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Temporal Trend of Congenital Heart Diseases in Iraqi Patients: An Analytic Study from Two Cardiac Institutions

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Abstract

Background: Congenital heart diseases are group of pathologies that involve the cardiovascular system since birth but their diagnosis might delay years then after**.**

Objective: This thesis focuses on the pattern of these anomalies in two Iraqi cardiac centers.

Method: Prospective cross-sectional study involves all the newly diagnosed patient with congenital heart diseases for eight months duration, in (IBN Al-Nafees Cardiovascular Teaching hospital and IRAQI Center of Cardiac Diseases) in Baghdad-Iraq.

Results: more than 200 patients involve in the study; Cardiac murmur was the comments presenting clinical finding to seek medical advice, VSD is the most frequent diagnosis.12% of the patient were syndromic with down syndrome was the most common enfaced clinical syndrome.

Conclusion: VSD is the most common A cyanotic CHD, While TOF is the most common cyanotic one.

Keywords: Ventricular septal defect, Tetralogy of Fallot; Down syndrome.

I. Introduction

Congenital heart defects (CHD) are the most common types of major birth defects reported in the literature (1). CHD is the leading cause of birth defect-associated infant death and illness. The incidence of CHD varies between populations according to the published studies conducted in different countries with an incidence ranging from 4 to 50 per 1,000 live births (2). Massive breakthroughs have been achieved in cardiovascular diagnostics and cardiothoracic surgery over the past century, leading to an increased survival of newborns with CHD. In countries with limited resources, the delay in diagnosing CHD adds to the already existing high mortality and morbidity rates. Early detection and proper treatment have increased the survival rate and decreased mortality from 80 to 20% resulting in an increase in the number of adults surviving with CHD (3).

Aim of study

Determine the current pattern of distribution of congenital heart disease, sex, age at time of presentation, the most common mode of presentation in two referring cardiac centers in Baghdad, with special concentration about any maternal risk factors that might triggered CHD.

II. Patients and method

A prospective study was done in the pediatric tertiary cardiology clinics of two referral-based centers (IBN Al-Nafees Cardiovascular Teaching hospital and IRAQI Center of Cardiac Diseases) in Baghdad-Iraq.

Two hundred and nine patients with newly diagnosed of CHD were enrolled in this study, during the period from first of 1st of December 2023 to 1st of August 2024.

The patient data regarding age, gender, consanguinity, clinical presentation, syndromic features and family history of CHD. Oral consent had taken from the parents of each child involved in the study.

All the children who suspected CHD were evaluated by full cardiovascular examination, transthoracic echocardiography, sometimes chest X-ray, ECG and cardiac catheterization was needed for definitive diagnosis of some cases

Echocardiography was obtained by a Vivid E9 machine with a mechanical sector scanner at 3 and 5 MHz by which M mode, two-dimensional echocardiography and Doppler studies had performed according to segmental analysis

Exclusion criteria

- Patient who Is a known case of CHD
- Patent ductus arteriosus in premature neonates

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- Structural defects with little or no functional abnormalities, like mitral valve prolapse, patent foramina oval, right aortic arch and bicuspid aortic valve.
- Acquired cardiac disease like rheumatic heart diseases, cardiomyopathy, functional alterations, such as mitral, tricuspid, aortic, and pulmonary regurgitations. The patients were classified into 6 age groups:
  1. Neonate: 0 – 28 days.
  2. Infant: 29 days – 1 year.
  3. Toddler: 1 year – 3 years.
  4. Preschool: 3 years – 6 years.
  5. School age: 6 years – 12 years.
  6. Teenage: 12 years – 18 years.
  7. Adult: > 18 years

III. Results

During a period of 8 months,209 cases collected in two pediatric cardiology centers, there were 111 males (53.2%) and 98 females (46.8%) as in Table no1.

Positive family history of CHD in the older sibling was 10.5 % (n=22) while positive Parental consanguinity was 57.9% (n=121) as in Table 1

Table 1 Distribution of demographic data and risk factors

Demographic/risk factors		**Numbers N=209**	**Percentage %**
Sex	Male	111	53.2
	Female	98	46.8
Consguanity	Positive	121	57.9
	Negative	88	42.1
Family History of CHD	Positive	22	10.2
	Negative	187	89.5
Maternal Comorbidities	DM	24	11.5
	Hypertensive	15	7
	TORCH	8	4
	Epilepsy	1	0.5
Syndromes	Non-Syndromic	183	87.5
	Syndromic	26	12.5

Maternal co-morbidities were present in 23 % (48 cases). Maternal Diabetes mellitus was present in 11.5 % (24 cases). Hypertension 7% (15 cases), TORCH infection 4% (8 cases) and Epilepsy 0.5% (1 case).

Among the diagnosed CHD children only 12.5 % (n=26) had syndromic features as in.

The majority of syndromic patients 77% (20/26 cases) had a phenotypic diagnosis of Trisomy 21 (Down syndrome), two patients (7%) had features suggestive of William syndrome and four patients had dysmorphic feature suggestive of Turner, Edward, Alagille and Ellis van syndromes as described in Diagram 1

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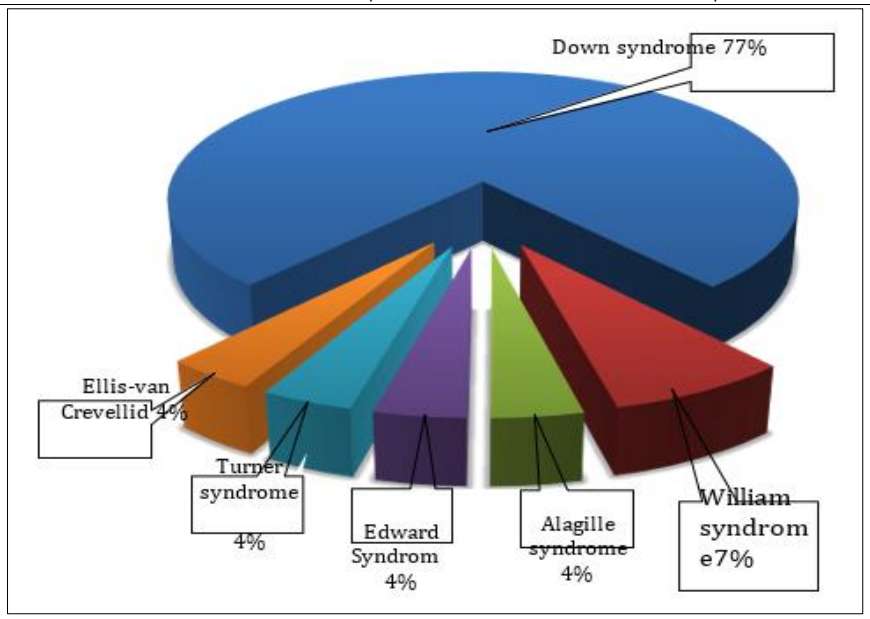

Diagram 1 Syndrome percentage with CHD

The commonest causes for referral to our pediatric cardiology clinic were Accidental murmur on auscultation in 31%, S.O. B in 22%, cyanosis 21%, dysmorphism 12%, repeated chest infection 8%, screening 3%, F.T. T 2.6% and stroke 0.4%.as in Diagram 2.

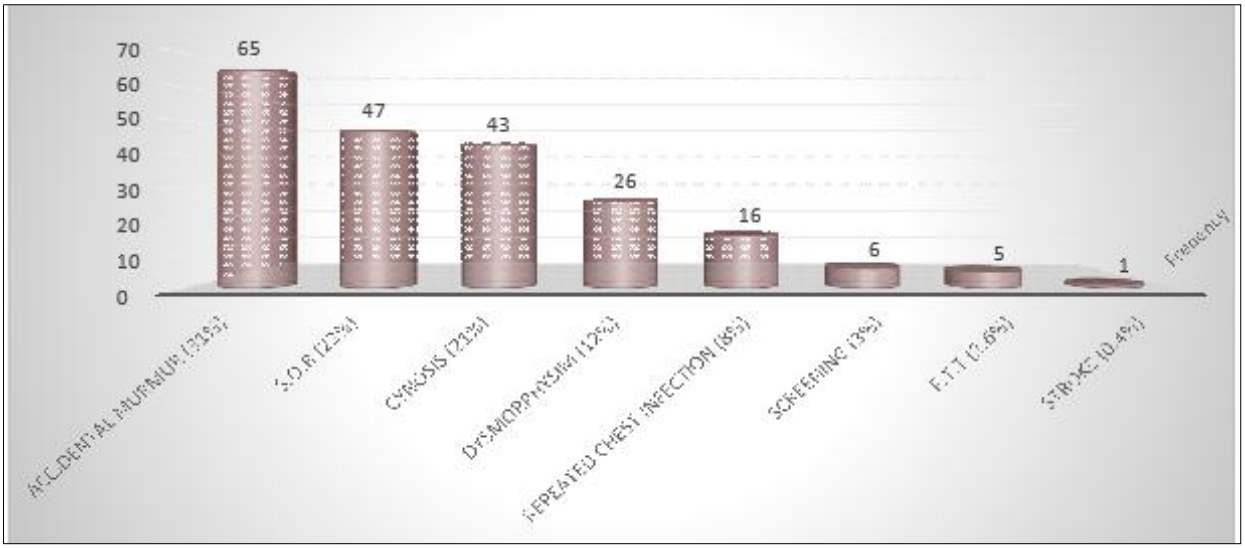

Diagram 2 Mode of Presentation among patients

Most of our patients had been diagnosed within the first year of life (53.1 % in the infancy and 26.8% in the neonatal period), The relative frequencies and ages of presentations of individual types of CHDs are shown in Table 2

The mean ages of patients 20.75±73.22 months as in Table 2.

Table 2 Different types of CHD according to age at diagnosis

CHD	Neonate	Infant	Toddler	Preschool	School	Teenage	Adult	Total
VSD	6	32	5	3	1	1	0	48
ASD	4	18	3	2	1	1	1	30
PDA	3	6	3	2	1	1	-	16
PS	2	7	4	1	1	1	-	16
VSD/ASD	6	7	-	-	-	-	-	13

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AVSD	2	10	-	-	-	-	-	12
ASD/PDA	4	6	-	-	-	-	-	10
VSD /PDA	4	2	-	-	-	-	-	6
COA	1	-	-	1	1	2	-	5
AS	-	-	-	1	2	1	-	4
ASD/PS	-	2	-	-	-	-	-	2
TOF	3	13	-	-	-	-	-	16
TGA	6	-	-	-	-	-	-	6
DORV	3	2	-	-	-	-	-	5
Tricuspid Atresia	2	1	-	-	-	1	-	4
TAPVR	3	-	-	-	-	-	-	3
Truncus Arteriosus	2	1	-	-	-	-	-	3
Single	2	1	-	-	-	-	-	3
HLHS	2	-	-	-	-	-	-	2
Ebstein anomalies	-	1	-	-	1	-	-	2
LTGA	-	2	-	-	-	-	-	2
PA/IVS	1	-	-	-	-	-	-	1
Total	56	111	15	10	8	8	1	209
Percent	26.8%	53.1%	7.2%	4.8%	3.8%	3.8%	0.5%	100%
Mean Age Months	0.37±0.28	4.65±3.13	19.26±7.75	49.6±9.96	96±21.6	172.5±20.2	300	20.75±73.22

Of the studied patients, noncyanotic CHD was encountered in 162 cases (77.5%) whereas cyanotic CHD in 47 cases (22.5%) as in Diagram 3.

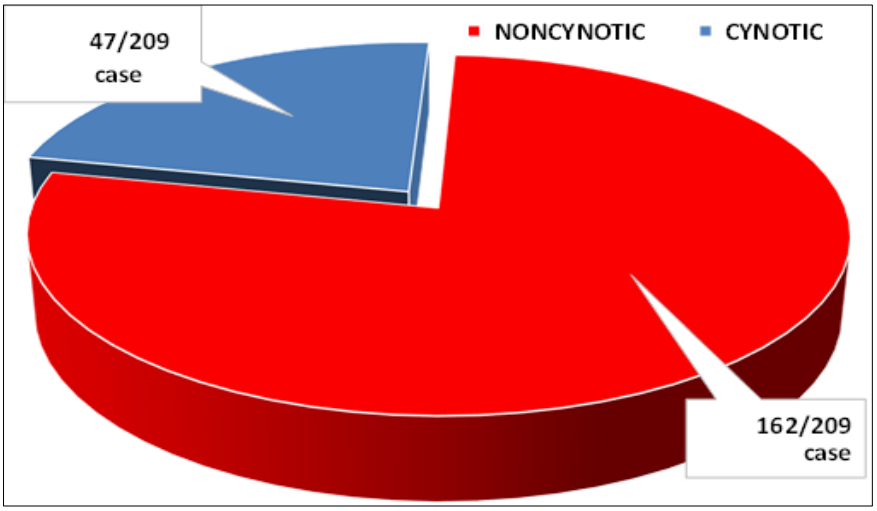

Diagram 3 **Major Types of CHD**

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The frequency of noncyanotic lesion of CHD shown in Table 3.

Table 3 Frequency of Noncyanotic CHD

Type of Noncyanotic CHD	Number of patients	Percent among Noncyanotic CHD (n=162)	Percent among total CHD (n= 209)
VSD	48	30%	23%
ASD	30	18.5%	14.3%
PDA	16	9.9%	7.7%
PS	16	9.9%	7.7%
VSD/ASD	13	8%	6.2%
AVSD	12	7.4%	5.7%
ASD/PDA	10	6.2%	4.8%
VSD/PDA	6	3.7%	2.9%
COA	5	3%	2.4%
AS	4	2.5%	1.9%
ASD/PS	2	1.2%	0.9%
Total	162	100%	77.5%

Regarding noncyanotic CHD, shunt lesions constitute 84% and obstructive lesions were 16%

Ventricular septal defect followed by atrial septal defect, patent ductus arteriosus and pulmonary valve stenosis were the commonest noncyanotic congenital heart lesions, comprising 23%, 14.3%, 7.7% and 7.7% respectively

VSD was the commonest septal noncyanotic CHD while Pulmonary valve stenosis was the commonest obstructive noncyanotic CHD

Tetralogy of Fallot (7.7 %) followed by transposition of the great arteries (2.9%), DORV (2.3%) and tricuspid atresia (1.9%) were the commonest cyanotic congenital heart lesions as shown in Table 4.

Table 4 Frequency of Cyanotic CHD

Type of Cyanotic CHD	Number of patients	Percent Among Cyanotic CHD (n=47)	Percent Among total CHD (n= 209)
TOF	16	34.04%	7.7%
TGA	6	12.77%	2.9%
DORV	5	10.64%	2.3%
Tricuspid Atresia	4	8.51%	1.9%
Truncus Arteriosus	3	6.38%	1.4%
TAPVR	3	6.38%	1.4%
Single ventricle	3	6.38%	1.4%
Ebstein anomalies	2	4.26%	1%
LTGA	2	4.26%	1%
HLHS	2	4.26%	1%
PA/IVS	1	2.13%	0.5%
Total	47	100.00%	22.5%

The male to female ratio was 1.13:1 as in Table 5.

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Table 5 Gender difference in all types of CHD

	CHD	Total	Male	Female	Ratio
	VSD	48	28	20	1.4:1
	ASD	30	12	18	1:1.5
NONCYNOTIC CHD	PDA	16	6	10	1:1.6
	PS	16	7	9	1:1.2
	VSD/ASD	13	8	5	1.4:1
	AVSD	12	7	5	1.7:1
	ASD/PDA	10	4	6	1:1.7
	VSD/PDA	6	4	2	2:1
	COA	5	3	2	1.5:1
	AS	4	3	1	3:1
	ASD/PS	2	1	1	1:1
	TOF	16	11	5	2.2:1
	TGA	6	4	2	2:1
	DORV	5	3	2	1.5:1
CYNOTIC CHD	Tricuspid atresia	4	2	2	1:1
	TAPVR	3	2	1	2:1
	Truncus Arteriosus	3	2	1	2:1
	Single Ventricle	3	1	2	1:2
	HLHS	2	1	1	1:1
	Ebstein Anomalies	2	0	2	Female
	LTGA	2	1	1	1:1
	PA/IVS	1	1	0	Male
	Total	209	111	98	1.13:1

Male predominance was seen in VSD, AVSD, COA, TOF, DTGA, DORV, TAPVR and truncus arteriosus while Female predominance was seen in ASD, PS and PDA and single ventricle, no sex difference was noticed in Tricuspid atresia, LTGA and HLHS as in Table 5

IV. Discussion

CHD was the most common congenital defect and had relatively higher mortality rate than other birth defects during first year of life.

In this prospective hospital-based study, we didn't address the incidence of CHD, but we studied the frequency and patterns of different types of CHD among Iraqi populations.

Two hundred nine patients were enrolled in this study, with 53.2% male and 46.8% female with male to female ratio 1.13:1 similar to these studies (Naik et al [4], Otaigbe et al [5], Mustafa et al [17] and Mohamud et al[49]) while other studies (Memon et al [6] and Taboo et al [7] show high male to female ratio and the other studies (Robida et al [8], Saleh et al [9] and Chelo et al [10] show female out number male

Positive family history of CHD in the older sibling was 10.5 % in our study while in these study (Taboo et al [7], Ul Haq et al [11], Al-Fahham et al [12] and Fung et al [13] were 13%, 14%, 9.2%, 4.1% respectively

Positive Parental consanguinity was 57.9%, Similar to these study (Taboo et al [7], Ul Hag et al [11], Al-Ani et al [14] and Nabulsi et al[59]) which detected consanguinity 60%, 49%, 77.9%, 34.7% respectively.

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The differences among various studies reflect the differences in the prevalence of consanguinity among different societies. Moreover, the high-risk factor in closely related parents indicates that consanguinity may act as a genetic predisposition that increases the susceptibility of developing CHD, especially when there is exposure to an environmental.

risk factor. This highlights the need for public health education regarding the hazards of inbreeding.

Maternal co-morbidities such as (D.M, H.T, Hypothyroidism, TORCH, Epilepsy) were seen in (23%) of the CHD cases in our study. Various studies (Taboo et al [7], Ul Hag et al [11], and Sawant et al [15] had shown maternal co-morbidities were present in 19.6%, 14%, 20% respectively.

Several studies (Al-Fahham et al [12], Fung et al, Sawant et al [15] and Majeed et al [16] on CHD have demonstrated syndromic cause of CHD was present in 16.7%, 9.5%, 22.8%, 12% respectively

In our study 12.5 % of cases had syndromic features, The majority 9.5% of all cases had a phenotypic diagnosis of Down syndrome like Several studies [12, 13, 15, 16] which detected Down syndrome (DS) being the most common chromosomal anomaly seen among patients with syndromic features 10.4%, 4.4%, 8.5%, 8.7% respectively.

Overall, 79.9% of CHD cases presented at age less than one year, which is similar to these studies 70% in Otaigbe et al [5], 71.16% in Mustafa et al [17] and 70% in Memo et al [6], while lower results reported in other studies 41% in Saleh et al [9], 43% in Khadim et al [18] and 33% in Bhardwaj et al [19].

This variations in the ages of diagnosis can be attributed to the improvement in the maternal and neonatal care, availability of diagnostic facilities and family awareness about early detection of CHD.

Accidental finding of heart murmur during regular physical exam was the most common indication for referral to our cardiology clinic and was ascertained in 31% cases similar to these studies (Otaigbe et al [5], AlFahham et al [12], Khasawneh et al [20] and Massoure et al [21] but in other studies (Al-Hammash et al [22] and Al-Zuhairy et al [22] repeated chest infection was the commonest presenting symptom while S.O.B was the most presenting symptom in these studies (Memon et al [6] and Chelo et al [10]. Hearing a heart murmur was the most common indication for referral to the cardiology department in recent studies due to better baby welfare clinics.

Regarding types of CHD, acyanotic lesions were 77.5% of CHD, and the remaining were cyanotic lesions 22.5% this result resembles other studies (Otaigbe et al [5], Mohamud et al[49], Memon et al [6], Al Fahham et al [12] in which noncyanotic lesion constitutes 83.4%, 81.3 %, 72.5%, 79.2% respectively.

Isolated VSD (23%) was the commonest noncyanotic lesions and all types of CHD which is similar to the most studies in Iraq [17, 18, 6] and worldwide [4, 5, 6, 8, 10] but differ from other studies [24] in which ASD was the commonest lesion while in Jordan [20], PDA was the commonest lesion.

Many asymptomatic neonate and infant was diagnosed with small ASD, and tiny PDA during screening, this might be responsible for the higher ASD and PDA prevalence found in these studies.

The second most common CHD was ASD accounting for 14.3% of all CHD like these studies [17, 6, 12, 15] However, other studies [10].

found that PS is the second most common CHD while these studies [18, 23] found that TOF was the second most common CHD and other studies [5] results show that PDA was the second most common CHD.

The most common noncyanotic obstructive CHD were PS (7.7%) followed by COA (2.4%) and AS (1.9%) with agreement to those studies (Mustafa et al [17], Robida et al [8], Cesar et al [25] and Reller et al [26] but in Jordan study [20] report that COA was the most common obstructive noncyanotic CHD.

AVSD constitute 5.7% of CHD in this study similar to other studies (Naik et al [4], Khadim et al [18], Cesar et al [25] and Reller et al [26] in which AVSD prevalence was 4.96%, 6.4%, 4%, 4.1% respectively.

The most common lesions present simultaneously in this study were VSD/ASD (6.2%) like these studies (Bhardwaj et al [19] and Pate et al [27] while VSD/PDA combination was the commonest combination in Bakhtyar et al [28]. This variation in the incidence, prevalence, and pattern of distribution of CHD types among different studies might be due to the variation in inclusion criteria of each study such as the age of patients, the size of certain heart defects and the methodology used for diagnosis. Also, the risk factors and geographical region differs from one country to another may contribute to these variations.

In our study, TOF was the commonest cyanotic CHD (8%), correlating well with most other studies in Iraq [17, 22, 23] and worldwide studies [5, 12, 15, 20, 25].

Transposition of great arteries was the 2nd most common cyanotic CHD (3%) in this study that resemble other studies [17, 15, 18, 20, 25].

The drawback of the present study is that being a hospital-based study it does not reflect true community prevalence, in addition to a short period of study and small sample of patients involved.

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V. Conclusion

- The study helps to know the pattern of CHD, and the familial risk factors in relation to congenital anomalies.
- Majority of CHD in our patients at pediatric Tertiary cardiac Hospital are noncyanotic, with male to female ratio 1.13:1
- VSD and TOF were the commonest noncyanotic and cyanotic lesions respectively.
- Most common age of presentation was below one year, and cardiac murmur was the most mode of presentation.
- The overall results in our study are within the range reported previously in Iraq and other countries.
- Echocardiography has become the most important, noninvasive and the gold standard method for diagnosis of CHD

VI. Recommendations

- A wider population-based study is needed to evaluate the incidence and better understand the patterns and distribution of CHD at a national level.
- There is need to establish pediatric cardiac surgical centers with specialized medical cardiology, intensive care, imaging, and interventions.
- The pediatrician should have high index of suspicion regarding CHD especially in neonates. This may help to treat them at an earlier age and thus give the affected patients hope of a better out come
- Amulti-center similar studies are needed to be done in different governorates, different geographical areas, rural and urban areas, though we still believe that this study can be considered as a nidus for such studies as it was done in a large tertiary referral-based cardiac center that receives patients from different geographical areas including those critical, severe, and complicated cases

Compliance with ethical standards

Disclosure of conflict of interest

No conflict-of-interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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