



## CLINICAL PROFILE AND PATTERN OF CONGENITAL HEART DISEASES IN INFANTS OF DIABETIC MOTHERS

### Paediatrics

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### ABSTRACT

**Background:** Maternal diabetes has teratogenic effects on evolution of foetal cardiovascular system. Offspring of diabetic mothers have fivefold incidence of congenital malformations compared to pregnancies in general healthy population. Prior to 20 weeks of gestation fetal pancreatic islet cells do not secrete insulin in response to maternal hyperglycemia, effects at this period of gestation are a direct consequence of hyperglycemia. Fetal complications in later gestation result from fetal hyperglycemia, hyperinsulinemia, or combined effect of both. The present retrospective study was conducted to find out prevalence and spectrum of congenital heart diseases in neonates of pre-gestational and gestational types of diabetes. **Methodology:** A retrospective study was carried out on 41 neonates born of diabetic mothers for past 2 years. Data was extracted from the records regarding diabetes in mother pregestational or gestational, gender of neonate, birth weight, gestational age, 2D ECHO finding of neonate. Patients with both inborn and out born babies, Neonates born to mothers with pregestational and gestational diabetes mellitus, all neonates term and pre-terms and irrespective of birth weight were included in the study. Chi square test is used to determine the P value, for relationship of dependent and independent variables. **Results:** 6 (22.22%) babies with CHD were born to mothers with gestational diabetes mellitus and 21 (77.78%) babies were born to mothers with pre gestational diabetes mellitus. Prevalence of CHD was 65.85% (n=27). Most common malformation is ASD in 48.14% (n=13) and PDA in 29.62% (n=8), VSD. CHD is more common in pre-gestational diabetic mothers (77.78%), after gestational age > 37 weeks (92.60%) and in Male Child (66.67%). Almost 1/3rd of the patients (33.33%) with CHD had birth weight more than 3.5 Kg compared to those without CHD, none had birth weight more than 3.5 Kg. No relationship between gestational age, sex, GDM or pre gestational diabetes mellitus and incidence of CHD is observed. Association with birth weight > 3.5 Kg was significant. **Conclusion:** Maternal diabetes is a risk factor for congenital heart diseases. Careful evaluation and early diagnosis of congenital heart disease in this high risk group is indicated. Because of growing incidence of obesity and diabetes mellitus in present era.

### KEYWORDS

Congenital heart diseases, pre-gestational and gestational diabetes Mellitus.

### INTRODUCTION:

Maternal diabetes has teratogenic effects on evolution of foetal cardiovascular system. Offspring of diabetic mothers have fivefold incidence of congenital malformations compared to pregnancies in general healthy population<sup>(1)</sup>. Cardiovascular malformations are the most common anomalies in infants of diabetic mothers. It was found that, pre-existing maternal diabetes is associated with a fivefold increase in the congenital heart disease<sup>(2)</sup>. Until 2009, a study in Norway confirmed that this association of CHD and DM mothers is almost two to three folds than the non-DM mothers<sup>(3)</sup>.

Prior to 20 weeks of gestation fetal pancreatic islet cells do not secrete insulin in response to maternal hyperglycemia, effects at this period of gestation are a direct consequence of hyperglycemia<sup>(4)</sup>. Fetal complications in later gestation result from fetal hyperglycemia, hyperinsulinemia, or combined effect of both the number of diabetic mothers is expected to rise as more and more obese females, changing lifestyles and with altered genetic factors, population progresses to child bearing age<sup>(5)</sup>.

The initial evaluation of any newborn suspected of having critical congenital heart disease includes a meticulous physical exam, four extremity blood pressures, preductal and postductal saturations, hyperoxia test, chest radiograph, ECG and ECHO<sup>(6)</sup>. Recognition of congenital heart disease in the newborn is important as this group of abnormalities constitutes a significant proportion of congenital malformation that present in neonatal life, and their early detection is important for appropriate management, and short term follow up for decision making regarding referral<sup>(7)</sup>.

In this context, this research is conducted to study the occurrence of congenital heart diseases in neonates of pre-gestational and gestational types of diabetes after controlling for other socio-economics characteristics and other health related variables.

### OBJECTIVES:

To study prevalence and spectrum of congenital heart diseases in neonates of pre-gestational and gestational types of diabetes.

### MATERIAL AND METHODS:

A retrospective study was carried out on 41 neonates born of diabetic

mothers for past 2 years. After getting approval, Institutional Ethical Committee study was started and informed consent was taken from the patients.

Data was collected regarding diabetes in mother pregestational or gestational, gender of neonate, birth weight of neonate, gestational age of neonate, 2D ECHO finding of neonate, Data has been extracted from the records.

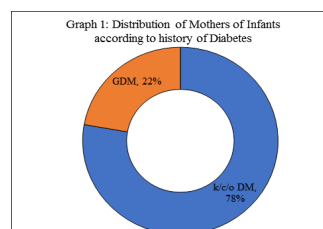
**Inclusion Criteria:** Patients with both inborn and out born babies, Neonates born to mothers with pregestational and gestational diabetes mellitus, all neonates term and pre-terms and irrespective of birth weight were included in the study.

**Exclusion Criteria:** Stillbirths born to mothers with pre-gestational and gestational diabetes mellitus and who were not willing to participate have been excluded from the study.

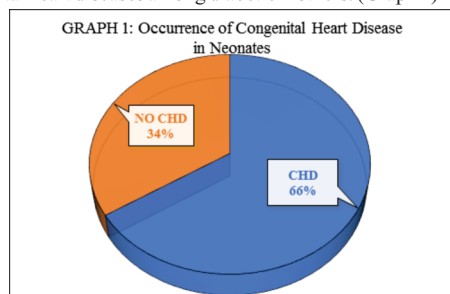
**Statistical Tests:** Data was collected and entered in MS Excel and analysed with the help of SPSS version 21 software. Association of data has been performed according to statistical analysis. Pearson Chi square test is used to determine the P value, for relationship of dependent and independent variables. P value less than 0.05 considered as statistically significant

### OBSERVATION AND RESULTS:

In the present study 41 neonates born of diabetic mothers for past 2 years were included. 6 (22.22%) babies with CHD were born to mothers with gestational diabetes mellitus and 21 (77.78%) babies with CHD were born to mothers with pre gestational diabetes mellitus. (Graph 1)



Our study shows that the prevalence of congenital heart diseases was 65.85% (n=27) and 35.15% (n=14) neonates were without any type of congenital heart diseases among diabetic mothers. (Graph 2)



Most common malformation is ASD in 48.14% (n=13), neonates others being PDA in 29.62% (n=8), VSD in 14.81% (n=4) and Patent Foramen Ovale in 7.40% (n=2) neonates. (Table 1)

**Table 1: Types of Congenital heart Disease in Neonates:**

| Type of CHD               | Frequency | Percentage |
|---------------------------|-----------|------------|
| Atrial Septal Defect      | 13        | 48.14%     |
| Patent Ductus Arteriosus  | 8         | 29.62%     |
| Ventricular Septal Defect | 4         | 14.81%     |
| Patent Foramen Ovale      | 2         | 7.40%      |
| Total                     | 27        | 100%       |

**Table 2: Association between occurrence of CHD and related factors:**

| Variables                 |                    | CHD         | NO CHD      | Total       | P value                 |
|---------------------------|--------------------|-------------|-------------|-------------|-------------------------|
| Type of Maternal Diabetes | Pre-Gestational DM | 21 (77.78%) | 7 (50%)     | 38 (92.68%) | 0.069 (not significant) |
|                           | Gestational DM     | 6 (22.22%)  | 7 (50%)     | 13 (7.32%)  |                         |
| Gestational Age           | > 37 weeks         | 25 (92.60%) | 12 (85.71%) | 37 (85.71%) | 0.372 (not significant) |
|                           | 34-36 weeks        | 1 (3.70%)   | 2 (14.29%)  | 3 (21.43%)  |                         |
|                           | < 34 weeks         | 1 (3.70%)   | 0 (0%)      | 1 (7.14%)   |                         |
| Gender of Neonate         | Male Child         | 18 (66.67%) | 6 (42.85%)  | 24 (58.54%) | 0.142 (not significant) |
|                           | Female Child       | 9 (33.33%)  | 8 (57.14%)  | 17 (41.46%) |                         |
| Birth Weight              | < 2.5 Kg           | 2 (7.41%)   | 1 (7.14%)   | 3 (7.32%)   | 0.046 (Significant)     |
|                           | 2.5 – 3.5 Kg       | 16 (59.26%) | 13 (92.86%) | 29 (70.73%) |                         |
|                           | > 3.5 Kg           | 9 (33.33%)  | 0 (0%)      | 9 (21.95%)  |                         |
| Total                     |                    | 27 (100%)   | 14 (100%)   | 41 (100%)   |                         |

According to Table 2, CHD is more common in pre-gestational diabetic mothers (77.78%), after gestational age > 37 weeks (92.60%) and in Male Child (66.67%). Almost 1/3<sup>rd</sup> of the patients (33.33%) with CHD had birth weight more than 3.5 Kg. In neonates with weight >3.5kg all were associated with CHD. P Value being significant (0.046) increasing birth weight is associated with increased incidence of CHD. Thus macrosomia (weight >4kg) being a risk factor for CHD. No relationship between gestational age, sex, gestational diabetes mellitus or pre gestational diabetes mellitus (p=0.069) and incidence of congenital heart diseases is observed. Association between birth weight more than 3.5 Kg and occurrence of CHD was significant (p value 0.046).

## DISCUSSION:

Congenital heart disease among the neonatal children was identified the types of CHD problems. The incidence varies from locality, region, exposure areas, and even the countries, however most countries reported it to be 4/1000 to 50/1000 live birth<sup>(7)</sup>. Impaired maternal glucose tolerance has been associated with several morbidities, including maternal toxemia and fetal macrosomia, congenital heart disease, growth restriction, neonatal hypoglycemia, hypocalcemia, hypomagnesemia, polycythemia, hyperbilirubinemia and respiratory

distress syndrome. Prevalence of congenital heart disease in infants of diabetic mothers is 65.85% (n=27) among diabetic mothers. Similar findings were seen in a study by Amir Mohammad et al<sup>(8)</sup>, 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. In a study by Arul AS et al<sup>(9)</sup>, 100 IDM were subjected to 2D ECHO; of this, 28 (28%) babies had cardiac abnormality. Among them 5 babies had CCHD and 23 babies had ACHD. A similar study done on cardiovascular malformations in IDM by Meyer et al<sup>(10)</sup> showed a lower incidence of 3.2 to 6.9 and a study by Tabib et al<sup>(11)</sup> showed an incidence of 8.8%.

In the present study 22.22% babies born to mothers with gestational diabetes mellitus and 77.78% babies born to mothers with pre gestational diabetes mellitus. Arul AS et al<sup>(9)</sup>, found that out of the 28 babies who showed cardiac abnormality, 16 babies (57%) were born to mothers with pregestational diabetes and 12 babies (43%) were born to mothers with gestational diabetes.

Present study shows most common malformation being ASD, others being PDA, VSD, Patent Foramen Ovale. No severe forms of congenital heart diseases are encountered. In a study by Arul AS et al<sup>(9)</sup>, 8% babies show ECHO abnormality more of septal hypertrophy, ASD, and TGA. Septal hypertrophy was most common followed by ASD, VSD, and PDA. This was in concordance with the previous studies done by Tabib et al<sup>(11)</sup> and Zielinsky et al<sup>(12)</sup>. Similarly, in a study by Ferdousi SA et al<sup>(13)</sup>, Patent Ductus Arteriosus was found in 31(55.3%), patent foramen ovale was found in 34 (60.71%), Hypertrophic Cardiomyopathy was found in 21(37.5%), ASD was found in 6 (10.71%) of neonates with some other uncommon findings like TR.

No relationship between gestational age (p=0.37), sex (p=0.14), gestational diabetes mellitus or pre gestational diabetes mellitus (p=0.069) and incidence of congenital heart diseases is observed. Relationship between birth weight (p=0.046) and congenital heart disease is observed. There was a statistically significant association present between the CHD of neonatal children and the mothers' diabetes. And Odds ratio for a cardiovascular malformation with maternal diabetes was 1.63 (95% confidence interval 0.87 to 3.04). This is lower as compared to the results found in study Simeone RM et al<sup>(14)</sup> In a study by C. Wran<sup>(15)</sup>, odds ratio for a cardiovascular malformation with maternal diabetes was 5.0 (95% confidence interval 3.3 to 7.8).

## LIMITATION:

Time bound retrospective study and small sample size were limitations in the present study.

## CONCLUSION:

Maternal diabetes is a risk factor for congenital heart diseases. Careful evaluation and early diagnosis of congenital heart disease in this high risk group is indicated. Because of growing incidence of obesity and diabetes mellitus in present era.

## RECOMMENDATIONS:

Strict glycemic control in mothers with diabetes mellitus pre-conceptional and during pregnancy is indicated. Need for development of prenatal screening programs for congenital heart disease in infants of diabetic mothers in our population.

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