

DOI: <http://dx.doi.org/10.18203/2320-1770.ijrcog20194612>

Original Research Article

## Study of fetal 2D echo in pregnant women with diabetes and gestational diabetes mellitus

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**Received:** 04 October 2019

**Accepted:** 09 October 2019

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### ABSTRACT

**Background:** Diagnosis of diabetes in pregnancy is an important public health issue. Present study was done to study incidence of abnormal foetal 2D echocardiography in women with diabetes and gestational diabetes mellitus and to know their obstetric outcome.

**Methods:** It is a prospective, observational study, which includes 80 patients. It was conducted at our tertiary care centre after the approval by ethics committee, and the results were analysed.

**Results:** Out of 80 patients included, 77% women had GDM and rest 23% had DM. In this study, all patients had fetal 2D echocardiography done. 3 patients had report suggestive of congenital heart disease in the fetus. 1 of them was suggestive of TAPVC, 1 was suggestive of enlarged right atrium, 1 report was suggestive of VSD. Two of the abnormal fetal 2D echocardiography diagnosis of TAPVC and VSD was confirmed by neonatal 2D echo. One baby with Normal antenatal 2D echo had ASD on post-natal evaluation. The baby with antenatally enlarged right atrium had no cardiac anomaly on post-natal evaluation.

**Conclusions:** Incidence of DM/GDM is increasing. As baby is likely to have congenital anomalies, out of which cardiac anomalies are most common, fetal echocardiography is a well-established, accurate, and safe method for diagnosing congenital heart disease. All the babies with abnormal fetal echocardiography need post-natal confirmation.

**Keywords:** Diabetes, Fetal 2D echo, Gestational diabetes mellitus, Pregnancy

### INTRODUCTION

The prevalence of diabetes in pregnancy in India ranges from 3.8% to 21%.<sup>1</sup> Diabetes mellitus is a disorder of carbohydrate metabolism characterised by high blood glucose levels, as a result of defect of insulin production or its action or both. It is the most common metabolic disorder in pregnancy. Diabetes has been classified by American Diabetes Association (ADA) on the basis of aetiology into four categories.<sup>2</sup>

- Type 1 diabetes

- Type 2 diabetes
- Other specific types (defects of beta cell function, insulin action, pancreatic disorders, endocrinopathies, drugs, infection etc.)
- Gestational diabetes mellitus.

Gestational diabetes can be defined as any degree of intolerance with onset or first recognition during pregnancy irrespective of gestational age at which it was diagnosed. Successful outcome in overt diabetes mellitus is related to degree of glycemic control but more importantly to the degree of underlying cardiovascular

and renal disease. Maternal effects of diabetes or GDM are as follows-preeclampsia- occurs in 10% of patients with GDM, acceleration of end organ damage as diabetic nephropathy, retinopathy, neuropathy, diabetic ketoacidosis and infections resulting in pre term labor, chorioamnionitis, polyhydramnios, urinary tract infection. Effect of diabetes on foetus depends upon the type of diabetes and degree of glycemia control during pregnancy. It includes growth abnormality eg. macrosomia, growth restriction, stillbirth, chronic fetal hypoxia, respiratory distress, congenital malformations, spontaneous abortions. Early diagnosis and meticulous management have successful outcome with minimal maternal and fetal morbidity and mortality

Primary objective of this study was to study incidence of abnormal foetal 2D echocardiography in women with diabetes and gestational diabetes mellitus, registered and referred to our tertiary care centre (department of obstetrics and gynaecology).

Secondary objective of this study was to study perinatal outcome:

- Intra uterine fetal death/still birth- antepartum or intrapartum
- Live births.
  - a. Birth weight
  - b. APGAR scores at 1 minute and 5 minutes
  - c. Early neonatal death <7 days of life
  - d. Neonatal 2D echocardiography report
  - e. Surgical intervention in newborn (immediate cardiac surgery).

## METHODS

A prospective, observational study conducted at our tertiary care centre after the approval by ethics committee. The study period was 2 years, from September 2015 to August 2017. Women who are registered at or referred to our hospital and are known cases of diabetes mellitus or diagnosed with gestational diabetes mellitus in pregnancy were included in the study, they were advised to undergo foetal echocardiography and were followed till term for their obstetric and perinatal outcome. By complete enumeration technique 80 participants were included in the study as was approved by institutional ethics committee.

### *Inclusion criteria*

- All diabetic women (GDM and DM) following up in ANC OPD or referred to our hospital irrespective of the, age of patient, parity status and gestational age.

### *Exclusion criteria*

- Pregnant women not willing to participate in the study

- Diabetic and GDM females opted for MTP
- Diabetic/GDM Females, who deliver outside our hospital
- Females with multiple systemic diseases along with Diabetes eg. heart disease (congenital heart disease), mSLE, maternal infections (TORCH).
- Females (diabetes and GDM) with abnormal foetal 2D echocardiography finding could not be confirmed post delivery:
  - a. Neonatal 2D echocardiography could not be done in live birth with antenatally documented abnormal foetal 2D echo report. (Either patient lost to follow up or went against medical advice)
  - b. Post mortem could not be done in still birth and IUFD or early neonatal death with antenatally documented abnormal foetal 2D echo report. (relatives didn't consent for post mortem examination).

### *The parameters to be studied*

- Age distribution
- Number of pregnant women with diabetes and gestational diabetes
- Gravidity and parity status
- Gestational age at the time of delivery
- Associated medical complications
- History of previous surgery in past
- HbA1C values
- Mode of delivery: vaginal/ assisted vaginal /cesarean
- Indications for caesarean section
- Sex of the child
- Weight of the child
- Fetal 2D echocardiography
- Neo-natal outcome/ neonatal 2D echo
- APGAR score at the end of 1 minute and 5 minutes
- Need for neonatal surgery
- Treatment received by mother.

### *Statistical analysis*

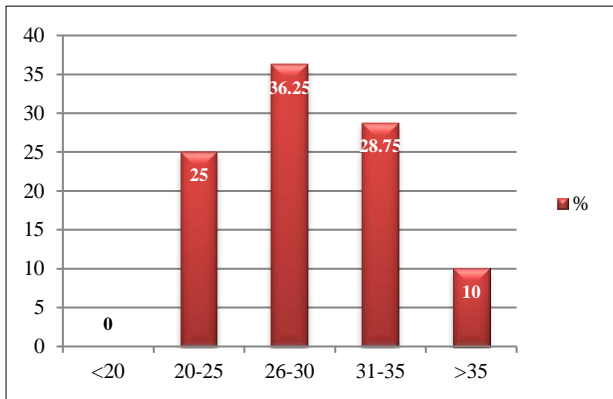
All the parameters were studied and analysed on the basis of percentages. As this was a purely observational study, the maternal and neonatal parameters were analysed using descriptive statistics i.e. percentages and proportions were calculated, and no statistical test was applied.

## RESULTS

In this study entitled "Observational study on fetal 2D echo in pregnant women with diabetes and gestational diabetes mellitus - A prospective study", 80 pregnant women with gestational diabetes or diabetes mellitus were included. These patients were followed up regularly with required antenatal care and delivered at our institution. Their gestational age at delivery was noted. Further the neonatal outcome was also considered in our

study. Multiple parameters were assessed, and the following analysis was done.

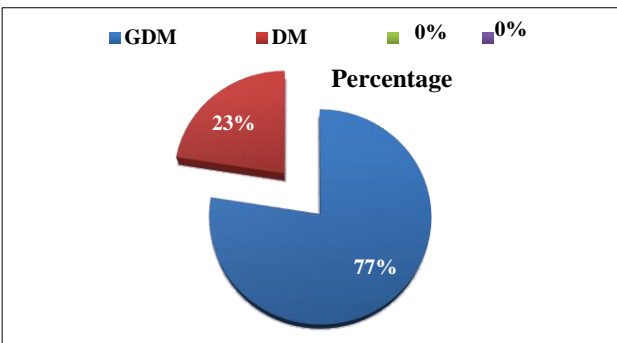
**Maternal demographic data**



**Figure 1: Age group distribution in study patients.**

The maximum number of patients in this study belong to age group of 26-30 years i.e. 36.25% (29) followed by age group 31-35 years i.e. 29% (23) followed by age group 20-25 years i.e. 25% (20) and 10% (8) were from age group >35 years. Mean age of the women included in the study was 29.08 years.

**Distribution of diabetic patients**



**Figure 2: Distribution on the basis of women with diabetes and gestational diabetes mellitus.**

As shown in the figure, 77% (62) of patients were diagnosed with Gestational diabetes mellitus and 23% (18) had overt diabetes mellitus.

**Table 1: Gravidity status of patients.**

Gravidity	Observation, n (%)
1	21 (26.25)
2	27 (33.75)
3	17 (21.25)
>/=4	15 (18.75)

Out of the total 80 patients, 21 were primigravida and 59 were multigravida enrolled in this study.

**Table 2: Gestational age at the time of delivery.**

Gestational age in weeks	Number of deliveries (n=80)
37-40	75 (94%)
<37	5 (6%)
>40	0

Only 5 patients had pre term delivery rest 75 patients had term delivery and none of the patients delivered after 40 weeks.

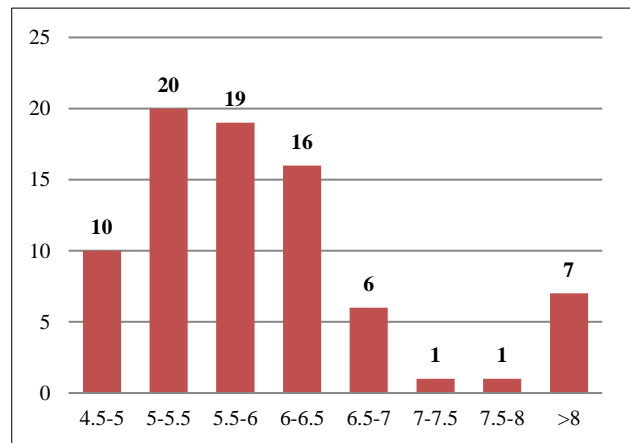
**Table 3: Hypertensive disorders in patients included in study.**

Gestational age in weeks	Number of deliveries (n=80)
Chronic hyper tension	1
Gestational hypertension/ preeclampsia	19
Normotensives	60

As seen in figure in this study of all patients 1 was known case of chronic hypertension, 19 patients had either gestational hypertension/ pre-eclampsia.

**Table 4: History of previous surgery in past.**

Type of surgery	No. of women (n)
Previous 1 LSCS	14 (17.5)
Previous 2 LSCS	5 (6.25)
Previous 3 LSCS	1 (1.25)
Hysterotomy	1 (1.25)
Myomectomy	1 (1.25)
No history of surgery in past	58 (72.5)



**Figure 3: HbA1C values.**

History of past surgery becomes important as it has an influence on mode of delivery in present pregnancy. Patients with previous 1 LSCS not willing for VBAC or with CPD (cephalo pelvic disproportion) underwent second LSCS. Patients with previous two or three LSCS

also underwent LSCS. Patients with history of hysterotomy or myomectomy in past were also taken up for LSCS, thereby adding to the number of patients with abdominal delivery. In our study 14 (17.5%) patients had history of previous 1 LSCS, 5 (6.25%) patients had history of previous 2 LSCS, 1 patient had history of previous 3 LSCS (1.25%), 1 (1.25%) patient had history of hysterotomy in past and 1(1.25%) patient had history of myomectomy.

In the patients included in the study average FBS 122.8 mg/dl and PLBS 175.9 mg/dl, and average HBA1C is 5.89.

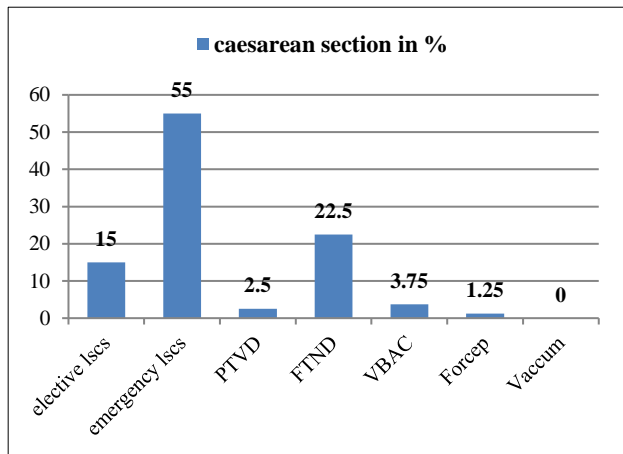


Figure 4: Mode of delivery.

Caesarean section was required in 70% patients whereas only 30% had vaginal delivery.

Table 5: Indications for LSCS.

Indication	Number (n=56)
Foetal distress	16
Previous two LSCS in labour	5
Previous hysterotomy/ myomectomy	2
Non reassuring IPM	10
Previous LSCS not willing for VBAC	5
Cephalo pelvic disproportion	4
Malpresentation (Breech / transverse lie)	3 (2/1)
Failure of induction	3
Abruption placentae	1
Doppler changes	3
Deep transverse arrest	2
Scar tenderness	1
Severe IUGR	1

Fetal distress was the commonest indication followed by non-reassuring IPM.

The 32 babies had birth weight between 2.5 to 3 kg followed by 22 babies had birth weight between 3 to 3.5

kg, 13 were between 2-2.5 kg, 8 babies had weight >3.5 kg, average baby weight in the study- 2.87 kg.

Table 6: Gender of the child.

	Number
Male	45(56%)
Female	35(44%)
Ambiguous	0

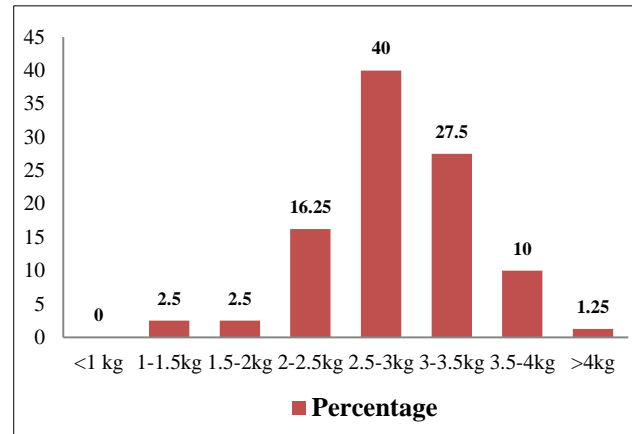


Figure 5: Weight of the baby born.

Table 7: Fetal 2D echocardiography.

Fetal 2D echocardiography	Number
Normal 2D echo	77
Abnormal 2D echo	3

- 1 of the fetal 2D echo report was suggestive of TAPVC
- 1 report suggestive of enlarged right atrium
- 1 report suggestive of VSD.

The 3 fetuses had an abnormal 2D Echo report.

Table 8: Neonatal 2D echocardiography report.

Fetal 2D echo report	Number
Normal	77
Abnormal	3

- Two abnormal foetal 2D echocardiography report were confirmed with neonatal 2D echo as a case of TAPVC and VSD.
- One baby with Normal foetal 2D echo had ASD diagnosed on neonatal 2D echo
- The baby with antenatally diagnosed enlarged right atrium was found to have normal neonatal 2D echo.

None of the babies needed immediate surgery and were advised to have follow up after 6 weeks.

There was no neonatal morbidity or mortality.

**Table 9: Apgar of baby at 1 minute and 5 minutes.**

Apgar score	1 minute	5 minutes
<6/10	0	0
6/10-9/10	1	0
9/10	79	80

**Table 10: Treatment received by pregnant women.**

Treatment received	Number (n)
GDM diet	33 (41%)
GDM diet with T Metformin	24 (30%)
GDM diet with T Metformin with Inj. Insulin	23 (29%)

## DISCUSSION

In the present study 80 women with diagnosis of DM or GDM were included. All of them underwent foetal 2D echocardiography and followed for their maternal and perinatal outcome. In our study, 23% patients had pre-gestational diabetes mellitus and 77% had gestational diabetes mellitus.

In our study, maximum number of women with GDM/DM belong to age group of 26-30 years which is same as study by Nilofer et al, seven out of nine patients with GDM were above the age of 303. Similarly, in the study by Kalra et al in Rajasthan compared with non GDM, GDM patients were older.<sup>4</sup>

In present study, the incidence of GDM was higher among multigravida (73.75%) compared to primigravida (26.25%) which was also similar to the study done by Nanda et al where the incidence of GDM was among multigravida was 69.23% as compared to primigravida 30.79%. Also, in the study by Kalyani et al and Sharma et al and Seshiah et al the prevalence of GDM increased with the parity.<sup>5</sup>

In this study, 6% patients had preterm delivery (<36 weeks). According to a study conducted by Jacobson John et al the incidence of SGA fetuses to be to 13% in the GDM group and 32% in the non GDM group.<sup>6</sup> This was not statistically significant. In the same study, it was seen that majority of the patients in the GDM group 90.3% were controlled on diet and did not require any medications. In our study 41% women had SMBG in normal range on GDM diet, 30% women took oral hypoglycemic 29% of women had control of blood sugars on injection insulin.

Some researchers have been trying to find the clear relation between PIH and GDM though in our study 23.75% of women had associated hypertensive disorder of pregnancy and 1 woman was known hypertensive.

A study conducted by Bryson CL et al, in 1992-1998 in Washington state to assess the relation between

gestational diabetes and pregnancy induced hypertension (n=62,982) by using a birth events records database (BERD).<sup>7</sup> It shows after adjustment for confounders, 1.5 times greater risk for developing serious disorders among gestational diabetics and both ethnicity and prenatal care modify the association between GDM and PIH.

Another study was performed in association between PIH and GDM in Columbia University, New York (NY), USA on basis of birth certificate data during 2001-2006. To evaluate crude and adjusted OR (odds ratio) of GDM, logistic regression was used among all ethnic groups. The adjusted OR ranged from 1.4-2.9 for PIH. Overall, ethnic variations were seen.

In Latin America, a large population-based study (n=878,680) was conducted by using a birth event records database (BERD) resulted that association between preeclampsia and GDM (relative risk=1.93, 95 percent CI: 1.66, 2.25) with no ethnicity and body mass index accounted in this study.<sup>8</sup>

Another prospective study of women for calcium supplementation trial to prevent pre-eclampsia showed that GDM have an increased risk of preeclampsia (OR=1.67, 95 percent CI: 0.92, 3.05) (Joffe et al).<sup>9</sup>

Another study in France including 15 maternity units has shown to have an association between GDM and almost all forms of PIH suggesting a direct relationship between the two. (OR=2.86, 95% CI: 1.05, 7.83).<sup>10</sup>

In our study, majority (70%) of women underwent caesarean section of which 55% were emergency LSCS and 15% were elective LSCS, 25% women had normal delivery 2.5% of these were preterm normal deliveries. 3.75% had vaginal birth after caesarean section (VBAC) and 1 women had forceps assisted delivery. In a study by Kalyani et al, it was noted that incidence of 56% LSCS in GDM group and 31.27% in non GDM group.<sup>5</sup> There were no still births and IUFD in the present study.

Maximum babies born were in range of 2.5 to 3 kg which is similar to studies conducted.

In our study, 3 out of 80 women had abnormal fetal 2D echo report. 1 was suggestive if VSD, 1 was ASD and 1 TAPVC. The incidence of congenital heart disease is estimated to be 4 to 8 per 1000 live births.<sup>11</sup> It was reported that the rate of major congenital anomalies was 2.9% (35.2% cardiovascular) compared to 8.9% in women with type 2 diabetes during the same period. Diabetes mellitus (types 1 and 2) is a known risk factor for defects of the cardiovascular, central nervous, and musculoskeletal systems. In a study covering more than 1.2 million Swedish births from 1987 to 1997, the total malformation rate was 9.5% in patients with preexisting diabetes, whereas the rate of congenital malformations in patients with gestational diabetes ( $\approx$ 5.7%) was similar to the population rate.<sup>12</sup> Clinical trial data suggest that the

disturbed glucose metabolism that occurs during embryogenesis is the main determining factor for the risk of fetal anomalies in pregnancies complicated by diabetes.<sup>13</sup> On the other hand, fetuses of diabetic mothers, both types 1 and 2, are known to have congenital heart defects along with anomalies of the central nervous and musculoskeletal systems.

## CONCLUSION

Incidence of DM/ GDM is increasing due to multiple factors like changed life style, increased stress, high BMI, familial predisposition. It's more common in urban population. Good obstetric and perinatal outcome needs a committed patient and team effort from an obstetrician, a dietician a diabetologist and a neonatologist. Early detection helps in preventing both maternal and fetal complications. As baby is likely to have congenital anomalies, out of which cardiac anomalies are most common hence fetal echocardiography is a well-established, accurate, and safe method for diagnosing congenital heart disease. These patients are more prone to develop pre-eclampsia or gestational hypertension due to hyperglycaemia. Their babies are also likely to become macrosomic, hence timely termination of pregnancy is needed to avoid complications. All the babies with abnormal fetal echocardiography need post-natal confirmation. Moreover, large population-based studies are required to establish the absolute risk of congenital heart defects in patients with gestational diabetes and the utility of routine screening.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Sikarwar R, Hatkar PA. Study of fetal 2D echo in pregnant women with diabetes and gestational diabetes mellitus. *Int J Reprod Contracept Obstet Gynecol* 2019;8:4213-8.