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Epidemiology of congenital heart disease among pediatric patients in Northwest, Saudi Arabia

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RESEARCH

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ABSTRACT

Background
Congenital heart defect (CHD) is considered one of the commonest major birth defects, causing children's morbidity and mortality.

Aims
To define the frequency and epidemiology of congenital heart disease among children in Tabuk, Saudi Arabia.

Methods
This was a retrospective observational study based on the medical hearts. The study population consisted of pediatric patients with confirmed CHD, who were referred to the pediatric cardiology clinic at the King Salman Armed Forces Hospital, Tabuk, Saudi Arabia between January 2015 and June 2019. Of patients with CHD, those with patent ducts arteriosus (PDA) and persistent foramen oval spontaneously resolved during the first four weeks of life were excluded.

Results
A total of 1,647 pediatric patients were referred to the pediatric cardiology clinic. Of these, 851 were confirmed to have CHD. The diagnosis was made most frequently during the neonatal period. The following three were most frequently observed (in the order of): Ventricular septal defect (VSD: 42 per cent), atrial septal defect (ASD: 32.6 per cent), PDA (16.2 per cent). Down syndrome (DS) was the most frequent underlying condition. Approximately two-thirds of cases were managed conservatively.

Conclusion
We demonstrated the characteristics of children's CHD in this referral center. The data may be important to further make health-policy-making in this area.

Key Words
Congenital heart diseases, syndromes, arterial septal defect, ventricular arterial septal defect, epidemiology

What this study adds:

1. What is known about this subject?
CHD considered the leading cause of morbidity and mortality. Globally, every year 1.35 million babies are born with CHD, Asian countries found to be the highest prevalence.

2. What new information is offered in this study?
This study demonstrated that the majority of the cases were diagnosed at neonatal and infancy periods and early disease detection can help in reducing mortality and morbidity.

3. What are the implications for research, policy, or practice?
This study demonstrated the characteristics of children's CHD in this referral center. The data may be important to further make health-policy-making in this area.

Background

Congenital heart disease (CHD) considered the major congenital birth defects in neonates and it is the leading cause of morbidity and mortality.[1] Globally, every year 1.35 million babies are born with CHD, Asian countries found that the highest prevalence of CHD whereas African countries was the lowest prevalence of 9.3 per 1000 live birth and 1.9/1000 live births, respectively.[2,3] In Saudi Arabia, one study about CHD reported that the incidence varies from 2.1 to 10.7 per 1000 persons.[4] CHD appeared as an isolated or in combination with other heart defects, associated with syndromes or due to genetic disorders, or environmental factors.[5] Several studies were conducted in Saudi Arabia showed that VSD is the most common type of CHDs followed by ASD.[6] In developed countries, the survival rate increased and the mortality rate reduced from 80 per cent to 20 per cent due to the early detection of CHD and optimal management.[7] In Saudi Arabia, there is no recent study and especially in Tabuk city about patterns of congenital heart disease. Hence, the aim of the current study to determine the frequency and epidemiology of congenital heart disease among children.

Method

This was a retrospective observational study based on medical charts was conducted at King Salman Armed Forces Hospital (KSAFH), Tabuk, between the period of January 2015 and June 2019. KSAFH is a secondary hospital and considered one of the major hospitals in Tabuk City. It received many cases of congenital heart disease. It was established in 1979, with a bed capacity of 900 beds. Children were identified from the clinic's database and the charts were reviewed. The inclusion criteria comprised: all children attended to pediatric cardiac clinic younger than 18 years old and diagnosed with CHD based on typical clinical features and confirmed by echocardiogram, presence of PDA, and persistent foramen oval beyond four weeks of age. The exclusion criteria comprised: the patients above the age of 18 years old, normal echocardiogram, presence of PDA and persistent foramen oval, in preterm or term babies at birth, consider normal before four week of age, incomplete data, the patient having an unconfirmed diagnosis of CHD and Children with acquired heart disease. The study was approved by the ethics and research committee at the KSAFH, Tabuk city, Saudi Arabia.

Data collection

Data sheet was used to collect and organize the study variables, which included patient age at diagnosis. Our institute received many referral cases therefore, the age at diagnosis is obtained from referral paper written by the primary physician, sex, echocardiography findings, associated syndromes, and types of Management. The participants were classified into four age groups (<28 days, 1 month to <1 year, and 1 year to <5 years). To ensure the patient's confidentiality and anonymity, each was assigned a numeric code on his or her respective data collection sheet.

Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences, version 23 (SPSS Inc., Chicago, ILL, USA). Categorical variables were presented as frequencies and percentages.

Results

A total of 1647 who attended to pediatric cardiology were screened for CHD, only 851 patients were included. Of the 851 patients, 446 (52.4 per cent) were males, while 405 (47.6 per cent) were females. We divided age at diagnosis into four groups, with one-third of patients (32.6 per cent) being younger than 28 days followed by second group infant and its represented (27.8 per cent) (Table1).

Regarding to congenital heart lesions; VSD was most frequent observed n=358 (42 per cent), followed by ASD n=278 (32.6 per cent), PDA n=138 (16.2 per cent), dilated cardiomegaly n=80 (9.4 per cent), Tetralogy of Fallot (TOF) n=42 (4.9 per cent), Atrioventricular (AV) canal n=23 (2.7 per cent), Hypertrophic cardiomegaly n=21 (2.5 per cent), Coarctation of the aorta (CoA) n=20 (2.5 per cent), D-transposition of great vessels (D-TGA) n=10 (1.2 per cent), truncus arteriosus n=8 (0.9 per cent), Double outlet right ventricle (DORV) n=5 (0.6 per cent), total anomalous pulmonary venous return (TAPVR) n=3 (0.4 per cent), Levo-Transposition of the Great Arteries (L-TGA) n=2 (0.2 per cent), one case (0.1 per cent) tricuspid atresia (Table2).

Approximately one-third of cases had tricuspid regurgitation (TR) (n=247, 29 per cent), followed by mitral regurgitation (MR) and pulmonary stenosis (PS), n=144 and n=90 respectively. While 78 of patients had aortic regurgitation (AR), pulmonary regurgitation (PR) presented in 40 cases, aortic stenosis (AS) in 35 of cases, mitral prolapse (MP) in 30 of cases, mitral stenosis (MS) only seen in 11 cases, the least valvular heart diseases were tricuspid stenosis (TS) and tricuspid prolapse (TP) only presented in three and four cases respectively (Table3).

However, regarding associated syndromes in patients with CHD, DS was most frequent underlying condition (n=53, 6.2 per cent), followed by two cases (0.2 per cent) in each of

Turner syndrome and Noonan syndrome, while one case (0.1 per cent) in each of Aicardi syndrome and Edward syndrome. Approximately two-thirds of cases were managed conservatively (81.8 per cent), whereas only 18.2 per cent of cases underwent surgical intervention (Table 4).

Discussion

In the first year of life, CHD represents the commonest congenital defect and considered relatively highest mortality rate compared to other birth defects. Globally, CHD is the highest birth prevalence, with a prevalence of 9.3 per 1000 live births in Asia as ameta-analysis of 114 studies reported that.[7] This is a retrospective study that included 851 out of 1647 patients who attended to the pediatric cardiology clinic. In the present study, more than half of the cases were males, (52.4 per cent), while 405 (47.6 per cent) were females. Several studies have been conducted in SA, reported CHD more common in males than females.[8,9] Internationally; Rahman et al., Najma et al., Rajkumar, and Vishal reported that male frequency 52.38 per cent to 56.98 per cent while, female 43.04 per cent to 47.62 per cent.[7,10-11]

In the present study, the most common age at diagnosis was below 28 days followed by 29 days to one year. In contrast to the study conducted in Yemen showed that the majority of patients were between 29 days and one year followed by more than one year to five years.[12] In additions Sen et al. reported that the majority of the cases were diagnosed between the age of 29 days and one year, followed by cases were diagnosed during the neonatal period.[13] However, in our center, the most common age at diagnosis was in the neonatal period. Early detection of CHD is possible and treatment can be started at an earlier age.

The most common congenital heart defect in our study was VSD, 42 per cent followed by ASD. This finding consistent with Dad et al., and Abbag whose reported studies conducted in Almadinah and Southwestern respectively.[9,14] In contrast Sen et al. reported that ASD was the commonest CHD followed by VSD.[13]

Several studies from around the world have been reported that the PDA was the third most common frequent form of CHD.[8,10,15,16] In contrast studies on Nigeria and PakistanPDA was 4th common frequent form of CHD.[7,11] Also, a study conducted in 2018 in Riyadh reported that PDA is the first common frequent form of CHD.[17] However, studies were done in Nigeria from 1964–2015, and another study in Iran was reported that PDA was the second most common condition.[18,19]

In our study, TOF presented in 42 out of 851, 4.9 per cent. Various studies in SA showed that the TOF ranged between 2.2 per cent and 5.4 per cent.[6] CoA in the present study represented 2.3 per cent. Many authors reported that CoA accounted for between 0.09 to 3.3 per cent.[7,9-11] The estimated incidence of the AVSD ranged between a 0.24/1000[w1] and 0.31/1000[w2] per live birth.[20] In the present study, AVSD represented 2.7 per cent. A similar finding was found in a descriptive and prospective study when the number of patients was 23 out of 1003, 2.3 per cent.[7]

Several studies have been reported the frequency of TGA and it ranged from 1.5 per cent to 5.5 per cent.[21] In the present study, D-TGA presented in 10 cases, 1.2 per cent whereas L-TGA presented in 2 cases, 0.2 per cent. A study in Pakistan reported that d-TGA seen in 41 cases out of 1003, 4.1 per cent, whereas l -TGA seen in eight cases out of 1003, 0.8 per cent.[7] TAPVR and Truncus arteriosus in our study represented 0.4 per cent, and 0.9 per cent respectively. Study in Pakistan the TAPVR represented 1.6 per cent whereas truncus arteriosus 0.2 per cent.[7] In the present study, TR is the most common congenital valvular disease followed by MR and PS. However, TR in our study high frequency it observed in 247 cases, 29 per cent. In contrast, a recent study in Riyadh reported low frequency in TR and it accounted for 2.2 per cent.[17] In our study, congenital MR accounted for 16.9 per cent. In contrast study in Pakistan showed a low rate of congenital MR 0.4 per cent.[7] PS in the present study observed in 90 cases, 16.9 per cent. In contrast study in Pakistan and Jordan PS accounted for 3.1 per cent, and 6.2 per cent, respectively.[7,21]

Moreover, AS in our study accounted for 4.1 per cent, this finding consistent with Amro, K. where AS accounted for 4.3 per cent.[21] A study in Riyadh reported that AS detected in 2.5 per cent.[17]

In the present study, the most common associated conditions among the studied patients were DS observed at 6.2 per cent. This finding consistent with Alabdulgader, reported that DS present in 6 per cent of all patients with CHD.[4] In this study, two cases (0.2 per cent) seen in each of Turner syndrome and Noonan syndrome. There was one case (0.1 per cent) seen in each of Aicardi syndrome and Edward syndrome. However, the study reported that one case in each of Turner syndrome and Edward syndrome.[22] Approximately two-thirds of cases were managed conservatively (81.8 per cent), while only 18.2 per cent of cases underwent surgical management.

Conclusion

In the present study, approximately most of the cases were diagnosed in neonatal and infancy periods. With the advancement of the diagnostic facility and neonatal care, early detection of CHD is possible which facilitates in starting of management at an earlier age. Besides, DS was the most common underlying syndromes and it was observed in 6.2 per cent. The finding here made were in general in accordance with the previous data. However, describing detailed data of the Northwest area regarding CHD is of practical use in future medical-pediatric health policymaking in this area.

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PEER REVIEW

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

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ETHICS COMMITTEE APPROVAL

The current survey was approved by research ethics committee of the armed forced hospital, North-western region, Saudi Arabia (Ref. Number-R&REC2019 -279, Date 16\05\2019).

Figures and Tables

Table1: Gender and age at presentation (n=851)

		N	%
Gender	Male	446	52.5%
	Female	405	47.5%
Age at presentation	0 day to 28 days	277	32.6%
	29 days to one year	237	27.8%
	More than one year to five years	182	21.4%
	More than five years	155	18.2%

N: number

Table 2: Types of congenital heart diseases (n=851)

		N	%
Types of CHD	VSD	358	42%
	ASD	278	32.60%
	PDA	138	16.20%
	DC	80	9.40%
	TOF	42	4.90%
	AVSD	23	2.70%
	HC	21	2.50%
	CoA	20	2.30%
	D-TGA	10	1.20%
	Truncus arteriosus	8	0.90%
	DORV	5	0.60%
	TAPVR	3	0.40%
	L-TGA	2	0.20%
	Tricuspid atresia	1	0.10%

VSD; ventricular septal defect, ASD; Atrial septal defect, PDA; patent ductus arteriosus, DC; dilated cardiomegaly, TOF; Tetralogy of Fallot, ASVD; Atrioventricular septal defect, HD; Hypertrophic

cardiomegaly, CoA; coarctation of aorta, D-TGA; Dextro-transposition of great vessel, DORV; Double outlet right ventricle, TAPVR; Total anomalous pulmonary venous return, L-TGA; Levo-Transposition of the Great Arteries

N: number

Table 3: Valvular diseases (n=851)

		N	%
Valvular diseases	Tricuspid regurgitation	247	29%
	Mitral regurgitation	144	16.9%
	Pulmonary stenosis	90	10.6%
	Aortic regurgitation	78	9.2%
	Pulmonary regurgitation	40	4.7%
	Aortic stenosis	35	4.1%
	Mitral prolapse	30	3.5%
	Mitral stenosis	11	1.3%
	Tricuspid stenosis	3	0.4%
	Tricuspid prolapse	4	0.5%

N: number

Table 4: Management and associated conditions (n=851)

		N	%
Associated syndromes	Down syndrome	53	6.2%
	Turner syndrome	2	0.2%
	Noonan syndrome	2	0.2%
	Aicardi syndrome	1	0.1%
	Edward syndrome	1	0.1%
Management	Conservative	696	81.8%
	Surgical	155	18.2%

N: number