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Incidence of antenatal moderate and severe congenital cardiac anomalies in Cairo (a multi-center retrospective study)

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ABSTRACT

Objectives: To determine the prenatal incidence of moderate and severe cardiac anomalies and determine the prenatal pattern of CHD. *Study design:* Multi-center retrospective observational study. *Settings:* Cairo, Al-Azhar and 6th October Universities. *Patients and methods:* 5499 pregnant women in the second and third trimester attending the fetal medicine unit in the three universities from January 2012 to June 2013 for anomaly scan were retrospectively reviewed. *Results:* One hundred and five cases were diagnosed as severe and moderate CHD with a incidence of 1.9%. Severe forms were approximately ten folds higher than moderate forms. The commonest lesions in order of frequency were VSD (34.3%), HLHS (21.9%) and AVSD (20%). Cases having associated anomalies were 56.2% of affected cases and those with ultrasound markers of chromosomal anomalies were 34.3%. *Conclusion:* Prenatal pattern of CHD differs from its postnatal pattern with dominance of severe forms. Prenatally diagnosed cases have poorer prognosis than those diagnosed postnatal with high associations with other anomalies especially chromosomal defects.

1. Introduction

Mild congenital heart disease (CHD) is the commonest entity of CHD, they are often asymptomatic and undergo spontaneous resolution. Moderate CHD require expert care, however, less intensive than severe degrees usually presenting in severely ill newborns or infants some of which die very early and might not be included in studies. Moderate and severe forms occur approximately in 6/1000 live births (about 3/1000 for each form) [1].

Prenatal diagnosis decreases neonatal morbidity as antibiotics use, mechanical ventilation or emergent surgery, which may allow proper planning of cardiac surgery optimizing the circumstances that affect neonatal survival as delivery and operative repair [2]. Therefore, screening for congenital heart should be offered to all pregnant women considering that more than ninety percent of cases occur in the low risk population [3].

Basic and extended basic cardiac ultrasound examinations maximize the rate of detection of CHD in the second trimester [4]. The aim of the current study was to estimate the incidence of moderate and severe cardiac anomalies and determine the prenatal pattern in three university hospitals in Egypt Kasr Al-Aini, Al-Azhar (Sayed Galal hospital) and 6th October.

2. Methods

This is a multi-center retrospective observational study, which was approved by the ethical comity of Kasr Al-Aini hospital. The study included all pregnant women 14 weeks or more attending the fetal medicine units of three University hospitals Kasr Al-Aini, Al-Azhar (Sayed Galal) and 6th October who did fetal echocardiography and detailed anomaly scan, while exclusion criteria involved all cases with mild CHD as small VSD or ASD and cases which didn't perform fetal echocardiography. Gestational age was calculated from the first day of last menstrual period (LMP) or a previous dating first trimester scan.

All relevant data were collected as history, general examination, all ultrasound scans whether two-dimensional (2D) or three-dimensional (3D), Doppler and fetal echocardiography. The used 2D ultrasound machines were Voulson 730 ProV, general electric, USA and SonAce X8, Medison, Korea.

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Ultrasonic data included biparietal diameter (BPD), femur length (FL), abdominal circumference (AC), estimated fetal weight (EFW) using [5] formula being the most popular formula in Egypt. Amniotic fluid volume was subjectively estimated; however, in some cases amniotic fluid index (AFI) and maximum vertical pocket (MVP) were measured. Detailed anatomical survey included head, face, neck, thorax, gastrointestinal tract (GIT), urinary tract, musculoskeletal system, spine and gender (in some cases) while cardiac examination included four chamber view and outflow tract to detect the following: cardiothoracic ratio, situs, position, axis, activity including contractility, presence and size of both atria and ventricles, size relationship between both sides, integrity of inter-ventricular septum, position of atrial septum, foreamen ovale overlap and the relationship between the great arteries as regards size and site.

We used the classification used by [1] which classified CHD into: Severe(Major) representing the majority of severely ill in the neonatal and infantile period, moderate representing cases requiring expert care which is less intensive than severe cases, and mild cases which represent most of the cases which are usually asymptomatic and may resolve spontaneously.

2.1 Statistical methods

Data was retrieved using the Astria medical software (Astria Software GMBH, Munich, Germany) version 1.10.0-139. Statistical analysis was done by IBM computer using Microsoft Excel 2003 (Microsoft Corporation, NY, USA) and SPSS (Statistical package for the Social Science; SPSS Inc., Chicago, IL, USA) version 12 for Microsoft Windows. Variables were described in terms of range, mean ± standard deviation (±SD), frequencies, percentages, prevalence and incidence when appropriate as follows: – Range: The difference between the maximum and minimum scores in a set of figures.

- Mean: The sum of the observed values divided by the number of observations.
- Standard deviation: A measure of the spread of scores away from the mean.
- Frequency: Number of cases.
- Percentage: (Number of cases/Total number) × 100.
- Prevalence: The existing number of cases of a condition at a single point in time as a percentage of population.
- Incidence: The number of new cases of a condition over a given time as a percentage of the population.

3. Results

After applying the exclusion criteria the total number of cases were 5499 case in the three centers 105 cases of which had moderate or severe CHD with a prevalence of 1.9% which makes 5394 case without moderate or severe cardiac anomalies representing 98.1%. Twenty five out of one hundred and five diseased cases had heart failure representing 23.8% of all the affected cases.

Mean maternal age was 29 years with an age range from 15 to 43 (SD ± 6.041), while mean gestational age at the time of diagnosis was 27 weeks and 3 days with a range from 14 weeks & 2 days to 41 weeks, and mean fetal weight was 1241.9 g with a range from 121 g to 4095 g (SD ± 935.317).

Placental position was anterior in 43 cases (41%), posterior in 36 cases (34.3%), fundal in 18 cases (17.1%), left lateral in 6 cases (5.7%)and right lateral in 2 cases (1.9%), while amniotic fluid was normal in 64 cases (61%), increased in 27 cases (25.7%) and decreased in 14 (13.3%), and the number of umbilical cord vessels were three in 100 case (95.2%) and two in 5 cases (4.8%). Fetal gender was examined in 39 out of 105 cases representing 37.1% of cases, twenty cases were females (19%), eighteen cases were males (17.1%) and one case had ambiguous genitalia (0.9%), while in the remaining sixty six cases (62.9%) the genitalia wasn't examined.

Sixty three out of the one hundred and five cases were diagnosed in the four-chamber view (60%), twelve cases were diagnosed in the out-flow tract view (11.4%), and the remaining thirty cases were diagnosed in both views (28.6%). Associated anomalies were present in 59 cases (56.2%), while no anomalies were found in 46 cases (43.8%), of the fifty nine cases having associated anomalies twenty three cases had non-chromosomal anomalies representing 21.9% of all affected cases and the remaining thirty six cases had ultrasound markers of chromosomal abnormalities representing 34.3% of all affected cases. Six cases (5.7%) out of the one hundred and five affected cases had fetal cardiac anomalies in previous pregnancies and five of those six cases had ultrasound markers of chromosomal anomalies while the sixth case had an isolated cardiac anomaly, the cardiac lesions in those 6 cases were 4 Ventricular septum defect (VSD) and 2 atrio-ventricular septum defect (AVSD).

4. Discussion

Congenital heart disease is the commonest cause of birth defects, and is the leading cause of death in the first year of life. It's incidence ranges between 19 and 75 per 1000 live births and a greater proportion is found in miscarriages [6] with a prevalence of 13% [7]**.** Prenatal diagnosis of such cases allows identification of the specific lesions and also the detection of other anomalies [8].

The current study was conducted on 5499 patients in three centers with 105 cases having moderate and severe forms of CHD representing 19:1000 which is higher than the figure in the study done by [9] which was 8:1000. A possible explanation for this difference is that those three centers are tertiary centers receiving referred abnormal cases from other secondary centers, in addition to, the percentage of cases associated with heart failure which is 23.8% denoting that severe forms are the main proportion of cases.

The current study showed higher percentage of severe form of CHD as compared to moderate form (81.9% vs 8.6%) almost 10 folds higher with the remaining 9.5% in the undifferentiated category (Fig. 1) because of failure to reveal the valvular area or the pressure gradient across the valves in valvular lesions, however, those cases were obviously not minor ones. This difference between the prenatal and postnatal pattern with tendency of the prenatal cases to be more complex was also shown in other studies [10,11]**.** Diagnosis of those lesions was in the four-chamber view in 60%, the outflow tract in 11.4% and both planes in 28.6% this is within the detection rate range found by [12] who found a detection rate of 43–96% in the four-chamber view.

Most cases in the current study had multiple anomalies and ventricular septum defect (VSD) was the commonest anomaly with a prevalence of 34.3% (Fig. 2) this prevalence is close to the prevalence found in the study done by [13] who found a prevalence of 34%, and lower than the prevalence found by [14] who found a prevalence of 42.6%. Hypoplastic left heart syndrome (HLHS) came second with a prevalence of 21.9% which is close to the prevalence found by [15] who found that HLHS represented one fifth of the cases and higher than the figure found by [16] who found the prevalence of HLHS to be 15%. The third most common anomaly in the current study was atrio-ventricular septum defect (AVSD) with a prevalence of 20% which is higher than the studies done by [11,16] which were 17 and 15% respectively. Those top three anomalies were about three quarters of the anomalies detected with other anomalies representing the remaining quarter. The high frequency of VSD and AVSD may be due to being the most common congenital cardiac anomalies associated with Down syndrome