PATTERN OF CONGENITAL HEART DISEASE IN 0 TO 28 DAYS INFANTS OF DIABETIC MOTHERS

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Abstract

Objectives: To determine the pattern of congenital heart disease in 0 to 28-day infants of diabetic mothers.

Methods:

This Cross-Sectional Study was conducted at the Department of Pediatrics, Mardan Medical Complex Mardan from 10th October 2022 to 10th April 2023 over 6 months.

A total of 150 neonates born to diabetic mothers and reported with congenital heart disease were included in the study. All neonates were sent to the department of Pediatric Cardiology for echocardiographic evaluation. Data regarding patterns of congenital heart disease was recorded. Descriptive analysis was done by applying frequency and percentages.

Results:

The Mean±SD of age in this study was 8.32±4.28 days with an age range of 2 to 26 days. Male patients were 61.33% while females were 38.66%. Patent ductus arteriosus was the commonest congenital heart disease 48 (32%) followed by Patent foramen ovale 44 (29.33%), hypertrophic cardiomyopathy 21 (14%), atrial septal defect 15 (10%), ventricular septal defect 10 (6.66%), transposition of great arteries 7 (4.66%) and tetralogy of Fallot 5 (3.33%).

Conclusion:

Patent ductus arteriosus was the most common congenital heart disease followed by patent foramen ovale, hypertrophic cardiomyopathy, atrial septal defect, and others in infants of diabetic mothers.

Keywords: Congenital heart disease, Diabetic mothers, Gestational diabetes, Infants.

Introduction

Obesity and diabetes mellitus are frequently observed with the globally emerging modern lifestyle adaptation and industrialization. Similarly, gestational diabetes mellitus (GDM) is also reported frequently in all parts of the world irrespective of the economic status of the population.[1] American Diabetes Association (ADA) has categorized diabetes based on etiology into four groups mentioned as type 1 diabetes, type 2 diabetes, GDM, and diabetes due to some specific etiology (e.g. MODY, monogenic diabetes).[2] Hyperglycemia in pregnancy (HIP) is a prevalent medical disorder as it is recorded in around 1 in every 6 pregnancies worldwide. In Southeast Asia, it is alarmingly high with approximately 1 in every 4 four pregnancies.[3]

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Adverse outcomes are observed in all types of diabetes mellitus for both mothers and neonates not only in the short term but also over the long term.[4] HIP is related to an elevated risk of perinatal complications including congenital anomalies and other malformations like defects at the levels of heart, kidney, skeletal and neurological anomalies. The future risk of developing diabetes is also increased in these cases for both the mother and the children.[5]

ADA explained the mechanism of congenital heart disease (CHD) in a way that during the process of heart development, the mothers with pre-gestational diabetes will have a hyperglycemic intrauterine environment which affects this development, while the onset of gestational diabetes occurs later between the 24th and 28th week of pregnancy, when the baby's heart is already fully developed.[6] As we continue to work on HIP, we find more evidence that the condition is heterogeneous.[7] Schraw JM suggested that a variety of underlying causes are involved in CHD abnormalities in women diagnosed with pre-gestational diabetes and those having gestational diabetes. [8,9]

Despite the success over the years in providing effective glycemic control in pregnant diabetic women, the impact of diabetes and the presence of impaired glucose tolerance is observed in the shape of adverse fetal outcomes.[4,10] The overall incidence of any type of illness in these mothers is

approximately 1% and CHD is among the frequently developed complications in diabetic mothers. It is estimated that CHD is found in 6-8 infants per 1000 cases of live births.[11] The prevalence of CHD in newborns of diabetic mothers was reported to be 28% in a study conducted in the Indian population. The researchers therefore recommended careful evaluation for timely diagnosis and management of diabetes in this group of patients.[12]

CHD may remain asymptomatic during the initial years of age and worsen in the latter years or may be presented with severity from the start and cause an increased ratio of neonatal death.[13] As the data regarding congenital heart diseases (CHD) in Pakistan is sparse, this study was planned to depict and document the spectrum of CHD in 0 to 28-day infants of diabetic mothers. The results of this study will help set up diagnosis and management plans for these infants in our hospital setups.

Methodology:

This cross-sectional study was conducted at the Department of Pediatrics, Mardan Medical Complex Mardan from 10th October 2022 to 10th April 2023 over 6 months. The sample size was calculated with Precision = 8%, Prevalence = 47.30%,[10] Population size= Infinite, With 95% Confidence interval and Specified limits [39.3%--55.3%]. A total of 150 neonates from both genders aged between 0-28 days born to diabetic mothers and reported with congenital heart disease were included in the study.

Exclusion criteria were set as neonates born to mothers reported with renal disease, hepatitis, heart failure, or tuberculosis.

All the demographics of mothers and neonates regarding age, gender, and residential status were taken and recorded in the given format. Clinical findings were also noted including gestational status, type of diabetes, mode of delivery and birth weight. All the neonates were referred to the cardiology department for echocardiographic evaluation by the consultant cardiologist. Data regarding patterns of congenital heart disease was recorded and noted down in given format.

Congenital heart disease was defined as active congestion seen in left-to-right shunts when right ventricular output is approximately 2.5 times that of the left ventricle and/or passive congestion is seen due to elevated pulmonary venous pressure which is reflected by left cardiac dysfunction or obstruction on X-ray.[5]

Ethical approval of conducting the study was taken from the ethical committee of the hospital (242/BKMC). The study purpose was explained and consent was taken from the parents of neonates participating in the study on written forms. Data analysis was performed using SPSS 26. Mean and standard deviation were calculated for quantitative parameters. Qualitative parameters were presented in the shape of frequency and percentage. Descriptive analysis was done by applying frequency and percentages.

Results:

The Mean±SD of age in this study was 8.32±4.28 days with an age range of 2 to 26 days. Male patients were 61.33% while females were 38.67%. Details of demographic findings are as shown in Table I.

Table I: Demographics (n=150)

Age (Mean±SD) Days		8.32±4.28
Gender	**Male n (%)**	92 (61.33)
	Female n (%)	58 (38.67)
Residential status	**Urban n (%)**	76 (50.67)
	Rural n (%)	74 (49.33)

The clinical findings of these mothers show that most of these mothers were at their term, and were having GDM and CS was performed in most of these cases as shown in Table II.

Table II: Clinical findings

Gestational status	**At term n (%)**	134 (89.33)
	Pre-term n (%)	16 (10.66)
Type of diabetes	**GDM n (%)**	115 (76.66)
	Pre-GDM n (%)	35 (23.33)
Mode of delivery	**Vaginal n (%)**	52 (34.67)
	Cesarean section n (%)	98 (65.33)
Birth weight (Mean±SD) Kg		3.71±0.61

The results of echo cardiac evaluation showed that patent ductus arteriosus (PDA) was the most commonly found CHD in these infants followed by patent foramen ovale (PFO), hypertrophic cardiomyopathy (HCM), atrial septal defect (ASD), ventricular septal defect (VSD), transposition of great arteries (TGA) and tetralogy of Fallot (TOF) as shown in Table-III.

Table-III: Patterns of congenital heart disease

Congenital heart disease	Frequency	Percentage
PDA	48	32
PFO	44	29.33
HCM	21	14
ASD	15	10
VSD	10	6.66
TGA	7	4.66
VOF	5	3.33
Total	150	100

Discussions

Despite recent developments in the care and management of diabetes in pregnancy, incidences of birth anomalies related to diabetes still persist. There are, however, few studies purely aimed to determine patterns of such structural heart defects in these infants.

Paauw ND reported on the role of hyperinsulinism in the development of cardiac hypertrophy in neonates and mentioned that hypertrophic cardiomyopathy is the most frequent congenital cardiac abnormality reported in 30% of the cases. It is more alarming that 13% of these remain asymptomatic.[14]

In a study conducted by Ferdousi SA, the most commonly reported CHD in the infants of diabetic mothers was PFO (60.71%) followed by PDA (55.3%), HCM (21.42%) and ASD (10.71%).[15]

A study conducted in Pakistan by Muhammad A. and co-workers reported the prevalence of CHD in infants of diabetic mothers as high as 47.5%. The most frequently reported disease was PDA (16.8%). The other reported were VSD (12.9%), ASD (8.9%), PFO (7.9%) and TGA (5.9%).[16]

In Nepal, a study with a similar aim shared the prevalence of CHD as 10.2%. PDA was the most frequent (38.4%) followed by VSD (23.1%) among these CHD cases. The other abnormalities were TOF and TGA (7.7%), however, no case of PFO was reported in this study.[17]

Shamaoon M worked on data from diabetic mothers to find the cardiac abnormalities in their infants using echocardiography. The overall prevalence of CHD was 47.3% with the top most anomalies as PDA (32.6%). The other anomalies and their frequencies were VSD (25.3%), ASD (14.5%), TGA (7.9%), and HCM (5.7%).[11]

Arjamandnia reported the prevalence of CHD as high as 49% with PFO and PDA being the most frequent anomalies (69.5% and 41% respectively).[18]

In our study, 88.82% of deliveries were at term and GDM was present in 76.3% of the mothers. Results of echocardiographic assessment for CHD showed that PDA was the most common congenital heart disease found in 48 (32%) of these infants. The results of previous studies conducted in this segment also reported PDA as among the 1st or the 2nd most prevalent cardiac anomalies in infants of diabetic mothers. The other most prevalent CHDs were PFO 44 (29.33%), HCM 21 (14%), ASD 15 (10%), VSD 10 (6.66%), TGA 7 (4.66%) and TOF 5 (3.33%). Similar cardiac anomalies were also reported in infants of diabetic mothers in other studies previously done on this subject.[10,15,16,17,18]

The results of this study thereby provide further input over the patterns of CHDs in infants of diabetic mothers and emphasize the need for early diagnosis and interventions for these new born.

Limitations

The major limitations of the study are its small sample size and being based on data from a single institute. Moreover, this was a cross-sectional study and couldn't focus on the co-relation between blood glucose management and the incidences of CHD in the infants.

Conclusion

The study confirms the prevalence of a variety of congenital heart defects in infants of diabetic mothers and finds PDA, PFO, HCM,

and ASD as the most frequent congenital heart diseases.

Conflict of interest

No

Disclaimer

No

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