Study of Risk Factor for Congenital Heart Diseases in Children at Rural Hospital of Central India

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Abstract

Introduction: Congenital heart disease is the most common congenital problem that accounts for up to 25% of all congenital malformations. Hence this study was aimed at improving the knowledge related to risk factors associated with CHD in a rural Indian scenario. It was a hospital- based case control study. **Materials and Methods:** The children up to twelve year of age with clinical suspicion of CHD were subjected to chest x-ray and electrocardiography, and final diagnosis was confirmed by echocardiography (n=209) as cases. The control group (n=418) were randomly selected from children without CHD who were admitted during the same period. The etiological factors like environmental, infections, drugs, and maternal factors were analyzed by using EPI 6 version. **Results:** In cases group, 56% were male and 44% female children. 82% cases presented at age of less than 5 years and 18% after 5 year. Exposure to smoking (OR=10.45), tobacco intake by mother (OR=8.28) and family history of CHD (OR=7.21) were the significant risk factor present in cases. **Conclusion:** The risk factors for CHD child identified were exposure to smoking and tobacco intake by mother, family history of CHD, antenatal infection in 1st trimester and history of diabetic mother.

Key words: Congenital heart disease, Etiology, Acyanotic, Cyanotic, Risk factor

Introduction

Congenital Heart Disease (CHD) is defined as a gross structural abnormality of the heart or intrathoracic great vessels that is actually or potentially of functional significance. It is the most common congenital problem that accounts for up to 25% of all congenital malformations that present in the neonatal period[1]. The etiology of CHD is largely unknown and so prevention is almost impossible. A multifactorial inheritance is gaining ground which include genetics and environmental interaction in 90% and solely of genetic origin in 8% (chromosomal in 5% and single mutant gene 3%)[2]. CHD may present in any age group from neonatal age to adolescent age group and it may present with or without cyanosis, rapid breathing, perspiration, some with congestive cardiac failure, cyanotic spells, while some children may be asymptomatic but with a cardiac murmur detected during examination for any other illness[3]. There are certain risk factors which are responsible for congenital heart disease therefore this study was conducted to determine the risk factors for the development of congenital heart diseases in children at rural hospital.

Materials and Methods

This study was conducted in Department of Paediatrics, Mahatma Gandhi Institute of Medical College, Sevagram over a period of three year from March 2004 to April 2007. All the children with clinical suspicion of CHD were evaluated with history and clinical examination. They were initially investigated by performing complete blood cell count, chest x-ray and electrocardiography and final diagnosis was confirmed by echocardiography. The detailed history was taken in the congenital heart disease (cases=209) regarding the history of consanguinity and family history of congenital malformation. Antenatal history regarding drug intake, tobacco intake, alcohol intake, exposure to smoking, number of previous abortions, or history of diabetes

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were inquired. The control group (n=418) were randomly selected from children without congenital heart disease who were admitted during the same period. The child with acquired heart disease was excluded from the study. The statistical EPI 6 version was used and calculated the odds ratio (OR) to evaluate the strength of association of risk factors.

Results

Total 11,748 admissions occured in the paediatric wards during three year period. There were 209 (1.77%) children with CHD of total admissions. 117(56%) cases were males and 92 (44%) females. Male to female ratio was 1.25:1. Approximately 70% children were having acyanotic CHD. 104 (49.76%) cases were presented in the first year of life, 68 (32.53%) in 1 to 5 year and 37(17.70%) cases after 5 year of life. Table 1 shows the distribution of risk factor according to type of congenital heart diseases. In 92% cases, symptom started in infancy. The commonest symptoms were repeated chest infection, breathlessness, palpitation, failure to thrive, and cyanosis. 13 (6.22%) cases had extracardiac malformation mainly limb and renal abnormality. Table 2 shows the distribution of risk factor in cases and controls group. Exposure to smoking (OR=10.45, 95% CI 2.13; 69.71), tobacco intake by mother (OR=8.28, 95% CI 1.62; 56.93) and family history of congenital heart disease (OR=7.21, 95%CI 1.48; 35.01) were the significant risk factor present in cases groups as compared to the control groups.

Table 1: Distribution of risk factor according to type of congenital heart disease.

Type of CHDs	FHC	HOC	ANC Infection (1st trimester)				HODM	DRG	ALC	TOB	Smoke
			Rub	Var	Hep	CMV					
1. Acyanotic CHD											
ASD	1	6	1	0	0	0	3	0	0	2	2
VSD	3	7	1	0	0	0	2	2	1	2	2
PDA	1	5	3	1	0	0	8	0	0	0	1
ECD	0	2	0	1	0	0	0	1	0	0	1
Mixed	1	3	0	0	0	0	0	0	0	0	0
2.Obstructive											
PS	1	1	0	0	1	0	0	0	0	1	0
AS	0	0	0	0	0	0	0	0	0	0	1
COA	0	0	0	0	0	0	0	1	0	0	0
3. Cyanotic CHD											
TGA	0	1	0	0	0	0	0	0	0	0	1
TOF	0	3	0	0	0	1	1	1	0	2	0
Ebstein's anomaly	0	0	0	0	0	0	0	0	0	0	1
TA	0	0	0	0	0	0	0	0	0	0	0
PAPVC	0	0	0	0	0	0	0	0	0	0	0
TAPVC	0	1	0	0	0	0	0	0	0	0	0
Truncus Arteriosus	0	0	0	0	0	0	0	0	0	0	1
Single Ventricle	0	1	0	0	0	0	0	0	0	0	0
4. Complex CHD	0	3	0	0	0	0	0	0	0	1	0
Total Number (%)	**7 (3.34)**	**33 (15.78)**	**5 (2.39)**	**2 (0.95)**	**1 (0.47)**	**1 (0.47%)**	**14 (6.69)**	**5 (2.39)**	**1 (0.47)**	**8 (3.82)**	**10 (4.78)**

FHC: family history of congenital heart disease, HOC: History of consanguinity, Rub: Rubella, Var: Varicella, Hep: Hepatitis, CMV: Cytomegalovirus, HODM: History of diabetic mother, DRU: Drug Intake, ALC: Alcohol intake, TOB: Tobacco intake, Smoke: Exposure to smoke

Table 2: Distribution of risk factor in cases and controls.

Risk Factors	Cases (n=209)	Control (n=418)	OR (95% CI)
History of consanguinity	33	24	3.08 (1.77;5.36)
Family history of CHD	7	2	7.21 (1.48;35.01)
Maternal History			
Maternal h/o previous abortions and stillbirths	11	7	3.26 (1.15; 9.47)
ANC Infection (1st trimester)	9	4	4.66 (1.42; 15.31)
Diabetic mother	14	5	5.93 (2.11; 16.70)
Drugintake	5	2	5.10 (0.98-25.50)
Tobacco intake	8	2	8.28 (1.62; 56.93)
Exposure to smoking	10	2	10.45 (2.13; 69.71)
Mother Age (years)			
<20	24	40	1.23 (0.70;2.09)
20-30	153	346	0.57 (0.38;0.85)
30-35	21	22	2.01 (1.08;3.75)
>35	11	10	2.27 (0.95;5.43)

Discussion

Congenital heart diseases are leading cause of neonatal and infant mortality. During cardiogenesis various genetic and non-genetic environmental etiological factors are starting pathogenetic mechanism results in developing of CHD[4]. In ~90% of the CHD cases, no identifiable cause detected and that can be attributed as multifactorial defects[2]. Hereditary factors may play a role since the incidence of CHD in sibling is significantly higher then in general population. If one child has the defect there is 2.5-5% chance that the second baby may have defect and 5-10% chance if second children have the defect[5,6]. The chances of the next child being affected by congenital cardiac malformation are more if the parents are consanguineous. In the present study, 15.78% were born of consanguineous marriages, mostly first cousin marriages. In our study, nearly 46% cases were born to primiparous mothers similar finding have been reported by Sugunabai[7]. Baltimore Washington Infant Study (BWIS)[8] reported, two-fold excess of familial CHD in cases than controls whereas 3.34% cases had history of CHD in the family.

CHD are occurred more when the mother comes in contact with certain substances during the first few weeks of pregnancy, while the baby's heart is developing. The mother who had viral diseases like rubella and mumps in the first three months of pregnancy is more prone to develop multiple congenital anomalies including defects in hearts. Campbell's[9] revealed that maternal rubella was responsible for 1-2% of malformation of the heart, Sugunabai[7] reported <2% whereas 2.3% in the present study. American Heart Association's 2006[10] concluded that women who smoke or are exposed to tobacco smoke early in their pregnancies are more likely to have children with certain types of CHD. Begic H et al[11] reported that 11.08% mothers were exposed to nicotine whereas in our study 3.82% had history of tobacco intake and 4.78% had exposure to smoking in mothers. Use of tobacco intake by mother during the 1st trimester of pregnancy may acts as teratogens. In rural area of Maharashtra, >50 adolescents are used to take tobacco are found to be a significant risk factor for the development of congenital heart disease.

Women who have seizure disorders and need to take anti-convulsant medications may have a higher risk for having a child with congenital heart disease[12]. Pre-existing maternal diabetes is associated with a fivefold increase in risk of cardiovascular malformations[13]. BWIS[8] concluded that maternal diabetes is highly correlated with cyanotic CHD. Risk of CHD remains high for infant of women with poorly controlled elevated phenylalanine levels. No infant in our study had a history of maternal phenylketonuria. Maternal history of previous abortions and stillbirths were significant risk factors for CHD in offspring. Begic H et al[11] reported that, more number of CHD cases (83.14%) were present in children whose mothers were 20-35 years old, while only 5.11% of mothers aged >35 year, same result was found in our study also. Major genetic defects such as chromosomal abnormalities were recognized as association with congenital heart disease with the identification of numerical excesses or deficiencies[14]. The chromosomal abnormality like trisomy 21 is mainly associated with endocardial cushion defect. We found that out of 10 cases of chromosomal abnormality, 8 cases had trisomy 21 defect.

Conclusion

According to our knowledge, this was the first study carried out in rural hospital for assessing the risk factors for congenital heart disease in children at rural area of Maharashtra state. The risk factors for CHD child identified were intake of tobacco, exposure to smoking, family history of CHD, ANC infection in 1st trimester and history of child with diabetic mother. Still there are more elaborative studies required to assess various etiological factors associated with congenital heart disease.

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