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Original Research Paper

A STUDY ON THE INCIDENCE AND SPECTRUM OF HEART DISEASES IN NEONATES BORN TO DIABETIC MOTHERS

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ABSTRACT:

Introduction: One of the important complications of diabetes in pregnancy is diabetic embryopathy leading to congenital anomalies. This study was done with the objective of estimating the incidence of congenital heart diseases in neonates born to diabetic mothers and to study the spectrum of heart diseases in neonates born to diabetic mothers.

Methodology: This study was a prospective observational study done at the department of neonatology, Kanyakumari Government Medical College and Hospital between January 2021 to October 2021 on 50 consecutive infants born to diabetic mothers fulfilling the inclusion and exclusion criteria. All neonates enrolled in the study were evaluated in the first 10 days of life with detailed clinical examination, Chest Xray, ECG and Echocardiography. **Results**: The incidence of heart disease in neonates born to diabetic mothers was 30% in our study. Of the 30 neonates with congential heart diseases, 26 (86.67%) had acyanotic congenital heart disease and 4 (13.33%) had congenital cyanotic heart disease. Hypertrophic obstructive cardiomyopathy was the commonest observed heart disease among neonates born to diabetic mothers. Clinical manifestations were present in only 56.4% of the neonates with heart diseases. Xray and ECG findings were present in 56.4% and 50.9% of the cases respectively. There was no statistically significant difference between incidence of heart disease and type of diabetes, gestational age and size of gestational age in the neonates born to diabetic mothers. **Conclusion:** Routine echocardiogram is recommended in all neonates born to diabetic mothers.

KEYWORDS: Infant of diabetic mother, Neonates born to diabetic mothers, Cardiac diseases in neonates of diabetic mothers, Gestational Diabetes, Congenital heart disease in neonates

INTRODUCTION:

Diabetes mellitus is a disorder of abnormal glucose metabolism complicating around 1% of total pregnancy. Diabetes mellitus in pregnancy may be classified into pregestational and gestational diabetes mellitus. Diabetes mellitus in pregnancy it leads to adverse fetal and maternal outcomes. Infants of diabetic mother can have complications such as prematurity, macrosomia, birth injuries and birth asphyxia. Metabolic complications like hypoglycemia, hypocalcemia, hypomagnesemia, polycythemia and hyperbilirubinemia may occur. Respiratory distress syndrome occurs due to lack of combination between lecithin and choline. One of the important complications of diabetes in pregnancy is diabetic embryopathy leading to congenital anomalies. The risk of congenital anomalies increases proportionately with poor glycemic control. Congenital anomalies often occur in first trimester due to poor glycemic control.(1) Careful evaluation and early diagnosis of congenital anomalies in infants born to diabetic mothers is highly indicated. The cardiovascular anomalies like hypertrophic cardiomyopathy, transposition of great vessels, coarctation of aorta, patent ductus arteriosis, atrial septal defect, ventricular septal defect, single ventricle, patent foramen ovale and Tetralogy of Fallot have been associated with diabetes mellitus in pregnancy. (2) This study was done with the objective of estimating the incidence of congenital heart diseases in neonates born to diabetic mothers and to study the spectrum of heart diseases in neonates born to diabetic mothers.

METHODOLOGY:

This study was a prospective observational study done at the department of neonatology, Kanyakumari Government Medical College and Hospital between January 2021 to October 2021 on 50 consecutive infants born to diabetic mothers fulfilling the inclusion and exclusion criteria. Inclusion criteria included live neonates born to mothers with gestational diabetes, Type I and Type II diabetes mellitus. Exclusion criteria

included neonates with severe hypoxic ischemic encephalopathy, mothers with TORCH infections, mother with systemic lupus erythematosus, mothers on teratogenic drugs, neonates with antenatally diagnosed cardiac anomalies and neonates with other syndromic anomalies.

Informed consent was obtained from the parents of the enrolled neonates. All neonates enrolled in the study were evaluated in the first 10 days of life with detailed clinical examination with special reference to cardiovascular system. Chest Xray, ECG and Echocardiography was done for all neonates. The data obtained was analyzed using suitable statistical methods using SPSS 25 software. P value less than $P<0.5$ was considered statistically significant.

RESULTS:

Out of the 50 neonates enrolled in the study, 23 (46%) were female and 27 (54%) were male. 42 (84%) of the mothers had gestational and 8(16%) of the mothers had pregestational diabetes. The antenatal and treatment details of the mothers are shown in Table 1.

Table 1 – Antenatal and treatment details of mothers

	Frequency	Percentage
Type of Diabetes		
Gestational Diabetes Mellitus	42	84%
Pregestational Diabetes Mellitus	8	16%
Treatment		
Insulin	30	60%
Oral Hypoglycemic Agents	0	0%
Meal Plan	15	30%
Untreated	5	10%
Compliance to treatment		
Compliant	30	60%
Non-compliant	15	30%
Not applicable	5	10%

Of the 50 neonates, 40 (80%) were term and 10 (20%) were preterm while 19 (38%) were Large for gestational age (LGA) and 31 (62%) were Appropriate for gestational age (AGA). Among the 50 neonates studied, 30% had congential heart diseases. Of the 30 neonates with congential heart diseases, 26 (86.67%) had acyanotic congenital heart diseases and 4 (13.33%) had congenital cyanotic heart disease. Of the 50 neonates studied 12% had clinical manifestations, 12% had Xray findings and 10% had ECG findings. The Spectrum of clinical, Xray and ECG findings are shown in Table 2.

Table 2 – Clinical, Xray and ECG findings

	Frequency	**Percentage**
Clinical Finding		
Respiratory Distress	2	4%
Cyanosis	1	2%
Systolic Murmur	3	6%
Shock	0	0%
Congestive cardiac failure	0	0%
No clinical findings	44	88%
X-ray Finding		
Cardiomegaly	3	6%
Pulmonary congestion	1	2%
Abnormal heart shape	2	4%
No Xray findings	44	88%
ECG findings		
Left ventricular hypertrophy	3	6%
Right ventricular hypertrophy	2	4%
No ECG findings	45	90%

The spectrum of heart diseases detected by echocardiography is as shown in Table 3. Hypertrophic obstructive cardiomyopathy was the commonest observed congenital cardiac anomaly among neonates born to diabetic mother (10%).

Table 3 – Spectrum of heart diseases in neonates born to diabetic mothers

ECHO finding	Frequency	Percentage
HOCM	5	10%
PFO	2	4%
ASD	2	4%
VSD	2	4%
PDA	2	4%
TOF	1	2%
TGV	1	2%
Normal	35	70%

The distribution of echocardiography findings among neonates born to mothers with gestational and pregestational diabetes is shown in Table 4. There was no statistically significant difference between echocardiography findings between mothers with Gestational diabetes and pregestational diabetes mellitus as shown in Table 4.

Table 4 – Distribution of Echocardiography findings

	Abnormal Echocardiography	Normal Echocardiography	Total	P Value
Type of Diabetes				
GDM	11(26.19%)	31(73.81%)	42	
Pregestational DM	4 (50%)	4 (50%)	8	0.178022 (Not significant)
Gestational Age				
Term	11(27.50%)	29(72.50%)	40	
Preterm	4 (40%)	6 (60%)	10	0.5952 (Not significant)
Size for gestational age				
LGA	8 (42.11%)	11 (57.89%)	19	
AGA	7 (22.58%)	24 (77.42%)	31	0.143651 (Not significant)

DISCUSSION:

The percentage of gestational diabetes (84%) outnumbered those with pregestational diabetes (16%) in our study similar to that observed by Kavita et al and Almhanna et al. (3,4) Among the mothers on treatment, 60% were compliant to the therapy similar to the study conducted at Karachi by Alam et al in the National Institute of Child Health, Karachi.(5). A incidence of 4% of congenital heart diseases was reported by Rowland et al in 1973 diagnosed by clinical examination, radiological findings and ECG findings. (6) The incidence of cardiac diseases in neonates born to diabetic mothers diagnosed by echocardiography in our study is 30%. A higher incidence of 100% was observed in the study by Shankar et al (2019), though the study may be limited by the small sample size of 25 cases.(7) Lesser incidences of 15% (Abu-Sulaiman et al) , 5% (Narchi and Kulayat) and 3.6% (wren et al) have been reported in various studies. (8–10). The most common heart disease encountered was hypertrophic obstructive cardiomyopathy (10%) in our study similar to that observed by Shankar et al. (7) A much higher incidence of hypertrophic cardiomyopathy was observed in the prenatal period (29%) in the study by Bogo et al. (11) The most common heart disease observed in the study by abu sulaiman et al and Akbariasbagh P et al was Patent Ductus Arteriosus.(8,12) Patent Foramen Ovale (60.71%) followed by patent Ductus arteriosus (55.3%) and Hypertrophic Cardiomyopathy (21.42%) were the most cardiac findings observed in the study by ara ferdos et al. (13) Conotruncal anomalies were the most common anomalies observed among type 1 diabetic mothers in the study by Lisowski et al. (14). Clinical manifestations were positive in only 56.4% of the neonates with echo findings, radiological manifestations in 56.4%, ECG in 50.9% of the cases in our study. 19% of the neonates with cardiac anomalies born to diabetic mothers did not show any initial symptoms in the study by shakar et al. (7) This

indicates the role of echocardiography in diagnosis of heart diseases in infants born to diabetic mothers.

It has been observed that overt diabetes around conception increases the risk of embryopathy. (15) However in our study, no statistically significant correlation was found between incidence of heart diseases between mother with gestational and pregestational diabetes. Similar findings were observed by Shankar P et al, Noureldin EH and Akbariasbagh P et al in their studies. (7,12,16) However a higher risk of cardiac malformations were observed in neonates born to mothers with preexisting diabetes compared to those born to mothers with gestational diabetes in the study by Billionnet C et al. (17) We found no statistically significant correlation of incidence of heart diseases with gestational age and size for gestational age. Our study is limited by the fact that still births, abortions and neonates with antenatally diagnosed cardiac anomalies were not included in the study. Also, neonates born to diabetic mothers with severe hypoxic ischemic encephalopathy were excluded in our study due to infrequent association of transient myocardial ischemia which may present as systolic murmur.

CONCLUSION:

The incidence of heart diseases is high (30%) in neonates born to diabetic mothers in our study with clinical manifestations present in only 56.4% of the neonates with heart diseases. An echocardiogram in all neonates born to diabetic mothers will help in the early detection of heart diseases especially in asymptomatic neonates. It is recommended that routine echocardiogram be done in all neonates born to diabetic mothers.

DECLARATIONS:

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Conflict of Interest	-	None

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