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# Incidence and maternal-neonatal outcomes in gestational diabetes mellitus

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### Abstract:

Gestational diabetes mellitus (GDM) is a common metabolic disorder of pregnancy and a major public health concern because of its adverse effects on both maternal and neonatal outcomes. This prospective observational study was conducted in the obstetrics department of a tertiary care hospital among 200 antenatal women to determine the incidence of GDM and assess its impact on fetomaternal outcomes. All participants were screened at 24–28 weeks of gestation using the oral glucose tolerance test according to standard diagnostic criteria and outcomes were compared between women with GDM and those without GDM. The study focused on complications such as pregnancy-induced hypertension, cesarean delivery, polyhydramnios, macrosomia, neonatal hypoglycaemia, respiratory distress syndrome and NICU admission. Thus, we show the value of universal screening and early intervention in improving maternal and neonatal outcomes in pregnancies complicated by GDM.

**Keywords:** Gestational diabetes mellitus (GDM), pregnancy, maternal outcome, neonatal outcome, macrosomia, cesarean section, neonatal hypoglycaemia

### Background:

With the rapid urbanization, lifestyle changes, obesity, late age at childbirth and the rising prevalence of type 2 diabetes mellitus in women of reproductive age, the prevalence of GDM has increased significantly over the past decade in the world [1]. The International Diabetes Federation reports that almost 1 in 6 live births are impacted by hyperglycemia during pregnancy and that most of these cases are due to GDM [2]. India has become the diabetes capital of the world and the burden of GDM is also on the rise among Indian women [3]. GDM is a condition that occurs when the insulin resistance of pregnancy hormones like human placental lactogen, progesterone, cortisol and prolactin cannot be compensated by the pancreatic  $\beta$ -cell function, which is genetically more susceptible in Asian Indian women with a prevalence of 4% to 27% depending on ethnicity, diagnostic criteria, geographic region and screening methods [4]. GDM has significant implications for mother and fetus. GDM is also a risk factor for women to develop type 2 diabetes mellitus, metabolic syndrome, and cardiovascular diseases later in life and also for GDM to recur in subsequent pregnancies [5]. Another significant risk of pregnancies with GDM is fetal and neonatal complications [6]. Fetal outcomes of GDM include macrosomia, shoulder dystocia, birth trauma, neonatal hypoglycaemia, respiratory distress syndrome, neonatal jaundice, hypocalcaemia and admission to the neonatal intensive care unit (NICU) in the long term, there is an increased risk of obesity, impaired glucose tolerance and type 2 diabetes mellitus in adolescence and adulthood [7, 8]. Minimizing adverse pregnancy outcomes is an important role of early diagnosis and effective glycemic control [9]. Several organizations recommend universal screening for GDM at 24 to 28 weeks of gestation, as many women with GDM are asymptomatic [10]. There are different screening criteria used around the world such as the WHO, DIPSI, Carpenter-Coustan and IADPSG criteria, which results in varying prevalence figures [11]. The Diabetes in Pregnancy Study Group India (DIPSI) has suggested a one-step Oral Glucose Tolerance Test (OGTT) for the practical implementation of screening in resource-limited settings in India [12]. The mainstay of GDM management is lifestyle modification which involves dietary

counselling, physical activity and monitoring of blood glucose levels. Insulin therapy is started when glycemic goals are not met with medical nutrition therapy. Good antenatal monitoring and timely obstetric interventions can substantially decrease the morbidity and mortality of mothers and babies [13]. Although screening and treatment have improved, GDM remains a major problem in developing countries due to lack of awareness, low utilization of antenatal care, lack of standardized screening and limited health care resources. Thus, it is important to identify high-risk mothers and to understand the impact of GDM on pregnancy outcomes to plan preventive and therapeutic strategies. Therefore, it is of interest to find the prevalence of GDM among antenatal women attending tertiary care center and to assess the impact of GDM on maternal and neonatal outcome.

### Materials and Methodology:

#### Study design:

The present study was a hospital-based prospective observational study conducted in the Department of Obstetrics and Gynecology at a tertiary care teaching hospital.

#### Study duration:

The study was conducted over a period of 18 months from January 2024 to June 2025.

#### Study population:

Pregnant women attending the antenatal outpatient department and admitted to the obstetrics ward during the study period were included in the study.

#### Sample size:

A total of 200 antenatal women fulfilling the inclusion criteria were enrolled in the study.

#### Inclusion criteria:

- [1] Pregnant women aged 18–40 years
- [2] Singleton pregnancy
- [3] Gestational age between 24–28 weeks
- [4] Women willing to participate and provide informed consent

**Exclusion criteria:**

- [1] Known cases of pregestational diabetes mellitus
- [2] Multiple pregnancies
- [3] Chronic hypertension
- [4] Renal disorders
- [5] Thyroid disorders
- [6] Chronic systemic illnesses
- [7] Women on corticosteroid therapy

**Data collection procedure:**

Detailed history regarding maternal age, parity, socioeconomic status and body mass index, family history of diabetes, previous obstetric history and personal medical history was obtained using a predesigned proforma. General physical examination and obstetric examination were performed for all participants. All enrolled women underwent screening for GDM between 24 and 28 weeks of gestation using a 75 g Oral Glucose Tolerance Test (OGTT). Venous blood samples were collected two hours after oral glucose administration. Diagnosis of GDM was established according to standard diagnostic criteria. Participants diagnosed with GDM were managed with medical nutrition therapy, lifestyle modification, and blood glucose monitoring and insulin therapy whenever indicated. All women were followed until delivery.

**Maternal outcome measures:**

The following maternal outcomes were assessed:

- [1] Pregnancy-induced hypertension
- [2] Polyhydramnios
- [3] Preterm labor
- [4] Mode of delivery
- [5] Cesarean section rate
- [6] Postpartum hemorrhage
- [7] Maternal infections

**Neonatal outcome measures:**

The following neonatal outcomes were evaluated:

- [1] Birth weight
- [2] Macrosomia
- [3] Neonatal hypoglycemia
- [4] Respiratory distress syndrome
- [5] Hyperbilirubinemia
- [6] NICU admission
- [7] Perinatal mortality

**Statistical analysis:**

Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software version 25. Quantitative variables were expressed as mean  $\pm$  standard deviation, while qualitative variables were expressed as percentages and proportions. Chi-square test and Student's t-test were used for comparison between groups. A p-value less than 0.05 were considered statistically significant.

**Results:**

A total of 200 antenatal women between 24 and 28 weeks of gestation were included in the present study. All participants

underwent screening for Gestational Diabetes Mellitus (GDM) using a 75 g Oral Glucose Tolerance Test. Among the enrolled women, 32 were diagnosed with GDM, giving an overall incidence of 16%. The remaining 168 women constituted the non-GDM group. Maternal and neonatal outcomes were compared between the two groups. The majority of women with GDM belonged to the age group above 30 years. Increased body mass index, multi gravidity, family history of diabetes mellitus and previous history of adverse obstetric outcomes were more commonly observed among women diagnosed with GDM. The incidence of GDM increased progressively with maternal age and body mass index. Statistical analysis showed a significant association between advanced maternal age and occurrence of GDM ( $p < 0.05$ ). The mean maternal age was significantly higher in the GDM group compared to the non-GDM group ( $30.8 \pm 4.2$  years vs  $25.9 \pm 3.8$  years;  $p = 0.001$ ). Obesity was more prevalent among women with GDM, with 62.5% having BMI greater than  $25 \text{ kg/m}^2$  compared to 30.9% in the non-GDM group. A positive family history of diabetes mellitus was observed in 56.2% of GDM patients, indicating a strong hereditary predisposition. Multi gravidity and previous adverse obstetric history were also significantly associated with GDM. These findings suggest that maternal age, obesity and genetic susceptibility are important risk factors for development of gestational diabetes mellitus (**Table 1**). Maternal complications were significantly more common among women diagnosed with GDM. Pregnancy-induced hypertension was observed in 25% of GDM mothers compared to 8.3% among non-GDM mothers. Polyhydramnios and preterm labor were also more frequent in the GDM group. Cesarean section rate was considerably higher among women with GDM due to fetal macrosomia, cephalopelvic disproportion and obstetric complications. Pregnancy-induced hypertension was significantly higher among women with GDM (25%) compared to non-GDM women (8.3%), demonstrating the impact of hyperglycemia on vascular and endothelial function during pregnancy. Polyhydramnios was also significantly associated with GDM due to fetal hyperglycaemias and osmotic diuresis. Cesarean section was performed in 59.3% of GDM mothers compared to 34.5% in non-GDM mothers, which was statistically significant ( $p = 0.011$ ). Although preterm labor and postpartum hemorrhage were more common among women with GDM, the differences were not statistically significant. Overall, maternal morbidity was considerably higher among pregnancies complicated by gestational diabetes mellitus (**Table 2**). Neonatal complications were also more prevalent among infants born to mothers with GDM. Macrosomia was the most common neonatal complication and was significantly associated with maternal hyperglycemia. Neonatal hypoglycaemia, respiratory distress syndrome, hyperbilirubinemia and NICU admissions were higher among neonates born to GDM mothers. Macrosomia was observed in 28.1% of neonates born to mothers with GDM compared to only 6.5% among non-GDM pregnancies, showing a highly significant association ( $p = 0.001$ ). Neonatal hypoglycaemia was significantly more common in the GDM group due to persistent fetal hyperinsulinemia after delivery. Respiratory distress syndrome was observed in 15.6%

of neonates in the GDM group, which was significantly higher than the non-GDM group. NICU admissions were required in 31.2% of neonates born to GDM mothers compared to 11.9% in the non-GDM group. These findings indicate that GDM significantly increases neonatal morbidity and need for specialized neonatal care (**Table 3**). Overall, the present study demonstrated that gestational diabetes mellitus adversely affects both maternal and neonatal outcomes. Women with GDM had significantly higher rates of pregnancy-induced hypertension, cesarean delivery and polyhydramnios, while neonates born to GDM mothers experienced higher rates of macrosomia, neonatal hypoglycemia, and respiratory distress syndrome and NICU admissions. Early diagnosis, strict glycemic control and appropriate antenatal surveillance may reduce these adverse outcomes and improve fetomaternal prognosis.

Table 1: Demographic and Obstetric Characteristics of Study Participants

| Variables                      | GDM (n=32) | Non-GDM (n=168) | p-value |
|--------------------------------|------------|-----------------|---------|
| Mean maternal age (years)      | 30.8 ± 4.2 | 25.9 ± 3.8      | 0.001   |
| BMI >25 kg/m <sup>2</sup>      | 20 (62.5%) | 52 (30.9%)      | 0.002   |
| Multigravida                   | 22 (68.7%) | 88 (52.4%)      | 0.041   |
| Family history of diabetes     | 18 (56.2%) | 39 (23.2%)      | 0.001   |
| Previous bad obstetric history | 10 (31.2%) | 24 (14.2%)      | 0.028   |

Table 2: Maternal Outcomes among Study Participants

| Maternal Outcomes              | GDM (n=32) | Non-GDM (n=168) | p-value |
|--------------------------------|------------|-----------------|---------|
| Pregnancy-induced hypertension | 8 (25%)    | 14 (8.3%)       | 0.008   |
| Polyhydramnios                 | 5 (15.6%)  | 7 (4.1%)        | 0.019   |
| Preterm labor                  | 6 (18.7%)  | 15 (8.9%)       | 0.091   |
| Cesarean section               | 19 (59.3%) | 58 (34.5%)      | 0.011   |
| Postpartum hemorrhage          | 3 (9.3%)   | 8 (4.7%)        | 0.292   |

Table 3: Neonatal Outcomes among Study Participants

| Neonatal Outcomes             | GDM (n=32) | Non-GDM (n=168) | p-value |
|-------------------------------|------------|-----------------|---------|
| Macrosomia (>4 kg)            | 9 (28.1%)  | 11 (6.5%)       | 0.001   |
| Neonatal hypoglycemia         | 7 (21.8%)  | 9 (5.3%)        | 0.003   |
| Respiratory distress syndrome | 5 (15.6%)  | 8 (4.7%)        | 0.026   |
| Hyperbilirubinemia            | 6 (18.7%)  | 18 (10.7%)      | 0.214   |
| NICU admission                | 10 (31.2%) | 20 (11.9%)      | 0.007   |

Discussion:

Gestational Diabetes Mellitus (GDM) has emerged as one of the most important metabolic disorders complicating pregnancy worldwide. In the present study, the incidence of GDM was 16% among the antenatal women who attended the tertiary care hospital. This is in line with recent Indian and international studies which have reported prevalence rates ranging from 10% to 20% depending on the population characteristics and diagnostic criteria employed [2]. A recent systematic review in India reported a pooled GDM prevalence of around 15%, highlighting the increasing burden of hyperglycemia in pregnancy in the Indian population [3]. In the present study, advanced maternal age was significantly related to GDM. The mean age of women diagnosed with GDM was 30.8 years while that of women without GDM was 25.9 years. Increasing maternal age was also a significant risk factor reported by D'Souza *et al.*, as insulin resistance and reduced pancreatic β-cell reserve increases with age [4]. Over 60% of women with GDM

had a BMI greater than 25 kg/m<sup>2</sup>, which was also a significant risk factor identified. Maternal obesity is associated with chronic low-grade inflammation and glucose intolerance, which makes them more vulnerable to gestational diabetes [5]. In the current study, family history of diabetes mellitus was found to be statistically significant with GDM. The higher risk seen in women with a family history may be due to genetic susceptibility and/or environmental factors. The same was reported by Semnani-Azad *et al.* who showed that hereditary metabolic factors play a significant role in pregnancy outcome among women with GDM [6]. The prevalence of maternal complications was significantly higher in this study for women with GDM. The incidence of pregnancy-induced hypertension was found to be 25% in GDM mothers and 8.3% in non-GDM mothers. The endothelial dysfunction and elevated oxidative stress caused by hyperglycemia could play a role in the development of hypertensive disorders in pregnancy. Increased incidence of polyhydramnios in the present study could be due to osmotic diuresis of the fœtes due to hyperglycaemia in the mother, which has been shown in previous studies to be associated with GDM [8]. The caesarean section rate among women with GDM was significantly higher than non-GDM women. This is in line with the studies carried out by Kang *et al.*, which demonstrated increased operative delivery rates among women with gestational diabetes [10]. Macrosomia, cephalopelvic disproportion, fetal distress and failed induction are major contributing factors for increased cesarean delivery among GDM pregnancies. The present study showed that infants born to mothers with GDM were significantly more likely to have neonatal complications. Macrosomia was the most common neonatal complication observed. This effect of maternal hyperglycaemias on fetal insulin production results in increased fetal growth and adiposity, as reported in several recent systematic reviews and meta-analyses of neonatal outcomes in GDM pregnancies [12]. The present study showed that infants born to mothers with GDM were significantly more likely to have neonatal complications. Macrosomia was the most common neonatal complication observed. This effect of maternal hyperglycaemias on fetal insulin production results in increased fetal growth and adiposity, as reported in several recent systematic reviews and meta-analyses of neonatal outcomes in GDM pregnancies [12]. Similarly, Yadav *et al.* (2026), in a prospective cohort study, reported significantly higher birth weight, macrosomia, neonatal hypoglycemia and NICU admission among neonates born to mothers with GDM, with GDM remaining independently associated with macrosomia, neonatal hypoglycemia and NICU admission after adjustment for maternal age and gestational age [14]. In the present study, neonatal hypoglycemia was significantly more prevalent in the infants of GDM mothers. This is in line with previous reports that stressed the need for maintaining glycemic control in the mother during labor and delivery to minimize neonatal metabolic complications, as the hyperinsulinemia persists after birth [15, 16]. Neonates born to mothers with GDM also had significantly higher rates of RDS. A recent meta-analysis by Yang *et al.* further showed that GDM almost doubles the risk of

neonatal respiratory distress syndrome (RDS) [12]. The present study found that the rate of NICU admission was significantly higher among neonates born to GDM mothers. Macrosomia, hypoglycemia, respiratory distress syndrome and neonatal jaundice may be secondary causes of increased NICU admissions [17]. In recent umbrella reviews that have assessed maternal and neonatal outcomes of GDM, similar findings have been reported [10]. The present study emphasizes the significance of early screening and diagnosis of GDM. Universal screening at 24-28 weeks of gestation enables early dietary changes, exercise, and glucose monitoring and insulin therapy as needed. New technologies like continuous glucose monitoring systems (CGM) have been shown to have potential for reducing macrosomia and improving neonatal outcomes in women with GDM [18]. The advantages of the present study are that it is prospective, both maternal and neonatal outcomes were evaluated and the screening methodology was standardized. There are some caveats, though. The study was conducted in a single tertiary care center and the sample size was small, which may limit the generalizability of the results. Maternal and childhood metabolic outcomes were not evaluated. Larger multicentric studies are recommended to gain more insight into regional differences and the long-term consequences of GDM. The present study, however, clearly shows that GDM is a significant risk factor for adverse maternal and neonatal outcomes despite these limitations. Early identification of high-risk women, universal antenatal screening, lifestyle interventions and strict glycemic control continue to be key strategies for improving fetomaternal health outcomes in pregnancies complicated by GDM.

#### Conclusion:

The prevalence of gestational diabetes mellitus was 16%, with advanced maternal age, obesity, multi gravidity and family history of diabetes identified as important risk factors. GDM was associated with significantly higher maternal and neonatal complications, including pregnancy-induced hypertension, polyhydramnios, cesarean delivery, macrosomia, neonatal

hypoglycaemia, and respiratory distress and NICU admission. Early screening, timely diagnosis, effective glycemic control and comprehensive antenatal care are essential to reduce adverse maternal and neonatal outcomes.

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