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Original Article

Epidemiology of clinical findings and outcome in neonates with congenital heart disease

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Abstract

***Background & Aims*:** Congenital heart disease (CHD) is the most common congenital anomaly, accounting for 28% of all congenital anomalies in infants. The present study was performed to determine the frequency, demographic characteristics, and clinical outcomes in neonates with CHD.

***Materials & Methods*:** This cross-sectional, descriptive-analytical study was conducted on 341 neonates with CHD admitted to Motahhari Hospital in Urmia (Iran) during 2014-2020. The obtained data were statistically analyzed by SPSS.

Results: Based on the results, the prevalence of CHD was 17 per 1000 live births, equal to 1.7%. The mean age of patients was 5.13 ± 6.41 days. Regarding gender, 61% of patients were boys, and 39% were girls. The mean birth weight and the mean gestational age of the patients were 3079.56 ± 735.547 gr and 37.14 ± 2.232 weeks, respectively. Also, the mean length of hospital stay was 5.87 ± 3.568 days. Ventricular septal defect, atrial septal defect, patent ductus arteriosus, coarctation of the aorta, and transposition of the great arteries were detected in 29.9%, 19.1%, 11.4%, 9.1%, and 7.6% of the patients, respectively. Mortality was found in 23.8% of patients. In addition, 51.02% presented with respiratory distress, 34.31% with cyanosis, and 9.3% with a heart murmur.

Conclusion: CHD is a common congenital anomaly in hospitalized neonates. Intraventricular and atrial wall defects are the most frequent congenital disease in neonates with CHD, especially in the male gender.

Keywords: Anomaly, Congenital heart disease, Neonates

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Introduction

Congenital heart disease (CHD), the most common congenital anomaly, accounts for 28% of all congenital anomalies in neonates (1). The prevalence of CHD has been reported to vary from region to region, but the most acceptable statistics is 8 per 1,000 live births (2). CHD is a structural disorder of the heart and large arteries inside the thorax and can potentially cause the dysfunction of the cardiovascular system (3). CHD presents with a wide range of clinical symptoms, ranging from asymptomatic heart damage to severe heart disease, ultimately leading to death (4). If CHD

requires surgical intervention or catheter treatment during the first year of life, it is called critical CHD and accounts for 25% of all CHD cases (5, 6).

CHD is caused by numerous factors, including genetic disorders and heredity as the main etiological factors, along with environmental factors such as maternal diseases viz lupus, diabetes, phenylketonuria, and high fever, especially in the first three months of pregnancy. Ventricular septal defect (VSD), atrial septal defect (ASD), aortic stenosis (AS), pulmonary stenosis (PS), and coarctation of the aorta (COA) comprise 85% of all CHDs (7, 8).

CHD is symptomatic in neonates, particularly in the first few days after birth (9). The survival of some neonates with this disease depends on the retention of the patent ductus arteriosus (PDA). The most common types of CHD are dextro-transposition of the great arteries, hypoplastic left heart syndrome (HLHS), and single ventricle. In some of these diseases, prostaglandin E1 is used to prevent PDA closure, and in most cases, surgical interventions are required for neonatal survival (10-12).

CHD is an important cause of mortality and clinical complications such as hypoxia and brain problems in neonates and children, and early detection of the disease and proper treatment can inhibit death or long-term clinical difficulties. Besides, identifying demographic and epidemiological characteristics of CHD can be effective in preventing the disease occurrence in subsequent pregnancies. This study was performed to determine the frequency, demographic characteristics, and clinical outcomes of CHD in neonates. The results of our study can be helpful for the early diagnosis and appropriate treatment of the disease.

Methods & Materials

This cross-sectional, descriptive-analytical study was conducted on 341 neonates hospitalized with CHD in Motahhari Hospital in Urmia (Iran) during 2014-2020. Exclusion criteria included death before echocardiography, personal discharge, incomplete clinical file, and premature neonates with only PDA. Patients' medical records was used to extract the prevalence, demographic characteristics (weight, gender, age of the newborn, and maternal gestational age), clinical outcome (discharge, referral to heart surgery, and death), and type of CHD. This study was ethically approved by the Urmia University of Medical Sciences, Urmia.

Statistical analysis:

For statistical analysis, SPSS version 21 was used. Mean and standard deviation as well as frequency and percentage were presented for quantitative and qualitative variables, respectively. A p value less than 0.05 were considered statistically significant.

Results

In this study, the clinical data of 341 out of 375 neonates with CHD were extracted. Among 19,941 patients, 11,081 were boys, and 8,860 were girls, and the mean age of the patients was 5.13 ± 6.41 days. The prevalence of CHD was 17 per 1,000 live births, equal to 1.7% (i.e. 341 cases per 19,941 neonates). Regarding gender, 61% (n = 208) of the patients were boys, and 39% (n = 133) were girls. Regarding place of residence, 64.8% (n = 221) of the patients' parents lived in urban areas and 35.2% (n =120) in rural areas. The mean birth weight of the cases was 3079.56 ± 735.54 gr, the mean gestational age of patients was 37.14 ± 2.23 weeks, and the mean length of hospital stay was 5.87 ± 3.56 days (Tables 1 and 2).

The frequency of the different types of CHD is depicted in Figure 1. According to Table 3, 206 patients (60.41%) were discharged, 81 cases (23.8%) died, 40 patients (11.7%) underwent surgery, and 14 cases (4.1%) left the hospital with personal consent. There was a significant relationship between the type of CHD and clinical outcome (p = 0.001; Table 4).

The highest percentage of discharge after receiving drug treatment was related to Ebstein anomaly and hypertrophic left ventricle (100%), PDA (92.3%), VSD (88.2%), and ASD (86.2%), respectively. The greatest percentage of surgery was related to AS and right ventricular muscle bundle (100%), pulmonary atresia (53.3%), PS (50%), and transposition of the great

arteries (TGA; 34.6%), respectively. The highest mortality rates were related to the hypoplastic aorta (100%), COA (80.6%), total anomalous pulmonary venous return (66.7%), HLHS (60%), single ventricle (57.1%), tricuspid atresia, and double outlet right ventricle (50%), respectively.

Table 1. Mean and standard deviation of quantitative data

Variable	Mean	Standard deviation	Minimum	Maximum
Age (day)	5.13	6.41	1	29
Birth weight (gr)	3079.56	735.54	1000	5400
Gestational age (Week)	37.14	2.23	26	43
Length of hospital stay (Day)	5.87	3.56	1	21

Table 2. Frequency and percentage of qualitative data

Variable		Frequency	Percentage
Gender	Boy	208	61
	Girl	133	39
Place of residence	Urban	221	64.8
	Rural	120	35.2
Weight	<2500 gr	57	16.71
	≥2500 gr	284	83.28
Gestational age	<37 weeks	99	29.03
	≥37 weeks	242	70.97

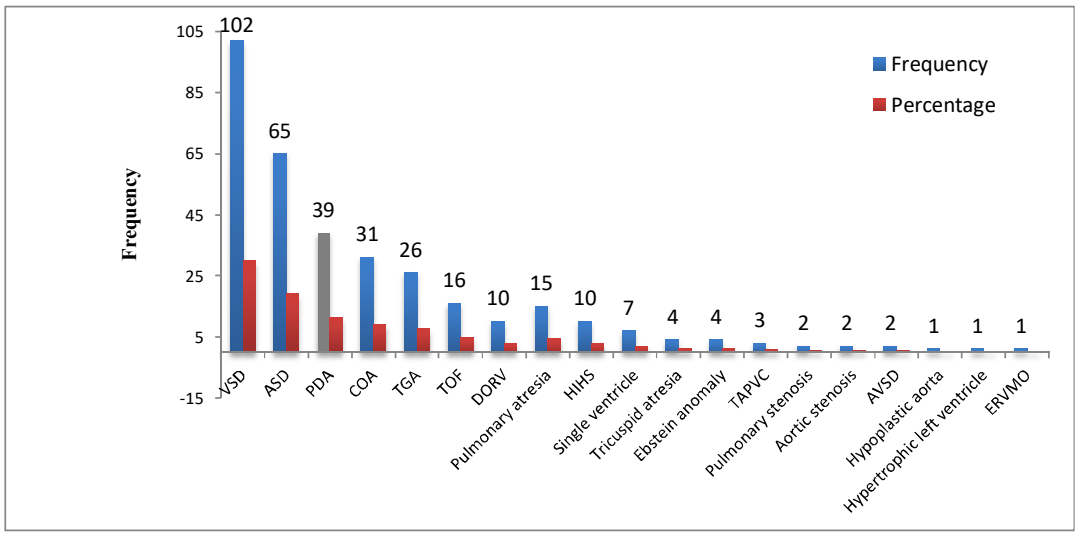

Fig. 1. Frequency of different types of CHD

Table 3. Clinical outcomes in a neonate with CHD

Clinical outcome	Frequency	Percentage
Discharge with physician consent	206	60.41
Death	40	11.7
Surgery	81	23.8
Discharge with personal consent	14	4.1

Table 4. Relationship between the type of CHD and clinical outcome

Variable		Discharge with physician consent	Surgery	Death	Discharge with personal consent	*p* value
VSD	Frequency	90	4	7	1	
	Percentage	88.2	3.9	6.9	1	
ASD	Frequency	56	3	4	2	
	Percentage	86.2	4.6	6.2	3.1	
COA	Frequency	1	4	25	1	
	Percentage	3.2	12.9	80.6	3.2	
TOF	Frequency	11	1	3	1	
	Percentage	68.8	6.3	18.8	6.3	
DORV	Frequency	3	2	5	0	
	Percentage	30	20	50	0	
PDA	Frequency	36	0	3	0	
	Percentage	92.3	0	7.7	0	
TGA	Frequency	0	9	12	5	
	Percentage	0	34.6	46.2	19.2	
Ebstein anomaly	Frequency	4	0	0	0	0.001
	Percentage	100	0	0	0	
HLHS	Frequency	0	1	6	3	
	Percentage	0	10	60	30	
Pulmonary atresia	Frequency	1	8	6	0	
	Percentage	6.7	53.3	40	0	
Tricuspid atresia	Frequency	1	1	2	0	
	Percentage	25	25	50	0	
RVMB	Frequency	0	1	0	0	
	Percentage	0	100	0	0	
TAPVR	Frequency	0	1	2	0	
	Percentage	0	33.3	66.7	0	
Single ventricle	Frequency	1	2	4	0	
	Percentage	14.3	28.6	57.1	0	
PS	Frequency	1	1	0	0	

	Percentage	50	50	0	0
Hypertrophic left ventricle	Frequency	1	0	0	0
	Percentage	100	0	0	0
Hypoplastic aorta	Frequency	0	0	1	0
	Percentage	0	0	100	0
AVSD	Frequency	0	0	1	1
	Percentage	0	0	50	50
AS	Frequency	0	2	0	0
	Percentage	0	100	0	0

TOF, Tetralogy of Fallot; TAPVR, total anomalous pulmonary venous return; DORV, double outlet right ventricle

Discussion

The present study showed that the prevalence of CHD in neonates admitted to Motahhari Hospital was 1.7%. In the studies of Sabzehei et al. and Hussain et al., the prevalence of CHD was 3.4% and 1.5%, which is higher and almost similar to our study (2, 13). However, in the studies of Lindinger et al. and Wu et al., the prevalence of CHD was 1.08% and 1.3%, respectively, which is lower than the rate observed in this study (14, 15).

In examining the demographic characteristics of neonates with CHD, the results of the current study showed that 61% of patients were male and 39% were female. In a study by Sabzehei et al., 61.9% of patients were male and 38.1% were female (2), while in Hussain et al.'s study, 57.47% were boys, and 42.52% were girls (13). In our study, the mean age of patients at the time of admission and their mean birth weight were 5.13 days and 3079.56 gr, respectively. Other studies did not report the mean age of neonates. Sabzehei et al. and Dees et al. reported lower mean birth weight (2568.81 gr and 1852 gr, respectively) than our study (2, 12). In Hussain et al.'s study, 45.97% of patients weighed less than 2500 gr, and 54.03% weighed equal to or more than 2500 gr (13). In the present study, the mean gestational age of the patients was 37.14 weeks, which was close to the mean gestational age (36.66 weeks) reported by Sabzehei et al. (2). Moreover, about 30% of our patients had a gestational age of less than 37 weeks. In a study by Hussain et al., 63.21% of patients had a gestational age of fewer than 37 weeks, which differs from our results (13). In the present study, the mean length of hospital stay was 5.87 days, which has not been mentioned in other studies.

In this study, the most common type of CHD was VSD with a prevalence of 29.9%, which was comparable to global results and various studies (2, 7, 8, 13, 14). Sabzehei et al. indicated higher prevalence (37.1%) and Hussain et al. displayed almost similar prevalence (31.03%) for VSD as compared to our reported prevalence (2, 13). Also, in the study of Lindinger et al., the prevalence of VSD was 48.9%, which is significantly different from the results of this study (14). As mentioned above, the most common CHD was VSD, followed by ASD with 19.1%, the second most common CHD. Hussain et al., as in our study, revealed that the third most common disease is PDA (13). In the present study, TGA was the fourth most prevalent CHD (7.6%), while in the studies of Hussain et al. and Lindinger et al., the prevalence of TGA was 2.2% and 4.59%, which was much lower and almost close to the results of the present study, respectively (13, 14). The prevalence of COA was 6.1% in our study, which was significantly different from the prevalence (3.6%) reported by Lindinger et al. (14). Regarding other CHDs, the prevalence in the present study was almost close to that of the global report.

In this study, 206 patients (60.41%) were discharged, 81 patients (23.8%) died, and 40 patients (11.7%) underwent surgery. Also, 14 patients (4.1%) left the hospital with personal consent. Other studies

have not stated these variables. Moreover, 174 patients (51.02%) had respiratory distress, 117 cases (34.31%) had cyanosis, and 32 patients had heart murmurs. Eleven patients were hospitalized due to lack of breastfeeding and vomiting, and seven patients due to abnormal fetal echocardiography. The most common clinical signs in the study population were respiratory distress, cyanosis, and a heart murmur, respectively. Our results demonstrated that most of the patients discharged were in good general condition. Due to the high number of deaths, the need for early diagnosis of CHD for treatment and, if necessary, surgery, becomes more apparent. Early diagnosis of CHD and treatment measures can help reduce the number of deaths following CHD.

Conclusion

CHDs are common in hospitalized neonates, especially in boys. Intraventricular and atrial wall defects are the most frequent CHD in the aforesaid neonates. Death in neonates with CHDs is high (23.8%), which is due to the hospitalization of neonates with severe heart disease. Early diagnosis and treatment can be key factors in good clinical outcomes in neonates with CHDs.

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None declared.

Conflict of interest

The authors have no conflict of interest in this study.

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Data availability

The raw data supporting the conclusions of this article are available from the authors upon reasonable request.

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