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FREQUENCY OF SUCCESSFUL VAGINAL DELIVERY IN GESTATIONAL DIABETES MELLITUS PATIENTS INDUCED WITH PROSTAGLANDIN E2 AT TERM

Original Research

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ABSTRACT

Background: Gestational diabetes mellitus (GDM) is a rising concern in obstetric care due to its association with adverse maternal and fetal outcomes. Timely and effective labor induction strategies are critical to optimize delivery outcomes in these patients. Prostaglandin E2 (PGE2) is commonly employed for cervical ripening, yet its success in women with GDM remains variably reported. Identifying clinical predictors of successful vaginal delivery following induction can help guide patient management.

Objective: To determine the frequency of successful vaginal delivery in women with GDM induced with Prostaglandin E2 at term and to assess the influence of maternal characteristics on delivery outcomes.

Methods: This cross-sectional study was conducted at the Department of Obstetrics and Gynecology, CMH Kohat, from December 3, 2023, to June 2, 2024. A total of 135 women aged 18–40 years with singleton pregnancies beyond 36 weeks gestation and diagnosed with GDM were enrolled through non-probability consecutive sampling. Induction of labor was performed using 2 mg vaginal PGE2 gel every 12 hours, up to a maximum of three doses. Successful vaginal delivery (SVD) was defined as delivery within 24 hours of induction without surgical intervention. Data were analyzed using SPSS version 26.

Results: The mean age and BMI of participants were 30.44 ± 5.54 years and 23.91 ± 2.51 kg/m², respectively. Of the 135 women, 103 (76.3%) achieved successful vaginal delivery. Significant associations were found between SVD and BMI ($p = 0.001$), as well as GDM duration ($p = 0.007$). No significant association was observed with maternal age, parity, or gestational age.

Conclusion: Prostaglandin E2 is an effective agent for inducing labor in women with GDM. Lower BMI and shorter GDM duration appear to favor successful vaginal delivery.

Keywords: Body Mass Index, Cesarean Section, Gestational Age, Gestational Diabetes Mellitus, Labor Induction, Prostaglandin E2, Vaginal Delivery.

INTRODUCTION

Gestational diabetes mellitus (GDM) affects a considerable proportion of pregnancies worldwide, with recent estimates from the International Diabetes Federation indicating that nearly 20 million deliveries annually—approximately 14.0% of all pregnancies—are impacted (1). This condition not only heightens the maternal risk for obstetric complications such as hypertensive disorders, cesarean delivery, and even pregnancy termination (2), but also predisposes both the mother and the fetus to long-term metabolic disturbances, including obesity, cardiovascular disease, and the development of type 2 diabetes mellitus (T2DM) later in life (3,4). The rising prevalence of GDM has added a substantial burden on healthcare systems globally, especially in low-resource settings where access to diagnostic and therapeutic options remains limited. Despite the breadth of research, the underlying pathophysiology of GDM remains incompletely understood. Current evidence suggests a multifactorial etiology involving complex molecular, biochemical, and environmental interactions (5,6). Lifestyle modifications, including dietary regulation and increased physical activity, form the cornerstone of GDM management. However, when these measures prove insufficient, pharmacologic intervention—primarily with insulin or oral hypoglycemics like metformin and glibenclamide—is instituted, particularly in resource-constrained settings (7).

Given the heightened perinatal risks associated with pharmacologically treated GDM, clinical guidelines advocate for induction of labor (IOL) at 39 weeks of gestation to mitigate adverse maternal and neonatal outcomes (8). Prostaglandins, particularly Prostaglandin E2 (PGE2), have been widely used as cervical ripening agents in this context. These compounds facilitate labor initiation by promoting cervical softening and uterine contractions. Among the various formulations, extended-release vaginal pessaries offer the advantage of reducing the need for multiple administrations and repeated vaginal examinations. While the use of vaginal prostaglandins has been shown to increase the likelihood of achieving vaginal delivery within 24 hours, it carries the potential risk of uterine hyperstimulation and transient fetal heart rate changes. Nonetheless, available evidence suggests that they do not significantly elevate the risk of cesarean section and may in fact reduce it (9-11). A study reported a 34.1% rate of successful vaginal delivery in GDM patients induced with PGE2 at term, underscoring the need for further evaluation of its clinical utility in this subgroup (12). Despite the widespread use of labor-inducing agents, an optimal, universally effective, and well-tolerated method remains elusive, particularly in women with GDM. Most current approaches only partially replicate the physiologic cascade of cervical effacement and uterine contractions, leading to inconsistent outcomes. Therefore, this study aimed to determine the frequency of successful vaginal delivery in term pregnancies complicated by gestational diabetes mellitus following induction with Prostaglandin E2, with the goal of informing best practices for labor management in this high-risk population.

METHODS

This cross-sectional study was conducted in the Department of Obstetrics and Gynecology at CMH Kohat from December 3, 2023, to June 2, 2024. A total of 135 women were enrolled based on a sample size calculated using WHO sample size software with a 95% confidence interval, an 8% margin of error, and an expected frequency of successful vaginal delivery of 34.1% in GDM patients induced with Prostaglandin E2 at term (10). The sampling technique used was non-probability consecutive sampling. Ethical approval was obtained from the hospital's institutional review board (IRB), and informed written consent was obtained from all participants. Confidentiality and anonymity were assured, and participation posed no risk to the participants. Women aged 18 to 40 years with a gestational age beyond 36 weeks, parity less than six, singleton pregnancy, cephalic presentation confirmed on ultrasound, intact fetal membranes, and a Bishop score of 4 or below were included if they were diagnosed with gestational diabetes mellitus. Diagnosis of GDM was based on a two-step process. Initially, a 50-gram glucose challenge test was administered, and a plasma glucose level >140 mg/dL prompted a confirmatory 75-gram 2-hour oral glucose tolerance test (OGTT) after an overnight fast. Diagnostic thresholds were 1-hour glucose ≥180 mg/dL and 2-hour glucose ≥150 mg/dL. Women with low-lying placenta, history of previous cesarean section, non-cephalic presentations, or non-reassuring cardiotocography (CTG) were excluded from the study (13,14). Baseline demographic and clinical information, including maternal age, gestational age at induction, parity, and duration of GDM, was recorded on a predesigned proforma. All participants underwent induction of labor using Prostaglandin E2 (PGE2) 2 mg vaginal gel, applied to the posterior vaginal fornix every 12 hours, up to a maximum of three doses, as per unit protocol. Proper cold chain maintenance of the medication was ensured throughout the process.

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Labor progression was monitored using a partogram, and fetal heart rate was observed continuously through periodic auscultation. Vaginal examination was performed upon initiation of contractions and intermittently thereafter to assess cervical changes. Maternal vital signs were recorded every four hours during labor. The onset of moderate to severe uterine contractions was documented, and if active labor failed to establish after the maximum number of PGE2 doses, the induction was considered unsuccessful, and cesarean delivery was recommended. Additional indications for cesarean section included fetal distress, arrest of labor progression, or prolonged second stage of labor. Successful vaginal delivery was operationally defined as the delivery of the fetus, placenta, and membranes through the vaginal route within 24 hours of PGE2 administration. Data were entered and analyzed using IBM SPSS version 25. Descriptive statistics were used to calculate frequencies and percentages for qualitative variables, such as successful vaginal delivery. Means and standard deviations were computed for continuous variables, including age, gestational age, parity, and duration of GDM. These variables were stratified to explore associations with the success rate of vaginal delivery. Post-stratification chi-square tests were applied, and a p-value <0.05 was considered statistically significant.

RESULTS

The study included 135 participants with a mean age of 30.44 ± 5.54 years and a mean BMI of 23.91 ± 2.51 kg/m². The mean period of gestation at the time of induction was 34.39 ± 4.91 weeks. Nearly half of the participants (51.9%) were older than 30 years, while 48.1% were aged 30 years or below. A majority (78.5%) had gestational age of 38 weeks or less at induction. Most participants (58.5%) had a BMI of 24.0 kg/m² or lower, whereas 41.5% had BMI values above this threshold. In terms of parity, 51.9% had three or fewer prior deliveries, and 48.1% had parity above three. Regarding the duration of gestational diabetes mellitus, 54.1% had GDM for more than three months, while 45.9% had GDM for three months or less. Educationally, 58.5% of women had qualifications above matriculation level, while 41.5% were matric or below. Most women (69.6%) were unemployed, and only 30.4% were employed at the time of the study. Overall, 103 participants (76.3%) achieved successful vaginal delivery within 24 hours of induction with Prostaglandin E2. Among women aged 30 years or below, 78.5% experienced successful vaginal delivery, compared to 74.3% in those above 30 years of age, with no statistically significant difference (p = 0.569). Likewise, successful delivery was observed in 75.5% of participants with gestational age 38 weeks or below and in 79.3% of those above 38 weeks (p = 0.667). No significant association was found between parity and vaginal delivery outcomes (p = 0.330). A statistically significant relationship was found between BMI and delivery outcome (p = 0.001). Women with BMI above 24.0 kg/m² had a markedly higher rate of successful vaginal delivery (91.1%) compared to those with lower BMI (65.8%). Similarly, a significant association was observed with the duration of GDM (p = 0.007), where those with GDM for three months or less had a higher success rate (87.1%) compared to those with longer durations (67.1%).

Table 1: Descriptive statistics of study participants (n = 135)

Baseline parameters	Mean	Std. Deviation
Age (years)	30.44	5.542
PoG (weeks)	34.39	4.907
BMI (kg/m^2)	23.909	2.5082

Table 2: Baseline parameters of study participants (n = 135)

Parameters		Frequency	Percent
Age (years)	30 or below	65	48.1
	Above 30	70	51.9
Gestational age (weeks)	38 or below	106	78.5
	Above 38	29	21.5
Parity	3 or below	70	51.9
	More than 3	65	48.1
BMI (kg/m^2)	24.0 or below	79	58.5
	Above 24.0	56	41.5
GDM duration (months)	3 or below	62	45.9
	More than 3	73	54.1
Education	Matric or below	56	41.5

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Parameters		Frequency	Percent
	Above matric	79	58.5
Profession	Employed	41	30.4
	Unemployed	94	69.6

Table 3: Stratification of SVD with baseline parameters (n = 135). SVD = Successful vaginal delivery, GDM = Gestational Diabetes Mellitus

		SVD		Total	P value
		No	Yes		
Age (years)	30 or below	14	51	65	0.569
		21.5%	78.5%	100.0%	
	Above 30	18	52	70	
		25.7%	74.3%	100.0%	
Gestational age (weeks)	38 or below	26	80	106	0.667
		24.5%	75.5%	100.0%	
	Above 38	6	23	29	
		20.7%	79.3%	100.0%	
Parity	3 or below	19	51	70	0.330
		27.1%	72.9%	100.0%	
	Above 3	13	52	65	
		20.0%	80.0%	100.0%	
BMI (kg/m^2)	24.0 or below	27	52	79	0.001
		34.2%	65.8%	100.0%	
	Above 24.0	5	51	56	
		8.9%	91.1%	100.0%	
GDM duration (months)	3 or below	8	54	62	0.007
		12.9%	87.1%	100.0%	
	Above 3	24	49	73	
		32.9%	67.1%	100.0%	

Figure 1 Successful Vaginal Delivery by BMI

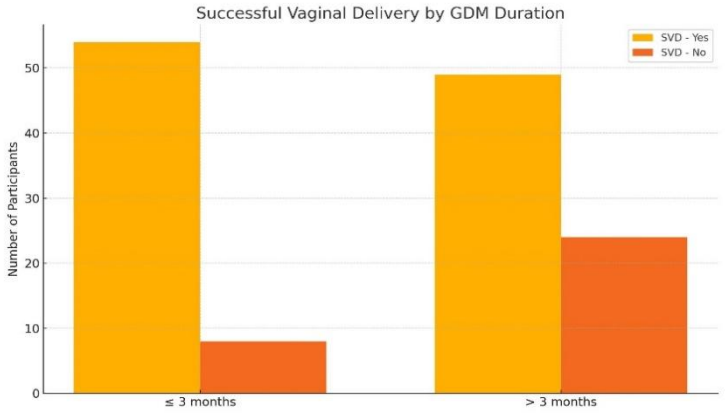

Figure 2 Successful Vaginal Delivery by GDM Duration

DISCUSSION

In diabetic pregnancies, the timing of delivery plays a crucial role in balancing maternal and fetal outcomes. It is generally recommended to delay delivery until fetal lung maturity is achieved, provided glycemic control is maintained and fetal monitoring remains reassuring. Elective delivery is typically scheduled between 38 and 40 weeks of gestation to minimize risks associated with macrosomia and

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perinatal complications. In the present study, all participants were induced after 36 weeks, aligning with recommendations aimed at optimizing neonatal respiratory maturity and minimizing the need for cesarean section in cases where labor induction fails or fetal macrosomia is anticipated (15,16). Although labor induction is commonly advised for diabetic pregnancies approaching term, limited data exist regarding its effectiveness and safety. A comprehensive review revealed only one Cochrane database analysis addressing this subject, highlighting the paucity of high-quality evidence (17). Earlier investigations did not report significant differences in outcomes such as macrosomia or cesarean section based on management strategies. However, it was noted that women undergoing expectant management beyond 40 weeks exhibited a higher incidence of obstructed labor, suggesting that delayed induction may be associated with unfavorable outcomes in some cases (18). Elective induction between 38 and 39 weeks in well-controlled diabetic pregnancies has been associated with a reduced incidence of macrosomia, traumatic deliveries, and cesarean sections, particularly when fetal weight estimation guides the decision-making process (19). Nonetheless, most prior studies excluded women with GDM not requiring insulin and lacked uniformity in labor induction protocols and cervical ripening techniques, limiting the generalizability of their findings (20). This study addressed such limitations by employing a uniform protocol, a single-center design, and a consistent clinical team over six months, thereby minimizing inter-facility variability and ensuring a standardized management approach (21).

The current study reported a successful vaginal delivery rate of 76.3% following induction with Prostaglandin E2, without notable maternal or neonatal complications. This is higher than rates reported in earlier studies, suggesting that prostaglandin-based induction, when administered under controlled conditions and in appropriately selected candidates, may be an effective and safe strategy for labor initiation in GDM patients. The comparatively higher success rate in this study cannot be solely attributed to the absence of fetal macrosomia; clinical caution surrounding shoulder dystocia and other diabetes-associated risks may also contribute to higher cesarean rates reported elsewhere (22). Moreover, induction for medical indications, including GDM, is generally associated with increased likelihood of operative deliveries, reflecting the inherent complexities in such cases (23). Variability in cesarean section rates reported across studies may also be influenced by parity. Research indicates that nulliparous women undergoing elective induction are at greater risk for operative deliveries compared to their multiparous counterparts (19,20). In this study, the proportion of nulliparous participants was relatively low, which may have favorably influenced the vaginal delivery outcomes. Had the nulliparity rate been higher, a correspondingly increased cesarean section rate could be anticipated, as supported by recent findings linking labor induction in first-time mothers to higher rates of cesarean and assisted deliveries (24). The strength of this study lies in its prospective design, uniform clinical protocol, and clear inclusion criteria, which collectively enhanced the reliability of outcomes. However, the study was limited by its single-center nature, relatively short follow-up period, and exclusion of important factors such as fetal weight estimation and detailed neonatal outcomes. Additionally, variables like Bishop score response dynamics and long-term maternal and neonatal follow-up were not explored. Future research should focus on multicenter trials with broader inclusion criteria and stratified analysis by parity, glycemic control level, and fetal biometry to establish clearer guidelines for labor induction in GDM populations.

CONCLUSION

In conclusion, induction of labor with Prostaglandin E2 proved to be an effective and practical method for achieving successful vaginal delivery in women with gestational diabetes at term. The findings highlight that, maternal characteristics such as earlier gestational age, lower BMI, and shorter duration of diabetes may favor better outcomes. While the majority of patients responded well to this approach, a proportion still required operative interventions, underscoring the need for individualized clinical decision-making. These results support the continued use of PGE2 in well-monitored settings and emphasize the value of future research exploring alternative strategies to optimize delivery outcomes while minimizing maternal and neonatal risks.

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AUTHOR CONTRIBUTION

Author	Contribution
Aeman Ameen*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Syeda Surayya Jabeen	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Raahima Nasim	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Faria Mumtaz	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

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