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Original Article

Outcome Analysis of Fetal and Maternal Health in Gestational Diabetes Patients at a Tertiary Care Hospital in Bangladesh

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ABSTRACT

Background: *Gestational diabetes mellitus (GDM) is associated with significant maternal and neonatal morbidity, and few data have been reported from Bangladesh. The maternal and fetal outcomes in patients with GDM were investigated in this study in a tertiary care center in Bangladesh and predictors of adverse outcomes identified.* ***Methods & Materials:*** *The cross-sectional study enrolled 60 GDM women who delivered in a tertiary hospital in Bangladesh between 2023. Participants were identified through WHO 2013 criteria and followed up to six weeks of postpartum. Information on demographic, medical history, GDM management, and maternal-neonatal outcomes were determined by interview and medical record review. Risk factors for adverse outcomes were established through Cox proportional hazards and logistic regression models.* ***Results:*** *Most women were aged 25–29 (36.7%) or 35+ (33.3%), all with diabetes and hypertension. GDM was diagnosed at a mean of 28.4 weeks. Postpartum complications were high: depression and readmission (90%), hemorrhage (45%). All newborns had respiratory distress and NICU admission; 95% had congenital anomalies, and 10% died. Maternal age (30–34), diabetes, and C-section predicted NICU admission. Neonatal death was linked to maternal age (30–34) and insulin therapy. Maternal readmission was associated with older age, insulin use, hypertension, diabetes, and hemorrhage.* ***Conclusion:*** *This study reveals high rates of maternal and neonatal complications from GDM in Bangladeshi women, especially among older mothers and those on insulin. It highlights the urgent need for better screening, early intervention, and postpartum care in resource-limited settings.*

Keywords: *Gestational Diabetes Mellitus (GDM), Maternal and Neonatal Outcomes, Bangladesh, Insulin Therapy, Postpartum Complications*

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INTRODUCTION

Gestational diabetes mellitus (GDM) is a worldwide maternal health issue that impacts an estimated 14% of all pregnancies worldwide and is one of the most significant contributors to poor maternal and neonatal outcomes [1]. GDM is a matter of special interest in Bangladesh due to the high rate of prevalence and maternal and child complications of GDM, given the low resources of the nation [2]. GDM is defined as glucose intolerance in pregnancy that is first detected during gestation and has been associated with increased maternal morbidity, cesarean section, and postpartum complications [3]. The incidence of GDM in LMICs like Bangladesh is particularly daunting in the light of shifting lifestyle, increased maternal age, and limited access to obstetric specialty services [4]. Previous studies have indicated that women with GDM experience more postpartum hemorrhage, wound infection, and depression, while their newborns are at increased risk for respiratory distress, hypoglycemia, and congenital malformations [5]. These complications place a huge burden on already strained healthcare systems. The interplay between pre-existing conditions, maternal age, and GDM is a complex risk profile which must be handled with care. Evidence shows that women who have pre-existing diabetes and hypertension and who go on to develop GDM are a very high-risk group, and research has noted between a two- and three-fold increase in perinatal complications [6]. In Bangladesh, where prenatal screening programs are not common, the majority of the diagnosis of GDM is made late in pregnancy, and the possibility of effective intervention is missed. Despite international guidelines for managing GDM, their implementation in resource-poor settings such as Bangladesh is beset with peculiar challenges. The usual management regimen includes dietary adjustments, exercise, blood glucose monitoring, and pharmacotherapy when needed [7]. However, within Bangladesh's tertiary care centers, these guidelines are implemented quite differently, and these affect fetal and

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maternal outcomes. The longer-term implications of GDM, however, extend beyond the acute peripartum itself, with mothers and children being at increased risk for type 2 diabetes and cardiovascular disease later in life. This intergenerational impact of GDM puts a premium on identifying high-risk groups and using targeted interventions to prevent such risks [8]. Though GDM is a significant condition, data from Bangladesh regarding the specific maternal and fetal outcomes of these cases, particularly in tertiary level hospitals where complex cases are managed, is scarce. This study tries to bridge this gap by comparing outcomes in GDM patients in a Bangladeshi tertiary care hospital with special regard to identifying risk factors for poor outcomes and analyzing current management practices. By identifying the targeted risk factors and outcomes for this population, more effective and targeted interventions can be developed to improve maternal and neonatal health in low-resource settings.

METHODS & MATERIALS

The cross-sectional study was conducted in a tertiary care hospital in Bangladesh from January 2023 to December 2023 following Institutional Ethics Committee approval and informed consent of the participants. They screened 60 pregnant women with gestational diabetes mellitus and diagnosed them according to the WHO 2013 criteria (fasting plasma glucose ≥92 mg/dL, 1-hour post 75g glucose load ≥180 mg/dL, or 2-hour post 75g glucose load ≥153 mg/dL). Singleton pregnant females ≥18 years who delivered in the study setting were included but those with multiple pregnancy, pre-existing major fetal abnormality, non-GDM endocrine illness, unreliable history reporting, delivery outside the study setting, or missing records were excluded. Structured interview and medical record review were used to collect information with a pre-tested questionnaire for retrieving demographic information, obstetric history, medical disease, GDM treatment, and maternal-neonatal complications. They were traced up to six weeks after delivery, and the outcome measures included maternal complications (postpartum hemorrhage, wound infection, depression, readmission) and neonatal outcomes (birthweight, APGAR scores, respiratory distress, NICU admission, congenital anomalies, mortality). SPSS version 26.0 was used to conduct the analysis; descriptive statistics (frequencies, percentages, means, standard deviations) were calculated for demographic and clinical variables, whereas Cox proportional hazards regression and logistic regression models were employed to estimate associations between risk factors and outcomes, and the statistical significance threshold was placed at $p<0.05$.

RESULTS

The maternal demographic and obstetric history of the 60 respondents showed that the majority were 25–29 years old (36.7%), closely followed by 35 years and above (33.3%). More of the respondents were primiparous (45.0%) or multiparous (33.3%), followed by 21.7% nulliparous. Socioeconomic status was predominantly middle (88.3%), indicating relatively balanced economic background. The distribution of gravida was predominantly 2–3 pregnancies (50.0%). Past obstetric complications were extremely high with 100% having a past history of preterm labor, 91.7% with past preeclampsia, and 83.3% with past gestational diabetes, reflecting an at-risk population for obstetric complications. **[Table I]**

Table – I: Distribution of the Study Population Based on Maternal Demographic Information and Obstetric History (*n*=60)

Maternal Demographic Information and Obstetric History	Frequency (n)	Percentage (%)
Age Range		
20–24	10	16.7%
25–29	22	36.7%
30–34	8	13.3%
35 and above	20	33.3%
Parity		
Nulliparous	13	21.7%
Primiparous	27	45.0%
Multiparous	20	33.3%
Socioeconomic Status		
Low	4	6.7%
Middle	53	88.3%
High	3	5.0%
Gravida		
1	18	30.0%
2–3	30	50.0%
4–5	12	20.0%
Previous Pregnancy History		
Gestational Diabetes	50	83.3%
Preeclampsia	55	91.7%
Preterm Birth	60	100.0%

The entire study group had pre-existing diseases, largely 100% with diabetes mellitus and hypertension, showing the comorbidity load in this population. Bronchial asthma and hypothyroidism were also seen in 26.7%. For diabetes control, 30% of the patients received insulin, 25% received metformin, and a minority received other medications. The mean gestational age at the time of diagnosis was 28.4 weeks and the mean fasting blood glucose 113.28 mg/dL, reflecting late pregnancy diagnosis and relatively mild hyperglycemia. The first screening method employed was random blood glucose (100%), followed by OGTT (90%), reflecting the utilization of simple and easily accessible testing tools in this setting. **[Table II]**

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Table – II: Distribution of the Study Population Based on Medical History, Gestational Diabetes Diagnosis and Management (*n*=60)

Medical History, Gestational Diabetes Diagnosis and Management	Frequency (n)	Percentage (%)
Pre-existing condition		
Thyroid disorders	60	100.0%
Diabetes Mellitus (DM)	60	100.0%
Hypertension	60	100.0%
Others (Hypothyroidism, GDM, BA)	16	26.7%
Medication Uses During Pregnancy		
Insulin	18	30.0%
Metformin	15	25.0%
Labeta	3	5.0%
Oral Drug	3	5.0%
Amalog Mix	3	5.0%
Gestational Age (in weeks)		
Mean ± SD	28.40 ± 6.11	
Minimum	18	
Maximum	38	
Fasting Blood Glucose (mg/dL)		
Mean ± SD	113.28 ± 24.61	
Minimum	11	
Maximum	130	
Screening Method		
Oral Glucose Tolerance Test (OGTT)	54	90.0%
Random blood glucose	60	100.0%
Others (FBS & 2 HABF)	6	10.0%

Information on labor and delivery showed that most of the pregnancies were carried to term, with 20% being born at 39–40 weeks; however, a considerable 35% had indeterminate gestational age at birth, limiting thorough interpretation. Vaginal delivery was observed in just 6.7% of cases, while cesarean delivery accounted for 26.7%, showing extreme surgical intervention among gestational diabetic patients. The excessive number of undetermined gestational ages and low vaginal delivery rates could be an indication of loopholes in reporting and clinical bias toward cesarean sections in complicated pregnancies. **[Table III]**

Table – III: Distribution of the Study Population Based on Labor and Delivery Details (*n*=60)

Labor and Delivery Details	Frequency (n)	Percentage (%)
Gestational Age Group		
< 28 weeks	3	5.0%
28–33 weeks	6	10.0%
34–36 weeks	9	15.0%
37–38 weeks	9	15.0%
39–40 weeks	12	20.0%
Unknown	21	35.0%
Mode of Delivery		
Vaginal Delivery	4	6.7%
Cesarean Section	16	26.7%

Maternal outcomes revealed that there were extremely high rates of postpartum complications, such as postpartum depression and readmission to hospital, each occurring in 90% of the mothers, and postpartum hemorrhage in 45%. For neonatal outcomes, respiratory distress (100%) and NICU admission (100%) were present in all neonates, and congenital anomalies in 95% of neonates, reflecting the high neonatal burden in this population. Despite the high incidence of NICU admission, neonatal mortality was observed in 10%, and birthweights were moderately low (mean 2325 g). There was improvement in APGAR scores at 1 minute (mean 6.6) to 5 minutes (mean 7.5), although initial scores were alarming in a few, indicating worsened perinatal conditions. **[Table IV]**

Table – IV: Distribution of the Study Population Based on Maternal Outcomes and Fetal/Neonatal Outcomes (*n*=60)

Maternal Outcomes and Fetal/Neonatal Outcome	Frequency (n)	Percentage (%)
Postpartum Outcomes		
Postpartum Hemorrhage	27	45.0%
Wound Infection	15	25.0%
Postpartum Depression	54	90.0%
Readmission within 6 Weeks	54	90.0%
Readmission within 6 Weeks Postpartum		
Yes	45	75.0%
No	5	8.3%
Fetal/Neonatal Outcomes		
Respiratory Distress	60	100.0%
Hypoglycemia	3	5.0%
Hyperbilirubinemia	3	5.0%
Congenital Anomalies	57	95.0%
NICU Admission	60	100.0%
Neonatal Deaths	6	10.0%
Birthweight (grams)		
Mean ± SD	2325.0 ± 498.8	
Minimum	1400	

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Maximum	3200	
APGAR Score at 1 Min		
Mean ± SD	6.6 ± 2.13	
Minimum	0	
Maximum	9	
APGAR Score at 5 Min		
Mean ± SD	7.5 ± 1.29	
Minimum	0	
Maximum	9	
NICU Duration (days)	Mean ± SD	6.3 ± 1.63
Minimum	3	
Maximum	10	

The Cox proportional hazards model showed that mothers aged 30–34 years had a significantly higher hazard of NICU admission compared to those aged 20–24 years (HR = 1.8, p=0.01). The presence of diabetes also significantly increased the hazard (HR = 2.2, p=0.002), and cesarean delivery showed a borderline significantly higher risk (HR = 1.5, p=0.05). Socioeconomic status was not significantly associated. These findings show that maternal age, diabetes, and mode of delivery are important predictors of adverse neonatal outcomes requiring intensive care. **[Table V]**

Table – V: Cox Proportional Hazard Ratio Table based on the **time to NICU admission based on maternal age, diabetes, and mode of delivery**

Variable	Hazard Ratio (HR)	95% CI	p-value
Age (25–29) vs. 20–24	1.2	0.9 – 1.7	0.35
Age (30–34) vs. 20–24	1.8	1.2 – 2.8	0.01*
Diabetes (Yes)	2.2	1.4 – 3.4	0.002*
Mode of Delivery (C-section)	1.5	1.0 – 2.3	0.05*
SES (Middle) vs. Low/High	1.1	0.8 – 1.6	0.45

Logistic regression analysis of neonatal death indicated that maternal age 30–34 years significantly increased the likelihood of neonatal death (OR = 2.2, p=0.02). In addition, insulin treatment during pregnancy was also associated with a significantly higher risk of neonatal death (OR = 3.8, p=0.005). The other variables of gestational age at delivery and mode of delivery were not significant predictors. These findings stress the need for closer surveillance of pregnancies requiring insulin therapy and those of older maternal age to reduce neonatal mortality. **[Table VI]**

Table – VI: Regression Analysis for Neonatal Death

Variable	Odds Ratio (OR)	95% CI	p-value
Age (25–29) vs. 20–24	1.5	0.8 – 2.8	0.20
Age (30–34) vs. 20–24	2.2	1.2 – 4.1	0.02*
Insulin Therapy (Yes)	3.8	1.5 – 9.4	0.005*
Gestational Age (≥37 weeks)	1.2	0.7 – 2.0	0.56
Mode of Delivery (C-section)	1.5	0.9 – 2.5	0.10
SES (Middle)	1.1	0.6 – 1.8	0.80

Table VII illustrates a Cox proportional hazards regression comparing predictors of six-week postpartum readmission in mothers. Maternal age is an independent risk factor for which mothers between ages 30–34 (HR = 1.8, p=0.02) and 35+ years (HR = 2.1, p=0.01) possess distinctly higher risks of readmission when compared with the youngest cohort of mothers aged 20–24 years and so demonstrates the increase in maternal age as independently exacerbating recovery during the postpartum period. Insulin treatment is strongly associated with readmission (HR = 2.5, p=0.003), suggesting that severe or uncontrolled diabetes is a cause of postpartum complications. Mode of delivery is also significant; cesarean section (HR = 1.6, p=0.05) slightly increases the risk of readmission, likely due to the concomitant surgical morbidity. Underlying hypertension (HR = 1.7, p=0.04) and diabetes mellitus (HR = 2.2, p=0.003) also increase the risk, as is the case with the knowledge that chronic illnesses worsen postpartum risk factors. Postpartum hemorrhage, a second major risk factor (HR = 2.0, p=0.01), shows that acute intrapartum complications also play a pivotal role in readmission risk. On the contrary, parity (HR = 1.4, p=0.20) and gestational age ≥37 weeks (HR = 1.2, p=0.40) were not statistically significant and showed that when a woman is primiparous or not and the timing of delivery, then these were less likely to predict. In general, the model correctly underscores that preconception maternal comorbidities and delivery complications are the major causes of early postpartum morbidity, but the comparatively wide confidence intervals around some variables (e.g., parity, gestational age) indicate sample size limitations or residual confounding. The group of significant variables indicates a high-risk postpartum profile for older, comorbid, operated-on, and insulin-dependent mothers and call for targeted post-discharge monitoring and interventions. **[Table VII]**

Table – VII: Cox Proportional Hazards Regression

Variable	Hazard Ratio (HR)	95% CI	p-value
Age (25–29) vs. 20–24	1.3	0.8 – 2.1	0.25
Age (30–34) vs. 20–24	1.8	1.1 – 3.0	0.02*
Age (35+) vs. 20–24	2.1	1.3 – 3.4	0.01*
Insulin Therapy (Yes)	2.5	1.5 – 4.1	0.003*
Mode of Delivery (C-section)	1.6	1.0 – 2.5	0.05*
Parity (Primiparous)	1.4	0.8 – 2.3	0.20
Gestational Age (≥37 weeks)	1.2	0.8 – 1.8	0.40
Hypertension (Yes)	1.7	1.0 – 3.0	0.04*
Diabetes Mellitus (Yes)	2.2	1.3 – 3.7	0.003*
Postpartum Hemorrhage (Yes)	2.0	1.2 – 3.3	0.01*

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DISCUSSION

Our findings reveal a disturbing profile of neonatal and maternal outcomes among gestational diabetes mellitus (GDM) patients in a Bangladeshi tertiary center. The incidence of suboptimal outcomes in the mother and neonate illustrates the enormous burden that the disease places on the patient as well as on the healthcare system. The demographic profile of our study population concurs with worldwide trends in GDM patients. The peak age group of 25-29 years (36.7%) agrees with findings of Zhu et al., who similarly found similar age patterns in their multi-center study [9]. Our cohort did, however, contain a much higher proportion of women aged 35 years and above (33.3%) compared to studies from neighboring South Asian countries, such as the 18.7% found by Shridevi et al. in India [10]. This difference may be due to changed reproductive patterns in urban Bangladesh or referral bias at our tertiary care center. Our cohort's very high frequencies of previous pregnancy complications, i.e., history of GDM (83.3%), preeclampsia (91.7%), and preterm birth (100%), are much higher than Wahabi et al. reported in Saudi women with GDM: 22.3%, 15.7%, and 19.6% respectively [11]. Such a stark disparity suggests either a very unusually high-risk population or selection bias at our tertiary center, which could see more complex cases. Our finding that 100% of the subjects presented with pre-existing diabetes mellitus and hypertension is a crucial departure from most literature. Seshiah et al. reported pre-existing diabetes in 8.3% of Indian patients with GDM, while Kampmann et al. reported hypertension in 22.1% of Danish patients with GDM [12,13]. This discrepancy has important implications towards the distinction between pre-existing diabetes and true GDM in our study population, which could represent misclassification or undiagnosed chronic illness. The mean gestational age at diagnosis of GDM (28.4 weeks) is considerably more delayed than recommended internationally, which has been to screen between 24-28 weeks [14]. The late diagnosis is likely to be the cause of high rates of complications found, as Sweeting et al. demonstrated that early diagnosis and treatment considerably reduce undesirable outcomes [15]. Cesarean section statistics verify a high dominance of 26.7% over vaginal delivery (6.7%), with the majority of cases remaining unrecorded. This cesarean rate is lower than the 41.4% of Wahabi et al. and the 44.3% of Billionnet et al., but the high percentage of unreported cases makes direct comparison impossible [11,16]. The predominance of cesarean seen here is in accordance with the worldwide trend of increased surgical delivery among GDM patients, although our incomplete data suggests the possibility of reporting bias. The excessively high postpartum complication rates, particularly depression (90%) and hospital readmission (90%), are far higher compared to those reported in comparable studies. Nicklas et al. detected postpartum depression in 34% of American women with GDM, and Berger et al. had 3.8% readmission rates [17,18]. The extreme difference is perhaps due to inadequate postpartum care, socioeconomics, or heterogeneity of diagnostic criteria. Neonatal outcomes in our study population were particularly concerning, with unanimous respiratory distress and NICU admission (100%) and extremely high rates of congenital anomalies (95%). These findings are well beyond the reported range in international literature—Wang et al. reported respiratory distress in 15.2% of neonates of Chinese women with GDM, whereas Balsells et al. reported NICU admission rates of 22.3% in a systematic review [19,20]. Our incidence of congenital anomaly in the present study is especially alarming given that Billionnet et al. have reported rates as low as 4.4% in a large series of French neonates [16]. Such vast differences could potentially suggest issues with neonatal exam protocols, diagnostic criteria, or reporting practices in our facility. Our regression analyses indicated that maternal age between 30-34 years, diabetes, and cesarean delivery were significant predictors for NICU admission and maternal age between 30-34 years and insulin therapy for neonatal death. The findings are partially in agreement with Sweeting et al., which also identified maternal age and insulin therapy as significant predictors but with much lower effect sizes [15]. The Cox regression model for maternal readmission revealed older maternal age, insulin therapy, cesarean delivery, hypertension, diabetes mellitus, and postpartum hemorrhage as significant predictors. These findings concur with Berger et al., who also discovered cesarean delivery and comorbidities as risk factors for readmission, although our hazard ratios were considerably higher [18]. These findings underscore the urgent requirement for improved GDM screening, care, and postpartum follow-up in Bangladesh. The extremely high rates of complications observed, which are higher than those documented in comparable settings, require further investigation into quality of care, diagnostic criteria, and reporting systems used in this setting.

Limitation of the study

This study was constrained by having a small number of patients, being single center, and high levels of missing data, particularly mode of delivery. Recall bias is likely to have affected reporting of previous obstetric complications, and the uniformity of our population (all with pre-existing hypertension and diabetes) makes it not generalizable to more typical GDM populations.

CONCLUSION

This study reveals alarmingly high levels of maternal and neonatal complications among GDM women in a Bangladeshi tertiary care setting. Complications were noted to be predicted by increased age, insulin therapy, and comorbidities. Extremely high rates of postpartum depression, readmission, respiratory distress, and congenital abnormalities suggest vital gaps in GDM care. Our findings underscore the urgent necessity for more rigorous screening protocols, earlier treatment, and more postpartum follow-up. Targeted surveillance of high-risk subgroups—i.e., older women and insulin-requiring women—may have the potential to reduce the heavy burden of GDM-related complications in resource-poor settings like Bangladesh.

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