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Original Research Article

Gestational diabetes mellitus and fetomaternal outcomes: a study of obstetric and neonatal complications in a tertiary care setting

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ABSTRACT

Background: Gestational diabetes mellitus (GDM) is associated with major maternal and neonatal complications contributing to perinatal morbidity. This study evaluated fetomaternal outcomes and predictors of adverse neonatal outcomes among women with GDM.

Methods: This prospective observational study was conducted at Sylhet MAG Osmani Medical College Hospital, Bangladesh, from January to December 2025. A total of 120 pregnant women with GDM who delivered at the tertiary hospital were included. Participants received either diet therapy alone or diet plus insulin according to glycemic control. Maternal complications, mode of delivery, and neonatal outcomes were recorded. Data were analyzed using SPSS version 26 with descriptive statistics, chi-square tests, and logistic regression.

Results: Mean maternal age was 29.8 ± 4.6 years, and 61.7% were multigravida. Treatment consisted of diet alone in 43.3% and diet plus insulin in 56.7%. Maternal complications included pregnancy-induced hypertension (21.7%), preeclampsia (15.0%), and polyhydramnios (18.3%). The cesarean section rate was 53.3%. Neonatal complications included macrosomia (23.3%), hypoglycemia (21.7%), respiratory distress syndrome (15.0%), and NICU admission (28.3%). Compared with the diet-only group, insulin-treated women had significantly higher rates of cesarean delivery (73.5% versus 26.9%, $p=0.001$), macrosomia (32.4% versus 11.5%, $p=0.006$), and NICU admission (38.2% versus 15.4%, $p=0.005$). Independent predictors of NICU admission were maternal age ≥ 35 years (OR=1.92), BMI ≥ 30 kg/m² (OR=2.38), insulin therapy (OR=2.76), poor glycemic control (OR=3.12), and preterm delivery (OR=2.54).

Conclusions: GDM is associated with substantial maternal and neonatal morbidity, particularly among women requiring insulin therapy, emphasizing the need for strict glycemic control and specialized tertiary-level care.

Keywords: Fetal-maternal outcomes, Gestational diabetes mellitus, Macrosomia, Neonatal complications

INTRODUCTION

Gestational diabetes mellitus (GDM) is one of the most frequent metabolic disorders observed during pregnancy, with a worldwide prevalence of about 14% of pregnancies, and rates differing dramatically among different populations according to varying definitions.¹ GDM is a condition associated with glucose intolerance that is observed for the first-time during pregnancy as a result of

relative insulin secretory dysfunction against the background of the enhanced metabolic demands of the pregnant state.² The worldwide prevalence of GDM has gradually increased over the last two decades, along with the rise in the proportion of obese and type 2 diabetes mellitus cases among the population at large.³ The pathophysiology that affects GDM has been explained by complex modifications in insulin resistance, impaired β -cell function, and placental hormonal effects that lead to

anomalies in glucose regulation.⁴ With pregnancy, there has been an influence of hormonal changes, which involves an excess of human placental lactogen, progesterone, cortisol, and tumor necrosis factor-alpha, thereby leading to an increase in insulin resistance, mainly in the second and third trimesters of pregnancy.⁵ Also, patients have not managed an insulin response that counteracts insulin resistance, thereby leading to hyperglycemia and eventually GDM. The maternal and infant consequences of GDM remain important and well-clarified in recent obstetric literature. These maternal complications include pregnancies with hypertension, preeclampsia, polyhydramnios, urinary tract infections, and Caesarean section deliveries.⁶ The intrauterine hyperglycemic conditions result in elevated glucose exposure to the fetus, which presents with hyperinsulinemia as a result of insulin resistance, culminating in intrauterine metabolic disorders of macrosomia, trauma, neonatal hypoglycemia, respiratory distress syndrome, and hyperbilirubinemia.⁷ Additionally, mothers as well as children exposed to GDM exhibit lifetime risks of chronic metabolic complications, including gestational diabetes mellitus, type 2 diabetes, and cardiovascular diseases.⁸ The different managerial approaches for GDM include medical nutrition therapy, diet and lifestyle changes, self-blood sugar monitoring, and pharmacotherapy when these changes do not lead to blood sugar control by dietary means alone.⁹ As yet, insulin therapy has remained the mainstay for pharmacologic control, although there has been an increasing trend for its use in some centers with the aid of oral hypoglycemics.¹⁰ Despite advances in screening and care algorithms, what has and continues to be an unanswered question regarding GDM involves how best to avoid adverse outcomes for mother and fetus. Understanding the spectrum and frequency of obstetric and neonatal complications related to GDM in a particular health setting is an essential step in the creation of interventions and the quality of perinatal care.¹¹ This study aimed to assess the fetomaternal outcome in women with GDM and the effects of various treatment strategies, and determine the predictors of poor outcomes in the newborn in a tertiary care setting.

METHODS

This prospective observational study was carried out at Sylhet MAG Osmani Medical College Hospital from January, 2025 to December, 2025 including 120 pregnant women diagnosed with gestational diabetes mellitus. The inclusion criteria included pregnant women diagnosed with GDM according to the criteria of the International Association of Diabetes and Pregnancy Study Groups by means of the 75 gm oral glucose tolerance test, having a singleton pregnancy, being between 24 and 28 weeks pregnant at the time of diagnosis, having received antenatal care and being a patient of the study institution at the time of delivery, and voluntarily seeking informed consent. The exclusion criteria were pre-existing cases of diabetes mellitus types 1 and 2 diagnosed before

pregnancy, multiple pregnancies including twins or other multiples, pregnancies with pre-existing congenital anecdotes identified by ultrasound scan among the fetuses, cases among women with other important medical conditions that would independently influence some pregnancy outcome provisions including hypertension and other cases of renal diseases and cases with other immune conditions like autoimmune diseases, cases with pregnancies complicated by cases of placenta preva and cases of abruptio placentae. Demographic details, obstetric details, family details regarding diabetes, and anthropometric details were collected. The patients were treated as per the hospital protocol with medical nutrition therapy or with medical nutrition therapy along with insulin therapy as per glycemic parameters. Obstetric parameters regarding maternal complications during the antenatal period, type of delivery, as well as post-delivery complications were collected. Newborn parameters such as birth weight, APGAR score, and the requirement for admission to the neonatal intensive care unit were collected. Data analysis was carried out using the SPSS software version 26. Chi-Square test, along with Logistic Regression analysis, was employed for the identification of risk factors associated with adverse maternal as well as fetal outcomes with a significance level of 0.05.

RESULTS

Table 1 shows a mean maternal age of 29.8 ± 4.6 years, with 60% of these women falling within the 25-34 years age range. Participants were multigravid in 61.7% of cases. On average, GDM was diagnosed at 26.9 ± 3.4 weeks. The average BMI was 27.6 ± 3.1 kg/m², showing overweight. Family history of diabetes was positive in 40% of the cases. Treatment modalities used were comparable, with 43.3% managed on diet alone while 56.7% needed additional insulin, thus indicating variable degrees of glycemic dysregulation.

Table 1: Socio-demographic and baseline clinical characteristics of mothers with GDM (n=120).

Variables	Category	N (%) /Mean±SD
Age (years)	Mean±SD	29.8±4.6
	<25 years	24 (20)
	25-34 years	72 (60)
	≥35 years	24 (20)
Parity	Primigravida	46 (38.3)
	Multigravida	74 (61.7)
Gestational age at diagnosis (weeks)	Mean±SD	26.9±3.4
BMI (kg/m ²)	Mean±SD	27.6±3.1
Family history of diabetes	Yes	48 (40)
	No	72 (60)
Treatment modality	Diet only	52 (43.3)
	Diet + insulin	68 (56.7)

Table 2: Antenatal and intrapartum maternal complications (n=120).

Complications	N (%)
Pregnancy-induced hypertension	26 (21.7)
Preeclampsia	18 (15)
Polyhydramnios	22 (18.3)
Recurrent urinary tract infection	14 (11.7)
Preterm labor (<37 weeks)	20 (16.7)
Shoulder dystocia	6 (5.0)
Postpartum hemorrhage	10 (8.3)

As indicated in Table 2, antenatal and intrapartum complications were common among study participants. Pregnancy-induced hypertension was found in 21.7%, with the onset of preeclampsia in 15%. Polyhydramnios, because of fetal hyperglycemia-induced osmotic diuresis, was found in 18.3%. Preterm labor occurred in 16.7% of cases. Recurrent urinary tract infections, because of glycosuria-induced susceptibility, were found in 11.7%. Intrapartum conditions were shoulder dystocia in 5%, and post-partum hemorrhage in 8.3%.

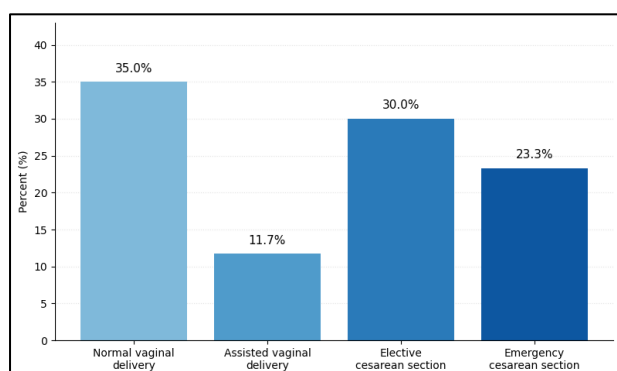
**Figure 1: Mode of delivery among mothers with GDM.**

Figure 1 illustrates that only 35% achieved normal vaginal delivery, while 11.7% required assisted vaginal delivery. There was, however, a very high rate of delivery via cesarean section: 53.3% in total; 30% being elective and 23.3% being emergency, which is well in excess of the national averages.

Table 3: Neonatal outcomes and complications (n=120).

Neonatal outcome	N (%) / mean±SD
Birth weight (kg), mean±SD	3.42±0.56
Macrosomia (≥4.0 kg)	28 (23.3)
Low birth weight (<2.5 kg)	14 (11.7)
Neonatal hypoglycemia	26 (21.7)
Respiratory distress syndrome	18 (15)
NICU admission	34 (28.3)
Hyperbilirubinemia	22 (18.3)
Perinatal mortality	4 (3.3)

Table 3 unveiled the existence of morbidity, as the average weight of the newborns was 3.42±0.56 kg. Macrosomia occurred in 23.3% of newborns, while the incidence of low birth weight was 11.7%, indicating variable glycemic control. Hypoglycemia in newborns occurred in 21.7%, directly due to hyperinsulinemia. Respiratory distress syndrome occurred in 15%, due to the deferred maturation process of the lungs. NICU admission was necessary in 28.3% of newborns. Hyperbilirubinemia developed in 18.3% of the study population, while perinatal mortality was seen in 3.3%.

Table 4: Comparison of fetomaternal outcomes by treatment modality (diet versus insulin).

Outcomes	Diet only (n=52)	Diet + insulin (n=68)	P value
Cesarean delivery	14 (26.9)	50 (73.5)	0.001
Preeclampsia	4 (7.7)	14 (20.6)	0.048
Macrosomia	6 (11.5)	22 (32.4)	0.006
Neonatal hypoglycemia	6 (11.5)	20 (29.4)	0.014
NICU admission	8 (15.4)	26 (38.2)	0.005

Table 4 showed that poor outcomes were even more significant in insulin-treated patients. The rate of caesareans in the insulin group was spectacularly high compared to the control group (73.5% versus 26.9%, $p=0.001$). The prevalence of preeclampsia, macrosomia, incidents of infant hypoglycemia, and NICU admissions in insulin-treated cases was notably high compared to the control group, pointing towards severe disease, and not treatment-induced side effects, as these were preeclampsia (20.6% versus 7.7%), macrosomia (32.4% versus 11.5%), neonatal hypoglycemia (29.4% versus 11.5%), and NICU admission (38.2% versus 15.4%).

Table 5: Logistic regression analysis of factors associated with adverse neonatal outcome (NICU admission).

Predictors	Adjusted OR	95% CI	P value
Maternal age ≥35 years	1.92	1.01-3.65	0.046
BMI ≥30 kg/m ²	2.38	1.24-4.58	0.009
Insulin-treated GDM	2.76	1.45-5.24	0.002
Poor glycemic control	3.12	1.62-6.02	<0.001
Preterm delivery	2.54	1.28-5.01	0.007

Table 5 demonstrated five independent predictors for NICU admission. Older maternal age of 35+ years ($OR=1.92$, $p=0.046$) and BMI of 30+ kg/m² ($OR=2.38$, $p=0.009$) stood as mother-related predictors. Insulin-induced GDM ($OR=2.76$, $p=0.002$) and uncontrolled diabetes ($OR=3.12$, $p<0.001$) were distinctly linked with

unfavorable outcomes in the infant. Preterm birth remained an independent predictor (OR=2.54, $p=0.007$).

DISCUSSION

This study demonstrates significant maternal and newborn morbidity, emphasizing the clinical importance of this frequent pregnancy condition. The sociodemographic distribution in our study, with a median maternal age of 29.8 years and 20% of women aged ≥ 35 years, confirms the association reported by Kalra et al. between high maternal age and the risk for GDM.¹² The high prevalence of multigravida (61.7%) and median BMI at 27.6 kg/m² confirms the association between parity, obesity, and the risk for GDM.¹³ The high frequency (40%) of positive family history emphasizes the genetic predisposition to problems with glucose metabolism, as the risk for GDM was found to be much higher in the presence of diabetes in first-degree family members.¹⁴ Our studies revealed a high incidence of pregnancy-induced hypertension (21.7%) and preeclampsia (15%), which is expected as there is a doubled risk of hypertensive disorders among women with GDM pregnancies relative to normoglycemic women, as reported by Bryson et al.¹⁵ Moreover, polyhydramnios was observed to occur in 18.3% instances that were attributed to the osmotic diuresis/polyuria associated with fetal hyperglycemia as a direct result of glycemic dysregulation.¹⁶ The high rate of cesarean sections, at 53.3%, stands out as much higher compared to the recommended rate by the WHO that does not exceed 15% because “fears” related to shoulder dystocia because of macrosomia, cephalopelvic disproportion, the inability to reassure the patient regarding the fetal condition, and the inadequacy of previous induction attempts have all contributed to the rate.¹⁷ Shang et al support the high rate of cesarean sections that range from 40-60% within the population with GDM in tertiary centers.¹⁸ Neonatal complications are also common in this study. The incidence of 23.3% for macrosomia is consistent with that of 15-30% described by Catalano et al. among pregnancies with GDM due to fetal hyperinsulinemia-induced excessive fetal growth.¹⁹ The incidence of 21.7% among neonates with hypoglycemia can be anticipated due to the abrupt loss of glucose delivery at birth despite persisting fetal hyperinsulinemia.²⁰ The 28.3% incidence of NICU admissions signifies the magnitude of resources needed that are devoted to neonates with GDM. The comparison of the treatment modalities showed a poorer outcome in those requiring insulin, which might be a result of the severity of the disease. Women requiring insulin showed inadequate glycemic control despite diet alone, which shows that the women have more disturbances in the metabolic functions.²¹ The result from the logistic regression analysis shows glycemic control as the predictor for the outcome (OR=3.12, p value<0.001). The recognition of maternal obesity (BMI ≥ 30 kg/m²) as an independent risk factor for adverse newborn outcomes (OR=2.38) highlights the cumulation of various metabolic abnormalities.²² Insulin resistance, inflammation, and adipokine abnormalities contributed by maternal obesity

cumulatively add adverse impacts during pregnancy, aside from GDM. Conversely, increased maternal age (≥ 35 years) was again an independent predictor for NICU admission, contributed by the aging placenta with higher complication risks.²³ These observations make significant contributions to the diagnosis and diversions of attention for women with GDM. Those with co-existing risk factors of obesity, older age, insulin use, and uncontrolled glycemic levels should receive intensive care monitoring and should give birth within institutions capable of managing neonatal complications.

This single-center study with a limited sample size may not represent the broader GDM population across diverse healthcare settings and geographic regions. The lack of long-term follow-up prevented assessment of postpartum maternal glucose metabolism and childhood developmental outcomes in offspring exposed to intrauterine hyperglycemia.

CONCLUSION

This study found a considerable impact of GDM on the mother as well as the infant, as evident by the high incidence of gestational hypertension, preeclampsia, operative delivery, macrosomia, infant hypoglycemia, and NICU admissions in our tertiary center dataset. Outcomes in women requiring insulin treatment remained decidedly poorer, which is an index of the severity of dysregulation and not because of the treatment modalities used. Multivariate predictors of severe outcomes in the infant included high maternal age at delivery, maternal obesity, insulin use, high glucose levels, and prematurity. These results emphasize the paramount value of early GDM testing and the importance of tailored prenatal management to ensure the best possible fetomaternal and perinatal outcomes.

Recommendations

Multicenter prospective studies with larger sample sizes are needed to validate these findings and develop robust risk prediction models for adverse outcomes. Long-term follow-up studies evaluating postpartum progression to type 2 diabetes in mothers and metabolic health trajectories in offspring would provide valuable insights for preventive interventions.

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