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Original Research Article

## Association of oral glucose tolerance test and pregnancy and fetal outcome

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### ABSTRACT

**Background:** Gestational diabetes mellitus (GDM) affects 2-25% of pregnancies depending on population characteristics and criteria used. It is associated with an increased risk of fetal malformation and perinatal mortality. The aim of the study was to know the prevalence of GDM, the risk factors associated with women with GDM and the fetomaternal outcome.

**Methods:** A prospective study conducted among 200 antenatal women attending Obstetrics and Gynaecology (OBG) Outpatient Department in A. J. Institute of Medical Sciences and Research Center from March 2019 to August 2019. GDM was diagnosed with 2-hour 75 gm oral glucose tolerance test according to diabetes in pregnancy study group of India (DIPSI) criteria. Basic demographic details and maternal and fetal outcomes were analysed.

**Results:** The prevalence of GDM was high (24.5%) compared to other studies. Normoglycemia was achieved with diet alone in 71.5%, diet and metformin in 16.3% and 12.2% with insulin. Risk factors included higher body mass index (BMI) and history of GDM. Emergency caesarean rate was higher among GDM women ( $p < 0.05$ ). Fetal complications and neonatal intensive care unit (NICU) admissions were also higher in this group ( $p < 0.001$  and  $p < 0.05$ ).

**Conclusions:** The higher prevalence shows the importance of early detection and timely intervention for pregnancy complicated with GDM. Due to this high-risk pregnancy, there's increased incidence of maternal and fetal outcomes which can be reduced with glycaemic control and adequate fetal surveillance.

**Keywords:** Gestational diabetes mellitus, Prevalence, Fetomaternal outcome, Oral glucose tolerance test, Glycaemic control

### INTRODUCTION

Gestational diabetes mellitus (GDM), defined as diabetes detected at any time in pregnancy excluding overt diabetes, affects 2-25% of pregnancies depending on population characteristics and criteria used.<sup>1,2</sup> Incidence of GDM is increasing due to lack of exercise and changing dietary habits. The disturbed carbohydrate metabolism creates maternal complications like abortions, pregnancy induced hypertension (PIH), polyhydramnios, preterm labour, fetal growth restriction (FGR) recurrent urinary infections (UTI) increased incidence of operative delivery

and maternal morbidity.<sup>3,4</sup> Pregnancies affected by GDM that are not adequately managed are consequently at risk of adverse neonatal outcomes, both immediately - shoulder dystocia, birth trauma, including birth hypoxic injuries, and neonatal hypoglycaemia and in the longer term - metabolic dysregulation in later childhood.<sup>5</sup> So, it is important rule out GDM in all pregnancies. If selective screening of high-risk group alone is done, many cases may be missed.

Hence, this study is aimed to find the prevalence of GDM in a tertiary care hospital, to determine the oral glucose

tolerance test (OGTT) value, and association of GDM and outcome of the glycaemic control with maternal and perinatal outcome.

## METHODS

The study was conducted in A. J. Institute of Medical Sciences and Research Center, Mangalore. It was a prospective study conducted between March 2019 and August 2019. It included 200 antenatal women attending the Obstetrics and Gynaecology (OBG) outpatient department (OPD) during this time. After obtaining the approval of the Institutional Ethics Committee, patients were taken to be part of the study based on the inclusion and exclusion criteria.

### Inclusion criteria

Singleton pregnancy, age >18 and <35 years, cephalic presentation were included.

### Exclusion criteria

Overt diabetes, abnormal presentation, medical disorders such as hypertension and hypothyroidism, multiple pregnancies were excluded.

### Method of study

All pregnant women attending the OPD at any period of their pregnancy were counselled and informed consent were taken. The principle of “universal screening” was adopted and the pregnant women underwent blood glucose test on the first prenatal visit, irrespective of the risk factors. The “Diabetes in pregnancy study group of India (DIPSI)” method was adopted. The DIPSI method is a one-step procedure: to take 75 gm glucose dissolved in 250 ml of water. Venous plasma glucose was estimated after 2 hours of glucose ingestion. A 2-hour plasma glucose with a cut off of  $\geq 140$  mg/dl was taken as diagnostic of GDM. Patients with abnormal OGTT value were investigated further for their fasting blood sugar (FBS) and post prandial blood sugar (PPBS) levels. If FBS and PPBS were normal, the patient was labelled as GDM on diet. In addition to the above, basic demographic details, patient characteristics, co-morbidities, maternal complications during pregnancy were noted.

The fetal well-being was assessed throughout pregnancy through various methods such as maternal weight gain, serial ultrasound scans, non-stress test (NST), and daily foetal movement count chart (DFMC). Doppler ultrasound was done only in selected cases. Earlier admission was done if there is any maternal or fetal compromise. Uncomplicated cases were allowed to go into spontaneous labour or wait till date. Termination was done early only in poorly controlled GDM and at times of fetal distress.

The mode of delivery, indications of caesarean and postpartum complications were noted along with neonatal

outcomes such as macrosomia, hypoglycaemia, respiratory distress syndrome, seizures, anomaly, stillbirth, and intrauterine device (IUD).

### Statistical analysis

Statistical analysis was performed using the chi-square test and Fisher's exact test. P values <0.05 were regarded as statistically significant.

## RESULTS

Out of the 200 participants included in this study, 49 (24.5%) were found to have 2-hour OGTT more than 140 mg/dl and were termed GDM according to DIPSI criteria. 34% of the participants belonged to the age group 26-30 years. A total of 97 women were primigravida, while 103 women were multigravida. Majority of the women (55.5%) had normal pre-pregnancy BMI and only 6% had history of GDM in previous pregnancy (Table 1).

**Table 1: Baseline characteristics (n=200).**

Characteristics	Number	Percentage (%)
<b>Age in years</b>		
<20	1	0.5
21-25	58	29
26-30	68	34
31-35	64	32
>36	9	4.5
<b>Parity</b>		
1	97	48.5
2	80	40
>3	23	11.5
<b>Pre-pregnancy BMI (kg/m<sup>2</sup>)</b>		
Underweight (<18.5)	28	14
Normal (18.5-22.9)	111	55.5
Overweight (23-24.9)	55	27.5
Obese (>25)	6	3
<b>Family history of diabetes mellitus</b>		
Yes	28	14
No	172	86
<b>History of GDM in previous pregnancy</b>		
Yes	12	6
No	188	94
<b>Gestational age at delivery (weeks)</b>		
<34	4	2
35-36	13	6.5
37-38	111	55.5
>39	72	36

Normoglycemia was achieved with diet alone in 35 (71.5%), diet plus metformin in 8 (16.3%), and diet plus insulin in 6 (12.2%) (Table 2). For the 49 patients with GDM, FBS and PPBS were done, and 61.2% were found to have higher FBS (>95 mg/dl) and only 53% had higher PPBS (>120 mg/dl).

**Table 2: Distribution of GDM and glycaemic control.**

Distribution	Number	Percentage (%)
<b>Development of GDM</b>		
Yes	49	24.5
No	151	75.5
<b>On treatment</b>		
On diet	35	71.5
On metformin	8	16.3
On insulin	6	12.2
<b>Fasting blood sugar</b>		
<95	19	38.8
96-119	20	40.8
≥120	10	20.4
<b>Postprandial blood sugar</b>		
<120	23	46.9
121-159	19	38.8
160-199	5	10.2
≥120	2	4.1

**Table 3: Distribution according to delivery and birth weight.**

Distribution	Number	Percentage (%)
<b>Mode of delivery</b>		
Normal vaginal	94	47
Induced	22	11
Elective LSCS	40	20
Emergency LSCS	44	22
<b>Indication for LSCS</b>		
PROM	11	13.1
Cephalo-pelvic disproportion	8	9.5
Deep transverse arrest	3	3.6
Failed induction	2	2.4
Fetal distress	15	17.8
Maternal request	4	4.8
Previous LSCS	29	34.5
Non-progression of labour	12	14.3
<b>Birth weight (kg)</b>		
≤2.4	30	15
2.5-2.9	67	33.5
3-3.9	100	50
≥4	3	1.5

No maternal complications were found in 24.5% of cases. Common obstetrical complications seen in this study were polyhydramnios in 8 cases, UTI in 10, premature rupture of membranes (PROM) in 15, IUD in 1, macrosomia in 1 and IUGR in 2 (Table 4). Regarding duration of pregnancy, 17 women delivered preterm and 183 delivered at term. No patients delivered past 40 weeks. Termination of pregnancy was either spontaneous, as in 47% of women, or terminated based on hospital protocols either by induction (11%), or caesarean section (44%). Patients who

underwent emergency lower segment caesarean section (LSCS) due to either maternal or fetal indications as mentioned in Table 3. 50% of the babies were weighing between 3 and 3.9 kg at birth. Three mothers delivered a baby of birth weight ≥4 kg by elective LSCS, and one among them belonged the GDM group. Concerning perinatal outcome in patients with GDM, 32.2% of the neonates had no complications. Most common complication was tachypnoea seen in 24.5% of babies, followed by respiratory distress syndrome (20%), and jaundice (14.2%). One of the babies had cardiac anomaly (ASD) and no neonatal deaths were noted in our study (Table 4).

**Table 4: Distribution according to maternal and fetal complications.**

Distribution	Number (49)	Percentage (%)
<b>Maternal complications</b>		
None	12	24.5
Polyhydramnios	8	16.3
UTI	10	20
PROM	15	30.1
IUD	1	2.5
Macrosomia	1	2.5
IUGR	2	4.1
<b>Fetal complications</b>		
None	16	32.2
Fetal anomaly	1	2.5
Hypoglycemia	2	4.1
Respiratory distress syndrome	10	20
Tachypnoea	12	24.5
Neonatal death	0	0
Large for gestational age	1	2.5
Jaundice	7	14.2

**Table 5: Comparison of GDM with risk factors and fetomaternal complications.**

Risk factors/complications	Patients with GDM (49)	Percentage (%)	P value
<b>Higher BMI (overweight and obese)</b>	24	49	<0.01
<b>Family history of DM</b>	9	18.4	>0.05
<b>History of GDM in previous pregnancy</b>	8	16.3	<0.01
<b>Emergency LSCS</b>	20	41	<0.05
<b>Birth weight &gt;4 kg</b>	1	2	>0.05
<b>Fetal complications</b>	33	67.3	<0.001
<b>NICU admissions</b>	17	34.7	<0.05

When comparing the risk factors among the study group, those who were overweight and obese ( $p < 0.01$ ), and who had history of GDM in previous pregnancy ( $p < 0.01$ ) had higher chances of developing GDM in the present pregnancy. Family history of diabetes mellitus had no association with GDM in this pregnancy ( $p > 0.05$ ). Women with abnormal OGTT had higher chances of undergoing emergency LSCS ( $p < 0.05$ ), fetal complications ( $p < 0.001$ ) and need for NICU admissions ( $p < 0.05$ ) than the ones with normal OGTT. Since only one woman out of 49 delivered a baby of birth weight  $> 4$  kg, we did not find any significant ( $p > 0.05$ ) relation between abnormal OGTT levels and birth weight of the baby (Table 5).

## DISCUSSION

GDM constitutes a metabolically distinct entity with clearly defined associated perinatal and maternal morbidities and hence need timely diagnosis and management. In this study, we performed a universal screening method with 2-hour oral glucose tolerance test with 75 gm of glucose for detecting GDM.

The main aim of the study was to know the prevalence of GDM in women attending our tertiary care hospital, association of one abnormal OGTT value and development of GDM, and maternal and perinatal outcomes in these patients.

A 24.5% incidence of gestational diabetes was found in our study, which was higher than that of other studies and global incidence.<sup>6</sup> Risk factors such as previous GDM and BMI  $> 23$  kg/m<sup>2</sup> are recommended to receive early screening before 24 weeks according to guidelines followed in Australia.<sup>7</sup> Early screening helped in detection of GDM in early stage of pregnancy and earlier opportunity for achieving normoglycemia, minimizing the adverse outcomes. The patients attending our OPD were screened for GDM, irrespective of the high-risk factors. Our study found significant correlation among overweight and obese patients and development of GDM. Kim et al concluded that GDM prevalence rates increase by BMI category, 2.3% in overweight, 4.8% in obese and 11.5% in extremely obese women.<sup>8</sup> Patients with history of GDM in previous pregnancy is the other important predictor of adverse outcome in present pregnancy, which was similarly seen in various other studies. However, family history of diabetes mellitus showed did not show any adverse outcome in this present study, though a meta-analysis comparing these two factors revealed a positive correlation.<sup>9</sup>

Among 49 women with GDM, almost 70% of them were euglycemic through diet and lifestyle modification alone, however 16% were started on metformin and 12% on insulin. Society of maternal-fetal medicine stated that many women can achieve euglycemia with just nutritional therapy alone, but up to 30 percent will require drug therapy.<sup>10</sup>

We found that the women diagnosed with GDM underwent emergency caesarean section more than the ones without any co-morbidities. The most common indication seen in this study was fetal distress, followed by non-progression of labour. In contrast, a study conducted by Roman et al, stating their leading cause was failed induction among the pre-GDM as well as GDM group.<sup>11</sup>

A study conducted in Punjab by Alia et al analysed the foeto-maternal complications among GDM and overt DM group of women, and concluded that vaginal candidiasis (43%), preterm labour (23%), UTI (23%), polyhydramnios (17%) and preterm rupture of membranes (10%), in descending order. Similar incidence was noted in our study, with PROM in 30%, UTIs in 20% followed by polyhydramnios in 16%. IUGR was seen in 2 patients with GDM in our study, with similar low incidence of 7% in Punjab study.<sup>12</sup>

Shefali et al studied the effect of diabetes on pregnancy outcomes, comparing pre GDM (PGDM; 79 women) and GDM (146 women) with non-diabetic mothers.<sup>13</sup> They observed that abortions and low birth weight ( $< 2500$  gm) were more common in the PGDM group than the GDM group.

Macrosomia, neonatal hypoglycemia, hyperbilirubinemia, shoulder dystocia, birth trauma and stillbirth could be the neonatal complications of women with GDM.<sup>14,15</sup> However, tachypnoea and respiratory distress syndrome were the two most common complications faced in our study. Though we experienced no neonatal deaths, one case of cardiac anomaly was noted. Garne et al reported that multiple congenital anomalies were present in 13.6% of diabetes cases and 6.1% of non-diabetes cases.<sup>16</sup> Parimi and Nitsch demonstrated that offspring born to mothers with any form of diabetes in pregnancy had 50% increased risk of congenital anomalies of the kidney and the urinary tract (CAKUT).<sup>17</sup>

Alia et al reported increased incidence of hypoglycemia and macrosomia in women with GDM, but our study showed only 2 neonates with hypoglycemia and only one with birth weight of  $> 4$  kg.<sup>12</sup>

Limitations of this study included, small sample size and lack of follow up of these females to see if any developed type 2 diabetes mellitus.

## CONCLUSION

The prevalence of GDM was 24.5% in our study which is slightly higher than other parts of India. The occurrence of GDM is a high-risk situation, with higher incidence of maternal and fetal adverse outcomes. All pregnant women should be screened with one step 75 gm oral glucose tolerance test for early detection and to prevent adverse outcomes by intervening on time. Those with abnormal value, should undergo further testing with FBS and PPBS. As we have seen, several factors play a role as risk factors

for development of GDM in pregnancy, including high BMI and history of GDM in previous pregnancy. Hence early detection and tackling of these factors prior conception may play a vital role. Proper glycaemic control during pregnancy through either diet alone or anti-diabetic drugs and insulin, reduces maternal and perinatal complications. Intensive sugar control, fetal surveillance, timely delivery, and intensive neonatal care play a dynamic role. Infections, polyhydramnios, and PROM were the common maternal complications. Fetal complications include tachypnoea, respiratory distress syndrome and jaundice being the most common causes. Hence, team effort by obstetricians, endocrinologists and neonatologist is required to manage GDM effectively.

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