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Original Research Article

Maternal and fetal outcomes of gestational diabetes in Bangladesh: a cohort analysis

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ABSTRACT

Background: Gestational diabetes mellitus (GDM) is a significant public health concern, affecting a growing number of pregnancies worldwide. It is associated with increased risks of maternal and neonatal complications, impacting both short- and long-term health outcomes. This study explores the maternal and fetal outcomes of GDM in a Bangladeshi cohort.
Methods: This cohort study was conducted at Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh from January, 2018 to December, 2020to evaluate maternal and fetal outcomes in pregnant women with and without gestational diabetes mellitus (GDM) at a tertiary care hospital in Bangladesh. A total of 100 pregnant women participated, with 50 women in the GDM group and 50 women in the non-GDM group. The data were analyzed using SPSS version 26. A p value of less than 0.05 is considered statistically significant.
Results: This study highlights significant maternal and neonatal risks associated with gestational diabetes mellitus (GDM) in Bangladesh. Hypertensive disorders (56% vs. 20%), caesarean delivery (70% vs. 36%) and preterm labor (40% vs. 14%) were notably higher in the GDM group. Neonatal complications included increased preterm births (40% vs. 14%), low birth weight (20% vs. 6%), macrosomia (16% vs. 4%), NICU admissions (36% vs. 12%) and congenital heart defects (12% vs. 4%).
Conclusions: This study on gestational diabetes mellitus (GDM) in Bangladesh reveals significant maternal and fetal complications associated with the condition. GDM was linked to increased rates of hypertensive disorders, caesarean delivery and postpartum hemorrhage. Neonates of mothers with GDM experienced higher incidences of preterm birth, macrosomia, neonatal hypoglycemia and NICU admissions, indicating the substantial impact of GDM on perinatal outcomes.

Keywords: Gestational diabetes mellitus, Hyperglycemia, Maternal complications, Neonatal complications

INTRODUCTION

Gestational diabetes mellitus (GDM), defined as glucose intolerance first identified during pregnancy, is a growing public health concern globally, particularly in low- and middle-income countries.[1] The global prevalence of GDM ranges from 1% to 28%, depending on the diagnostic criteria and population characteristics.[2] In Bangladesh, GDM has been increasingly reported, with significant implications for maternal and fetal health outcomes.[3] Despite its rising prevalence, there remains a gap in understanding the context-specific maternal and fetal outcomes associated with GDM in low-resource settings like Bangladesh, where healthcare access, awareness and prenatal care practices vary widely. The pathophysiology of GDM is linked to hormonal changes during pregnancy that lead to insulin resistance, compounded by pre-existing or pregnancy-induced beta-cell dysfunction.[4] Risk factors for GDM include advanced maternal age, obesity, a family history of diabetes and a history of adverse obstetric outcomes, all of which are increasingly common in South Asian populations.[5,6] These risk factors contribute to a

unique epidemiological profile of GDM in Bangladesh, characterized by high rates of undiagnosed cases and late diagnoses during pregnancy. GDM is associated with a spectrum of adverse maternal outcomes, including preeclampsia, polyhydramnios and an increased likelihood of cesarean delivery.[7,8] Furthermore, it poses long-term risks of developing type 2 diabetes for affected mothers. Neonatal complications such as macrosomia, preterm birth, respiratory distress syndrome and neonatal hypogycemia are also significantly more prevalent among infants of mothers with GDM.[9] Notably, congenital anomalies and stillbirths have also been linked to poorly controlled GDM, underscoring the need for early diagnosis and management.[10]

In Bangladesh, the management of GDM is challenged by socioeconomic disparities, limited healthcare infrastructure and variations in clinical practices. Studies have shown that adherence to GDM screening protocols remains inconsistent, with many women being diagnosed only after complications arise.[11] Moreover, cultural barriers and a lack of awareness about GDM contribute to poor glycemic control during pregnancy, exacerbating adverse outcomes. Given the substantial burden of GDM and its complications, understanding its maternal and fetal outcomes in the Bangladeshi context is critical.

While international studies have extensively documented the complications of GDM, the findings may not be entirely generalizable to low-resource settings like Bangladesh, where cultural practices, dietary patterns and healthcare access significantly differ.[12] This study aims to analyze the maternal and fetal outcomes associated with GDM in a cohort of pregnant women in Bangladesh. This study seeks to bridge the knowledge gap and provide evidence-based insights for improving clinical management and policy formulation in the region. Additionally, the study underscores the importance of tailored interventions, including enhanced screening programs, patient education and postpartum follow-up, to mitigate the long-term risks of GDM for both mothers and their offspring.

METHODS

Study design

This cohort study was conducted at Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh from January, 2018 to December, 2020 to evaluate maternal and fetal outcomes in pregnant women with and without gestational diabetes mellitus (GDM) at a tertiary care hospital in Bangladesh.

Sample size

A total of 100 pregnant women participated, with 50 women in the GDM group and 50 women in the non-GDM group.

Inclusion criteria

Pregnant women aged 18 to 40 years, diagnosed with GDM based on the American Diabetes Association's diagnostic criteria, were included in the study.

Exclusion criteria

Women with pre-existing diabetes mellitus, chronic hypertension, multiple pregnancies or any other significant medical complications were excluded.

Data collection

Data were collected through structured interviews, clinical examination and review of medical records.

Ethical approval

Ethical approval for the study was obtained from the Ethical Review Board of the institution and informed consent was obtained from all participants, ensuring voluntary participation and confidentiality.

Statistical analysis

The data were analyzed using SPSS version 26, with continuous variables such as maternal age and gestational age expressed as mean±standard deviation (SD) and categorical variables presented as frequency and percentage. Statistical significance was determined using the chi-square test for categorical variables and independent t-tests for continuous variables, with a p-value of less than 0.05 considered statistically significant.

RESULTS

Table 1 presents the distribution of the study population based on maternal age and gestational age (GA). The mean maternal age in the GDM group was 30.5±4.2 years, compared to 28.7±3.9 years in the non-GDM group. The mean GA at delivery was 37.2±1.8 weeks in the GDM group and 38.5±1.6 weeks in the non-GDM group, with a statistically significant difference ($p = 0.045$).

Table 2 summarizes the distribution of the study population based on obstetric and gynaecological history. The GDM group had a higher prevalence of previous preterm births (16% vs. 6%, $p=0.055$) and previous caesarean deliveries (20% vs. 10%, $p=0.120$) compared to the non-GDM group.

Prior gestational diabetes was significantly more common in the GDM group (24% vs. 4%, $p=0.005$). Other variables, including gravida, para, abortions, polycystic ovarian syndrome (PCOS), menstrual regularity, history of ectopic pregnancy and infertility history, showed no statistically significant differences between the two groups.

Table 3 illustrates the distribution of maternal pregnancy complications in the study population. The incidence of hypertensive disorders was significantly higher in the GDM group compared to the non-GDM group (56% vs. 20%, p=0.001), with gestational hypertension and preeclampsia observed in 36% and 20% of GDM cases, respectively, versus 10% and 6% in non-GDM cases (p=0.003 and p=0.015). Gestational polyhydramnios was more frequent in the GDM group (24% vs. 8%, p=0.022) and oligohydramnios was also significantly higher (18% vs. 6%, p=0.025).

Table 4 presents the maternal labor and delivery outcomes in the study population. Caesarean delivery was significantly more common in the GDM group (70% vs. 36%, p=0.002).

Induction of labor and preterm labor were also higher among GDM patients, occurring in 40% and 40%, respectively, compared to 16% and 14% in the non-GDM group (p=0.010 and p=0.005). Postpartum hemorrhage was observed in 14% of GDM cases versus 4% in non-GDM (p=0.030), while perineal tears (3rd/4th degree) were more frequent in the GDM group (8% vs. 2%, p=0.045).

Table 5 outlines the neonatal and birth outcomes in the study population. Preterm birth was significantly more frequent in the GDM group (40% vs. 14%, p=0.005).

Low birth weight (<2.5 kg) was observed in 20% of GDM cases compared to 6% in the non-GDM group (p=0.015), while macrosomia (>4 kg) was more prevalent among GDM neonates (16% vs. 4%, p=0.025). Large for gestational age (LGA) infants were significantly higher in the GDM group (30% vs. 10%, p=0.008). The difference in the occurrence of small for gestational age (SGA) infants between the groups was not statistically significant (12% vs. 8%, p=0.350).

Table 6 highlights the neonatal morbidity outcomes in the study population. Neonatal hypoglycemia was significantly more common in the GDM group (30% vs. 8%, p=0.010) and respiratory distress syndrome occurred in 24% of GDM neonates compared to 6% in the non-GDM group (p=0.020).

Jaundice requiring phototherapy was more frequent among GDM neonates (28% vs. 10%, p=0.012). NICU admission was significantly higher in the GDM group (36% vs. 12%, p=0.008). The difference in neonatal sepsis was not statistically significant (10% vs. 4%, p=0.100).

Table 7 shows the distribution of perinatal and infant mortality in the study population. Perinatal mortality was higher in the GDM group (10% vs. 2%, p=0.050), showing a marginally significant difference. Stillbirth occurred in 6% of GDM cases compared to 2% in the non-GDM group (p=0.100), while neonatal death within 28 days was reported in 4% of GDM neonates and none in the non-GDM group (p=0.080), though these differences were not statistically significant.

Table 8 presents the distribution of neonatal congenital anomalies in the study population. Congenital heart defects were significantly more common in the GDM group (12% vs. 4%, p=0.045). Neural tube defects were observed in 8% of GDM neonates compared to 2% in the non-GDM group, with a marginally significant difference (p=0.050). Limb deformities were reported in 6% of GDM cases but none in the non-GDM group (p=0.070), though this difference was not statistically significant.

Table 1: Distribution of study population based on maternal age and gestational age (Mean±SD) (n=100).

Group	Mean age (in years)±SD	Mean GA (weeks)±SD	P value
GDM	30.5±4.2	37.2±1.8	0.045
Non-GDM	28.7±3.9	38.5±1.6	

Table 2: Distribution of study population based on obstetric and gynaecological history (n=100).

History	GDM (n=50)	Non-GDM (n=50)	P value
Gravida (total pregnancies)	2.5±1.2	2.2±1.1	0.312
Para (live births)	1.8±0.9	1.7±0.8	0.600
Abortions (spontaneous/induced)	0.4±0.5	0.3±0.4	0.428
Previous preterm births (<37 weeks)	8 (16%)	3 (6%)	0.055
Previous cesarean deliveries	10 (20%)	5 (10%)	0.120
Previous gestational diabetes	12 (24%)	2 (4%)	0.005
Polycystic ovarian syndrome (PCOS)	6 (12%)	3 (6%)	0.321
Menstrual regularity	40 (80%)	44 (88%)	0.312
History of ectopic pregnancy	2 (4%)	0 (0%)	0.150
Infertility history	4 (8%)	1 (2%)	0.071

Table 3: Distribution of study population based on maternal pregnancy complications (n=100).

Outcome	GDM (n=50)	Non-GDM (n=50)	P value
Hypertensive disorders	28 (56%)	10 (20%)	0.001
Gestational hypertension	18 (36%)	5 (10%)	0.003
Gestational preeclampsia	10 (20%)	3 (6%)	0.015
Gestational polyhydramnios	12 (24%)	4 (8%)	0.022
Oligohydramnios	9 (18%)	3 (6%)	0.025

Table 4: Distribution of study population based on maternal labor and delivery outcomes (n=100).

Outcome	GDM (n=50)	Non-GDM (n=50)	P value
Cesarean delivery	35 (70%)	18 (36%)	0.002
Induction of labor	20 (40%)	8 (16%)	0.010
Preterm labor	20 (40%)	7 (14%)	0.005
Postpartum haemorrhage	7 (14%)	2 (4%)	0.030
Perineal tears (3rd/4th degree)	4 (8%)	1 (2%)	0.045

Table 5: Distribution of study population based on neonatal and birth outcomes (n=100).

Outcome	GDM (n=50)	Non-GDM (n=50)	P value
Preterm birth (<37 weeks)	20 (40%)	7 (14%)	0.005
Low birth weight (<2.5 kg)	10 (20%)	3 (6%)	0.015
Macrosomia (>4 kg)	8 (16%)	2 (4%)	0.025
Small for gestational age (SGA)	6 (12%)	4 (8%)	0.350
Large for gestational age (LGA)	15 (30%)	5 (10%)	0.008

Table 6: Distribution of study population based on neonatal morbidity (n=100).

Outcome	GDM (n=50)	Non-GDM (n=50)	P value
Neonatal Hypoglycemia	15 (30%)	4 (8%)	0.010
Respiratory Distress Syndrome	12 (24%)	3 (6%)	0.020
Jaundice Requiring Phototherapy	14 (28%)	5 (10%)	0.012
Neonatal Sepsis	5 (10%)	2 (4%)	0.100
NICU Admission	18 (36%)	6 (12%)	0.008

Table 7: Distribution of study population based on perinatal and infant mortality (n=100).

Outcome	GDM (n=50)	Non-GDM (n=50)	P value
Perinatal mortality	5 (10%)	1 (2%)	0.050
Stillbirth	3 (6%)	1 (2%)	0.100
Neonatal death (within 28 days)	2 (4%)	0 (0%)	0.080

Table 8: Distribution of study population based on neonatal congenital anomalies (n=100).

Outcome	GDM (n=50)	Non-GDM (n=50)	P value
Congenital heart defects	6 (12%)	2 (4%)	0.045
Neural tube defects	4 (8%)	1 (2%)	0.050
Limb deformities	3 (6%)	0 (0%)	0.070

DISCUSSION

Gestational diabetes mellitus (GDM) is a prevalent condition associated with significant maternal and neonatal complications. This study investigated maternal and fetal outcomes in a Bangladeshi cohort, highlighting disparities between women with and without GDM. The mean maternal age was significantly higher in the GDM group, consistent with previous studies indicating advanced maternal age as a risk factor for GDM.[5,13] The gestational age (GA) at delivery was significantly lower among GDM patients, reflecting an increased risk of

preterm delivery due to GDM-related complications, such as hypertensive disorders and fetal macrosomia. A higher prevalence of hypertensive disorders, including gestational hypertension and preeclampsia, was noted in the GDM group, aligning with the literature that implicates GDM in endothelial dysfunction and increased vascular resistance.[14] The GDM group exhibited higher rates of caesarean delivery, induction of labor and preterm labor.

These findings support existing evidence that GDM increases obstetric interventions due to fetal macrosomia, cephalopelvic disproportion and other complications.[15] The significantly higher incidence of postpartum haemorrhage in the GDM group may be related to prolonged labor or uterine atony, conditions exacerbated by diabetes-related macrosomia. GDM was associated with significantly higher rates of adverse neonatal outcomes, including preterm birth, low birth weight and macrosomia. The increased frequency of preterm birth (40% vs. 14%) highlights the need for close monitoring of GDM pregnancies, as preterm infants are more vulnerable to respiratory distress syndrome (RDS) and other morbidities.[16]

Low birth weight, observed in 20% of neonates in the GDM group, may reflect poor glycaemic control or placental insufficiency, which has been documented in diabetic pregnancies.[17] Conversely, macrosomia was significantly more common, consistent with evidence linking hyperglycemia to increased fetal glucose and subsequent overgrowth.[18] Large-for-gestational-age (LGA) neonates were more prevalent in the GDM group, while the occurrence of small-for-gestational-age (SGA) neonates did not differ significantly. LGA infants face risks of shoulder dystocia, birth trauma and long-term metabolic disorders.[19]

Additionally, neonatal hypoglycemia was more frequent in GDM pregnancies, likely due to hyperinsulinemia induced by maternal hyperglycemia during gestation.[20] The study also revealed higher rates of neonatal morbidity in the GDM group, including RDS, jaundice requiring phototherapy and NICU admissions. These findings corroborate prior studies that identify GDM as a significant risk factor for neonatal respiratory and metabolic complications.[21]

The marginally significant difference in perinatal mortality underscores the importance of timely intervention to optimize outcomes. Congenital anomalies, including congenital heart defects and neural tube defects, were more prevalent in the GDM group. This supports prior research suggesting an increased risk of anomalies due to maternal hyperglycemia during organogenesis.[22] While some anomalies, such as limb deformities, were not statistically significant, their occurrence highlights the importance of preconception glycaemic control to reduce teratogenic risks.

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

This study on gestational diabetes mellitus (GDM) in Bangladesh reveals significant maternal and fetal complications associated with the condition. GDM was linked to increased rates of hypertensive disorders, caesarean delivery and postpartum haemorrhage. Neonates of mothers with GDM experienced higher incidences of preterm birth, macrosomia, neonatal hypoglycemia and NICU admissions, indicating the substantial impact of GDM on perinatal outcomes.

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