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Pattern of Congenital Heart Disease among Children Referred for Echocardiography in Ramadi City, West of Iraq

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ABSTRACT

Background: Congenital heart disease (CHD) carries a high rate of mortality and morbidity in the pediatric population. The gold standard technique for diagnosing CHD is echocardiographic examination.
Objectives: To assess the CHD pattern among children referred for echocardiography in Ramadi city, west of Iraq and to determine the correlation of various types of CHD with age and gender.
Materials and methods: The study conducted at Maternity and Children Teaching Hospital in Ramadi. All patients who evaluated by echocardiography from June 2013 to March 2015 were included in this study. All children were evaluated by transthoracic echocardiography using M-mode by a pediatrician trained in pediatric ECHO. The pattern of CHD was studied, taking into consideration age and gender distribution.
Results: The age range of our 262 patients was 1 day to 14 years (mean 16.6±30.3 months) and the male to female ratio 1.04:1. Acyanotic CHD comprises 87% of the cases. There were 188 (71.76%) patients diagnosed in infancy. Ventricular septal defects (29.39%) were the commonest type, atrial septal defects (16.03%) were the second, and the least Ebstein anomaly (0.38%). The commonest cyanotic cardiac defect was Fallot Tetralogy. There was a male predominance in ventricular septal defects, Tetralogy of Fallot, aortic stenosis, coarctation of the aorta, and D-transposition of the great arteries. While, female predominance observed in atrioventricular canal defect, atrial septal defects, patent ductus arteriosus, and pulmonary stenosis.
Conclusion: CHD mostly diagnosed in the infants. Acyanotic CHD was the commonest defect. Ventricular septal defects were the commonest acyanotic defect. While Fallot Tetralogy was the commonest cyanotic CHD. Sex distribution was comparable to that observed in the studies from other parts of the world.

Keywords: Congenital heart disease, Echocardiography, Ramadi, Iraq.

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INTRODUCTION

CHD constitute one of the common anomalies in the newborn [1]. It is a major cause of death resulting from congenital anomalies [2]. There is wide variation had been observed in the CHD prevalence among various studies in different geographical locations with an increment in the overall prevalence of CHD in the newborn during the last century, approximately around 9 per 1,000 newborns during the last 15 years [3]. The risk of occurrence of CHD elevates if there is affected 1st-degree relative (sibling or parent) [4]. If the mother delivered a child with CHD or if one of the parents is affected, the incidence elevates to 2−6% for a 2nd pregnancy. The risk of recurrence varies according to the lesion [5, 6]. The etiology of most CHD is still unknown. Many cases of CHD are due to a mixture of different etiological factors, and mostly multifactorial resulting from genetic factors and an as-yet-to-be-determined environmental stimulus [7]. There is no evidence of a racial difference in the overall incidence of the CHD, anyhow there are some differences in

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particular lesions such as a higher rate of transposition of the great arteries (TGA), is noticed in a white race [8]. While sex differences in the occurrence of certain heart defects have been detected. In general, the prevalence of cyanotic and complex defects is significantly greater in males than in females [9].

CHD are classified according to presence, or absence of cyanosis into cyanotic heart defects and acyanotic heart lesions [7]. Ventricular septal defect (VSD) is considered the commonest lesion and constitute about 30% of all CHD and Tetralogy of Fallot (TOF)is the most common cyanotic CHD accounts for 5−7% of the whole CHD [10].

Echocardiography (ECHO) is an essential way in the assessment and diagnosis of heart lesions in newborn, infant, children and adolescent population, whether they are congenital or acquired lesions [11]. The non-invasive nature, portability, availability, and is cost-effective, in addition to the abundance of information it supplies, make ECHO the 1st-option imaging technique for the detection and follow-up of most cardiac lesions [12]. The echocardiographic examination can help in the evaluation of cardiac structure in CHD, quantitation of contractile function of the heart (during systole and diastole), assessment of intracardiac pressures and gradients across stenotic valves and vessels, also help to check the coronary arteries integrity, detection of the flow direction across the lesion, and discover vegetations due to endocarditis, as well as , detection of cardiac tumors, pericardial fluid and chamber thrombi [8].

Our objectives were to assess the pattern of CHD among children referred for echocardiography at Maternity and Children Teaching Hospital in Ramadi, west of Iraq and to assess the correlation of different types of CHD with age and gender.

MATERIALS AND METHODS

The present study was a retrospective descriptive study that was conducted at Maternity and Children Teaching Hospital in Ramadi. This hospital is serving Al-Anbar governorate, west of Iraq. All patients who were evaluated by echocardiography from June 2013 to March 2015 were enrolled in the study. All the children with suspected CHD were evaluated by transthoracic echocardiography using M-mode, two dimensional and color, pulse Doppler echocardiogram with GE Vivid 5 echo machine which was performed by a pediatrician trained in pediatric ECHO. The data were obtained from the records of the pediatric echocardiography clinic in the same hospital which contains age, gender, and clinical diagnosis. The study approved by the College of Medicine, University of Anbar. And informed consent was taken from every parent of the child.

Only the children in which diagnosis of CHD is confirmed (according to the definition as a structural abnormality of the heart or intrathoracic great vessels that is actually or potentially of functional significance) [13] were included in the study. CHD was classified into two: cyanotic and acyanotic [7].

Exclusion criteria: Patent ductus arteriosus in premature neonates, structural defects with little or no functional abnormalities, like mitral valve prolapse, patent foramina ovale, and bicuspid aortic valve, and acquired cardiac defects [13].

Analysis of the data was made using version 20 of the SPSS (Statistical Package for the Social Sciences). The results were put in tables as the numbers and percentages of the variables.

RESULTS

Out of 576 echocardiographic examinations during 22 months, 262 (45.5%) patients were diagnosed as having CHD. One hundred thirty-four were male (51.15%) and 128 were females (48.85%) giving a male/female 1.04:1.

The range of age was from 1 day to 14 years. The mean age was (16.6 ± 30.3 months). Most of the patients presented in infancy 188 (71.76%), 52 (19.85%) of them were neonates and 136 (51.91%) beyond the neonatal period up to 1year. Fifty-four (20.61%) were preschool, while the remaining 20 patients (7.63%) were among school-age as shown in Table 1.

Majority of the patients 228 (87.03%) had acyanotic CHD, while 34 patients had cyanotic CHD (12.97%). Overall CHD, VSD was found to be the commonest defect 77 cases (29.39%), followed by atrial septal defect (ASD) 42 (16.03%), Patent ductus arteriosus (PDA) 36 (13.74%), TOF 16 (6.11%), atrioventricular canal (AV canal) 13 (4.96%), pulmonary stenosis (PS) 12 (4.58%), ASD+PDA 11(4.20%) and coarctation of aorta (CoA) 10(3.82%) as shown in Table 2. Among acyanotic CHD, the commonest 3 were VSD 77 (29.39%), followed by ASD 42 (16.03%) and PDA 36 (13.74%) Table 2.

TOF was found to be the most common form of cyanotic CHD 16 (6.11%), followed by TGA 10 (3.82%) as shown in Table 2.

Overall CHD, no difference was observed in the occurrence of CHD between male and female. However, some defects were seen more in boys than girls like TOF, CoA, D-TGA, AS and VSD, while other defects are seen more in girls like AV canal, PS, ASD+PS, VSD+PDA, PDA and ASD as in Table 3.

DISCUSSION

In this study, 188 cases (71.76%) of CHD presented in the first year of age, which nearly comparable with the results of Hyderabad, Benha in Egypt, and Liverpool in the UK [14–16], while lower results reported in Basrah and Southern Yemen [17, 18]. However, higher figure reported in Qatar (90.7%) and Baghdad (95.5%) [19, 20]. Age of detection of CHD varies from one center to another. Many CHD especially that are minor,usually not causing symptoms and skipped diagnosis unless explored specifically [21]. On the other hand, other factors such as availability of diagnostic facilities, accessibility to these facilities and family awareness to search for early medical help, can affect the early diagnosis [17, 22]. Early detection of CHD in the first year of life in the current study is probably related to increased awareness among pediatricians about CHD and availability of echocardiography in the hospital.

The present study showed 87% of the cases were acyanotic CHD and, the remaining were cyanotic. This is consistent with other studies in Iraq [20, 23], and many other studies

Table 1. The age distribution of various CHD.

Age	Number	Percentage%
Infancy	188	71.76
Neonates ≤ 28 days	52	19.85
> 28 days−1 yr	136	51.91
Preschool age > 1yr − ≤ 5yr	54	20.61
School-age > 5yr − ≤14 yr	20	7.63
Total	262	100

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Table 2. Distribution of various CHD in relation to the type of lesion.

Type of lesion	Number	Percentage%
Acyanotic CHD		
Isolated VSD	77	29.39
ASD	42	16.03
PDA	36	13.74
AV canal	13	4.96
PS	12	4.58
ASD+PDA	11	4.20
CoA	10	3.82
ASD+PS	9	3.44
VSD+ASD	8	3.05
VSD+PDA	5	1.91
Aortic stenosis (AS)	3	1.15
Cor triatriatum	1	0.38
Shone complex	1	0.38
Cyanotic		
TOF	16	6.11
Transposition of great arteries (D-TGA)	10	3.82
Double outlet right ventricle (DORV)	2	0.76
Truncus arteriosus	2	0.76
Tricuspid atresia	2	0.76
Total anomalous pulmonary venous connection (TAPVC)	1	0.38
Ebstein anomaly	1	0.38
Total	262	100

Table 3. Sex distribution of CHD.

Type of CHD	NO.	Male	Female	M:F
Isolated VSD	77	42(54.55%)	35(45.45%)	1.2:1
ASD	42	20(47.68%)	22(52.38%)	1:1.1
PDA	36	17(47.22%)	19(52.78%)	1:1.17
TOF	16	11(68.75%)	5(31.25%)	2.2:1
AV canal	13	5(38.46%)	8(61.54%)	1:1.7
PS	12	5(41.67%)	7(58.33%)	1:1.4
ASD+PDA	11	5(45.45%)	6(54.55%)	1:1.2
CoA	10	7(70%)	3(30%)	2.3:1
D-TGA	10	7(70%)	3(30%)	2.3:1
ASD+PS	9	2(22.22%)	7(77.78%)	1:3.5
VSD+ASD	8	4(50%)	4(50%)	1:1
VSD+PDA	5	2(40%)	3(60%)	1:1.5
AS	3	2(66.67%)	1(33.33%)	2:1
DORV	2	-	2	Female
Truncus arteriosus	2	2	-	Male
Tricuspid atresia	2	-	2	Female
Cor triatriatum	1	1	-	Male
Shone complex	1	-	1	Female
TAPVC	1	1	-	Male
Ebstein anomalie	1	1	-	Male
Total	262	134(51.15%)	128(48.85%)	1.04:1

worldwide reported that 74−85% of CHD being acyanotic [18, 22, 24].

VSD was found to be the commonest CHD in the present study constituting (29.39%) of the whole CHD. Worldwide, VSD is the most prevalent CHD with few exceptions [25]. The VSD percentage differs among various geographical locations (11.07−52.5%). The percentage of VSD in many studies is comparable to ours as found in Mosul, Saudi Arabia, southern Yemen, Turkey, Egypt, South Iran, UK, Brazil & China, while the higher figure was found in Baghdad, Basrah, Jordan, Qatar, Pakistan & USA studies. However, few studies showed lower & different results as shown in Table 4.

The 2nd most common CHD in the current study was ASD accounting for (16.03%) of all CHD which is in agreement with Mosul, Saudi Arabia, Jordan, Pakistan, USA & Egypt studies. However, other studies found that TOF is the second most common CHD in Baghdad, Basrah, and south Iran [17, 20, 24]. PDA ranking the second in Turkey, and the UK [16, 27]. While, PS in Yemen, Qatar, and Brazil [18, 19, 29] Table 4.

The current study showed that the third most common CHD is PDA forming (13.74%). Similar results observed in other studies in Baghdad, Yemen, Egypt, Pakistan, and China with frequency ranging (7.75%−17.2%). ASD was reported as the 3rd most common CHD in Basrah, Turkey, and Qatar, while PS reported 3rd in Mosul, Saudi Arabia, south Iran, and UK (Liverpool) Table 4.

Atrioventricular septal defects constituted (4.96%) in this study which is similar to the results reported in Saudi Arabia, Yemen, Jordon, Turkey, Pakistan & USA, while, the higher rate observed in Basrah, and Brazil Table4

Pulmonary stenosis was found to be (4.58%) of all CHD in the present study. This figure is similar to prior studies in Iraq [17, 20] ,Pakistan [14] ,USA [28],Iran[25] & China [30], but lower than reported in many other studies [15, 18–20, 23, 24, 26, 27]. CoA accounted for (3.82%) of all CHD. Comparable results observed in Jordon [22], Turkey [27], USA [28], Qatar [19], and Brazil [29]. On the other hand, CoA was not reported in previous available studies in Iraq Table 4.

These differences in the results among studies in various geographical locations could be due to the sample size, different inclusion criteria like live or stillbirths in the study or diagnosis ways, sensitivity of diagnostic methods, whether study performed in general or specialized center, and racial/ethnic differences and genetic factors in different populations [9, 31]. TOF is considered one of the most common or even the most common, type of cyanotic CHD [32]. The present study showed that TOF was the commonest cyanotic CHD (6.11%), correlating well with other studies in Turkey, Qatar, Egypt, USA, and the UK. Other studies also reported TOF the commonest cyanotic CHD but with a higher percentage Table 4.

The lacking of precise echocardiographic definition of TOF because some researchers still regard double outlet right ventricle with pulmonary stenosis as TOF, even if most of the aorta arises from the right ventricle, will lead to exaggeration in the TOF incidence and causing these differences between studies [26].

TGA ranked second in frequency among cyanotic CHD (3.82%). Comparable results were noted in Basrah, Yemen, Southern Iran, Turkey, Pakistan, and Qatar. The lower finding was observed in the USA, Saudi Arabia, Brazil, and China, while higher found in Baghdad, Jordon, and UK Table 4.

In general, the prevalence of cyanotic and complex lesions is significantly greater in boys than in girls. All left heart defects, in particular, hypoplastic left heart syndrome, aortic stenosis, and coarctation show uniformly higher occurrence rates in males than in females. Less severe lesions, including ASD, PDA, and atrioventricular (AV) septal defects,

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Table 4. Distribution of various CHD in the current study in comparison to other studies.

Country/city	VSD%	ASD%	PDA%	TOF%	AV canal%	PS%	CoA%	TGA%	AS%	Others%	Complex%
Current study	29.39	16.03	13.74	6.11	4.96	4.58	3.82	3.82	1.15	16.4	-
Baghdad [20]	51.8	3.4	13.5	17.9	-	4.5	-	8.9	-	-	-
Mosul [23]	34.17	23.52	10.5	9.02	-	10.65	-	2.51	1.92	-	2.36
Basrah [17]	43.3	11.9	9.4	12.6	6.4	3.8	-	4.2	1.9	-	2.6
Saudi Arabia [26]	33.9	18.1	11.6	3.5	3.5	12.4	2.3	2.1	2.5	10.1	-
Yemen [18]	26.5	15.8	17.3	8.9	4.1	17.6	0.8	3.1	3.1	3.1	-
Jordan [22]	43.4	13.6	8.3	9.5	3.6	6.2	3.4	5.5	4.3	-	2.25
TURKEY [27]	32.6	13.1	15.9	5.8	3.6	7.9	4.8	3	4.5	1.3	-
South Iran [24]	28.1	9.7	9.1	13.2	-	12.1	2.4	3.1	8.7	3.82	-
Qatar [19]	40.6	7.2	5.1	5.1	2.8	8.7	4.1	3.1	2.5	5.8	-
Egypt [15]	29.65	17.93	12.4	5.51	-	9.65	-	-	8.27	6.2	10.34
Pakistan [14]	52.5	8.75	7.75	8.75	3.75	3.75	-	3.75	-	-	2.5
UK [16]	32.5	5.9	11.9	5.9	2.4	7.6	6.3	5	5.1	17.4	-
USA [28]	41.8	13.1	2.9	4.7	4.1	5.5	4.4	2.3	1.1	20.1	-
Brazil [29]	28.3	7.7	5.9	7.5	8.1	9.3	3.8	1.8	4.3	17	-
Iran [25]	11.07	19.54	17.97	16.99	0.1	3.59	1.7	0.1	-	-	-
China [30]	29.2	20.8	13.7	4.2	-	5.4	-	1.3	-	-	-

Table 5. Male/female ratio of the CHD in the current study in comparison to other studies.

Study (male: female)	VSD	ASD	PDA	TOF	TGA	CoA	AV canal	PS	AS
Present study	1.2:1	1:1.1	1:1.1	2.2:1	2.3:1	2.3:1	1:1.7	1:1.4	2:1
Baghdad [20]	1.1:1	1:3	1:1.7	1.6:1	1.6:1	-	-	1:1	-
Basrah [17]	1.2:1	1.3:1	1:1.7	1.8:1	1.4:1	-	1.2:1	1:1	-
Mosul [23]	1:1	1:1	1:2	1.9:1	1:1.1	-	1.8:1	2:1	-
Egypt [15]	1.7:1	1:2	1:1.7	1:1	-	-	-	1:1.25	2:1
Qatar [19]	1:1	1:1.6	1:1.4	1.4:1	1.7:1	1.1:1	1:1.4	1:1	1.1:1
Turkey [27]	1:1	1:1.4	1:1.1	1.4:1	1.8:1	1.7:1	1:1	1:1.4	2.5:1
Saudi [26]	1:1	1:1.1	1:1.4	1:1	2.4:1	2.5:1	1:1.1	1:1.1	3:1
Yemen [18]	1.1:1	1.6:1	1:2.5	1:1.4	1:1.4	2:1	1:2	1:1	-
Pakistan [14]	1.8:1	1.3:1	2:1	2.5:1	1:2	-	1:2	2:1	-

dominate in females. Ventricular septal defects and perhaps pulmonary stenosis appear to be evenly distributed by sex [9].

Our results showed male predominance in TOF (68.75%), TGA (70%), CoA (70%), AS (66.67%) & VSD (54.55%), while female predominance was found in AV canal(61.55%), ASD+PS(77.78%) , VSD+PDA (60%) , PS(58.33%) and to a lesser extent PDA (52.78%) and ASD (52.38%).

Most studies with few exceptions showed a male predominance in TOF, TGA, AS and VSD and female predominance in PDA, ASD, AV canal, and PS, which are nearly comparable to our results as shown in Table 5.

The males' distribution with CHD suggests a not well understood important causative link. With categorizing all isolated lesions according to the time of disturbance of organogenesis during embryonic life, the male showed predominance in those that are occurred later in gestation [17, 26].

CONCLUSION AND RECOMMENDATIONS

This study provides an overview of the CHD pattern at Maternity and Children Teaching Hospital in Ramadi. Most of the patient with CHD were detected during the first year of life with the majority of lesions were acyanotic. The commonest acyanotic congenital heart diseases were VSD, ASD, and PDA, while TOF and TGA were the commonest cyanotic congenital heart diseases. Coarctation of aorta was found in (3.82% of the CHD), while no cases of CoA was reported in other available studies in Iraq.

Obvious male predominance was found in TOF, TGA, CoA, and AS, while female predominance in AV canal, PS and ASD+PS. So, it is recommended that routine clinical screening for CHD should be done for all neonate and infants after delivery and during attendance for vaccinations or examination for inter-current illnesses. Larger sample size will be more informative and proper registration policies that will help for estimation of the prevalence of CHD.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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