

Pattern of Congenital Heart Diseases and Associated Risk Factors among Children at a Tertiary Care Hospital

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ABSTRACT

Objective: To find out the pattern of CHD and associated risk factors among children presenting at a tertiary care hospital.

Study Design: A case-control study.

Place and Duration of the Study: The Department of Pediatrics and Department of Cardiology, Sheikh Khalifa Bin Zayed Al Nahyan Hospital, Rawalakot from July 2020 to June 2021.

Material and Methods: A total of 207 children of both genders, screened by ECG along with chest x-ray and further confirmed with the diagnosis of CHD through echocardiography were enrolled as cases. Same number of healthy controls (n=207) were recruited from immunization center of the study institution. Among cases, types of CHD were noted. For cases and controls, demographic, antenatal and maternal risk factors including maternal age, gender of the child, history of consanguinity, history of febrile illness in pregnancy, use or multi-vitamin or folic acid in pregnancy, bad obstetrical history and maternal diabetes mellitus were noted.

Results: In a total of 414 children (207 cases and 207 controls), there were 219 (53.8%) male. In terms of CHD types among cases, VSD was the most noted in 62 (30.0%), ASD 35 (16.9%), TOF 33 (15.9%) and PDA in 30 (14.5%). Cases were found to have significant association with younger age (78.3% cases below 1 year of age vs. 64.7% in controls, $p=0.0085$), bad obstetrical history ($p=0.0002$), history of febrile illness in 1st trimester of pregnancy ($p=0.0229$) and lack of multivitamins and folic acid in the 1st trimester of pregnancy ($p=0.0147$).

Conclusion: Majority of the children with CHDs were male and aged below 1 year. VSD, ASD, TOF and PDA were the most frequent types of CHD. Younger age, bad obstetrical history, history of febrile illness in 1st trimester of pregnancy and lack of multivitamins and folic acid in the 1st trimester of pregnancy were found to have significant association with CHDs among children.

Keywords: Congenital heart disease, echocardiography, ventricular septal defect.

INTRODUCTION

Congenital heart disease (CHD) is known to be one of the commonest types of congenital anomalies and its prevalence varies from 3-10/1000 live-births from various parts of the world.^{1,2} Data from Pakistan has indicated that there are around 40000 estimated live births to have CHDs every year.³

The CHDs are considered to be an important cause of morbidity and mortality in pediatric as well as adult population. In comparison to developed countries, burden of CHDs is thought to be increasing more in developing countries.⁴ In the recent decades, lots of progressive is seen regarding diagnosis and management of children with CHD. Data from developed countries has shown that the survival rates of have significantly risen in cases living with CHD while death rates has reduced from 80% to 20%.^{5,6}

Lack of pediatric healthcare facilities and late diagnosis of CHDs in developing countries further worsen the prognosis of children living with CHD.⁷ In Pakistan, ventricular septal defect (VSD) has been labeled as the most prevalent type of acyanotic heart defect observed in 27% CHD cases while tetralogy of fallot (TOF) is considered as the most frequent cyanotic heart defect seen in 11% CHD cases.⁸ Data from India Indicated VSD to be

prevalent among 30.4%, atrial septal defect (ASD) in 17.6% and patent ductus arteriosus (PDA) as 9.6% among CHD cases.⁹ Researchers from different parts of the world have identified various risk factors for the development of CHDs.¹⁰

In Pakistan, CHD is responsible for significant morbidity and mortality among pediatric population. It is also presumed that many of the CHD cases remain undiagnosed up until those develop or present with complications. The present study was aimed at finding out the pattern of CHD and associated risk factors among children presenting at a tertiary care hospital.

MATERIAL AND METHODS

This case-control study was conducted at The Department of Pediatrics and Department of Cardiology, Sheikh Khalifa Bin Zayed Al Nahyan Hospital, Rawalakot from July 2020 to June 2021. Approval from Institutional Ethical Committee was taken and informed consent was sought from parents/guardians of all study participants.

A total of 207 children of both genders, screened by ECG along with chest x-ray and further confirmed with the diagnosis of CHD through echocardiography were enrolled as cases. All children having acquired heart disease were

excluded. Same number of healthy controls were recruited from immunization center of the study institution. Controls were not subjected to chest x-ray, ECH or echocardiography.

Among cases, types of CHD were noted. For cases and controls, demographic, antenatal and maternal risk factors including maternal age, gender of the child, history of consanguinity, history of febrile illness in pregnancy, use or multi-vitamin or folic acid in pregnancy, bad obstetrical history and maternal diabetes mellitus were noted.

A specially formatted proforma was designed to collect all relevant study data whereas SPSS version 26 was used for data analysis. Qualitative data was expressed as frequencies and percentages whereas quantitative data was represented as mean and standard deviation (SD). Chi square test was used to compare risk factor between both groups considering p value below 0.05 as statistically significant.

RESULTS

In a total of 414 children (207 cases and 207 controls), there were 219 (53.8%) male and 195 (46.2%) female. Majority of the children, 296 (71.5%) were aged below 1 year. VSD was the most frequent type of CHD noted in 62 (30.0%), ASD 35 (16.9%), TOF 33 (15.9%) and PDA in 30 (14.5%). Figure 1 is showing distribution of types of CHDs among cases.

No difference in terms of gender was seen among cases and controls (p=0.7677). Cases were found to have significant association with younger age in comparison to controls (78.3% cases below 1 year of age vs. 64.7% in controls, p=0.0085). Table 1 is showing comparison of characteristics of children between cases and controls.

Table 2 is showing comparison of maternal risk factors between cases and controls. It was noted that bad obstetrical history (p=0.0002), history of febrile illness in 1st

trimester of pregnancy (p=0.0229) and lack of multivitamins and folic acid in the 1st trimester of pregnancy (p=0.0147) were significantly associated with CHDs.

Figure 1: Types of Congenital Heart Disease (n=207)

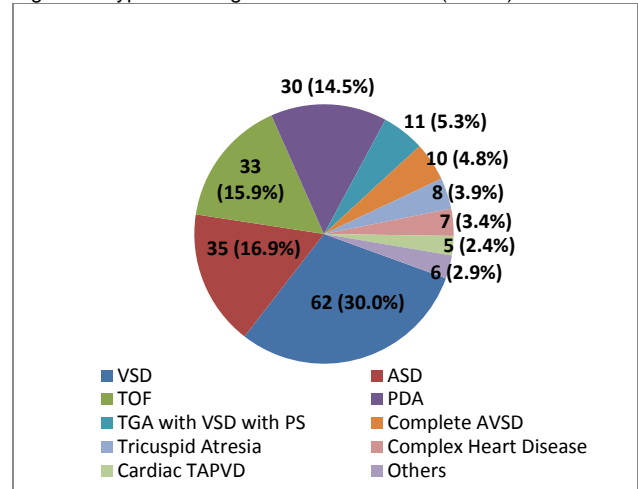


Table 1: Comparison of Characteristics of Children in Cases and Controls (N=414)

Characteristics		Cases (n=207)	Controls (n=207)	P-Value
Gender	Male	111 (53.6%)	108 (52.2%)	0.7677
	Female	96 (46.4%)	99 (47.8%)	
Age (years)	<1	162 (78.3%)	134 (64.7%)	0.0085
	1-5	34 (16.4%)	52 (25.1%)	
	>5	11 (5.3%)	21 (10.1%)	

Table 2: Comparison of Maternal Risk Factors of Children in Cases and Controls (N=414)

Maternal Risk Factors		Cases (n=207)	Controls (n=207)	P-Value
Maternal Age (years)	<25	44 (21.3%)	57 (27.5%)	0.0841
	25-30	138 (66.7%)	116 (56.0%)	
	>30	25 (12.1%)	34 (16.4%)	
History of consanguinity		41 (19.8%)	30 (14.5%)	0.1515
Maternal Education Status as Illiterate		46 (22.2%)	39 (18.8%)	0.3944
Bad Obstetric History		49 (23.7%)	21 (10.1%)	0.0002
History of Febrile Illness in 1 st Trimester		21 (10.1%)	9 (4.3%)	0.0229
History of Multivitamin and Folic Acid Intake in 1 st trimester of Pregnancy		118 (57.0%)	142 (68.6%)	0.0147
Maternal Diabetes		11 (5.3%)	7 (3.4%)	0.3350

DISCUSSION

Availability of high quality healthcare services in the developed countries have resulted in the early diagnosis of management of CHD among children yet in a developing country like Pakistan, we are far away from a minimum desired level about the timely diagnosis and management of children with CHDs. No many studies in Pakistan have analyzed epidemiological and etiological factors contributing to CHDs in Pakistan.

In the present study, we observed that 53.6% children with CHDs were male. A recent study from Multan revealed 55.8% children with CHDs to be male which is quite similar to what we noted in the present study.¹¹ Another local study by Mohammad N and Colleagues¹² stated 55% of the children with heart diseases to be male while data from neighboring India¹³ revealed 66% CHD cases to be male. The exact cause of male predominance among children with CHD is not yet known.

We noted that 78.3% of the children having CHDs were aged below 1 year. Variation has been seen regarding age of CHD diagnosis among children in different parts of the world which could be due to multiple factors. Many of the children with CHD are asymptomatic and many of those with symptoms do not get timely evaluation especially in developing countries. Recent local data suggested 83.4% children with diagnosis of CHDs to be below 1 year of age.¹¹ Regional data also suggested 69.7% of the CHD cases to have age less than 1 year.¹³ A local study revealed 71% children with CHDs to have age below 1 year.¹⁴

In the present study, we noted VSD, ASD, TOF and PD to be the most frequent types of CHDs observed in 30.0%, 16.9%, 15.9% and 14.5% cases respectively. A local study from Karachi analyzing children with CHDs noted VSD TOF to be the most common types of CHDs.¹⁵ Another study from Hazara revealed VSD to be the most frequent type of CHD noted in 61.4% while ASD and TOF were each noted among 8.8% cases.¹⁶ Recent local data from Multan also correlates well with the present findings where the authors found VSD, ASD and TOF to be the most prevalent types of CHDs observed among 25.8%, 19.8% and 12.2% cases.¹¹ VSD is said to be the most frequent type of CHD worldwide and present study reiterates that VSD is also the most frequent type of CHD among Children in Pakistan.¹⁷

In terms of risk factors evaluated for CHDs among children in the present study, young age, bad obstetrical history, history of febrile illness in 1st trimester of pregnancy and lack of multivitamins and folic acid in the 1st trimester of pregnancy were found to have significant association with the existence of CHD ($p < 0.05$). A study from India by Abqari S et al revealed bad obstetrical history, antenatal febrile illness and advance maternal age to have significant association with presence of CHD among children whereas multivitamins intake was noted to have a protective effect against presence of CHD.¹⁸ A recent study from United Kingdom found low maternal educational status, maternal diabetes, maternal clotting disorders and vaginal infections to have significant correlation with CHD among children of those mothers.²⁰ All this reflects difference in possible maternal risk factors among women of different geographical regions. More research is required to further verify about what little is known about the correlation of different risk factors with CHDs.

Our study had some limitations as well. As this was a single center study, our findings cannot be generalized for the general population. As mothers were interviewed 1 time in this study, recall bias can have possible effects of the possible relation of maternal risk factors. We were unable to label genetic risk factors of CHD in the present study which could have further given us important insights. We could not study paternal risk factors among study population. Further population based studies having aged and gender matched controls are required to add to what little is known about the possible risk factors of CHDs among children.

CONCLUSION

Majority of the children with CHDs were male and aged below 1 year. VSD, ASD, TOF and PDA were the most frequent types of CHD. Younger age, bad obstetrical history, history of febrile illness in 1st trimester of pregnancy and lack of multivitamins and folic acid in the 1st trimester of pregnancy were found to have significant association with CHDs among children.

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