



CONGENITAL HEART DISEASE IN INFANTS OF DIABETIC MOTHERS, THEIR CLINICAL PROFILE AND ECHOCARDIOGRAPHIC FINDINGS IN TERTIARY CARE HOSPITAL

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ABSTRACT

Objective: The study aimed to determine clinical presentation and the prevalence of different types of Congenital Heart Disease (CHD) through echocardiogram and to perceive the utility of Echocardiogram in a diagnosis of CHD in Infant of Diabetic Mother (IDM).

Methods: A prospective cross-sectional study was carried out at the tertiary care center over a period of 12 months. 75 consecutive neonates born to diabetic mothers both gestational diabetes or type 2, type 1 diabetes mellitus admitted in neonatal intensive care unit [NICU] were included in this study. All the patients were evaluated for congenital heart disease by echocardiography by a pediatric cardiologist of the same institute within 7 days of admission.

Results: Out of 75 neonates, male were 45 and females 30 with M:F ratio of 1.5:1. 33.3% were preterm, 60% were term and 6.6% post term. Fetal macrosomia with birth weight more than 4000 grams was present in 28%. Common clinical presentations were fast breathing (44.5%) and cyanosis [17.3%]. Isolated murmur in 16%. Cardinal clinical signs were respiratory distress [70.6%] and low saturation [13.3%]. The common echocardiographic findings were Patent foramen ovale (84%), Patent ductus arteriosus (58.6%), Interventricular septal hypertrophy in [30.6%]. Among the significant CHD ventricular septal defect, coarctation of aorta and Transposition of the Great Vessels were seen.

Conclusion: There is need of high index of suspicion, detailed history, clinical examination, and echocardiography to diagnose the CHD in infants of diabetic mothers.

KEYWORDS : Congenital heart disease, infant of diabetic mother (IDM), echocardiography

INTRODUCTION

Diabetes Mellitus is a syndrome of diverse genetic, environmental and pathogenic origin characterized by hyperglycemia resulting from impaired insulin secretion and/or effectiveness.[1] Gestational diabetes mellitus (GDM) is carbohydrate intolerance of variable severity at onset which is first recognized during the pregnancy[2] GDM complicates 1% to 3% of all pregnancies[3] Different studies showed that congenital anomalies occur 3 - 5 times more commonly in the Infant of Diabetic Mother (IDM) than in the general population[4,5] These anomalies include Neural Tube Defects, Caudal Regression Syndrome, Renal Malformations and Congenital Heart Disease. The risk of fetal cardiac malformations in IDM has been found to be significant, most notably Atrial Septal Defect (ASD), Ventricular Septal Defect (VSD), Transposition of the Great Vessels, Truncus Arteriosus, Coarctation of Aorta and Hypertrophic Cardiomyopathy [4,5] In a large population based case-control study (Baltimore-Washington study) showed that the overall risk of structural CHD was 3.2 times more in diabetic mother than non-diabetic mother[6] To date, there are very few significant studies to find out the pattern of cardiac abnormalities including structural cardiac anomalies or hypertrophic cardiomyopathy in IDM in the Kashmiri population. So the objective of this study was to investigate infants of diabetic mothers and documenting the prevalence and spectrum of CHD and the utility of echocardiography in the early diagnosis of CHD

MATERIALS AND METHODS

The study was conducted in the Neonatal intensive care unit of the Department of Pediatrics, Government Medical College Srinagar between January 2017 to December 2018. A total of 75 consecutive neonates born to diabetic mothers including gestational diabetes, Type 1 and Type 2 diabetes mellitus admitted in Neonatal Intensive care unit were included in this study. Detailed history and clinical examination were performed. Birth weight, age, sex, gestational age of all neonates were recorded. All the babies were screened for congenital heart disease. Saturation monitoring, arterial blood gas, Chest X-ray, Electrocardiogram was done. Echocardiography to confirm the CHD was done in all cases using Seimens Accuson S 2000 machine with 8-MHZ/pediatric probe. A single pediatric cardiologist reviewed all echocardiographic studies. Significant septal hypertrophy was considered when echocardiographic observation of the Interventricular septum to the posterior left ventricular wall exceeds 1.3mm [7]. Atrial septal defects were considered to be significant when they measured >3 mm in size.

Statistical analysis:

Data was collected and appropriate computer program was compiled for data analysis and bring out the tables. As the study recalled, SPSS PC 17 Computer Program was used where in the relevant

RESULTS

A total of 75 neonates of diabetic mother admitted in NICU were analyzed during the study. The basic characteristic of these neonates are shown in Table 1. Of 75 neonates 60 were Males and 30 Females with M: F ratio of 1.5:1. 25 (33.3%) of them were born preterm, 45 [60%] were the term and only 5 [6.6%] post term. Regarding the birth weight, 4 neonates were low birth less than 2500 grams [5.3%]. 35 neonates were between 2500 to 3500-gram weight. 18 neonates were between 3500 grams to 4000 grams. 18 neonates were more than 4000 gram.

Table 1: Basic characteristics

Gender		
Male	45	60
Female	30	40
Birth weight [grams]		
<2500	4	5.3
2500_3500	35	46.6
3500-4000	18	28
>4000	18	28
Gestational age		
Early term 37 0/7 to 38 6/7	25	33.3
Term 39 0/7 to 40 6/7	45	60
Post term 41 0/7 to 41 6/7	5	6.6

Table 2 depicts the main presenting clinical feature of the neonates of diabetic mother admitted in the neonatal intensive care unit. Main presenting symptom was fast breathing in 44 neonates [58.6%], blue discoloration in 13 [17.3%]. Murmur was present in 12 [16%] while refusal to feed was present in 6 neonates [8%]. Cardinal clinical sign in 53 neonates [70.6%] was respiratory distress. Low oxygen saturation was second commonest clinical sign present in 10 neonates [13.3%]. Tachycardia was present in 9 neonates [12%]. Hepatomegaly with respiratory distress was least common present only in 3 neonates [4%].

Table 2: Presenting clinical features

Clinical symptoms	N=75	Percentage
Fast breathing	44	58.6
Blue discoloration	13	17.3
Refusal to feed	6	8
Murmur	12	16
Clinical sign	N=75	Percentage
Respiratory distress	53	70.6
Low saturation	10	13.3
Hepatomegaly and respiratory distress	3	4
Tachycardia	9	12

Echocardiography was performed within 7 days after birth in all the neonates. Table 3 depicts the echocardiographic findings in 75 infants of the diabetic mother. The most common echocardiographic finding was Patent foramen ovale seen in 63 neonates. 44 neonates had Patent ductus arteriosus. The Interventricular septal hypertrophy was present in 23 cases. The hypertrophy observed in this study of the left ventricle was in the mild form, no patient had significant obstruction of left ventricular. The Atrial septal defect in 9 patients. Severe forms of CHD encountered were a Nonrestrictive ventricular septal defect in 3 neonates while transposition of the great vessel and severe coarctation of the aorta was present in 1 patient each.

Table 3: Echocardiographic finding

Echocardiographic finding	Number	percentage
Patent foramen ovale	63	84
Patent ductus arteriosus	44	58.6
Interventricular septal hypertrophy	23	30.6
Atrial septal defect	9	12
Valvar pulmonary stenosis	5	6.6
Ventricular septal defect	3	4
Transposition of great vessels	1	1.3
Coarctation of aorta	1	1.3

DISCUSSION

Total of 75 neonates of diabetic mothers was admitted in NICU during the study period of them 45 were Males and 30 Females with M:F ratio of 1.5:1. This is comparable to many studies by Shah GS, et al in Nepal wherein the male to female ratio was 1.5:1 [8]. Similarly in a study conducted by Humayun et al [9] in Pakistan, male to female ratio was 1.7:1. Male preponderance in congenital heart disease was seen in the majority of the studies conducted worldwide. This male dominance pattern could be due to Indian social and cultural factors. Neglect, differential treatment, or poor access to health-care facilities is putting girls at disadvantages. Moreover, this could be the reason for the less female child seeking health-care facilities.

In the present study, the incidence of prematurity was 33.3%. Gabbe SG et al [10] observed 11%, Watson et al observed [11] 46% incidence of prematurity. In our study n=4, 5.3% of neonates were low birth weight. 53 neonates were appropriate for gestational age between 2500 grams to 4000 gram. Fetal macrosomia with birth weight more than 4000 gram was present in n=18 [28%]. A study conducted by Ranade et al [12], Deorari et al [13] had 40% and 20.2% of fetal macrosomia respectively.

In this study, the most common symptom was fast breathing (58.6%), blue discoloration as noticed by parents in 17.3%. Cardiac murmur was presenting complaint in 16% and decreased feeding in 8%. The most common clinical sign was respiratory distress in 70.6% neonates. Cyanosis was seen in 13.3%. Tachycardia in 12 % and hepatomegaly along with respiratory distress in 4%. Akbar Molaei reported respiratory distress was the most common complaint (70.7%) and cyanosis was the second most common complaint (24.4%) in his study [14]. Islam MN [15] found respiratory distress was the commonest symptom (71%) followed by cyanosis (26%). In our study, the isolated cardiac murmur was present in 16 %. This stresses the need for a thorough clinical examination of all neonates of diabetic mothers. In the study by Ainsworth S et al [16] showed that neonatal examination detects 44% of cardiac malformation in infancy if a murmur is heard there is 54% chance of there being an underlying cardiac malformation.

Echocardiography was performed within 7 days of admission. Echocardiographic data are summarized in Table 3. The most common echocardiographic finding was Patent foramen ovale (PFO) in 84%, followed by Patent ductus arteriosus in 58.6%. High incidence of these

defects is attributed to the fact that the echocardiography was done in early neonatal age before the physiological closure of these defects. Mild forms of CHDs revealed Atrial septal defect in 12% and mild valvar pulmonary stenosis in 6.6%. Severe forms of CHD were large ventricular septal defect, transposition of great vessels and severe coarctation. The large population-based case-control study design of the Baltimore Washington Study showed that the overall risk of structural heart disease given overt maternal diabetes mellitus was 3.2 times higher than the risk if maternal diabetes was not present [6]. Mills et al. reported an incidence of 2.8 and 3.2% in controlled and noncontrolled diabetes mellitus patients, respectively [17]. The fact that poor diabetic control and hyperglycemia are associated with an increased risk of congenital malformation in offspring is well documented [18]. Our high incidence is due mainly to the detection of minor forms of congenital heart lesions by echocardiography, which could not be detected during routine physical exam immediately after birth and during infancy. Other genetic and environmental factors may play a role. In the Baltimore Washington Study [6] the risk of cardiomyopathy among offspring of mothers with IDDM was 18 times the risk not affected. In this study, 30.6% of neonates had septal hypertrophy. Although the incidence of septal hypertrophy is high, no significant left ventricular outflow tract obstruction occurred. Our population showed an increased incidence but a milder clinical course. Among the significant CHD Ventricular septal defect was commonest, followed by TGA and coarctation of aorta. In a study by Keeskes et al [19], Rein et al [20] VSD and coarctation of aorta were the most common diagnoses in their study.

Limitations of study:

Data was not a true presentation of CHD as the number of patients were less. Data were collected from single tertiary care hospital.

CONCLUSION:

High index of suspicion, detailed history, clinical examination, and echocardiography help us to diagnose the CHD in neonates. The rule is no different in infants of diabetic mother, as index of suspicion has to be higher. There is need of proper evaluation and counselling of such mothers especially in this part of the world.

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