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CONVENTIONAL AND NON-CONVENTIONAL RISK FACTORS OF CYANOTIC AND ACYANOTIC CONGENITAL HEART DISEASES IN CHILDREN OF SOUTHERN PUNJAB, PAKISTAN

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Contribution
SS conceived the idea and designed the study. Data collection and manuscript writing was done by SS and AA. All the authors contributed equally to the submitted manuscript.

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ABSTRACT

Objective: To explore the frequency and factors leading to cyanotic and acyanotic congenital heart diseases in children

Methodology: A sample of 430 children with congenital heart diseases were enrolled in the study from the Pediatric Cardiology Department at CPE Institute of Cardiology Multan, Pakistan. Data regarding different factors were collected through direct personal interviews form mothers and the children files maintained in the hospital. Responses were noted on Proforma. For Statistical analysis, we adopted the bivariate frequency analysis and Logistic regression model based on the best subset selection. Odds ratios and a 95% confidence interval were also calculated to measure the contribution of risk factors.

Results: Out of 430 children, the male-female ratio in cyanotic and acyanotic congenital heart diseases is 2.5:1 and 1.3:1 respectively. The 54.6% and 45.8% of mothers of cyanotic children and acyanotic children respectively are taken poor nutrition during their pregnancy.

Conclusion: Improving the physical activity, nutrition, partner interaction, access to basic health care facilities, calories in food, environment, and housing condition during the pregnancy period reduce the risk factors of cyanotic and acyanotic congenital heart diseases in children.

Keywords: Congenital Heart Disease, Cyanotic Congenital Heart Disease, acyanotic Congenital Heart Disease, Distribution, Logistic Regression Model, Best Subset Selection.

INTRODUCTION

Congenital Heart diseases (CHD) are the major cause of mortality and morbidity in children and adults.[1] CHD has been affecting 1.35 million newborns worldwide annually.[2] It is the structural or functional heart disease, present at birth, even if, it is detected later on.[3] It is one of the major cause of birth defects leads to death.[4] According to Children Heart Foundation, CHD is the most common birth defect in the United States of America. Each year approximately 40,000 babies are born in the United States of America with CHD, 25% of them do not reach their first birthday, 85% of them live to their age 18 and more of them die before they reach their adulthood.[5] The incidence of CHD in the United States of America is ranging from 4 to 50 in every 1000 live births and it accounts for 3% of all the infant deaths.[6] In China, the incidence of CHD was found to be 8.2 in every 1000 live births.[7] In Bangladesh, Atlanta and India the CHD incidence was found to be 25, 8.1 and 26.4 in every 1000 live births respectively.[8-10]

In Pakistan, about 60,000 children are born with a CHD annually.[11] According to Pakistan Children Heart Foundation, there is no functioning specialized heart hospital for children in Pakistan. In the entire country, there are less than 25 trained pediatric cardiologists and only eight pediatric cardiac surgeons. In just one of the hospitals, the number of children waiting in the queue for surgery has crossed 9,000. There are 25 to 30 children who are newly registered for surgery every week.[12] The true incidence and prevalence of CHD in Pakistan is unknown due to limited access to medical care and limited resources to undertake intense population studies.[13] In Pakistan, 86 in every 1000 children die before the age of 5 years, 44 in 1000 die before they are a month old, with 11% of neonatal mortality due to cardiac anomalies.[14] In Pakistan, mostly children of CHD are belonging to low and middle socioeconomic class and the cost of basic health care facilities put an economic burden on their families.[15] CHD is considered the leading cause of mortality in neonates even though the medical facilities are improved, and diagnostic facilities are advanced.[16] The development of CHD was associated with environmental factors, mother health conditions and genetic disorder.[17] The Cyanotic CHD and acyanotic CHD are the two major types of CHD.[18]

The objectives of this study were to determine the distribution of cyanotic and acyanotic CHD in children and identify the contribution of the risk factor in the incidence of cyanotic and acaynotic CHD. Which can be helpful for parents in reducing the incidence of this disease in their next child.

METHODOLOGY

The data were collected from the Pediatric Cardiology Department at CPE Institute of Cardiology Multan, Pakistan. A sample of 430 children of CHD was included in the study, from the Outpatient Department (OPD) of the hospital from November 2017 to June 2018 and diagnosed CHD of type cyanotic and acyanotic with the help of echocardiographic. As this is only the cardiac hospital in south Punjab so the patients were representative of south Punjab territory.

To determine the sample size, we use the following formula as available in.[19]

$$n = \frac{z^2 p(1-p)}{\varepsilon^2} \times D$$

where z, is the critical value from z-table at a specified level of significance, p is the prevalence of disease which is considered as 9/1000, D the design effect ($1<D<10$), and for purposive sample it can approach 10 and ε is the precision level and can be fixed within 10%.[20]

The data was collected regarding the gender of the baby, diabetes in the family, smoking status in family, family history, anemia in mother during pregnancy, physical active mother during pregnancy, use of fast food, use of low-caloric food, nutrition type, use of staple food, number of children in family, education level of parents, occupation of father, dwelling area, home environment, health condition of other person live in home, interaction with partner, quality of health care facilities, access to health care facilities, housing tenure and housing condition. Data related to environmental effect and maternal factors were collected from the mother of the selected children. For data collection, a proforma was used also direct personal interviews were carried out and the responses were noted on proforma. All the ethical consideration was followed in the data collection process. Respondents voluntarily participate in this study and sovereign in answer to a question or any part of the question. Additionally, the identification and personal information of all the respondents was kept confidential in the study.

For data analysis bivariate frequencies and percentages were calculated. For identifying the impact of the risk factors logistic regression model with a forward selection approach was used. Also, a 95% confidence interval of odds ratios were calculated. The response variable of the logistic regression model was taken as children having cyanotic CHD and acyanotic CHD. All the statistical analysis was performed using the R language.

RESULTS

In this study, the male female ratio in cyanotic and acyanotic CHD is 2.5:1 and 1.3:1 respectively. Which shows the male predominance in cyanotic and acyanotic CHD. Table 1 present the distribution of cyanotic and acyanotic CHD and results shows that male is mostly affected by cyanotic CHD and female are mostly affected by acyanotic CHD.

Table 1: Distribution of Cyanotic and Acyanotic CHD

Variable	Category	Cyanotic	Acyanotic	Variable	Category	Cyanotic	Acyanotic
Gender of Baby	Male	165(72.1%)	112(55.7%)	**Diabetes in Family**	No	143(62.4%)	131(65.2%)
	Female	64(27.9%)	89(44.3%)		Yes	86(37.6%)	70 (34.8%)
Family History	No	97(42.4%)	57(28.4%)	**Low Calorie Food**	No	163(71.2%)	120(59.7%)
	Yes	132(57.6%)	144(71.6%)		Yes	66(28.8%)	81(40.3%)
Physical Inactive	No	136(59.4%)	149(74.1%)	**Health care Access**	No	157(68.6%)	137(68.2%)
	Yes	93(40.6%)	52(25.9%)		Yes	72(31.4%)	64(31.8%)
Dwelling Area	Rural	116(50.7%)	134(66.7%)	**Home Environment**	Stressed	138(60.3%)	105(52.2%)
	Urban	113(49.3%)	67(33.3%)		Normal	64(27.9%)	53(26.4%)
Nutrition Type	Poor	125(54.6%)	92(45.8%)		Good	27(11.8%)	43(21.4%)
	Normal	56(24.5%)	49(24.4%)	**Partner Interaction**	Poor	128(55.9%)	102(50.7%)
	Good	48(21.0%)	60(29.9%)		Normal	61(26.6%)	55(27.4%)
Health Condition of Other Person Live in Home	Poor	139(60.7%)	104(51.7%)		Good	40(17.5%)	44(21.9%)
	Normal	65(28.4%)	53(26.4%)	**Housing Tenure**	Rented	10(4.4%)	9(4.5%)
	Good	25(10.9%)	44(21.9%)		Owned	219(95.6%)	192(95.5%)
Quality of Healthcare Facilities	Poor	131(57.2%)	88(43.8%)	**Housing Condition**	Poor	140(61.1%)	108(53.7%)
	Normal	70(30.6%)	58(28.9%)		Normal	79 (34.5%)	54(26.9%)
	Good	28(12.2%)	55(27.4%)		Good	10(4.4%)	39(19.4%)

Table 2 shows the results of logistic regression based on the best subset selection for cyanotic and acyanotic CHD. Results show that the family history, physical inactive mother during pregnancy, poor nutrition during pregnancy, dwelling area, poor partner interaction during pregnancy and no access to basic health care facilities increase the risk of acyanotic CHD. While, the use of low-calorie food, stressed home environment, poor quality of basic health care facilities and poor housing conditions are the risk factors of cyanotic CHD.

DISCUSSION

CHD causes stress and economic burden to the family, also a substantial burden in terms of costs on the country's health system. The prevalence of CHD is increased in children and adults. The results of this study showed that there was male predominance in cyanotic and acyanotic CHD patients. Similar findings were noted in multiple studies.[12,15,21] Family history of heart disease was found in 57.6% and 71.6% of children among cyanotic and acyanotic children respectively. Only 40.6% and 25.9% of mothers of cyanotic children and acyanotic children respectively were active during their pregnancy. Most of the patients (50.7% and 66.7%) of cyanotic and acyanotic children are from the rural area. Only 21.0% and 29.9% of mothers of cyanotic children and acyanotic children respectively had taken good nutrition during their pregnancy. There are 12.2% and 27.4% of cyanotic and acyanotic children had a good quality of basic health care facilities in their area.

The gender is statistically significant and contributes 2.65 times more in the risk of cyanotic CHD. In other words, for an acyanotic patient, there are approximately 2.65 cyanotic patients. The use of low-calorie food contributes 1.50 times, the poor home environment contributes 2.46 times, poor health care quality contributes 3.43 times and poor housing condition 2.77 times in increases the risk of cyanotic CHD among children. The risk of acyanotic increases 38% with family history, 46% with physical inactive mother during pregnancy, 38% with poor nutrition, 58% with the rural area, 31% with poor partner interaction during pregnancy and 31% with no access to basic health care facilities in their area.

Table 2: Logistic Regression Based on Best Subset Selection

Variable	Estimate	S.E	t-test	p-value	O.R	95% C.I
Intercept	0.269	0.255	1.058	0.290	1.310	0.794 - 2.159
Gender	0.977	0.241	4.054	0.000*	2.656	1.656 - 4.257
Family History	-0.953	0.244	-3.912	0.000*	0.386	0.239 - 0.621
Inactive	-0.762	0.235	-3.237	0.001*	0.467	0.294 - 0.740
Use of low-calorie food	0.411	0.285	1.444	0.149	1.508	0.863 - 2.637
Nutrition	-0.959	0.363	-2.643	0.008*	0.383	0.188 - 0.780
Dwelling Area	-0.535	0.224	-2.385	0.017*	0.586	0.377 - 0.908
Home Environment	0.901	0.419	2.151	0.031*	2.462	1.083 - 5.594
Partner Interaction	-1.155	0.408	-2.831	0.005*	0.315	0.141 - 0.701
Health Care Quality	1.233	0.365	3.379	0.001*	3.432	1.678 - 7.020
Health Care Asses	-1.147	0.440	-2.604	0.009*	0.318	0.134 - 0.753
Housing Condition	1.019	0.263	3.877	0.000*	2.770	1.655 - 4.636

S.E = Standard Error; O.R = Odds Ratio; C.I= Confidence intervals of the Odds ratio

*** show the 5% level of significant**

CONCLUSION

The problem of cyanotic and acyanotic CHD is increasing gradually due to ignoring some important risk factors. As the number of trained pediatric cardiologists and pediatric cardiac surgeons is very small, so an increase in the number of incidences causes a burden on health care and hospitals. Similarly, most of the parents are unaware of the risk factors that increase the chances of the incidents. This paper concluded that improving the physical activity, nutrition, partner interaction, access to basic health care facilities, calories in food, environment, and housing condition during the pregnancy period reduces the risk factors of cyanotic and acyanotic CHD.

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