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Spectrum of congenital heart diseases in infants of diabetic mothers

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ABSTRACT

Objectives: The objectives of this study were as follows: To find out if babies born to diabetes mothers have congenital cardiac disease. To ascertain the congenital heart disease pattern that affects babies whose mothers have diabetes. To determine the relationship between the mother's type of diabetes and the newborn's congenital heart condition.

Material and Methods: The study, which involved 49 newborns with diabetic mothers, was carried out at Yenepoya Medical College. These babies had clinical examinations of the cardiovascular system. SpO_2 was measured, and an echocardiogram was obtained. Demographic profiles and relevant information from medical records were collected using a structured Pro forma.

Results: Out of 49 babies,8 babies were detected with congenital heart disease. Among them 4 were having Atrial septal defect(ASD) and 4 were having ventriculoseptal defect.The spectrum of congenital heart diseases mentioned are moderate atrial septal defect and ventricular septal defect.

Conclusion: Among babies whose mothers have diabetes, congenital cardiac disease is prevalent. Acyanotic heart disease was predominant, and ASD was the most common in our study. Neonatal heart disease is more commonly seen in infants of maternal diabetes mellitus than that of gestational diabetes mellitus.

Keywords: Congenital heart disease, Echocardiography, Gestational diabetes mellitus, Infant of diabetic mother

INTRODUCTION

Diabetes mellitus is a multifactorial disease with genetic, environmental and pathogenic origins that is typified by elevated blood sugar levels due to insufficient or ineffective insulin secretion.[1] Pregnancy is the initial indicator of glucose intolerance with varying degrees of severity at the beginning, known as gestational diabetic mellitus (GDM).[2]

GDM was more common in urban women in southern India (17%), semi-urban women (13.8%) and rural women (9.8%).[3,4] Compared to the general population, infants of diabetes mothers (IDM) are 3 to 5 times more likely to be born with congenital abnormalities.[5] Neural tube defects, congenital heart disease, renal malformations and Caudal regression syndrome are some of these anomalies. Significant correlations have been shown between IDM and foetal cardiac anomalies, such as atrial septal defect (ASD), ventricular septal defect (VSD), transposition of the great vessels, truncus arteriosus, coarctation of the aorta and hypertrophic cardiomyopathy.[6]

Compared to women without diabetes, mothers with overt diabetes had a 17-fold higher incidence of transposition of great arteries.[7] When compared to a normal newborn, kids of diabetic mothers experienced delayed ductal closure and a drop in pulmonary pressure.[8,9] Sustaining appropriate blood

sugar levels did not affect the incidence of asymmetrical septal hypertrophy, but it did enhance outcomes and lower the risk of foetal heart illness.[10] During the first few months of life, diabetic cardiomyopathy was frequently a transient ailment that went away. It had no clinical ramifications and was also self-limiting.[7] Septal hypertrophy happens regardless of the type of diabetes, even in mothers with adequate glycaemic control.[11] Compared to type 2 and GDM, type 1 diabetes had a higher prevalence of septal hypertrophy. Congenital malformations were 3 to 4 times more likely in mothers with diabetes than in mothers without the disease. The hyperglycaemia and hyperinsulinemia of these infants made them more likely to grow larger.[12]

MATERIAL AND METHODS

This prospective cross-sectional investigation was carried out from 1 March to 31 August 2023 at the Yenepoya Medical College Hospital in Mangalore. Before beginning the study, ethical clearance was acquired from the Ethics Committee. The study covered all diabetic mothers' babies born at Yenepoya Medical College Hospital in Mangalore. The study excluded all diabetic mothers who also had systemic lupus erythematosus, toxoplasmosis, rubella, cytomegalovirus, herpes and other agents (TORCH) infections, usage of teratogenic cardiotoxic medications, or newborns with syndromic anomalies as additional risk factors for the development of congenital heart problems. This study included 49 infants born to diabetic mothers. With knowledge, the parents gave their approval. Each baby born to a diabetic mother underwent a clinical assessment. Both pre-ductal and post-ductal oxygen saturation were measured. 48 h after the baby was born, an echocardiography was conducted. A structured proforma was used to collect data relevant to the demographic profile. The required information was provided by the mother's and the neonate's case sheets. The association between the study parameter and the Chi-square test was assessed.

RESULTS

1. Gender out of 49 neonates, 25 were male and 24 were female [Figure 1].

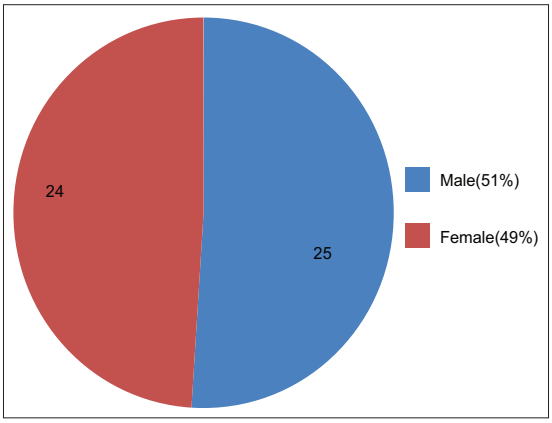

Figure 1: Gender.

2. Type of maternal diabetes 40 were having gestational diabetes and nine were having pregestational diabetes [Figure 2].

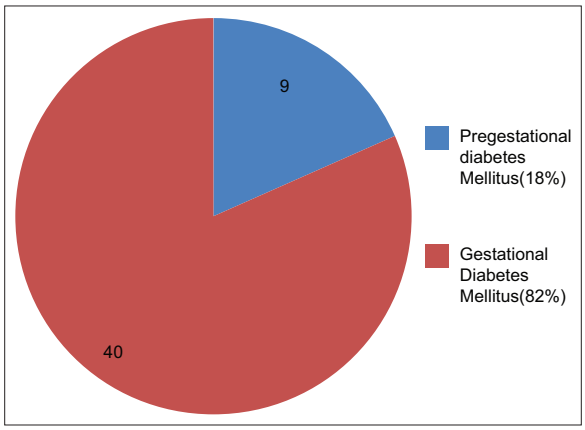

Figure 2: Type of maternal diabetes.

3. Maternal treatment regimen – Twelve were on oral glycaemic agents, 18 were on insulin and 19 were receiving nutritional therapy [Figure 3].

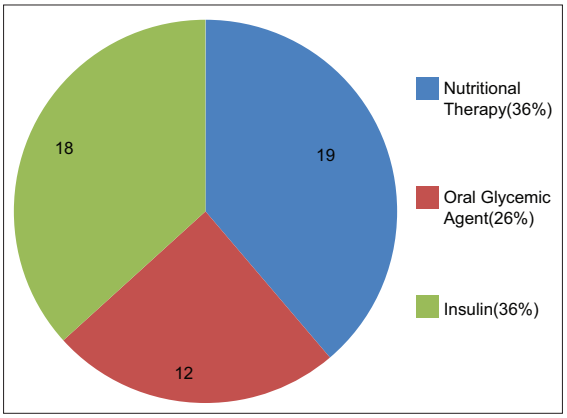

Figure 3: Maternal treatment regimen.

4. Mode of delivery – 17 were vaginal delivery and 32 were caesarean sections [Figure 4].

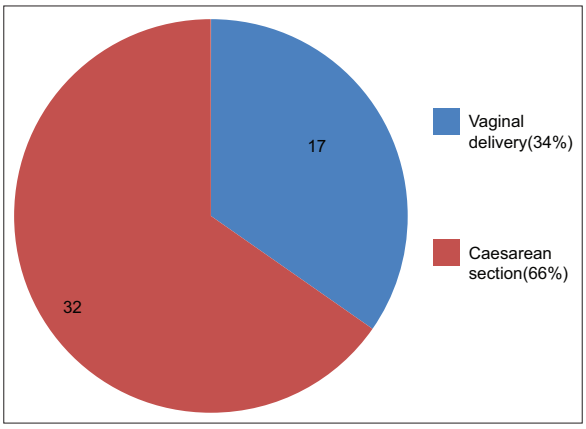

Figure 4: Mode of delivery.

5. Gestational – age 37 were terms, 12 were preterms [Figure 5].

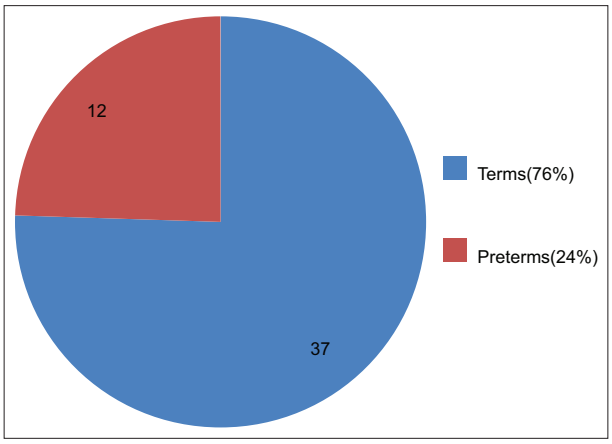

Figure 5: Gestational age.

6. Birth weight 11 were <2.5 kg, 34 were between 2.5 and 4 kg and 4 were more than 4 kg [Figure 6].

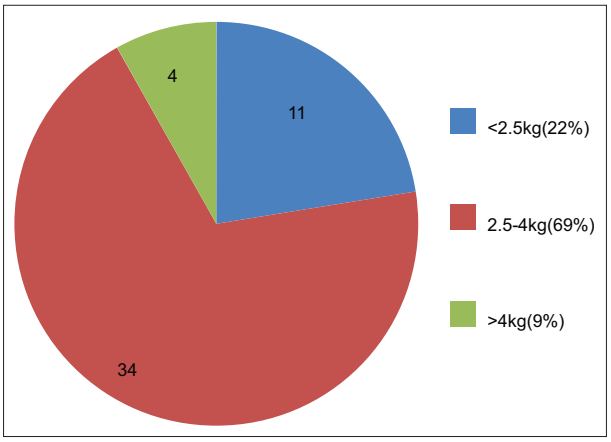

Figure 6: Birth weight.

7. Out of 49 babies, eight babies were detected with congenital heart disease. Among them four were having atrial septal defect (ASD) and four were having ventriculoseptal defect. The spectrum of congenital heart diseases mentioned are moderate ASD and ventricular septal defect [Figure 7].

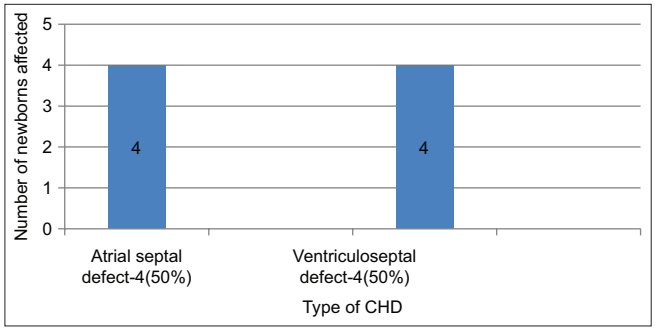

Figure 7: Congenital heart diseases (CHD)-8/49(16%).

8. It has been noted that there is no statistically significant correlation between congenital cardiac disease and the type of maternal diabetes (Pearson Chi-square test statistic value=0.060 [*P*=0.806]) [Table 1].

Table 1: Association of type of maternal diabetes and congenital heart disease.

Maternal diabetes type * congenital heart disease			
	Congenital heart disease		Total
	CHD	Normal	
Maternal diabetes type			
Gestational	6	34	40
Pregestational	2	7	9
Total	8	41	49

CHD: Congenital heart disease, * means indicates

9. It has been noted that there is no statistically significant correlation between maternal treatment regimen and congenital cardiac disease (Pearson Chi-square test statistic value=1.793 [*P*=0.408]) [Table 2].

Table 2: Association of maternal treatment regimen and congenital heart disease.

Maternal treatment regimen * Congenital heart disease			
	Congenital heart disease		Total
	CHD	Normal	
Maternal treatment regimen			
Meal plan	3	16	19
OHA	2	10	12
Insulin	3	15	18
Total	8	41	49

Pearson's Chi-square test *P*=0.408. CHD: Congenital heart disease, OHA: Oral hypoglycemic agents, * means indicates

DISCUSSION

The incidence of congenital heart disease (CHD) (16%) in this study is comparable to other studies which is comparable to other studies, i.e., 15%.[13] All congenital heart diseases detected were acyanotic which is common with other previous studies.[13-15] In our study, the echocardiography findings of the neonates were 50% ASD and 50% VSD which is not consistent with other studies[13-15] Since all newborns with CHD were asymptomatic, it is preferable to perform a two-dimensional echocardiogram on every child whose mother has diabetes. A prior study concluded that foetal echocardiography should be performed in IDM due to their elevated risk of cardiovascular malformation.[15]

Although it has been noted that mothers using insulin therapy (used to treat uncontrolled diabetes) and newborns with overt diabetes have higher rates of congenital cardiac disease, this association is not statistically significant,

possibly due to the smaller sample size. Maternal insulin-dependent diabetes is a substantial risk factor for CHD. For this patient population, timely diagnosis and treatment are critical.

Limitation

Due to the small sample size, the relationship between the type of maternal diabetes, the treatment plan for the mother and congenital heart disease is not statistically significant. An adult cardiologist did an echocardiogram.

CONCLUSION

An echocardiography aids in the early diagnosis of congenital heart disease in asymptomatic newborns. Maternal diabetes is a substantial risk factor for congenital heart disease. The congenital cardiac conditions in this study are ASD and ventricular septal defect. All the congenital heart disorders found are acyanotic heart diseases. Compared to gestational diabetes mellitus, neonatal cardiac damage is more prevalent in newborns with overt diabetes mellitus.

Ethical approval: The research/study approved by the Institutional Review Board at Yenepoya Ethics Committee-1, number YEC-1/2023/051, dated 31st March 2023.
Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent.
Financial support and sponsorship: Nil.
Conflicts of interest: There are no conflicts of interest.
Use of artificial intelligence (AI)-assisted technology for manuscript preparation: The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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