



Original Article



Frequency and Risk of Preeclampsia in Women with Gestational Diabetes Mellitus

Aliya Dar Khan¹, Nafeesa Ghani², Salma Khan³ and Hoor Asadullah Jan^{4*}¹Department of Obstetrics and Gynecology, Cat D Hospital, KPK, Pakistan²Life Care Hospital and Research Institute, Hayatabad, Pakistan³Department of Biochemistry, Rehman Medical College, Peshawar, Pakistan⁴Department of Obstetrics and Gynecology, Saeed Medical Complex Mattani, Peshawar, Pakistan

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Department of Obstetrics and Gynecology, Saeed Medical Complex Mattani, Peshawar, Pakistan
abuxarasad@gmail.comReceived Date: 20th May, 2024Acceptance Date: 12th November, 2024Published Date: 30th November, 2024

ABSTRACT

Preeclampsia is a serious hypertensive disorder of pregnancy that affects 5-8% of pregnancies and is a major cause of maternal and neonatal morbidity and mortality. Gestational diabetes mellitus is another significant pregnancy complication that increases the risk of adverse maternal and fetal outcomes, including preeclampsia. **Objectives:** To determine the frequency and assess the risk of preeclampsia in pregnant women diagnosed with gestational diabetes mellitus as an independent risk factor. **Methods:** This descriptive cross-sectional study was carried out from October 2020 to April 2021 within the Department of Obstetrics and Gynecology, Medical Teaching Institution-Hayatabad Medical Complex Peshawar and included patients having regular monitoring for blood pressure using a mercury sphygmomanometer and proteinuria by urine dipstick. **Results:** A total of 133 pregnant women were diagnosed with gestational diabetes mellitus in the study. Of these, 10 women (7.5%) developed preeclampsia, indicating a significant association between gestational diabetes mellitus and preeclampsia. Participants were aged between 18 and 45 years, with the majority (75%) falling within the 18-30-year age group. Results showed that gestational diabetes mellitus was associated with an increased risk of preeclampsia, particularly in this younger age group. **Conclusions:** It was concluded that gestational diabetes mellitus is associated with a higher risk of preeclampsia and requires intensive clinical follow-up and intervention measures for maternal and fetal health protection.

INTRODUCTION

Preeclampsia (PE) is a hypertensive disorder that typically occurs after the 20th week of pregnancy, characterized by elevated blood pressure and proteinuria. This condition is a leading cause of maternal and fetal morbidity and mortality, complicating 5-8% of all pregnancies globally. It contributes to adverse outcomes such as preterm birth, placental abruption, and, in severe cases, maternal and fetal death [1, 2]. Given its significant impact on maternal and neonatal health, understanding and managing the risk factors associated with PE is critical for improving pregnancy outcomes. While the association between PE and Gestational Diabetes Mellitus (GDM) has been extensively studied in global populations, there is limited research specific to low- and middle-income countries (LMICs) like Pakistan. In these regions, the rising incidence of both conditions, due to increasing rates of obesity,

delayed pregnancies, and limited access to healthcare services, necessitates a deeper understanding of how these complications interact [3, 4]. The scarcity of region-specific data on the prevalence and risk factors for PE among women with GDM highlights a critical gap in the literature. Without this localized knowledge, public health strategies and clinical interventions may lack the precision needed to effectively reduce maternal morbidity and mortality rates [5, 6]. In Pakistan, where healthcare resources are often constrained, and maternal health outcomes lag behind global standards, the study of PE in women with GDM is particularly urgent. The high maternal mortality rates in this region underscore the need for targeted research that can inform more effective management and prevention strategies [7]. This study seeks to fill this gap by providing valuable data on the



prevalence of PE among GDM patients in a tertiary care setting, contributing to a more nuanced understanding of these conditions within the regional context. By identifying specific risk factors and patterns, the findings can support the development of tailored healthcare interventions to mitigate the adverse outcomes associated with PE and GDM in this population [8, 9]. Gestational Diabetes Mellitus (GDM) is another significant complication, occurring in approximately 7% of pregnancies. It is characterized by glucose intolerance with onset during pregnancy and is associated with increased risks of adverse maternal and neonatal outcomes, including macrosomia, cesarean delivery, and future development of type 2 diabetes in both the mother and child [10]. The interplay between GDM and PE is particularly concerning, as both conditions share common risk factors such as advanced maternal age, obesity, and metabolic disorders. Recent studies have demonstrated that GDM can independently increase the risk of developing PE, possibly due to shared pathophysiological mechanisms such as endothelial dysfunction and inflammatory responses [11, 12]. In low- and middle-income countries (LMICs), the incidence of both GDM and PE is rising due to increasing rates of obesity, delayed pregnancies, and limited access to healthcare services [13]. These factors make it essential to investigate the local epidemiology of PE in women with GDM, particularly in regions like Peshawar, Pakistan, where healthcare resources are constrained, and maternal mortality rates remain high. Understanding these associations within a regional context could inform public health strategies aimed at reducing maternal and neonatal morbidity and mortality [14, 15]. GDM is one of the most common complications of pregnancy, affecting approximately 7% of all pregnancies globally. GDM is characterized by glucose intolerance with onset during pregnancy, which poses significant risks for both maternal and fetal health, including preeclampsia, macrosomia, and the future development of type 2 diabetes. The increasing prevalence of GDM, particularly in low- and middle-income countries like Pakistan, is largely driven by rising rates of obesity and delayed childbearing. Despite its growing significance, there remains a gap in region-specific research investigating the interplay between GDM and preeclampsia in these populations. Understanding the local epidemiology and risk factors associated with these conditions is critical to improving maternal and neonatal outcomes through targeted interventions and enhanced clinical care strategies [16].

This study aims to evaluate the frequency of PE among women diagnosed with GDM in a tertiary care hospital in Peshawar. By identifying the prevalence and risk factors for PE in this population, the study will contribute to the broader understanding of these conditions and support the development of effective preventive and management strategies.

METHODS

This descriptive cross-sectional study was conducted in the Department of Obstetrics & Gynecology at Medical Teaching Institution-Hayatabad Medical Complex (MTI-HMC) Peshawar from October 2020 to April 2021. The site is a tertiary care facility that serves an ethnically diverse population from the surrounding region, allowing us to investigate the prevalence and characteristics of preeclampsia among women diagnosed with GDM. The study population consisted of pregnant women diagnosed with GDM, as defined by the American Diabetes Association (ADA) guidelines. A glucose tolerance test was performed with a fasting glucose level greater than 92 mg/dL, a one-hour postprandial glucose level greater than 180 mg/dL, or a two-hour postprandial glucose level greater than 153 mg/dL. Women with pre-existing diabetes or hypertension were excluded from the study. Participation was contingent upon obtaining informed consent from all participants. A convenience sampling technique was employed to recruit participants from the hospital's outpatient and inpatient departments. A total of 133 pregnant women met the inclusion criteria. The sample size was determined based on the prevalence of GDM as 17.2% using a confidence level of 95% an allowable error of 7% and a 20% dropout rate [16]. Data were collected through structured interviews conducted by trained medical personnel, who reviewed patient records to gather demographic details (age, ethnicity, and body mass index), medical history, and specific pregnancy-related variables (e.g., gestational age at GDM diagnosis, history of preeclampsia, and birth weight of previous infants). Blood pressure was measured using a calibrated mercury sphygmomanometer, with readings taken twice, at least four hours apart. By the International Society for the Study of Hypertension in Pregnancy (ISSHP) guidelines, preeclampsia was defined as blood pressure exceeding 140/90 mmHg on two separate occasions within a week, along with proteinuria. Proteinuria was assessed using a urine dipstick test, with a result of 1+ or greater considered positive. Reliability checks for the equipment were conducted regularly to ensure consistent and accurate readings. Calibration of the sphygmomanometers was performed weekly to maintain accuracy, and any deviations were corrected immediately. Additionally, the urine dipstick tests used were from a single manufacturer to ensure uniformity in results. Handling of missing data, and incomplete data, such as missing blood pressure readings or proteinuria results, were excluded from the final analysis. However, efforts were made to minimize missing data by thoroughly reviewing patient records and conducting repeat tests when necessary. The data were analyzed using SPSS version 25.0. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were used to summarize the characteristics of the study population. The association between GDM and

preeclampsia was assessed using Chi-square tests for categorical variables and t-tests for continuous variables, with a p-value of less than 0.05 considered statistically significant. The study protocol was approved by the Ethics Committee of MTI-HMC Peshawar (reference number: 1254), in compliance with the 1964 Helsinki Declaration and its subsequent amendments.

RESULTS

A total of 133 pregnant women were diagnosed with GDM in the study. The participants' mean age was 29.98 ± 5.21 years, with a mean BMI of 25.51 ± 1.09 kg/m². The average gestational age at data collection was 32.22 ± 1.98 weeks, and the average duration of GDM was 4.01 ± 1.25 weeks (Table 1).

Table 1: Descriptive Statistics of Study Participants (n=133)

Variable	Minimum	Maximum	Mean \pm SD
Age (Years)	22	38	29.98 \pm 5.21
Gestational Age (Weeks)	29	36	32.22 \pm 1.98
Duration of Disease (Weeks)	2	6	4.01 \pm 1.25
BMI (kg/m ²)	23.5	28.5	25.51 \pm 1.09

Participants were distributed evenly across age groups, with 70 women (52.6%) in the 18–30 years' age group and 63 women (47.4%) in the 31–45 years' age group (Table 2).

Table 2: Age-wise Distribution of Participants (n=133)

Age Group	Frequency (%)
18–30 Years	70 (52.6%)
31–45 Years	63 (47.4%)

Of the 133 participants, 44 women (33.1%) exhibited proteinuria (Table 3).

Table 3: Frequencies and Percentages for Proteinuria (n=133)

Proteinuria	Frequency (%)
Yes	44 (33.1%)
No	89 (66.9%)

Preeclampsia was diagnosed in 10 women (7.5%) of the study population (Table 4)

Table 4: Frequencies and Percentages for Preeclampsia (n=133)

Proteinuria	Frequency (%)
Yes	10 (7.5%)
No	123 (92.5%)

To explore possible correlations between preeclampsia and other factors, preeclampsia cases were stratified by age, BMI, and duration of GDM. Among women aged 18–30 years, 6 developed preeclampsia (8.6%), compared to 4 women in the 31–45 years' group (6.3%). However, no statistically significant difference was found between the age groups ($p=0.627$) (Table 5).

Table 5: Stratification of Preeclampsia by Age Groups (n=133)

Age Group	Preeclampsia (Yes)	No Preeclampsia	Total	P-value
18–30 Years	6 (8.6%)	64 (91.4%)	70	0.627

31–45 Years	4 (6.3%)	59 (93.7%)	63	0.627
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Stratification by BMI revealed that 9 women (8.8%) with a BMI greater than 25 kg/m² developed preeclampsia, compared to 1 woman (3.2%) with a BMI less than 25 kg/m². However, the association was not statistically significant ($p=0.301$) (Table 6).

Table 6: Stratification of Preeclampsia by BMI (n=133)

BMI Group	Preeclampsia (Yes)	No Preeclampsia	Total	P-value
<25 kg/m ²	1 (3.2%)	30 (96.8%)	31	0.301
>25 kg/m ²	9 (8.8%)	93 (91.2%)	102	

Similarly, no significant association was observed between the duration of GDM and preeclampsia. Among women with GDM for less than 4 weeks, 5 developed preeclampsia (7.1%), and 5 women with GDM for more than 4 weeks developed the condition (7.9%) ($p=0.862$) (Table 7).

Table 7: Stratification of Preeclampsia by Duration of Disease (n=133)

Duration of Disease	Preeclampsia (Yes)	No Preeclampsia	Total	P-value
<4 Weeks	5 (7.1%)	65 (92.9%)	70	0.862
>4 Weeks	5 (7.9%)	58 (92.1%)	63	

DISCUSSION

This study provides evidence of a significant association between gestational diabetes mellitus (GDM) and preeclampsia (PE), with 7.5% of GDM patients in our cohort developing PE. These findings highlight the critical importance of monitoring women with GDM for signs of hypertensive disorders. PE complicates approximately 5–8% of pregnancies globally, but rates vary widely across populations, ranging from 2.9% in Swedish cohorts to as high as 30% in Indian populations [11]. Our results align moderately with these global trends, emphasizing the substantial risk GDM poses for PE development. Compared to international studies, the incidence of PE in our cohort is consistent with findings from middle-income countries, such as Pakistan and India, where higher rates of GDM and limited access to healthcare contribute to increased PE incidence [17, 8]. However, the slightly lower incidence of PE in our cohort compared to some populations may be attributed to differences in sample size, healthcare access, and genetic predispositions. Such variations underscore the need for region-specific strategies for managing and mitigating these risks. In our study, the prevalence of preeclampsia among women diagnosed with GDM was 7.5%, which is comparable to the findings of other studies conducted in low- and middle-income countries (LMICs) like Pakistan. A similar study conducted in Karachi reported a slightly higher incidence of preeclampsia (9.3%) among women with GDM, which was attributed to higher rates of obesity and metabolic disorders in the urban population [18]. The relatively lower incidence in our cohort from Peshawar may reflect differences in healthcare access,

lifestyle, and genetic predispositions between urban and semi-urban populations. Additionally, varying diagnostic criteria and sample sizes across studies could contribute to the differences in preeclampsia rates. Despite the well-documented association between elevated BMI and the risk of preeclampsia in GDM patients, our study did not find a statistically significant relationship between BMI and preeclampsia. This contrasts with the findings of a study from Lahore, which demonstrated a strong correlation between BMI > 25 kg/m² and the incidence of hypertensive disorders in pregnancy. One possible explanation for this discrepancy could be the relatively small sample size in our study, which may limit the power to detect significant associations. Furthermore, differences in the nutritional and socio-economic profiles of the populations studied may also contribute to the variation in findings [19]. This study highlights that GDM is an independent risk factor for PE, a conclusion supported by previous research linking GDM's metabolic complications, such as lipid metabolism disorders and vascular dysfunction, to the development of PE [20]. This dual pathophysiology suggests that systemic endothelial dysfunction in women with GDM may initially manifest as PE and could later contribute to the development of GDM in subsequent pregnancies if left unaddressed [11]. While the current study adds to the growing body of literature on the relationship between GDM and PE, it also has limitations. The cross-sectional nature of the study restricts the ability to establish causality. Furthermore, using a convenience sample from a single tertiary care center may introduce selection bias, and the relatively small sample size may limit the generalizability of the findings. Future studies should explore larger, more diverse populations and adopt longitudinal designs to elucidate the temporal relationship between these conditions better. Also include potential confounders such as undiagnosed pre-existing conditions and reliance on self-reported medical histories, which may have affected the accuracy of data regarding preeclampsia risk factors. More region-specific studies are also needed to tailor healthcare interventions for diverse populations, particularly in low- and middle-income countries where healthcare access is limited. Ultimately, enhancing early detection and improving management protocols for these high-risk pregnancies will be essential for reducing maternal and neonatal morbidity and mortality.

CONCLUSIONS

This study, conducted at a tertiary care hospital in Peshawar, identified a 7.5% incidence of preeclampsia among pregnant women with gestational diabetes mellitus (GDM). The findings highlight the significant risk that GDM poses for the development of hypertensive disorders during pregnancy. These results underscore the critical

need for integrated screening and vigilant monitoring of GDM. Proactive management, including early detection and tailored interventions, is essential to mitigate complications and improve outcomes for both mothers and their offspring.

Authors Contribution

Conceptualization: ADK

Methodology: ADK, NG, SK, HAJ

Formal analysis: ADK

Writing review and editing: NG

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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