Prevalence and Risk Factors for Congenital Heart Anomalies Among Hospital Attendees in Mosul City

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ABSTRACT:

BACKGROUND :

Congenital heart disease (CHD) define as abnormalities of heart structure that originate before birth, they are responsible for more deaths in the first year of life than any other birth defects.

OBJECTIVE:

To determine the prevalence of the identifiable CHDs and to identify risk factors that may predispose for its occurrence .

METHODS:

This is a case series hospital based study carried out in IB- IN- Al-Atheer teaching hospital of pediatric in Mosul city. during the period from April 2013 to April 2014 . 460 cases with CHD were compared with an equal number of controls selected from the general population and individually matched for age, sex, and family practitioner Information was obtained by Questionnaire sheets ,medical examination and investigations.

RESULT:

Out of 75320 attendants, 680 cases were referred to echocardiography unit where 460 cases of CHD were detected, the prevalence was (6.1/1000 patients). Atrial septal defect (42. %), ventricular septal defect was detected (30%) and Patent ductus arteriosus (9.3%) are the most common CHD detected. More than half of cases of CHD (86%) are detected at infancy with female- male ratio of 1.4:1 An association was found between family history, consanguinity and occurrence of CHD. Also an association was found between maternal risk factors such as mothers disease ,drug intake, obesity, smooking during pregnancy.

CONCLUSION:

CHD is a public health problem among infants and young children and there are many risk factors showed a significant effect on its occurrence such as positive family history, consanguinity and material risk factors during pregnancy So proper and timely counseling, regular antenatal care. folate supplementation especially during the most sensitive period of embryogenesis is essential to avoid congenital heart malformation

KEY WORD : congenital heart disease .

INTRODUCTION:

Congenital heart diseases (CHDs) defined as any abnormalities of the heart's structure and function caused by abnormal or disordered heart development before birth[1] The congenital heart anomalies are one of the most common causes of disability in developed and developing countries[2] It began to emerge as one of the major childhood health problems[3] Congenital heart diseases are responsible for more deaths in the first year of life than any other birth defects [2] The prevalence of (CHD) is around 1% of live birth[4] The actual numbers of these anomalies vary from country to country [5] .

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The etiology of most CHDs is unknown . The heart and the vascular system are almost fully formed by midgestation[6]. Although early recognition of anomalies is important for planning care[7], knowing etiology of congenital anomalies is the base of prevention programs even if these etiology is not completely understood. Only around 15% of CHDs can be attributed to a known cause [8]. Approximately 5–10% are associated with a chromosome abnormality, 3–5% can be linked to defects in single genes, and about 2% are attributed to known environmental factors [9]. It is difficult to establish the role of a single factor, because in many cases, the cause of a defect is believed to be multifactorial [10,11], including environmental

teratogens with genetic and chromosomal conditions [8]. Most of the causes of these anomalies occur within the fetal– placental–maternal "environment" [12]. Maternal illnesses may play a significant role in the development of heart defects in fetuses. Although the embryo does not have the disease, prolonged exposure to metabolites of the maternal illness leads to the development of congenital malformations [11].

AIM:

This study was carried out to determine the prevalence of congenital heart anomalies, identify the

Covariates which may predispose to anomalies and the pattern of distribution of congenital heart anomalies in Mosul city, in the north of Iraq

PATIENTS AND METHODS:

This study conducted in IB-IN-Al-Atheer teaching hospital of pediatric in Mosul city. This hospital serves both urban and rural area. The study was conducted over 12 months period from 1-4-2013 to 1-4 -2014. and included all attendants of children (up to 12 years) to pediatric clinics , any child with signs and symptoms suggesting CHD was referred to echocardiography unit to confirm the diagnosis and the type of the CHDS.

For every CHD cases, a patients admitted at same period in same hospital were selected randomly as controls to compare the rate of certain variables which considered as risk factor with that of our CHD cases., selected control must be without CHD.

Data collection was performed by means of structured form which contained two parts, similar to study of Tootoonchi [13] In the first part, variables recorded were about familial characteristics e.g. family history, consanguinity, age, and gravidity of the mother, parity, social class, history of chronic illness, drug ingestion, exposure to X-ray, history of congenital anomalies in other offspring, ,. The second part was about child such as, gestational age, weight, sex, existence of other congenital anomaly. Main presenting symptoms of cases (history was taken from mothers or care givers) All the patients with signs and symptoms suggesting CHD were scanned and diagnosed by

1-Plain x – ray: Postero-anteriorfor chest and heart.

2- Electrocardiogram (ECG)

3- Echocardiography (SONOACE X6) and Echo-Doppler: by using Echo-Doppler apparatus (HD11XE Patients with acquired heart disease such as rheumatic fever are excluded The different types of CHDs considered for the present investigation are: Ventricular septal defect (VSD), Atrial septal defect (ASD), Tetralogy of Fallot (TOF), Patent Ductus Arteriosus (PDA), Pulmonary Stenosis (PS), Aortic Stenosis (AS), and Complex CHDs (various types of CHDs existing together including rare type of CHDs).

Statistical analysis: Package used was SPSS version 17 software, the data of questionnaire were installed in the computer by coding every data of the variable to make it easier to calculate, then interpreting and analyzing the output. Quantitative variable, are expressed as the mean and standard deviation (SD) and compared by t-test in addition analysis performed by the chi-square test,. $P<0.05$ was considered to be statistically significant.

RESULTS:

During the study period from April 2013 –April 2014 , 75320 patients were referred to IB-IN AL-Atheer hopital, 680 patients were referred to Echo unit. 460 were diagnosed as having CHD giving a prevalence of 6.1/ 1000 of the total. hospital admission during the study period .There were 270 (59%) females and 190 (41%) males with: female- male ratio of 1.4:1.

Table 1 shows frequencies of various types of CHDs. It is clear that isolated ASD is the most frequent form. It was found in 200 patients (42%), followed by VSD 140(30%)and the PDA was 42(9%) followed by complex cardiac lesions(5%)

Table (2): shows distribution of CHDs among various age groups at the time of diagnosis. It is clear that highest percentage of CHD (86%)were detected at the age of infancy (> 1 month – 24 months)

Table (3): This table shows personal characteristics of cases with CHD It was found that more than half of cases with CHD (60.9%) had 3rd or more birth order, on the other hand a low percentage of cases of CHD had born as twin (4.3%), preterm (3.3%) and born with Down syndrome (2.8%) compared to 0.7%, 0.7% and 0.2% respectively to those without CHD with significant difference($P < 0.05$). . The table shows a positive association between twin,(OR= 4.6 , 95% CI.= 1.37 –15.57) , pre maturity (OR =4.2, 95 % CI = 2.05 – 8.16) and Down syndrome(OR= 1.83, CI = 1.06 –3.13) and presence of CHD

Table (4): This table shows familial characteristics of cases with CHD. There was an association

between positive family history (OR= 3.4 ,95% CI= 1.07 – 10.77) & consanguinity (OR= 9.9 , 95 % CI= 2.76-35.3)and occurrence of CHD It was found that 13% and 60.8% of cases with CHD had a positive family history and their parents are married from their relatives (consanguinity) in compared to 2.2%, 19.6% respectively to those without CHD On the other hand, it was found that 10.8 % of mothers of cases with CHD had aged 35 years or more at birth with significant difference (P<0.001).

Table (5): This table shows frequency of maternal risk factors and its association with the occurrence of CHD .There was positive association between febrile illness (OR=4.2,95%,95% CI 2.04-8.72), toxoplsmosis(OR = 3.4 ,95% CI 1.07-10.77) and occurrence of CHD. It was found that 10.9%, 8.7% of mothers of cases with CHD had taken drugs(antihistamine and non steroidal) and 3.3% was smoker, (P <0.05) while 4.3% and 6.5 % of them had history of febrile illness and diabetes - in compared to 0.4% and, 4.8% , respectively to mothers born cases without CHD with significant difference Also 26.1 %of mothers of cases with CHD had history of pregestational obesity in corresponding to 8.7% of mothers born cases without CHD with significant difference (p<0.001)

Table 1: Frequencies of various types of CHDs.

Type of defect	number	Percentage(%)
ASD	200	42%
VSD	140	30%
PDA	42	9.3%
TOF	40	8.7%
Complex CHD	23	5%
AS	10	2%
Coarctation of Aorta	5	1%
TOTAL	460	100%

Table 2: Distribution of studied sample according to the age.

Age / month type of CHD	Neonate (> m)		Infant (1-24m)		Preschoole (>24-72m)		School (>72-144m)		Total
	No	%	No	%	No	%	No	%	No
ASD	15	7.5	178	89	3	1.5	4	2	200
VSD	5	3.6	120	85	10	7.1	5	3.5	140
PDA	6	14.2	32	76.2	4	9.5	-	-	42
TOF	5	12.5	35	87.5	-	-	-	-	40
Complex CHD	3	13	20	86	-	-	-	-	
AS	-	-	9	90	1	10	-	-	10
Coarctation of Aorta	1	20	3	60	1	20	-	-	5
Total	35	8	397	86	19	4	9	2	460

Table 3: The Association between personal characteristics and occurrence of CHD among the studied sample.

Personal characteristic	With CHD (cases) N=460		WithoutCHD (control) N=460		OR(95%C.I)	X2	p-value
	NO.	%	No	%			
Birth order First Second thirdor more	80 100 280	17.4 21.7 60.9	90 260 110	19.6 56.5 23.9		20.1	<0.001
Twin Only one	20 440	4.3 95.7	3 475	0.7 99.3	4.6(1.37-15.57)	18.4	<0.001
Maturity Full term preterm	445 15	96.7 3.3	458 3	99.3 0.7	4.2(2.04-8. 72)	7.2	<0.005
Down syndrome Yes No	13 447	2.8 97.2	1 459	0.2 99.8	1.83(1.06-3.13)	4.7	<0.005

OR (95% C.I) = Odds Ratio (95 % Confidence Interval

Table 4: The Association between familial characteristics and occurrence of CHD among the studied sample.

Type of familial charecteristic	With CHD N=460		Without CHD N=460		OR(95%C.I)	X2	P-value
	NO	%	No	%			
Family history + ve _ve	60 400	13 87	10 450	2.2 97.8	3.4(1.07-10.77)	4.7	<0.005
Consanguinity : Yes No	280 180	60.8 39.2	90 370	19.6 80.4	9.9(2.76-35.3)	18.3	<0.001
Age of mother at birth of the child < 25y 25 -35 >35	110 300 50	24 65.2 10.8	180 270 10	39 58.7 2.2		8	<0.001

Table 5: The Association between maternal risk factors during pregnancy and occurrence of CHD among the studied sample.

Type of maternal risk factor	With CHD N=460		Without CHD N=460		OR(95%C.I)	X2	P value
	No	%	No	%			
DISEASE							
Febrile illness	20	4.3	2	0.4	4.2(2.04-8.72)	4.6	<0.05
Diabetes	30	6.5	6	1.3	1.83(1.05-3.16)	4.8	<0.05
Hypertension	15	3.3	12	2..6	1.18(0.66-2.13) 1.07(0.72-1.57)	0.5	>0.05
Convulsion	3	0.6	1	0.2	0.7(0.95-2.16)	0.3	>0.05
Rubella	8	1.7	1	0.2	3.4(1.07-10.77)	2.1	>0.05
toxoplsmosis	15	3.2	2	0.4		4.2	<0.05
Exposure to radiation	10	2.2	6	1.3	0.9(0.5-2.49)	0.5	>0.05
Folic acid and multivitamin intake	100	21.7	400	86	9.9(2.76-35.3)	118	<0.001
Druge intake	10	2.2	6	1.3	1.07(0.72-1.57)	0.1	>0.05
Antibiotic	50	10.9	2	o.4	4.6(1.37-15.57)	8	<0.001
antihistamine	40	8.7	10	2.2	3.4(1.07-10.77)	7.5	<0.001
non steroidal anti-inflammatory	10	2.2	8	1.9	1.4(0.54-3.67)	0.5	>0.05
antihypertensive	15	3.3	2	0.4	3.4(1.07-10.77)	4.5	<0.05
Smoking	120	26.1	40	8.7		17	<0.001
History of pre gestational obesity					9.9(2.76-35.3)		

DISCUSSION:

Congenital heart diseases are important group of diseases that cause great morbidity & mortality in children [14]. Disease prevention has been hampered by lack of information about modifiable risk factors for abnormalities in cardiac development [15]. Knowing incidence of various types of congenital cardiac defects and their clustering may lead to understanding the causes of them [5]..

In this study, the overall prevalence of congenital heart malformation among the children attended to out patient pediatric clinic of IB- IN- Al-Atheer teaching hospital during the year of the study was 6.1 /1000 patient,. This finding was lower than that reported with Alaani *et **al***[16] in Fallujah Iraq, who found that the prevalence of CHD was 10.1/ 1000. Also is lower than that of India (24/1000 patient) [17] and of Egypt(21.4/ 1000 patient) [18] there were a significant geographical differences. The reason for the difference of prevalence's congenital anomalies according to regional might be attributed to the many factors, such as: maternal risk factors, environmental exposures, ecological, economical , ethnic and other factors. [5]

According to different types of congenital heart diseases, the study showed that atrial septal defect (ASD), ventricular septal defect (VSD) and patent ductus arteriousus (PDA) were the main congenital heart defects where they represented 42%, 30% and 9.3% respectively. Different patterns in different studies with lower rate of the VSD (21.3%), followed by ASD (18.9%) and PDA (14. 6%.) were recorded in india[17] while in Lebanon ,mansour *et al* [19] recorded higher rates for VSD and ASD (62%) and TOF (39%) and Alaani *et al* in Fallujah Iraq recorded a high rate for VSD .(47.7%) followed by ASD(20.9%)[16]

Studying socio demographic characteristics of the

studied sample and its association to CHD, the results showed that more than half (86 %)of cases with CHD are detected during infancy (from one month to 24 months) This is similar to the studies done in Mosul [20], and Saudi Arabia [21]. In India, Kapoorand Gupta (2007)[17] reported that most cases of children with CHD (82.9%) were diagnosed from birth to third year of age

By studying personal characteristics of the studied cases with CHD, it was found that (60.9%) of cases with CHD were at third birth order or more . This finding was relatively in agreement with ***El-***Hourany et al. (1990)[21] who found that 57.14% of all patients with CHD occur in 4th birth order, but not in agreement with Abou El-Hassan et al. (1998)[22] who found that 74.9% of cases with CHD in Shatbi Alexandria hospitals were mostly of 1st, birth order. Falconer (1995) [23] explained this when mentioned that birth order by itself is not a direct cause of CHD but if CHD are considered to have multi factorial etiology (genetic & environmental) and on the basis of the liability – threshold module , by increasing birth order , the liability to create the disorder increases

The study also revealed an association between prematuraity and CHD (OR = 3.4, 95% CI = 1.07–10.77) where 3.3% of cases of CHD were preterm infants compared to only 0.7% to those without CHD with significant difference (P < 0.05) (Table 3). ***Frenz et al. (2005)(24)*** mentioned that preterm infants are at greater risk for short and long term complications including, cardiovascular malformations specially PDA .

Also the study showed a positive association between twin and CHD (OR = 9.9, 95 % CI =2.76 35.3) where 2.2%.of cases with CHD were born twin in corresponding 0.7% only to those without CHD with significant difference (P < 0.001),(Table 3). Pradat (2002) [25] linked an association between twins, preterm and CHD because twins are more often born to be preterm.

As regards chromosome abnormalities e.g. Down syndrome and its association with the occurrence of CHD, the study showed that 2.8 % of cases with CHD were diagnosed as having down syndrome in corresponding to only 0.2 % to those without CHD with significant difference (P < 0.01) another study in Saudia Arabia found that 13% of Children with Down syndrome had CHD and V.S.D. was the commonest lesion. [26]. Abbag (2006)[27] concluded that chromosomal abnormalities resulting in genetic syndromes such as down syndrome often associated with a higher incidence of congenital cardiac lesions.

The results of our study indicate that the proportion of consanguineous marriages, positive family history, are significantly higher in cases of CHD compared to controls. Previous studies reported from the Middle East also show that the proportion of consanguinity and first-cousin marriages among cases of CHD is appreciably higher than controls.[28] Another study has shown a high incidence of mental retardation and physical handicap as well in children born of consanguineous than non-consanguineous marriages.[29] As regards maternal age during pregnancy, it was found that 10.8% of cases with CHD had mothers aged 35 years or more during pregnancy compared to 2.2% to those without CHD with significant difference

(P < 0.001) Compbell (2003)[30] mentioned that maternal age is one of the factors that determine risks of exposure of fetus to many congenital anomalies. It is generally accepted that women aged 35 years or older at delivery may give a baby with many congenital anomalies including CHD and Down syndrome.

By studying the relationship between maternal obesity and development of CHD, the study revealed through asking mothers patients with CHD about history of pregestational obesity, a positive association was found (OR =9.9, 95 % CI 2.76-35.3) This finding was conformed by other study El wood et al. (2002)[31] found a positive association between maternal obesity in early pregnancy and congenital heart defects in offspring specially for VSD and ASD that reached statistical significance while Cornel et al.(2007)[32 found no association between maternal over weight or obesity during pregnancy and development of CHD in offspring.

By studying various maternal risk factors during pregnancy, Morgan et al. (2008)[33] classified environmental risk factors known to produce malformations including CHD into infectious agents, maternal illness and physical agents including radiation and medications.

Maternal co-morbidities such as diabetes mellitus were seen in(6.5%) of the CHD cases and only (1.6%) of controls in our study . Similarly, in a study carried out in Egypt, diabetes in the mother was seen to be independently associated with increased risk of CHD[18] also our study showed that 4.8% of mothers are exposed to febrile illness in corresponding to 0.4 % to mothers patients without CHD with insignificant difference . Jupta (2002)([34] mentioned that

maternal febrile illness during first trimester of pregnancy may be associated with increased risk of certain CHD that may reach two folds. The study also showed association was found between the toxoplasmosis and CHD ,6.20% of mothers patients with CHD had a history of toxoplasmosis compared to 0.3 % of mothers patients without CHD

The present study revealed association between drug intake, especially antihistamine (antiemetic) and non steroidal anti-inflamatary druge, during pregnancy and occurrence of CHD (table 4) ***Fekry*** (2002)[35] reported a significant association when he found that 40.74%of mothers of patients with CHD had taken different forms of medication (antibiotics & analgesics) during first trimester of pregnancy

Shaw *et al* (1995)·[36] showed that maternal use of vitamins during the sensitive period of heart development reduced the risk of heart defects .Our group demonstrated that folic acid and multivitamins intake among the mothers of CHD child were significantly lower in corresponding to mothers patient without CHD.

The study showed that 2.2% of mother's patients with CHD had exposed to irradiation (x – ray) during first trimester of pregnancy in corresponding to 1.3% to mother's patients without CHD with insignificant also (3.3)of mother's patients with CHD were smoker in corresponding to 0.2% to mother's patients without CHD with significant Kallen (1997)[37] mentioned that although some studies showed an association between

maternal exposure to irradiation during pregnancy and increased risk of down syndrome, CHD and other trisomes in offspring, no reports have been demonstrated any consistent association with the low dose of X – ray exposure. Some studies have reported associations between maternal smoking and ASD, AVSD[38]

CONCLUSION :

CHDs are on e of the most important causes of fetal deaths and hence it becomes mandatory to keep on account of incidence and prevalence in the society . The study definitely helps to know the pattern of congenital heart anomalies and the familial risk factors in relation to congenital anomalies. So proper and timely counselling, regular antenatal care with folate supplementation especially during the most sensitive period of embryogenesis is essential to avoid CHD

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