

**Original Article****Echocardiographic Study of Congenital Heart Disease in Infants of Diabetic Mother****Babita Khanal<sup>1</sup>, Manoj Kumar Shrivastava<sup>1</sup>, Prakash Kafle<sup>2</sup> and Pushpa Kumari Shah<sup>1</sup>**<sup>1</sup>Department of Pediatric, <sup>2</sup>Department of Neurosurgery, Nobel Medical College Teaching Hospital, Biratnagar, Nepal  
Article Received: 5th February, 2019; Revised: 26th March, 2019; Accepted: 12th April, 2019DOI: <http://dx.doi.org/10.3126/jonmc.v8i1.24476>**Abstract****Background**

Maternal diabetes mellitus has been shown to be high risk factor for congenital anomalies. It carries 3-5 times higher risk of incidence compared to the general population. The aims of present study was to investigate and portray the incidence of congenital heart disease in infants of diabetic mothers and know the utility of echocardiography in the early diagnosis of congenital heart disease at Nobel Medical College teaching hospital, a tertiary care centre in the eastern part of Nepal and review the current literature.

**Materials and Methods**

This is a prospective observational study conducted in Nobel Medical College Teaching hospital, Kanchanbari, Biratnagar Nepal over the period of 12 months. A structured questionnaire was designed which included demographic profile and the Echocardiography findings. The collected data were analysed using window's SPSS version 20.

**Results**

In the present study of the total deliveries 1.99 % was diabetic mother comprising 208 deliveries. 127 had undergone echocardiography in which 10.2 % (n=13) had anomalies. One hundred sixteen were term and 11 were preterm. Patent ductus arteriosus was the most common anomaly (38.4%) followed by ventricular septal defect (23.1%) and Hypertrophic cardiomyopathy (15.4%).

**Conclusion**

With the review of current literature it has been found that maternal diabetes mellitus is a significant risk factor for congenital heart disease so it is suggested that the presence of diabetes mellitus in a pregnancy should be taken as a strong suspicious of having congenital heart disease and infants should be screened for the same so as to diagnose the anomaly at the earliest possible.

**Keywords:** *Echocardiography, Gestational Diabetes Mellitus, Heart disease.*

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## Introduction

Diabetes Mellitus is very common entity which is a syndrome of multiple factors like genetic, environmental and pathogenic origin which is characterized by increased blood glucose level resulting from impaired insulin secretion and/or effectiveness [1]. Maternal diabetes mellitus (DM) has long been recognized as risk factor for congenital anomalies. It carries 3-5 times higher risk of incidence compared to the general population [2]. In the new born to the mother with DM, CHD is the single most important causes of perinatal mortality [3]. Neural Tube Defects, Caudal Regression Syndrome, Renal Malformations and Congenital Heart Disease are the common anomalies associated with GDM. Furthermore, the risk of fetal cardiac malformations in IDM is significant. The most common anomalies are Atrial Septal Defect (ASD), Ventricular Septal Defect (VSD), Transposition of the Great Vessels, Truncus Arteriosus, Coarctation of Aorta and Hypertrophic Cardiomyopathy.

Most of the cases are usually asymptomatic however some may present immediately following delivery with decreased cardiac output, respiratory distress and other symptoms of cardiac failure requiring aggressive medical therapy. Many reported literature claims spontaneous resolution in survivors within 4-6 months nonetheless there are reports of patients continuing to have abnormal dimensions into the second year of life [4]. As per the World Health Organization report of 2014, the population aged above 18 years, the prevalence of diabetes mellitus (DM) is 9% worldwide [5]. A study by Dana et al in universally screened multiethnic population showed that the prevalence of GDM is increasing globally [6].

In Nepal, there are limited data on the clinical profile of CHD and GDM. The aims of present study is to investigate and portray the incidence of congenital heart disease in infants of diabetic mothers for the purpose learning and in the mean time documenting the prevalence and spectrum of CHD and the utility of echocardiography in the early diagnosis of CHD at Nobel Medical College teaching hospital, a tertiary care centre in the eastern part of Nepal.

## Materials & Methods

This is a prospective observational study conducted in the department of pediatric medicine at Nobel Medical College Teaching hospital, Kanchanbari, Biratnagar, Nepal over the period of one year (from 16 September 2017 to 15 September 2018) after the ethical clearance from institutional review committee. Written consent was taken for all the participants from the parents. Neonates born to all newly diagnosed mothers with gestational diabetic mother (GDM), irrespective of gestational age, who agreed to participate by informed/written consent, were included. Those known to have diabetes mellitus in the past and with other co-morbid diseases like chronic kidney diseases, hepatitis, heart failure and tuberculosis and those who denied for consent were excluded in the study. Those who meet inclusion criteria were screened for congenital heart disease. Echocardiography was performed in all. A single pediatric cardiologist reviewed all echocardiography studies. Non probability continuous sampling was done. Diagnosis of gestational diabetes mellitus made as per diagnostic criteria of American Diabetic Association Guidelines [7].

Complete history and physical examination were performed. After delivery capillary blood glucose test was done within first 6 hours by glucometer and APGAR score was evaluated at 1, 5- and 10-minutes action taken as per necessary. Neonates were thoroughly examined with special focus on cardiac and extra-cardiac abnormalities. Each IDM underwent chest X-ray, electrocardiography (ECG) and echocardiography within 7 days of delivery. All the collected data were analyzed using windows SPSS version 20. and the result was shown in graphs and tables where necessitates.

## Results

Total of 208 diabetic mothers were identified from the total deliveries of 10415 of which 13 cases were found to have CHD which is shown in flow chart 1.

In the present study total of 127 cases underwent echocardiography. Remaining 81 patients denied for the evaluation.

### Patient Characteristics

among total examined neonates, male were 69.9% and female were 33.1% with male to female ratio is 2.02:1 which is shown in Table 1.



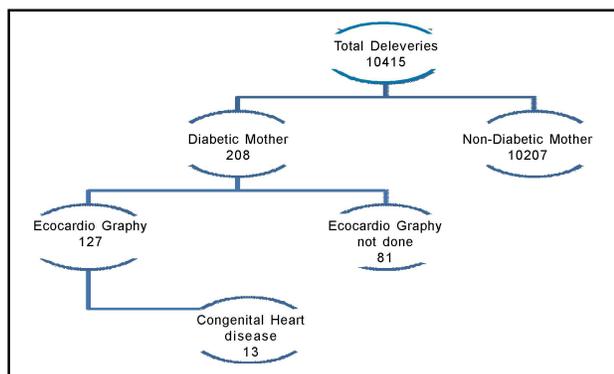


Figure 1: Flow Chart of Included Patients

Table 1: Gender of the study population

Gender	Frequency(n)	Percentage (%)
Male	85	69.9
Female	42	33.1
Total	127	100

### Gestational Age

Gestational age in this study ranges from 34 weeks to 42 weeks (mean= 39.2 weeks). Among the examined neonates, 91.3% of deliveries were term and 8.7% were preterm.

Table 2: Gestational Age

Gestational Age	Frequency(n)	Percentage (%)
Term	116	91.3
Preterm	11	8.7
Total	127	100

### Birth weight

Twenty-one neonates i.e. 16.5% were large for gestational age while 59.1 % were appropriate for the gestational age and remaining 24.4 % were small for the gestational age.

Table 3: Birth Weight

Birth weight (gm)	Frequency(n)	Percentage (%)
<2500	31	24.4
2500-4000	75	59.1
≥4000	21	16.5
Total	127	100

### Echocardiography findings

Only 13 neonates came to have positive findings in echocardiography suggestive for congenital

heart disease. In the present study most common finding seen was Patent Ductus Arteriosus in 38.4% which was followed by Ventricular Septal Defect in 23.11%. Echocardiography findings are summarized in Table 4.

Table 4: Echocardiography findings

Echocardiography findings	Frequency (n)	Percentage (%)
Patent ductus arteriosus (PDA)	5	38.4
Ventricular septal defect (VSD)	3	23.1
Hypertrophic cardiomyopathy (HCM)	2	15.4
Atrial septal defect (ASD)	1	7.7
Tetralogy of Fallot	1	7.7
D-Transposition of great arteries	1	7.7
Total	13	100

### Discussion

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 [8]. Congenital cardiovascular malformation affects around 6–8 per 1000 live births and accounts for the common birth defect [9]. Only few cases have genetic origin and environmental causes while in most of the cases cause is unknown. In only 1% of the cases, maternal disease is the cause [10]. In published studies reported risk of maternal diabetes having teratogenic effect is 1.7-4.0 % [11]. In the studies of antenatal echocardiography and diabetic pregnancy it has been reported that there is an excess of cardiovascular malformations where the authors has concluded that the GDM has “increased risk” of cardiovascular malformation in infants and it is an indication for fetal echocardiography [11]. Increased risk of CHD has also been shown in a population-based case control study where it has showed that the overall risk of structural heart disease in infants born to maternal diabetes mellitus was 3.2 time higher than in non diabetic mother. [12-13]. There has been different incidence in CHD among diabetic (3.2%) and non diabetic (2.8%) mother as reported by Mills et al. [14]. The fact that the poor

diabetic control and hyperglycemia are associated with an increased risk of congenital malformation in offspring is well documented [15, 16, 17]. In this study the different echocardiography findings were PDA in 38.4 % and ASD in 7.7 % which is comparable to the study by Ferdousi et al [11] where PDA in 55.3%, ASD in 10.71% and VSD in 3.54%. Whereas VSD in 23.1% in our study and other findings as mentioned in Table 4. Different types of severe CHD have been reported with a predisposition to D-transposition of great arteries, tetralogy of Fallot, hypoplastic left heart syndrome and pulmonary/tricuspid atresia [15, 18, 19]. These above findings in this study are not much consistent with above observations.

In one study [20] done in a tertiary care hospital in Nepal it has been found that the sequence of CHD were as :-ASD 87.1%, PFO 23.5%, PDA 21.2%, Complex Congenital Heart Disease in 11.8% and TOF in 1.2% respectively which does not correlate with the present study in term of the common finding being the PDA 38.4%. The maternal diabetes is a known significant risk factor for CHDs. There is an extremely high incidence of CHDs was seen in various studies. Due to the lack of national data, incidence could not be calculated. Only some institutional base studies are there. A hospital-based study in Nepal has shown that the incidence of CHD is 5.8 per 1000 hospitalized patients [21] Early diagnosis of disease and proper counseling of the parents will help in early intervention and reduce mortality and morbidity of neonates.

### Conclusion

Gestational Diabetes mellitus is a risk factor for congenital cardiac malformation. There is great need for recommendation of prenatal screening programs for CHD in our population. In the present study PDA is the commonest echocardiography finding. In Nepal to have the incidence and the common echocardiography findings in babies born to diabetic mother needs a large national based study where as it can be said that echocardiogram can be used as safe effective and reliable tool to detect CHD in infants of diabetic mother.

### Conflicts of Interest

None

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