a child with CHD.[4] Also women with insulin dependant diabetes mellitus (particularly if the diabetes is not well controlled) or lupus may have a higher risk of having a child with CHD .[4,7,9] The risk increases when either parent has CHD or when another sibling was born with CHD· [4,7]

Parental consanguinity is a risk factor for CHD worldwide suggesting that a recessive inheritance model may contribute substantially to CHD.[10]

A mother who contacts rubella virus during her pregnancy has a very high risk of having a child with CHD. [4,5,7-9,11]Some heart defects are considered to have autosomal dominant i The risk increases when either parent has CHD or when another sibling was born with CHD· [4,7]

Methodology

Materials and Methods

Study design

Case-control study

Place of study

Department of Paediatrics, Sir Salimullah Medical college & Mitford Hospital, Dhaka.

Period of study

From 1st January 2013 to 30th June 2014

Inclusion criteria

- Children admitted in paediatric units of Sir Salimullah Medical College & Mitford Hospital with any type of congenital heart disease confirmed by echocardiography.
- Age: 0 -5 year
- Sex: Both male and female
- 107 age and sex matched controls were taken from paediatrics indoor of Sir Salimullah Medical College & Mitford Hospital, Dhaka, having illness other than congenital heart disease.

Exclusion criteria

Children having severe illness like chronic kidney disease (CKD), chronic liver disease (CLD), Hepatic encephalopathy or any other moribund condition.

Study procedure

Children, both male and female aged 0-5 years with suspected congenital heart disease were enrolled in the study. After taking detailed history they were examined thoroughly and provisional diagnosis was made. The provisional diagnosis was then confirmed by chest X ray and echocardiography. After confirmation of diagnosis data were collected using a structured questionnaire. The cases which were not confirmed by echocardiography were excluded from the study. Children who had no congenital heart disease confirmed by history, clinical examination and chest x-ray but were admitted in paediatrics units of the same hospital for their

other illness were considered as controls and data were collected by using the same questionnaire.

Data Analysis

After collection of all data it was statistically analysed using the software named Statistical Package for the Social Sciences(IBM SPSS) version 17.In analysis for comparison of quantitative data Student t test and for qualitative data chi-square test was used.In both cases confidence interval upto 95% and p value <0.05 are considered as significant. The results were then displayed in tabulated form.

Results

Table - I

Age distribution of studied children

Characteristics	Case	Control	t-test	df	p
	Mean ± SD	Mean ±SD			Age in months
	15.60±4.8	15.78±5.4	0.086	212	0.932

Table I shows the age distribution of cases and controls where both the groups were of similar age.

Table - II

Sex distribution of studied children

Sex	Case N(%)	Control N(%)	Chi-square	df	p
Male	63(58.9)	60(56.1)			
Female	44(41.1)	47(43.9)	0.172	1	0.678
Total	107(100.0)	107(100.0)			

Table II shows the sex distribution of studied children where male: female in case group was 1.4: 1 and in control it was 1.2 : 1 . The ratio did not differ significantly among the cases and controls(Table II).

Table- III

Types of Congenital heart 3: disease among the studied children

Name of heart defect	Total number of patients	Percentage of patients
VSD	42	39.2
ASD	30	28.0
TOF	16	14.9
PDA	09	8.4
AV Canal defect	02	1.86
TGA	02	1.86
CoA	02	1.86
Others	05	4.67

Among the cases most children(39.2%) are of VSD.Then ASD (28%) and TOF(14.9%) are the commonest (Table III).

Table-IV

Average maternal age and BMI of studied children

Characteristics	Case Mean ± SD	Control Mean ± SD	t-test	df	p
Maternal age	27.09 ± 4.63	24.06 ± 3.79	5.230	212	0.000
Maternal BMI	24.10 ± 2.28	22.94 ± 3.69	2.769	212	0.006

The mean of maternal age was 27 years and 24 years among cases and controls respectively and their corresponding BMI was 24 and 22 and the difference was statistically significant, i.e. the age and BMI of mothers of cases were significantly higher than those of controls (Table 4) .

Table-V

Consanguinity among studied children

Consanguinity	Case N(%)	Control N(%)	Chi-square	df	p
Present	34(31.8)	14(13.1)			
Absent	73(68.2)	93(86.9)	10.743	1	0.001
Total	107(100.0)	107(100.0)			

Table V shows that among cases consanguinity was present in 31.8% babies conversely among controls it was present in 13.1% babies. Statistically this difference was significant.(Table 5).

Table-VI

Distribution of mother of studied children having history of fever during pregnancy

History of fever	Case N(%)	Control N(%)	Chi-square	df	p
Yes	29(27.1)	10(9.3)			
No	78(72.9)	97(90.7)	11.319	1	0.001
Total	107(100.0)	107(100.0)			

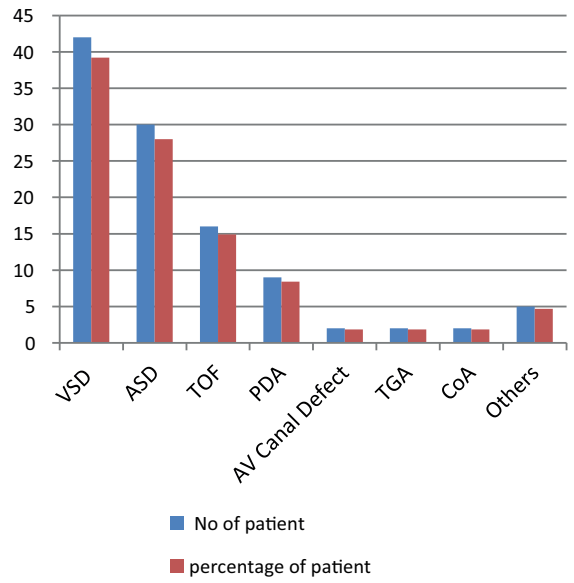
Among the mothers of studied babies 27.1% cases had fever during pregnancy which was 9.3% among the controls and the difference was statistically significant(Table 6).

Table-VII

Distribution of studied children according to presence of having history of gestational diabetes mellitus in their mothers

History of gestational diabetes	Case N(%)	Control N(%)	Chi-square	df	p
Yes	37(34.6)	17(18.9)			
No	70(65.4)	73(81.1)		1	0.014
Total	107(100)	107(100.0)	6.048		

More than one third of study subjects in case group had history of gestational diabetes mellitus(34.6%), on the other hand only 18.9% controls had so and the difference is statistically significant (Table VII).



Figure

Discussion

In the present study number of male was a bit higher among the cases than controls (58.9% and 56.1% respectively) and among cases male female ratio was 1.43:1 which is consistent with the study done by Sharmin et al.[2]

In this study 57% cases had feeding problem, 56.1% cases had bronchopneumonia and 85% had murmur. Sharmin et al[2] found 26.1% feeding problem which is similar to the present study. Study done by NN Fatema et al[8] found 21.58% definite CHD had murmur and Sharmin et al[2] found pansystolic murmur in 100% cases of VSD, ejection systolic murmur in 100% cases of TOF and 88.2% cases of ASD, continuous machinery murmur in 100% cases of PDA which is consistent with the present study.

In the present study mean maternal age among cases was 27.09 ± 4.63 and among controls age was 24.06 ± 3.79. NN Fatema et al [3] also found 9.42% mother was beyond 30 years and Pijtsik et al[12] found that the odds ratio(OR) was twice as high as the average value for pregnant women under 16 and three times as high for those over 41.

Mills et al[13] found all obese women having BMI ≥30 were significantly more likely to have children with CHD than those with normal weight .They also found highly significant trend of increasing OR for CHD with increasing maternal obesity which is consistent with present study.

Huq FU et al [14] found 48.8% babies having CHD were born of consanguineous marriages and Al-Ani ZR [15] found 78% consanguinity among cases and 43.3% among controls which is almost similar to the present study. Fung et al [16] found only 9% of CHD in first degree relatives.

Oster ME et al [17] found significant association between fever and CHD especially right sided obstructive defect. They found OR 2.04% with 95% confidence interval (CI) . Botto LD et al[18] found that febrile illness during pregnancy was positively associated with the occurrence of heart defects in offspring (OR-1.8; 95% CI=1.4-2.4) which is similar to the present study. In this study 27.1% cases had history of fever during pregnancy while only 9.3% controls had fever during pregnancy. NN Fatema et al[8] found 2.13% mother had antenatal infection.

Corrigan et al. 2009 and Wren et al. 2003 found significant association with maternal gestational diabetes mellitus and congenital heart disease(OR 4.6 – 10) with 95% confidence interval(CI).[7] Another study done by Lisowsky et al.[19] found significant association between gestational diabetes mellitus and congenital heart disease . In this study 34.6% mother of case group had history of gestational diabetes mellitus and the finding is similar to those studies.

Conclusion

From the result of the present study it can be concluded that elderly, obese mother, consanguineous parents, history of fever during pregnancy, history of gestational diabetes mellitus had a significant chance of having a child with congenital heart defect. To ascertain the significance of these findings, large and multi-centered case control studies are required to prove.

Limitation of the study

Sample size of this study was small. Multiple centers could not be involved. So, the result does not reflect the status of children of the whole country.

Recommendation

Although congenital heart disease is a multifactorial disorder its risk can be reduced by some measures like

- Weight control during the periconceptional period
- Discourage about consanguinous marriage
- Ensure antenatal check up
- Maintenance of personal hygiene for prevention of fever and flu like illness during pregnancy.

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