Patterns of Congenital Heart Diseases among Children in Mosul City

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ABSTRACT

Background: Congenital heart diseases are the most common human birth defect worldwide, and it is one of the leading causes of mortality in the first year of life.

Aim: The purpose of this study is to highlight the pattern of congenital heart diseases in Mosul City and compare it with other countries.

Patients and Methods: This is a case series hospital based study carried out over six month’s period between February and July 2011. Cases were collected from the two main regional hospitals in Mosul City, Ibn-Sinna and Al-Khansaa Teaching Hospitals. Data collected were fed into computer and analysis was done by using SPSS program.

Results: Out of 345 referred suspected cases, congenital heart defects were detected in 200 patients. There were 51.5% male and 48.5% female. Acyanotic congenital heart diseases were observed in 87.5% of cases and cyanotic congenital heart diseases were found in 12.5% of cases. Ventricular septal defect was detected in 36% of cases, atrial septal defect made a frequency of 19.5%. Tetralogy of fallot was shown in 7.5%. There was a possible significant association between first-cousin consanguinity and ventricular septal defect, atrial septal defect, complex congenital heart disease, tetralogy of fallot, coarctation of aorta, and aortic stenosis.

Conclusions: Ventricular septal defect was the most common form of acyanotic congenital heart diseases which is consistent with other studies done in Iraq and regional countries. Tetralogy of fallot was the most common form of cyanotic congenital heart diseases.

Key Words: congenital heart diseases, ventricular septal defect, tetralogy of fallot

INTRODUCTION

Congenital heart diseases (CHD) are the malformations of the heart or large blood vessels associated with the heart, affecting various parts or functions. It is one of the leading causes of mortality during the first year of life (¹), and it is the most common human birth defect worldwide (²), it is prevalence approaching 1% of live births (³). The incidence is higher in stillborns (3–4%), spontaneous abortions (10–25%), and premature infants (about 2% excluding patent ductus arteriosus (PDA) (⁴).
The causes of most congenital heart defects are unknown. Most cases of congenital heart disease were thought to be multifactorial and result from a combination of genetic predisposition and environmental factors. A small percentage of congenital heart lesions are related to chromosomal abnormalities, in particular, trisomy 21, 13, 18 and Turner syndrome. Heart disease is found in more than 90% of patients with trisomy 18, 50% of patients with trisomy 21, and 40% of those with Turner syndrome, and about 2% are attributed to known environmental factors. The risk of recurrence of congenital heart disease increases if a first-degree relative (parent or sibling) is affected (4,5). Two to four percent of cases of CHD are associated with maternal conditions and teratogenic factors, including maternal diabetes mellitus, phenylketonuria, systemic lupus erythematosus, congenital rubella syndrome, maternal obesity and maternal ingestion of drugs (lithium, ethanol, warfarin, thalidomide, antimetabolites, vitamin A derivatives, and anticonvulsant agents) (6,7).

Sex differences in the occurrence of specific cardiac lesions have been identified. Transposition of the great arteries (TGA) and left-sided obstructive lesions are slightly more common in males (≈65%), whereas ASD, VSD, PDA, and pulmonary stenosis (PS) are more common in females (4).

Congenital cardiac diseases can be divided according the presence or absence of cyanosis into two major groups, these groups can be further subdivided according pulmonary blood flow to increased, normal, or decreased pulmonary vascular marker. The diagnosis can be confirmed by echocardiography, ECG, CT scan or MRI of the chest, or cardiac catheterization (8).

Acyanotic congenital heart diseases can be classified according to the predominant physiologic load that place on the heart. The most common lesions are those that produce a volume overload, and the most common of these are left-to-right shunt lesions such as ventricular septal defect (VSD), atrial septal defect (ASD). The second major class of lesions causes an increase in pressure load, most commonly secondary to ventricular outflow obstruction (pulmonary or aortic valve stenosis) or narrowing of one of the great vessels (coarctation of the aorta) (8).

Cyanotic congenital heart diseases can be divided according to pathophysiology: whether pulmonary blood flow is decreased (Tetralogy of Fallot (TOF), pulmonary atresia with an intact septum, tricuspid atresia, total anomalous pulmonary venous return with obstruction) or increased (transposition of the great vessels (TGA), single ventricle, truncus arteriosus, total anomalous pulmonary venous return without obstruction) (8). There is no clear definition for complex CHD. In this study, complex CHD applied to patients with combination of more than two cardiac lesions of the following: Double outlet right ventricle, Tricuspid atresia, single ventricle, ASD, Patent ductus arteriosus (PDA), and Pulmonary stenosis (PS).

The aim of the present study was to determine the pattern of congenital heart disease in Mosul City, its age and sex distribution, mode of presentation and finally to identify a possible association between CHD experience and first cousin consanguinity.

PATIENTS AND METHODS

This is a hospital based cross-sectional study conducted over six months period between February and July of year 2011. The data was collected from Echo units in two main hospitals in Mosul City: Ibn-Sinna Teaching hospital and Al-Khansaa Teaching Hospital.

Three hundred and forty five patients were referred from outpatient clinic to echocardiography units during the study period. The age of patients ranged from 1 day to 15 years. Two hundred of them were diagnosed as having CHD. One hundred and three were male and 97 were female. Cases with acquired CHD as rheumatic heart diseases were excluded. The diagnosis was done by a specialist pediatrician using 2D echocardiography (Echo) machine (Model: Logic and Philips). Chest X-ray was done for all patients prior to Echo study. ECG was done for all of them.
Data analysis was done by using SPSS version 19 program. Chi square test was used to determine the presence of a possible association between CHD experience and first cousin consanguinity. \( P \) value \(<0.05\) was considered significant throughout the present study.

**RESULTS**

During the study period, 345 patients were referred to Echo unit, 58.0\% of them were diagnosed as having CHD. There were 103 males and 97 females with male: female ratio of 1:1.1. The mean age was 14.9 months. One hundred and seventy five patients (87.5 \%) had acyanotic CHD, while 12.5\% had cyanotic type of CHD. **Table 1** shows frequencies of various types of CHDs with sex distribution. It is clear that isolated VSD is the most frequent form. It was found in 72 patients (36\%), 38 males and 34 females, with male to female ratio of 1:1.1. It was associated with PDA in 6 patients (3\%) and with ASD (secondum) in 8 patients (4\%).

Among patients with cyanotic CHD, tetralogy of fallot (TOF) was the most frequent form of cyanotic CHD, occurring in 15 patients (60 \% of the cyanotic CHD), 11 males and 4 females, with male to female ratio 2.7:1. Complex CHD were seen in 8 patients (4\%), 5 males and 3 females.

**Table 2** shows the common presentations of various types of CHD. It is evident that respiratory distress was the most common presentation of CHD which occurs in 63\% of cases followed by recurrent chest infection (52\%). Asymptomatic patients formed 11.5\%.

**Table 3** shows distribution of CHDs among various age groups at the time of diagnosis. It is clear that 19 patients (9.5\%) were neonates, 121 patients (60.5\%) were infants (between 1.1-12 months), 47 patients (23.5\%) were toddlers (between 12.1-36 months), 8 patients (4\%) were in preschool age (between 36-72 months) , and 5 patients (2.5\%) were in school age and above.

<table>
<thead>
<tr>
<th>Cardiac lesion</th>
<th>Male No.</th>
<th>Male (%)</th>
<th>Female No.</th>
<th>Female (%)</th>
<th>Total No.</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated VSD</td>
<td>38</td>
<td>52.8</td>
<td>34</td>
<td>47.2</td>
<td>72</td>
<td>36</td>
</tr>
<tr>
<td>Isolated ASD</td>
<td>18</td>
<td>46.2</td>
<td>21</td>
<td>53.8</td>
<td>39</td>
<td>19.5</td>
</tr>
<tr>
<td>PS</td>
<td>7</td>
<td>38.9</td>
<td>11</td>
<td>61.1</td>
<td>18</td>
<td>9.0</td>
</tr>
<tr>
<td>PDA</td>
<td>5</td>
<td>31.2</td>
<td>11</td>
<td>68.8</td>
<td>16</td>
<td>8.0</td>
</tr>
<tr>
<td>TOF</td>
<td>11</td>
<td>73.3</td>
<td>4</td>
<td>26.7</td>
<td>15</td>
<td>7.5</td>
</tr>
<tr>
<td>Complex CHD</td>
<td>11</td>
<td>62.5</td>
<td>4</td>
<td>37.5</td>
<td>8</td>
<td>4.0</td>
</tr>
<tr>
<td>VSD+ASD (secondum)</td>
<td>4</td>
<td>50.0</td>
<td>4</td>
<td>50.0</td>
<td>8</td>
<td>4.0</td>
</tr>
<tr>
<td>AV canal</td>
<td>4</td>
<td>57.1</td>
<td>3</td>
<td>42.9</td>
<td>7</td>
<td>3.5</td>
</tr>
<tr>
<td>VSD+ PDA</td>
<td>4</td>
<td>66.7</td>
<td>2</td>
<td>33.3</td>
<td>6</td>
<td>3.0</td>
</tr>
<tr>
<td>Coarctation of Aorta</td>
<td>3</td>
<td>60.0</td>
<td>2</td>
<td>40.0</td>
<td>5</td>
<td>2.5</td>
</tr>
<tr>
<td>AS</td>
<td>2</td>
<td>50.0</td>
<td>2</td>
<td>50.0</td>
<td>4</td>
<td>2.0</td>
</tr>
<tr>
<td>TGA</td>
<td>2</td>
<td>100.0</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>103</strong></td>
<td><strong>52.6</strong></td>
<td><strong>97</strong></td>
<td><strong>47.4</strong></td>
<td><strong>200</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

**Table (1):** Types of CHDs according to sex

**Table (2):**

<table>
<thead>
<tr>
<th>Cardiac lesion</th>
<th>No.</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The common presentations of various type of CHD</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

98
99

Asymptomatic
No. (%)  Shortness of breath
No. (%)  Recurrent chest infection
No. (%)  Failure to thrive
No. (%)  Cyanosis
No. (%)  
Isolated VSD 12 (16.6) 40 (55.5) 20 (27.7) 4 (5.6) - 
Isolated ASD 6 (15.3) 20 (51.3) 24 (61.5) - - 
PS 2 (11.1) 13 (72.2) 12 (66.7) 2 (11.1) 2 (11.1) 
PDA 2 (12.5) 12 (75.0) 12 (75.0) - - 
TOF - 10 (66.7) 13 (86.7) 2 (13.3) 14 (93.3) 
Complex CHD - 7 (87.5) 5 (62.5) - 7 (87.5) 
ASD+VSD - 6 (75.0) 6 (40.0) 2 (25.0) - 
AV canal - 4 (57.1) 4 (57.0) 1 (14.3) 3 (42.9) 
VSD+PDA - 4 (66.7) 4 (66.7) - 1 (20.0) 
Coa. of Aorta - 5 (100.0) - - - 
AS 1 (25.0) 3 (75.0) - - - 
TGA - 2 (100.0) 2 (100.0) - 2 (100.0) 
Total 23 11.5% 126 63% 102 51% 11 5.5% 29 14.5%

Table (3): Distribution of CHDs among various age group

<table>
<thead>
<tr>
<th>Age group</th>
<th>Neonate (0-1m) No. (%)</th>
<th>Infancy (1.1-12m) No. (%)</th>
<th>Toddler (12.1-36m) No. (%)</th>
<th>Preschool (36.1-60m) No. (%)</th>
<th>School age (&gt;60m) No. (%)</th>
<th>Total No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated VSD</td>
<td>4 (5.6)</td>
<td>48 (66.7)</td>
<td>16 (22.2)</td>
<td>2 (2.8)</td>
<td>2 (2.8)</td>
<td>72</td>
</tr>
<tr>
<td>Isolated ASD</td>
<td>4 (10.3)</td>
<td>23 (59.0)</td>
<td>9 (23.1)</td>
<td>2 (5.1)</td>
<td>1 (2.6)</td>
<td>39</td>
</tr>
<tr>
<td>PS</td>
<td>2 (11.1)</td>
<td>11 (61.1)</td>
<td>2 (11.1)</td>
<td>1 (5.6)</td>
<td>-</td>
<td>18</td>
</tr>
<tr>
<td>PDA</td>
<td>3 (18.8)</td>
<td>8 (50.0)</td>
<td>5 (31.3)</td>
<td>-</td>
<td>-</td>
<td>16</td>
</tr>
<tr>
<td>TOF</td>
<td>-</td>
<td>9 (60.0)</td>
<td>6 (40.0)</td>
<td>-</td>
<td>-</td>
<td>15</td>
</tr>
<tr>
<td>Complex CHD</td>
<td>1 (12.5)</td>
<td>6 (75)</td>
<td>1 (12.5)</td>
<td>-</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>ASD+VSD</td>
<td>3 (37.5)</td>
<td>4 (50)</td>
<td>1 (12.5)</td>
<td>-</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>AV canal</td>
<td>-</td>
<td>4 (57.1)</td>
<td>2 (28.6)</td>
<td>1 (14.3)</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>VSD+PDA</td>
<td>1 (16.7)</td>
<td>3 (50.0)</td>
<td>2 (33.3)</td>
<td>-</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>Coa. Of Aorta</td>
<td>-</td>
<td>1 (20.0)</td>
<td>2 (40.0)</td>
<td>1 (20.0)</td>
<td>1 (20.0)</td>
<td>5</td>
</tr>
<tr>
<td>AS</td>
<td>-</td>
<td>3 (75.0)</td>
<td>1 (25.0)</td>
<td>-</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>TGA</td>
<td>1 (50.0)</td>
<td>1 (50.0)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>19 9.5%</td>
<td>121 60.5%</td>
<td>47 23.5%</td>
<td>8 4%</td>
<td>5 2.5%</td>
<td>200</td>
</tr>
</tbody>
</table>

First-cousin parental consanguinity was present in 101 patients (50.5%). There was significant association between first-cousin consanguinity and isolated VSD (p=0.000), ASD (p=0.04), complex CHD (p=0.002), TOF (p=0.000), coarctation of aorta (p=0.04), and AS (p=0.005). No significant
association was found regarding other forms of CHD (AV canal, PS, PDA, (VSD+PDA), (VSD+ASD), and TGA.

DISCUSSION

Congenital heart diseases are important group of diseases that cause great morbidity & mortality in children (9).

This study showed the relative frequency of various forms of CHD. There were 200 cases of CHD. Male to female ratio was 1.1:1 which is nearly similar to that reported from other studies done in Mosul City (10), which was 1.05:1, Jordan (1.2:1) (11) and slightly higher than that reported from Saudi Arabia (0.9:1) (12).

One hundred and seventy five patients (87.5%) were acyanotic and 25 patients (12.5%) were cyanotic and this is similar to other studies done in Jordan (11) in which 74% of cases were acyanotic and 26% were cyanotic CHD. and in Yemen (13) in which 85% of cases were acyanotic and 15% were cyanotic CHD.

Ventricular septal defect was the most common form of CHD in the present study; it was seen in 36% of cases. Ventricular septal defect was also the most common form of CHD in other studies done in Iraq with different frequencies. It was seen in 54.8% of cases in Mosul (10), and in 52% of cases in Baghdad (14). In other countries, VSD was still the most common form of CHD. It was seen in 33.9% and 33.1% of cases in two different studies done in Saudi Arabia (9,12). In Jordan (11) VSD was seen in 43.4% of cases, while in Turkey (15) VSD was seen in 32.6%, and in 26.5% of cases observed in Yemen (13). This difference in frequency of VSD in various studies could be attributed to differences in locality, time and study design.

In the present study the second most common form of CHD found was ASD. It was seen in 19.5% of cases. This is higher than that reported by other studies done in Iraq. It was seen in 3.5% in a study done in Mosul (10), and in 2.2% in a study done in Baghdad (14). In other countries, ASD was seen in slightly lower frequencies than the present study. It was seen in 13.6% in a study in Jordan (11), 13.1% in a study in Turkey (15), and 12.2% of cases in Saudi Arabia (12).

In the present study PS was seen in 9%. This figure is higher than that reported from other studies done in Iraq (5.3% in Mosul and 4.5% in Baghdad) (10,14). A different figure was seen in other countries; Jordan (6.2%) (11), Saudi Arabia (12.4%) (9), Turkey (7.9%) (15). The difference between figures of the present study and that of Jordan and previous studies done in Iraq may be attributed to the difference in the sample size used by the present study and other work.

In the present series, PDA was seen in 8% of cases. This is lower than that reported in other studies done in Iraq which was 12.3% in Mosul (10) and in 13.6% in Baghdad (14). In Jordan (11), PDA was seen among 8.3%. Saudi Arabia (6%) (12) and Turkey (15.9%) (15).

In the present study, PDA and ASD showed female predominance (0.8:1 and 0.4:1) respectively. This is consistent to that reported in Mosul study (0.5:1) and (0.3:1) for PDA and ASD in that order. Female predominance also seen in other countries. In Saudi Arabia (12) male to female ratios were 0.9:1 for PDA and 0.7:1 for ASD. While in Turkey (14), such ratios were 1.1:1 and 1.4:1 for PDA and ASD correspondingly.

In the present work coarctation of the aorta was seen in 2.5% of cases, which is consistent to that reported in other study in Saudi Arabia (2.3%) (9), and lower than that reported in Jordan (3.4%) (11).

Tetralogy of Fallot was the most common form of cyanotic CHD in the present study, which is consistent to other studies done in Iraq (10,14), Jordan (11) and Saudi Arabia (9).

In the present study most of cases were diagnosed during infancy. This is similar to the studies done in Mosul (10), and Saudi Arabia (9). Pulmonary vascular resistance drops gradually through the first few months of life which increase left to right shunt and result in symptoms appearance (17,18).
In the present study, the main presentation of acyanotic CHD was respiratory distress (63%) followed by recurrent chest infection (51%), while the cyanosis was the main presenting symptom in cyanotic CHD (92%). This presentation is similar to that reported in other study in Mosul (10).

There was significant association between first-cousin consanguinity and isolated VSD (p=0.000), ASD (p=0.04), complex CHD (p=0.002), TOF (p=0.000), coarctation of aorta (p=0.04), and AS (p=0.005). The association between first-cousin consanguinity and some form of CHD may be due to inheritance of homoygous recessive genes in the causation of different types of isolated congenital heart malformations, known to follow a multifactorial pattern of inheritance (16).

In a study carried out in Saudi Arabia (9), there was a significant association between first-cousin consanguinity and ASD (p=0.01), VSD (p=001), AV canal (p=0.01), pulmonary stenosis (p=0.02) and pulmonary atresia (p=0.05).

Congenital heart diseases are the most common human birth defect worldwide. Majority of them are non cyanotic. In the present study VSD was the most common form of. There was male predominance except in PDA, ASD, and PS in which female sex was predominant. Most of cases of CHD were diagnosed during infancy. There was significant association between first-cousin consanguinity and VSD, ASD, complex CHD, TOF, coarctation of aorta, and AS.

REFERENCES