

# FREQUENCY OF CONGENITAL HEART DISEASES IN INFANTS OF DIABETIC MOTHERS REFERRED TO PEDIATRICS DEPARTMENT

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Date Received:

July 01, 2013

Date Revised:

December 25, 2013

Date Accepted:

December 31, 2013

## ABSTRACT

**Objective:** To determine the frequency of congenital heart disease in infants of diabetic mothers referred to Pediatrics department.

**Methodology:** A total of 101 full-term neonates, aged from 0 to 29 days, admitted in the Neonatology unit, Lady Reading Hospital Peshawar – Pakistan, diagnosed clinically and confirmed by echocardiography were included in the study. All the children included in the study were sent to Cardiology Department of the Institute for echocardiography. After Echocardiography report, frequency of normal and congenital heart diseases (CHD) like VSD, ASD, PDA, TGA and PFO among these children was determined.

**Results:** Out of 101 neonates, 67 (66.30%) were males and 34 (33.7%) were female. Majority (n=97, 96.0%) neonates' age ranged from 0-10 days. Maternal history showed that 55 (54.5%) mothers got diabetes during the pregnancy and 46 (45.5%) were having pre-gestational diabetes. The frequency of CHD was 52.5% in infants of diabetic mothers. Following CHDs were found in 53 neonates of diabetic mothers; Patent ductus arteriosus (PDA) in 17 (16.8%) cases, Ventricular septal defect (VSD) in 13 (12.9%), Atrial septal defect (ASD) in 09 (08.9%), Patent foramen ovale (PFO) in 08 (7.9%) and Transposition of the great arteries (TGA) in 6 (5.9%) cases respectively.

**Conclusions:** Frequency of congenital heart disease in IDMs was 52.5%. Careful evaluation and early diagnosis of CHD in this high-risk group are highly indicated and echocardiography is recommended for all infants of diabetic mothers as soon as possible.

**Key Words:** Congenital heart diseases, Diabetic mothers, pre-gestational diabetes mellitus, Gestational diabetes mellitus.

This article may be cited as: Muhammad A, Khan M, Khan I, Anwar T. Frequency of congenital heart diseases in infants of diabetic mothers referred to pediatrics department. *J Postgrad Med Inst* 2014; 28(1):37-41.

## INTRODUCTION

Infant of a diabetic mother (IDM) is, defined as, a neonate born to mother who had diabetes mellitus, but this term refers specifically to the neonate born to a woman who had persistently elevated blood sugar during pregnancy<sup>1</sup>.

About 3 – 10% of all pregnancies are complicated by diabetes<sup>2, 3</sup>. Infants born to diabetic women are at increased risk compared to those of non-diabetic women<sup>4, 5</sup>.

Fetuses of diabetic mothers are at increased risk of perinatal morbidity and mortality<sup>6</sup>. The exact teratogenic mechanism of maternal diabetes is not fully defined

and is likely to be multifactorial<sup>7, 8</sup>. Diabetes mellitus affects the fetal heart both structurally and functionally<sup>9-11</sup>.

In Pakistan, the true incidence and prevalence of congenital heart disease is unknown due to limited access to medical care and limited resources to undertake intense population studies<sup>12</sup>. There is no facility of diagnosis of prenatal CHD in the country. Thus the objective of this study was to determine the frequency of congenital heart disease in infants of diabetic mothers referred to Pediatrics department. By early detection/diagnosis of CHD in neonates of diabetic mothers, it would be helpful to prevent the possible complications of CHD and improve the quality of life. This study would also help us to maintain a proper data and frequency of CHD in infants of diabetic mothers at our department.

**METHODOLOGY**

This cross sectional study was done at the Department of Paediatrics and Neonatology, Lady Reading Hospital Peshawar - Pakistan for a period of 01 year from January 2012 to December 2012. A total of 101 full-term neonates, aged from 0 to 29 days, admitted in the Neonatology unit, diagnosed clinically and confirmed by echocardiography to be having CHD were included in the study. Already confirmed cases of CHD and pre-term neonates (less than 37 weeks), neonates with major central nervous system, pulmonary anomalies, severe hypoxia, or neonatal sepsis were excluded from this study. Mothers with history of hypertension, pre eclampsia, rheumatic heart disease or drugs intake except insulin for DM were excluded from the study.

After getting approval from the hospital ethical committee, data was collected of all those patients who were included in the study. An informed written consent was taken from parents or relatives of the patients for further evaluation. All these children were sent to Cardiology Department of the Institute for echocardiography (was done by echocardiographer (Cardiologist) to confirm the CHD. After Echocardiography report, frequency of normal and Congenital heart diseases (CHD) like Ventricular septal defect (VSD), Atrial septal defect (ASD), Patent ductus arteriosus (PDA), Transposition of the great arteries (TGA) and Patent foramen ovale (PFO) among these children was determined.

All this information and other demographic data like name, age, and gender were also entered into a proforma specially designed for this purpose. All the qualitative variables like presenting signs and symptoms like

central cyanosis, recurrent chest infection, echocardiographic findings like normal, cyanotic CHD, cyanotic CHD, were analyzed for percentages and frequencies. Mean  $\pm$  standard deviation was calculated for quantitative variables like age. For gender, male to female ratio was calculated. All the data was entered and analyzed by statistical program SPSS version 12 for windows.

**RESULTS**

A total of 101 neonates of diabetic mothers were included in the study. Out of 101 neonates 67 (66.30%) were males while 34 (33.7%) were female. The overall male to female ratio was 1.97:1.

Majority of neonates (n=97, 96.0%) were within the age range 0-10 days, while only 04 (4.0%) neonate were in the age range of 11-20 days. Mean age was  $3.6238 \pm 2.9794$  days. In 73 (72.3%) neonates' weight ranged from 2.50 Kg to 3.90 Kg. In 28 (27.7%) neonates' weight ranged from 4.00 Kg to 5.00 Kg with mean weight of  $3.5822 \pm 0.5650$  Kg.

Out of 101 neonates included in the study, majority 86 (85.1%) were born by normal vaginal delivery (NVD) and the remaining 15 (14.9%) were delivered by cesarean section (C-section). Maternal history showed that majority of mothers 55 (54.5%) got diabetes during the pregnancy and 46 (45.5%) were having pre-gestational diabetes.

Out of 101 neonates of diabetic mothers, majority 53 (52.5%) were having various congenital heart diseases (CHD) and remaining 48 (47.5%) were found normal after echocardiographic examination. So in this study frequency of congenital heart disease was 52.5%

**Table 1: frequency of congenital heart disease in neonates of diabetic mothers (n=101)**

| CONGENITAL HEART DISEASES                 | NO. OF CASES | PERCENTAGE |
|---|--------------|------------|
| Normal                                    | 48           | 47.5%      |
| Congenital heart disease                  | 53           | 52.5%      |
| Total                                     | 101          | 100%       |
| Patent ductus arteriosus (PDA)            | 17           | 16.8%      |
| Ventricular septal defect (VSD)           | 13           | 12.9%      |
| Atrial septal defect (ASD)                | 09           | 08.9%      |
| Patent foramen ovale (PFO)                | 08           | 7.9%       |
| Transposition of the great arteries (TGA) | 06           | 5.9%       |

in neonates of diabetic mothers. Following CHD were found in 53 neonates of diabetic mothers; Patent ductus arteriosus (PDA) in 17 (16.8%) cases, Ventricular septal defect (VSD) in 13 (12.9%) cases, Atrial septal defect (ASD) in 09 (08.9%), Patent foramen ovale (PFO) in 08 (7.9%) and Transposition of the great arteries (TGA) in 6 (5.9%) cases respectively (Table No. 1).

## DISCUSSION

Diabetes mellitus constitutes a significant risk for the foetus if present in pregnant women. Reports so far have focused predominantly on the population of mothers with type 1 diabetes<sup>13-15</sup>. There is increasing evidence that foetuses of mothers with type 2 diabetes mellitus may be prone to a similar pathology inducing complications on a multitude of organ systems of the foetus and the placenta<sup>16-19</sup>.

In a local study also done at this institution, only in 2 (4.7%) of the total 42 infants of diabetic mothers, congenital heart defects were noted<sup>20</sup>.

Results of a study showed that overall incidence of congenital heart diseases was 9.3% after exclusion of PDA and hypertrophic cardiomyopathy (HCMP) cases<sup>21</sup>. Results of a local study conducted in Lahore reported that a total of 1530 full-term newborns were registered, out of which 84 (6%) were infants of diabetic mothers (IDMs)<sup>22</sup>. While in our study, we have found a vast majority of IDMs (52.5%) was having various congenital heart diseases. The high incidence of congenital heart disease in IDMs of our study's population could be due to the fact that we had a very small sample size for this hospital-based study. The other reason could be that majority of these babies were delivered in this hospital and soon after the birth they were send for the early detection and diagnosis of CHD to the NICU by the gynecologists/obstetricians.

In a local study also done at this institution, 29 (69%) of the newborn infants of diabetic mothers were male and thirteen (31%) were females<sup>20</sup>. In another local study during the study period total admissions in pediatric ward were 9614. Out of them 96 were confirmed congenital heart disease patients. There were 64 male and 32 female patients with ratio of 2:123. Similar results were also found in our study where majority (66.30%) was males and (33.7%) were females with overall male to female ratio of 1.97: Male preponderance in our study and some other studies done in the country also reported same results<sup>24-26</sup>. In one study done from Hazara by Burki reported equal frequency in both sexes<sup>27</sup>.

Incidence of congenital heart diseases in a study was more common in infants of pre-gestational than gestational diabetic mothers, 49 (65%) and 36 (35%) respectively<sup>21</sup>. Another study showed that gestational diabetes

was documented in 63 (75%) mothers whereas established diabetes mellitus was present in 21 (25%) of the diabetic mothers<sup>22</sup>.

Our study's results showed that majority (54.5%) of mothers of infants got diabetes during the pregnancy and remaining (45.5%) were having pre-gestational diabetes. Differences in results in studies could be due to different sample size selections and antenatal checkup of mothers on regular or irregular basis affect their diabetes status.

Maternal diabetes mellitus (MDM) is known to increase the likelihood of fetal CHD, with an estimated increased risk of up to 8.5% of live births. Most types of cardiac structural lesions have been associated with MDM, ranging from small septal defects to duct-dependent heart disease<sup>28, 29</sup>.

More or less same frequencies are also reported in various studies done at national and international levels. Differences in frequencies of various CHD in all studies are due to different sample size selection and duration of study periods. As we have very limited study period while in few studies they have been studied their cases from 1 to 5 years.

An observational prospective study investigated newborns of mothers with GDM enrolled during a period of 9 months. The study enrolled 65 newborns born to 82 of mothers with impaired glucose metabolism. Patent ductus arteriosus (PDA) was observed in 11 (16.9 %) patients, pulmonary stenosis of mild grade in 4 (6.2 %) patients, and hypertrophy of the ventricular septum in 22 (33.8 %) patients<sup>30</sup>.

In one study the most common echocardiographic findings showed patent ductus arteriosus (PDA) in 54.7% cases, hypertrophic cardiomyopathy (HCMP) in 24%, ventricular septal defect (VSD) in 4%, atrial septal defect (ASD) in 2.7%, transposition of great arteries (TGA) in 1.3% and coarctation of the Aorta (COA) in 1.3% cases<sup>21</sup>.

Results of a local study conducted in Lahore reported that out of a total of 1530 full-term newborns registered in the study, 84 (6%) were infants of diabetic mothers (IDMs). Congenital anomalies were seen in 11(13%) of the IDMs and most implicated of these had congenital heart disease<sup>22</sup>.

In a study conducted in Saudi Arabia, the most common echocardiographic findings in the infant of diabetic, were patent ductus arteriosus (PDA) in 70%, patent foramen ovale (PFO) in 68%, atrial septal defect (ASD) in 5%, small muscular ventricular septal defect in 4%, mitral valve prolapse in 2%, and pulmonary stenosis in 1% case respectively<sup>31</sup>.

In a recent study, researchers found that the most

common echocardiographic findings in IDMs were asymmetrical septal hypertrophy in 80%, patent foramen ovale (PFO) in 37.5%, and patent ductus arteriosus (PDA) in 27.5% cases<sup>32</sup>.

In order to avoid complications, early detection of CHD is utmost important for proper management. This can be achieved by examining newborns in maternity units, post natal clinics, special baby care units, immunization centers, primary Health care units and at school entry.<sup>24</sup>

## CONCLUSIONS

Our results showed that frequency of congenital heart disease in IDMs was 52.5%. Careful evaluation and early diagnosis of CHD in this high-risk group are highly indicated and echocardiography is recommended for all infants of diabetic mothers as soon as possible. There is a need for development of prenatal screening programs for CHD in neonates of diabetic mothers in our setup.

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### CONTRIBUTORS

AM conceived the idea, planned and wrote the manuscript of the study. MK, IK and TA helped in the data analysis and write up of the manuscript. All the authors contributed significantly to the research that resulted in the submitted manuscript.