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Congenital Heart Disease: Frequency and the Need for Intervention on the First Year of Birth

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ABSTRACT

Congenital heart diseases are described as structural abnormalities of the heart and large vessels which are very important in the heart function and are differently prevalent in many societies. Few studies have been carried out on the prevalence of the congenital heart diseases and the condition of such patients within the first year of their life. In this investigation, the frequency of the neonates suffered from congenital heart diseases and the necessity to do interventional treatment within the first year after their birth have been studied. Methods: In this cohort study, all infants born in 2014 in Kashan city are examined for possible congenital heart diseases through physical and paraclinical examinations. The infants suffering from congenital heart disease were followed up for the necessity of interventional treatment during their first year of life. Findings: The frequency of the congenital heart disease was 1.09 percent. Valvular abnormalities and tetralogy of fallout with 23.1 and 21.8 percent respectively, were the most common congenital heart diseases. Among 78 patients, only 16 infants (20.5%) required early interventional treatment during the first year. Conclusion: In this study, it was found that congenital cardiac diseases are rarely common. Tetralogy of fallout as well as valvular defect was mostly common abnormality that needs early interventional treatments.

Keywords: Congenital Heart Disease, Intervention, Treatment

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INTRODUCTION

The congenital abnormalities and structural disorders of the child organs are one of the treats to their health. In the meantime, the congenital heart disease with different prevalence of 4.1 to 5 per each one thousand live births is the most important congenital abnormality in the children [1]. The most prevalent congenital abnormality in the United States is the heart disease which involves 1 percent of the total live births in the US [2]. The congenital heart diseases are described as the structural heart abnormality and large vessels that are significantly effective in the heart function. Ventricular Septal Defect (VSD) with 30-35% prevalence is the most common congenital heart defect [3, 4]. The highest prevalence rate (9.3 per one thousand live births) of congenital heart abnormality is happening in Asian countries [5]. In the years 1999-2006, there has been reported 41,494 death due to congenital heart abnormalities, 48% of which was happened in the age less than one-year [6]. A rate of 2.5-3 per one-thousand live births has been reported equally in different studies to need advanced cardiac care [1]. The previous investigations showed that deaths due to congenital abnormalities have been decreased from 17.7% to 9.8% within the past 29 years [7, 8]. However, in contrast to the progress of medical and surgical treatment, deaths due to congenital heart abnormalities have been increased from 7.2 to 7.7% [1]. Most of the patients suffering from mild cases of congenital cardiac deceases need no treatment [4], but about 25% of the people with such disease require early surgical or catheterization before the end of their one-year [9]. It is costly to prolong the life of the people with cardiac abnormalities which underwent surgical treatment and is followed by the sufferings from late effects of such surgeries including heart failure and arrhythmias [10]. A few studies have been investigated on the prevalence of congenital heart diseases and the status of the patients during the first year after birth. This investigation focuses on the frequency of infants with congenital cardiac disease and their need to interventional treatment during the first year after birth.

MATERIALS AND METHODS

This Cohort study was conducted on all neonates born in 2014 at Kashan- Iran that are suspected to suffer from cardiovascular disease and their disease was confirmed after diagnostic evaluation. All infants born in Kashan hospitals were examined by pediatricians for possible congenital problems within first 6-hour after their birth. All suspected neonates were referred to consult with pediatric cardiologist for diagnostic evaluation and treatment. Demographic and clinical characteristics of the patients were recorded in the designed checklist. All neonates underwent echocardiography in addition to clinical examinations. The type of treatment was determined by the pediatric cardiologist, based on the examination and paraclinical findings. All patients were examined every month up to one year of age to check their clinical status and the possible need to early interventional measures. The cases required early treatments were referred for interventional procedures and all other cases underwent medicinal treatment or follow-up.

The data collected in this study were statistically analyzed by SPSS18. The quantitative results were reported as Mean ±SD and the qualitative results as absolute and relative frequency. The data were analyzed using Chi Square test, Fisher's exact test and independent T-test. Two-sided P values less than 0.05 were considered statistically significant.

Table 1:- Participant' Characteristics

Characteristics	Congenital Heart Disease		P value
	No	Yes	
Gender [a]			0.77
Male	144 (50.7)	41 (52.6)	
Female	140 (49.3)	37 (47.4)	
Delivery Type [a]			0.07
NVD	171 (60.2)	38 (48.7)	
C/S	113 (39.8)	40 (51.3)	
Pregnancy Type [a]			0.03
Normal	253 (89.1)	62 (79.5)	
Assisted	31 (10.9)	16 (20.5)	
Family History [a]			0.53
No	258 (90.8)	69 (88.5)	
Yes	26 (9.2)	9 (11.5)	
Birth weight [b]	3240.32±519.21	3195.13±551.56	0.5
Gestational Age [b]	36.79±2.01	36.91±1.98	0.64
Maternal Age [b]	27.91±6.69	30.17±6.67	0.01

[a]Values presented as No.(%); [b]Valures presented as mean±Standard deviation; [c]abbreviations: NVD; Normal Vaginal Delivery, C/S; Caesarian Section

Table 2:- Patients' Demographic and Clinical Charctristics

Characteristics	First year intervention		P value
	Yes	No	
Gender [a]			0.41
Male	10 (62.5)	31 (50.0)	
Female	6 (37.5)	31 (50.0)	
Delivery Type [a]			0.16
NVD	5 (31.3)	33 (53.2)	
C/S	11 (68.7)	29 (46.8)	
Pregnancy Type [a]			0.06
Normal	10 (62.5)	52 (83.9)	
Assisted	6 (37.5)	10 (16.1)	
Family History [a]			>0.99
No	14 (87.5)	55 (88.7)	
Yes	2 (12.5)	7 (11.3)	
Birth weight [b]	3287.5±530.07	3171.29±558.66	0.46
Gestational Age [b]	36.37±1.75	37.05±2.02	0.23
Maternal Age [b]	26.37±4.14	31.14±6.87	0.01
Anomalia Type [a]			<0.001
Septal Defect	0 (0)	11 (17.7)	
FallotTetralogia	0 (0)	17 (27.4)	
Aortic Coarctation	0 (0)	5 (8.1)	
Valvular Defect	5 (31.3)	13 (21.0)	
TGV/TGA	6 (37.5)	0 (0)	
Multiple Anomalies	2 (12.5)	8 (12.9)	
Patent Ductus Arteriosus	3 (18.8)	8 (12.9)	
Arrhythmia [a]			0.41
No	12 (75.0)	52 (83.9)	
Yes	4 (25.0)	10 (16.1)	
Ejection Fraction [b]	61.5±2.87	61.67±2.65	0.81
O_2 Saturation [b]	90.75±10.15	94.52±3.97	0.02

[a]Values presented as No.(%); [b]Valures presented as mean±Standard deviation
[c]abbreviations: TGV; Transposition of the great vessels

RESULTS

During the time of the study, 7154 neonates were born in three hospitals in Kashan, among which 362 (5.06%) were suspected for congenital cardiovascular diseases.

The results of clinical and paraclinical examinations showed that 78 (21.5%) neonates suffered from congenital heart disease. The frequency of congenital heart diseases was calculated as 1.09% among all the newborns. The demographic and clinical characteristics of the study's neonates were shown in table 1.

Among 78 infants suffered congenital heart disease, 16 (20.5%) patients required interventional treatments (surgery or catheterization) in the first year of life. The table 2 shows demographic factors and clinical characteristics of the study patients according to needs to interventional treatment in their first year of life.

DISCUSSION

The Congenital heart diseases are the most prevalent abnormality in the infants and the main reason for deaths due to the congenital abnormities [11-14]. The prevalence of congenital heart diseases in the live term neonates was 05-0.8 percent, it is 10-25 percent in the aborted fetuses, and it is 3-4 percent in the stillbirth and 2 percent in the premature neonates [13, 14]. Several factors are effective in causing Congenital heart diseases including environmental and

genetic factors which play an important role in its pathogenesis [15-20]. Different parts of the heart as well as all other organs of the fetus are formed within the period of the second to tenth week of pregnancy. The harmful effects of the mentioned factors in this period may cause anatomy disorders in the heart and all other organs and after this period, they may affect the function and heart rate of the fetus. The most important kinds of Congenital heart diseases consist of cyanotic and non-cyanotic one [23]. 85 percent of all Congenital heart diseases include Ventricular Septal Defect VSD, Atrial Septal Defect (ASD), aortic stenosis, pulmonary artery stenosis and coarctation of the aorta and remaining 15 percent consists of all non-prevalent kinds of Congenital heart diseases. The Congenital heart diseases are diagnosed in 40-50% of the cases in the first week after birth and in 50-60%, it happens in the first month [21]. The Congenital heart diseases and arrhythmias can be diagnosed through echocardiography of the fetus heart [22, 23]. The prevalence of the congenital heart diseases have been studied in several studies which has been reported as approximately 3.7-17.5 per one thousand or more live births [24, 25].

The prevalence rate of this disease has been reported as 7.1%in Oman, 26.4% in India, 11.1% in Italy, 1.7% in Island, 5.7% in UK and 6.67%in Czech and Slovakia [26-30] among which more than half will need surgery within the first year after their birth [30]. Furthermore, about 400 thousand and 250 thousand cases of open heart surgeries are done annually in the world and the US, respectively, using cardiopulmonary bypass; approximately 6% of such cases are children. During the recent years, deaths of children due to congenital heart diseases have been increased from 7.2% to 7.7% that is possibly resulted by the increased rate of heart surgeries at an early age [36]. Most of such surgeries are performed in the advanced centers of the world in order to fully modify the congenital cardiac abnormality for which it requires cardiopulmonary bypass [31].

This study showed that all cases of tetralogy of Fallout have happened after one-year age, while the appropriate age to perform TOF surgeries was suggested by Gustafson and Touati et al under one-year age. In the recent studies, the full TOF recovery in asymptomatic infants was mentioned in 3-6 months [32, 33]. In the investigation carried out by Hennein et al in Michigan University, full recovery was made for 30 infants without any hospital mortality. Meanwhile, the survival rate in one-month, one-year and five-year was reported as 100%, 93% and 93% respectively [34]. Early TOF recovery involves in two advantages; first early restoration of the lung flood flow to normal condition helps to the growth of pulmonary vascular system. Secondly, lack of timely intervention in restoration of the right ventricular outflow stenosis affects negatively the rate of long-term survival of the patients [34].

The heart septal defect in all children under this study has been recovered in the ages after one-year. The heart wall disorders should be treated in childhood. An appropriate age for surgery in developed countries is about 4-5 years old. However, the patients refer to the physician and undergo surgery later in older ages and it is difficult to diagnose clinically. During the recent two decades, ASD non-surgical recovery (putting amplatzer through catheterization) has been considerably progressed [15].

Considering the annual statistics of the number of surgeries, it is found that the quantity of such surgeries has been increased about 2-3 times, which shows improved facilities and increased experience of the caregiver team. In general, the surgery of the patients is done in older ages due to lack of timely reference of the patients to the physician, lack of the patients' parents awareness, long waiting period for surgery, lack of advanced facilities in the surgery room and ICU as well as the inadequacy of the medical team skills.

According the previous studies, the surgery and the interventional treatment in the children suffering from Congenital heart diseases causes some effects on different body systems among which we may suggest to neurological (such as coma, delirium and restorable ischemic neurologic defect), digestive, endocrine, renal, pulmonary, hematologic and cardiac complications.

CONCLUSION

In this study, it was found that congenital cardiac diseases are rarely common. Tetralogy of fallout as well as valvular defect was mostly common abnormality that needs early interventional treatments.

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Conflict of Interest
The authors have no conflict of interest to disclose.

Authors' Contribution
Amir Hossein Movahedian developed the study concept and design and the acquisition of data, interpretations of data, and drafting of the manuscript. Jamshid Kadkhodaii, Marzieh Heidarzadeh, Ziba Mosayebi, Mansour Sayyah and Zahra Soleimani developed the protocol, analysis of data and drafting of the manuscript.

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