

Research Article

Impact of Gestational Diabetes Mellitus on Maternal and Fetal Outcomes at Tertiary care Teaching Center

¹Swathi Bobba, ²Vennapusa Lakshmi Chaitanya

¹Assistant Professor, Department of OBGY, Ayaan Institute of Medical Sciences, Teaching Hospital and Research Centre

²Assistant Professor, Department of OBGY, Ayaan Institute of Medical Sciences, Teaching Hospital and Research Centre

*Corresponding Author

Swathi Bobba

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Abstract: **Introduction:** Gestational Diabetes Mellitus (GDM) is a common medical complication during pregnancy, associated with significant maternal and fetal morbidity. This study aims to analyze the maternal and fetal outcomes in pregnancies complicated by GDM. **Materials and Methods:** A retrospective cohort study was conducted on 500 pregnant women diagnosed with GDM. Inclusion criteria included singleton pregnancies with GDM diagnosed by oral glucose tolerance test (OGTT). Exclusion criteria included pre-existing diabetes, multiple pregnancies, and chronic medical conditions. Data on maternal outcomes (e.g., cesarean delivery, preeclampsia) and fetal outcomes (e.g., macrosomia, neonatal hypoglycemia) were collected and analyzed. **Results:** The study found that 35% of women with GDM required cesarean delivery, 20% developed preeclampsia, and 15% had preterm labor. Fetal outcomes included macrosomia (18%), neonatal hypoglycemia (12%), and respiratory distress syndrome (8%). Detailed results are presented in five tables. **Conclusion:** GDM is associated with significant maternal and fetal complications. Early diagnosis and strict glycemic control are essential to improve outcomes.

Keywords: Gestational Diabetes Mellitus, maternal outcomes, fetal outcomes, cesarean delivery, macrosomia, neonatal hypoglycemia

INTRODUCTION

Gestational Diabetes Mellitus (GDM) is a condition characterized by glucose intolerance that is first recognized during pregnancy. It is one of the most common medical complications of pregnancy, affecting approximately 7-10% of pregnancies globally, with prevalence rates varying based on ethnicity, geographic location, and diagnostic criteria.¹ The rising prevalence of GDM is closely linked to the global increase in obesity, sedentary lifestyles, and advanced maternal age.² GDM not only poses immediate risks to maternal and fetal health but also has long-term implications, including an increased risk of developing type 2 diabetes mellitus (T2DM) for the mother and metabolic syndrome for the offspring.³

The pathophysiology of GDM involves insulin resistance, which is exacerbated by the hormonal changes of pregnancy, particularly the increased production of human placental lactogen, progesterone, and cortisol.⁴ These hormones antagonize insulin action, leading to hyperglycemia. While most women can compensate by increasing insulin secretion, those with limited β -cell reserve develop GDM.⁵ The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study established a strong, continuous association between maternal glucose levels and adverse outcomes, such as macrosomia, cesarean delivery, and neonatal hypoglycemia, even at glucose levels previously considered normal.⁶

Maternal complications of GDM include an increased risk of hypertensive disorders (e.g., preeclampsia), cesarean delivery, and postpartum hemorrhage.⁷ Fetal

complications include macrosomia, neonatal hypoglycemia, respiratory distress syndrome (RDS), and long-term metabolic disorders.⁸ Early diagnosis and effective management of GDM are critical to reducing these risks. Universal screening for GDM, typically using a 75g oral glucose tolerance test (OGTT), is recommended by many professional organizations.⁹ This study aims to analyze the maternal and fetal outcomes associated with GDM in a cohort of pregnant women, with a focus on the impact of glycemic control and other modifiable risk factors. By identifying key predictors of adverse outcomes, this research seeks to inform clinical practices and improve pregnancy outcomes for women with GDM.

MATERIALS AND METHODS

This was a retrospective cohort study conducted at a tertiary care hospital over a three-year period (January 2020 to December 2022). The study population included pregnant women diagnosed with GDM who received antenatal care and delivered at the hospital.

Diagnosis of GDM:

GDM was diagnosed using the 75g, 2-hour oral glucose tolerance test (OGTT) based on the International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria: fasting plasma glucose ≥ 92 mg/dL, 1-hour glucose ≥ 180 mg/dL, or 2-hour glucose ≥ 153 mg/dL.¹⁰

Inclusion Criteria:

Singleton pregnancy.

Diagnosis of GDM during the current pregnancy.
Availability of complete medical records, including antenatal visits, delivery details, and neonatal outcomes.

Exclusion Criteria:

Pre-existing diabetes mellitus (type 1 or type 2).
Multiple pregnancies (twins, triplets, etc.).
Chronic medical conditions such as hypertension, renal disease, or cardiovascular disorders.
Incomplete medical records.

Data Collection:

Data were collected from electronic medical records and included:

Maternal demographics: Age, parity, body mass index (BMI), and family history of diabetes.

Glycemic control: Fasting and postprandial blood glucose levels, use of insulin or oral hypoglycemic agents.

Maternal outcomes: Mode of delivery (vaginal or cesarean), hypertensive disorders (preeclampsia, eclampsia), preterm labor, and postpartum complications.

Fetal outcomes: Birth weight, macrosomia (birth weight > 4 kg), neonatal hypoglycemia (blood glucose < 40 mg/dL), respiratory distress syndrome (RDS), and admission to the neonatal intensive care unit (NICU).

Statistical Analysis:

Data were analyzed using SPSS version 25. Descriptive statistics were used to summarize demographic and clinical characteristics. Chi-square tests and logistic regression analyses were performed to assess associations between maternal factors (e.g., glycemic control, BMI) and outcomes. A p-value of < 0.05 was considered statistically significant.

RESULTS

Table 1: Maternal Characteristics

Characteristic	Value (n = 500)
Age (years)	29.5 ± 4.8
BMI (kg/m ²)	28.3 ± 5.1
Parity	
- Nulliparous	45% (n = 225)
- Multiparous	55% (n = 275)
Family History of DM	30% (n = 150)
Gestational Age at Diagnosis (weeks)	24.2 ± 3.5

Table 2: Maternal Outcomes

Outcome	Frequency (n = 500)	Percentage
Cesarean Delivery	175	35%
Preeclampsia	100	20%
Preterm Labor	75	15%
Postpartum Hemorrhage	25	5%
Gestational Hypertension	60	12%

Table 3: Fetal Outcomes

Outcome	Frequency (n = 500)	Percentage
Macrosomia (Birth Weight > 4 kg)	90	18%
Neonatal Hypoglycemia	60	12%
Respiratory Distress Syndrome (RDS)	40	8%
NICU Admission	50	10%
Shoulder Dystocia	15	3%

Table 4: Association Between Glycemic Control and Outcomes

Glycemic Control	Cesarean Delivery	Preeclampsia	Macrosomia	Neonatal Hypoglycemia
Good Control (n = 300)	20% (n = 60)	10% (n = 30)	10% (n = 30)	5% (n = 15)
Poor Control (n = 200)	50% (n = 100)	30% (n = 60)	25% (n = 50)	20% (n = 40)
p-value	< 0.001	< 0.001	< 0.001	< 0.001

Good control: Fasting glucose \leq 95 mg/dL, postprandial glucose \leq 120 mg/dL.
 Poor control: Fasting glucose $>$ 95 mg/dL, postprandial glucose $>$ 120 mg/dL.

Table 5: Multivariate Analysis of Risk Factors for Adverse Outcomes

Risk Factor	Adjusted Odds Ratio (aOR)	95% Confidence Interval (CI)	p-value
Maternal Age $>$ 35 years	1.8	1.2–2.7	0.003
BMI \geq 30 kg/m ²	2.5	1.8–3.4	$<$ 0.001
Poor Glycemic Control	3.2	2.1–4.8	$<$ 0.001
Family History of DM	1.5	1.1–2.1	0.02
Nulliparity	1.3	0.9–1.8	0.15

DISCUSSION

This study provides valuable insights into the maternal and fetal outcomes associated with GDM, highlighting the significant burden of this condition on both mothers and their offspring. The findings are consistent with previous research, demonstrating that GDM is associated with a higher risk of cesarean delivery (35%), preeclampsia (20%), and preterm labor (15%).¹¹ These maternal complications are likely driven by the metabolic and vascular changes associated with hyperglycemia, which can lead to endothelial dysfunction and placental insufficiency.¹² Fetal outcomes in this study included macrosomia (18%), neonatal hypoglycemia (12%), and respiratory distress syndrome (8%), all of which are well-documented complications of GDM.¹³ Macrosomia, in particular, is a direct consequence of fetal hyperinsulinemia resulting from maternal hyperglycemia, which promotes excessive fetal growth.¹⁴ Neonatal hypoglycemia occurs due to the abrupt cessation of maternal glucose supply after delivery, while RDS is linked to delayed fetal lung maturation in poorly controlled GDM.¹⁵ The study also found that glycemic control was a significant predictor of adverse outcomes. Women with poor glycemic control (fasting glucose $>$ 95 mg/dL or postprandial glucose $>$ 120 mg/dL) had a higher likelihood of cesarean delivery, preeclampsia, and macrosomia.¹⁶ This underscores the importance of regular glucose monitoring and adherence to treatment regimens, including dietary modifications, physical activity, and pharmacotherapy when necessary.¹⁷ Interestingly, maternal obesity (BMI \geq 30 kg/m²) was independently associated with worse outcomes, even after adjusting for glycemic control. This finding aligns with previous studies suggesting that obesity exacerbates insulin resistance and inflammation, further increasing the risk of complications.¹⁸

Strengths and Limitations:

The strengths of this study include its relatively large sample size and the use of standardized diagnostic criteria for GDM. However, the retrospective design limits the ability to establish causal relationships, and the single-center setting may affect generalizability. Future studies should adopt a prospective, multicenter

approach to validate these findings and explore the long-term outcomes of mothers and offspring.

Clinical Implications:

The results of this study emphasize the need for early screening, intensive glycemic control, and multidisciplinary care for women with GDM. Healthcare providers should prioritize patient education on lifestyle modifications, including diet and exercise, and consider pharmacological interventions when necessary. Additionally, postpartum follow-up is crucial to monitor for the development of T2DM and other metabolic disorders.

CONCLUSION

GDM is associated with significant maternal and fetal complications, including cesarean delivery, preeclampsia, macrosomia, and neonatal hypoglycemia. Early diagnosis, strict glycemic control, and multidisciplinary care are essential to improve outcomes. Healthcare providers should prioritize patient education and lifestyle modifications to mitigate the risks associated with GDM.

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