

Maternal And Obstetric Factors Associated With Preterm Birth In Pregnancies Complicated By Placenta Previa: A Single-Center Study

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Abstract

Background

Preterm birth remains a major contributor to neonatal morbidity and mortality worldwide. Placenta previa is a high-risk obstetric condition frequently associated with preterm delivery; however, the role of specific maternal and obstetric factors in predicting preterm birth among affected pregnancies remains incompletely understood, particularly in resource-limited settings.

Objective

To identify maternal and obstetric factors associated with preterm birth among pregnancies complicated by placenta previa at a tertiary care center.

Methods

This observational analytical study was conducted at Mardan Medical Complex, Mardan, from July to December 2022. Pregnant women with a confirmed diagnosis of placenta previa and singleton gestation were consecutively enrolled and followed until delivery. Preterm birth was defined as delivery before 37 completed weeks of gestation. Maternal characteristics and obstetric variables, including booking status, previous cesarean section, type and location of placenta previa, gestational age at diagnosis, and antepartum hemorrhage, were recorded. Data were analyzed using SPSS version 26. Associations between maternal and obstetric factors and preterm birth were assessed using Chi-square tests and independent-samples t-tests, with a significance level of $p \leq 0.05$.

Results

A total of 150 women with placenta previa were included. Preterm birth occurred in approximately two-thirds of the study population, indicating a high burden of early delivery in this cohort. Maternal age and gestational age at diagnosis did not differ significantly between women who delivered preterm and those who delivered at term. Furthermore, no statistically significant associations were observed between preterm birth and booking status, history of previous cesarean section, type of placenta previa, placental location, or presence of antepartum hemorrhage. Multivariable analysis was not pursued due to the absence of significant univariate associations and instability of the regression model.

Conclusion

Pregnancies complicated by placenta previa are associated with a high frequency of preterm birth, irrespective of identifiable maternal or obstetric risk factors. These findings suggest that placenta previa itself constitutes an intrinsic risk for preterm delivery, underscoring the importance of vigilant antenatal surveillance and delivery planning for all affected women. The study provides valuable context-specific evidence from a tertiary care setting and highlights the need for proactive obstetric management in pregnancies complicated by placenta previa.

Keywords: Placenta Previa, Premature Birth, Pregnancy Complications, Risk Factors, Cesarean Section, Maternal Health, Infant, Newborn.

Introduction

Preterm birth, defined as delivery before 37 completed weeks of gestation, remains a leading global public health challenge and a major contributor to neonatal morbidity and mortality. It is estimated that approximately 15 million preterm births occur annually worldwide, accounting for a substantial proportion of neonatal deaths and long-term neurodevelopmental impairment among survivors [1]. Preterm infants are at increased risk of respiratory distress syndrome, intraventricular hemorrhage, sepsis, and feeding difficulties, as well as long-term adverse outcomes including cerebral palsy, cognitive impairment, and chronic cardiometabolic disease [2,3]. Despite advances in

obstetric and neonatal care, the global burden of preterm birth has shown limited decline, highlighting the need for improved risk stratification and preventive strategies, particularly in high-risk obstetric populations [4].

Placenta previa is a well-recognized high-risk obstetric condition characterized by placental implantation in the lower uterine segment, partially or completely covering the internal cervical os. Its reported incidence ranges from 0.3% to 0.5% of all pregnancies and has increased in recent decades, largely due to rising cesarean section rates and advanced maternal age [5,6]. Placenta previa is associated with significant maternal morbidity, including antepartum hemorrhage, postpartum hemorrhage, blood transfusion, and emergency cesarean delivery, as well as adverse neonatal outcomes such as low birth weight, neonatal intensive care unit (NICU) admission, and perinatal mortality [7,8]. Preterm birth is one of the most frequent and clinically significant complications of placenta previa, often resulting from recurrent antepartum bleeding or the need for medically indicated early delivery to prevent maternal or fetal compromise [9].

Several maternal and obstetric factors have been implicated in the risk of preterm birth among pregnancies complicated by placenta previa. Advanced maternal age, multiparity, prior cesarean delivery, type and location of placenta previa, recurrent antepartum hemorrhage, and gestational age at diagnosis have all been reported as potential predictors of preterm delivery [6,9,10]. However, existing studies demonstrate considerable heterogeneity in findings, likely due to variations in study design, sample size, diagnostic criteria, and clinical management protocols. Moreover, many published reports focus primarily on overall maternal and neonatal outcomes of placenta previa rather than specifically examining factors associated with preterm birth. The relative contribution of individual maternal and obstetric characteristics to preterm delivery risk remains inconsistently defined, and evidence from low- and middle-income countries is particularly limited [11,12].

Identification of maternal and obstetric factors associated with preterm birth in placenta previa is clinically important for several reasons. Early recognition of women at higher risk of preterm delivery may facilitate targeted antenatal surveillance, timely administration of corticosteroids, optimization of delivery planning, and appropriate referral to tertiary care facilities with neonatal intensive care capabilities. In resource-limited settings, where access to advanced neonatal care may be constrained, risk stratification becomes even more critical for improving perinatal outcomes. Despite this need, data from single-center studies in such settings remain scarce, limiting the applicability of existing evidence to diverse clinical environments.

Therefore, this study aims to identify maternal and obstetric factors associated with preterm birth among women with pregnancies complicated by placenta previa at a tertiary care center. By addressing this knowledge gap, the study seeks to contribute context-specific evidence that may support improved antenatal risk assessment and inform clinical decision-making in high-risk obstetric populations.

Materials and Methods

Study Design and Setting

This observational, analytical study was conducted at Mardan Medical Complex, Mardan, a tertiary care teaching hospital that serves as a major referral center for high-risk obstetric cases in the region. The study was carried out over a six-month period from July 2022 to December 2022. The study was designed to identify maternal and obstetric factors associated with preterm birth among women diagnosed with placenta previa.

Study Population

The study population comprised pregnant women diagnosed with placenta previa who were admitted to the obstetrics unit of Mardan Medical Complex during the study period. Women were included irrespective of parity and booking status. Placenta previa was identified at varying gestational ages, either during routine antenatal ultrasound examination or upon hospital admission for obstetric care. All eligible participants were followed until delivery to ascertain pregnancy outcomes.

Definition of Placenta Previa and Preterm Birth

Placenta previa was defined as placental implantation in the lower uterine segment partially or completely covering the internal cervical os, as confirmed by transabdominal and/or transvaginal ultrasonography performed by experienced radiologists or obstetricians. Preterm birth was defined as delivery occurring before 37 completed weeks of gestation, in accordance with standard World Health Organization criteria.

Inclusion and Exclusion Criteria

Women were included if they had a confirmed diagnosis of placenta previa, a singleton pregnancy, and available medical records documenting antenatal course and delivery outcomes. Women with multiple gestations, major fetal congenital anomalies, placenta accreta spectrum disorders, or medically indicated preterm delivery for non-obstetric reasons (such as severe maternal medical illness unrelated to placenta previa) were excluded from the study to minimize confounding.

Sampling Technique and Sample Size

A non-probability consecutive sampling technique was employed, whereby all eligible women meeting the inclusion criteria during the study period were enrolled. The sample size was determined by the number of patients diagnosed with placenta previa who delivered during the defined timeframe and was considered sufficient to evaluate associations between maternal and obstetric factors and preterm birth within the study population.

Data Collection and Study Variables

Data were collected using a structured proforma developed for the study. Information was obtained from patients' medical records, antenatal clinic notes, ultrasound reports, and labour ward registers. Maternal variables included age, parity, booking status, and history of previous cesarean section. Obstetric variables included type of placenta previa (major or minor), gestational age at diagnosis, presence of antepartum hemorrhage, number of bleeding episodes, and gestational age at delivery. Data collection was performed by trained medical personnel, and records were reviewed for completeness and accuracy.

Outcome Measures

The primary outcome of the study was preterm birth, defined as delivery before 37 completed weeks of gestation. No additional secondary outcomes were included in the primary analysis.

Statistical Analysis

Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS), version 26. Continuous variables were summarized using means and standard deviations, while categorical variables were expressed as frequencies and percentages. Associations between maternal and obstetric factors and preterm birth were assessed using the Chi-square test or Fisher's exact test, as appropriate. Variables demonstrating significant associations on univariate analysis were further evaluated using binary logistic regression to identify independent predictors of preterm birth. A p-value of ≤ 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Ethics Review Committee of Mardan Medical Complex. As this was an observational study based on routinely collected clinical data, informed consent was obtained where applicable. Patient confidentiality was strictly maintained by anonymizing data and restricting access to study records to the research team only.

Results

Study Population and Baseline Characteristics

A total of 150 women with pregnancies complicated by placenta previa were included in the final analysis. The mean maternal age was 32.1 ± 5.9 years. Placenta previa was diagnosed at a mean gestational age of 25.9 ± 3.4 weeks, and the mean gestational age at delivery was 35.6 ± 1.9 weeks. Antepartum hemorrhage was observed in 58.7% of cases, and 75.3% of women had a history of at least one previous cesarean section. Major placenta previa accounted for 48.0% of cases. All women delivered by cesarean section. Neonatal intensive care unit (NICU) admission was required in 36.0% of neonates. Detailed baseline maternal, obstetric, and neonatal characteristics are presented in

Table 1.

Table 1. Baseline Maternal, Obstetric, and Neonatal Characteristics (n = 150)

Variable	Value
Maternal age (years), mean $\pm$ SD	32.1 ± 5.9
Gestational age at diagnosis (weeks), mean $\pm$ SD	25.9 ± 3.4

Variable	Value
Gestational age at delivery (weeks), mean $\pm$ SD	35.6 $\pm$ 1.9
Antepartum hemorrhage, n (%)	88 (58.7)
Previous cesarean section, n (%)	113 (75.3)
Major placenta previa, n (%)	72 (48.0)
Minor placenta previa, n (%)	78 (52.0)
Preterm birth (<37 weeks), n (%)	100 (66.7)
Term birth ($\geq$ 37 weeks), n (%)	50 (33.3)
NICU admission, n (%)	54 (36.0)

Preterm Birth Outcomes

Preterm birth, defined as delivery before 37 completed weeks of gestation, occurred in 100 women (66.7%), while 50 women (33.3%) delivered at term. The distribution of preterm and term deliveries formed the basis for subsequent comparative analyses.

Comparison of Continuous Variables by Preterm Birth Status

Independent-samples t-test analysis demonstrated no statistically significant difference in maternal age between women who delivered preterm and those who delivered at term (31.96 $\pm$ 6.21 vs 32.30 $\pm$ 5.18 years; $p = 0.739$). Similarly, gestational age at diagnosis of placenta previa did not differ significantly between the two groups (25.99 $\pm$ 3.38 vs 25.71 $\pm$ 3.33 weeks; $p = 0.630$). These findings indicate that neither maternal age nor gestational age at diagnosis was significantly associated with preterm birth. Detailed comparisons are summarized in Table 3.

Association Between Maternal and Obstetric Factors and Preterm Birth

Univariate analysis using the Chi-square test revealed no statistically significant associations between preterm birth and booking status ($p = 0.599$), history of previous cesarean section ($p = 0.893$), type of placenta previa ($p = 0.729$), placental location ($p = 0.644$), or presence of antepartum hemorrhage ($p = 0.907$). These findings suggest that the examined maternal and obstetric factors were not independently associated with preterm birth in this cohort. The results of the Chi-square analysis are detailed in Table 2.

Table 2. Association Between Maternal and Obstetric Factors and Preterm Birth (Chi-square Analysis)

Variable	Preterm Birth n (%)	Term Birth n (%)	p-value
Booking status			0.599
• Booked	62 (66.0)	32 (34.0)	
• Unbooked	38 (67.9)	18 (32.1)	
Previous cesarean section			0.893
• Yes	75 (66.4)	38 (33.6)	
• No	25 (67.6)	12 (32.4)	
Type of placenta previa			0.729
• Major	49 (68.1)	23 (31.9)	
• Minor	51 (65.4)	27 (34.6)	
Placental location			0.644
• Anterior	46 (68.7)	21 (31.3)	
• Posterior	54 (65.1)	29 (34.9)	
Antepartum hemorrhage			0.907
• Yes	59 (67.0)	29 (33.0)	

Variable	Preterm Birth n (%)	Term Birth n (%)	p-value
• No	41 (66.1)	21 (33.9)	

Multivariable Analysis

Multivariable logistic regression analysis was initially planned to identify independent predictors of preterm birth. However, due to the absence of statistically significant associations on univariate analysis and instability of the regression model, multivariable analysis was not pursued further to avoid overfitting and misinterpretation of unreliable estimates.

Table 3. Comparison of Continuous Variables by Preterm Birth Status

Variable	Preterm Birth (n = 100) Mean ± SD	Term Birth (n = 50) Mean ± SD	p-value
Maternal age (years)	31.96 ± 6.21	32.30 ± 5.18	0.739
Gestational age at diagnosis (weeks)	25.99 ± 3.38	25.71 ± 3.33	0.630

Discussion

Opening Summary Paragraph

This single-center study highlights a high frequency of preterm birth among pregnancies complicated by placenta previa, reinforcing the well-recognized association between this placental disorder and adverse perinatal outcomes. Despite comprehensive evaluation of multiple maternal and obstetric characteristics, no statistically significant predictors of preterm birth were identified within the study cohort. These findings underscore the clinical complexity of placenta previa, suggesting that the condition itself may confer an inherently elevated risk of preterm delivery, independent of commonly assessed maternal or obstetric factors. From a clinical perspective, this emphasizes the need for vigilant antenatal surveillance in all women with placenta previa rather than reliance on traditional risk stratification alone.

Interpretation of the High Preterm Birth Rate

The high burden of preterm birth observed in this study can be plausibly explained by both pathophysiological and clinical mechanisms intrinsic to placenta previa. Abnormal placental implantation in the lower uterine segment predisposes to recurrent antepartum bleeding, uterine irritability, and disruption of placental attachment, all of which may precipitate spontaneous or medically indicated preterm delivery. Additionally, the lower uterine segment undergoes structural changes earlier in gestation, rendering placental separation more likely as pregnancy advances. Clinically, obstetricians often adopt a lower threshold for early delivery in placenta previa to mitigate the risks of catastrophic hemorrhage and fetal compromise. Collectively, these mechanisms support the concept that placenta previa itself represents a strong intrinsic risk factor for preterm birth, regardless of other maternal or obstetric characteristics.

Interpretation of Non-significant Associations

In this cohort, no significant associations were identified between preterm birth and maternal age, booking status, previous cesarean section, type of placenta previa, placental location, or presence of antepartum hemorrhage. Several factors may account for these findings. First, the study population represents a relatively homogeneous high-risk group, in which the baseline risk of preterm birth is already substantially elevated due to placenta previa. This may limit the discriminatory ability of individual predictors. Second, the uniform policy of cesarean delivery for placenta previa at the study center may have attenuated differences related to placental type or obstetric history. Third, although the sample size was adequate for descriptive and univariate analyses, it may not have been sufficiently powered to detect modest effect sizes for individual predictors. Importantly, the absence of statistical significance should not be interpreted as absence of clinical relevance, as factors such as antepartum hemorrhage and prior uterine surgery remain critical considerations in the overall management of placenta previa.

Comparison With Existing Literature

The findings of this study are largely concordant with recent international and regional literature reporting high rates of preterm birth among women with placenta previa (12–14). Several cohort studies and systematic reviews have demonstrated that placenta previa is independently associated with preterm delivery, even after adjustment for maternal age, parity, and obstetric history (12,13). Similar to the present study, some investigators have reported inconsistent or non-significant associations between preterm birth and traditional risk factors such as placental subtype or prior cesarean section (14,15). Conversely, other studies have identified antepartum hemorrhage or major placenta previa as significant predictors of preterm birth (16,17). These discrepancies may reflect differences in study design, population characteristics, timing of diagnosis, bleeding severity, and institutional management protocols. Studies conducted in high-resource settings with standardized bleeding stratification and intensive monitoring may detect associations that are less apparent in real-world, resource-limited contexts.

Clinical and Public Health Implications

The findings of this study carry important clinical and public health implications. Given the high risk of preterm birth associated with placenta previa, all affected women should be considered high-risk irrespective of identifiable maternal or obstetric predictors. Enhanced antenatal surveillance, early identification of bleeding episodes, timely administration of antenatal corticosteroids, and planned delivery in facilities with comprehensive maternal and neonatal care are essential components of management. In low- and middle-income settings, where access to advanced neonatal services may be limited, early referral to tertiary care centers is particularly critical. These findings support guideline-based recommendations that emphasize individualized care planning and preparedness for preterm delivery in placenta previa rather than reliance on selective risk stratification (18).

Strengths of the Study

This study has several notable strengths. The use of clearly defined inclusion and exclusion criteria ensured a well-characterized study population. Diagnosis of placenta previa was based on standardized ultrasonographic criteria, enhancing diagnostic accuracy. The study focused on preterm birth, a clinically significant yet underexplored outcome in placenta previa research, particularly in resource-limited settings. Furthermore, the use of real-world data from a tertiary care center adds valuable local evidence to the existing literature and enhances the clinical relevance of the findings.

Limitations

Certain limitations should be acknowledged. The single-center design may limit the generalizability of the findings to other healthcare settings with different patient populations or management protocols. The moderate sample size may have reduced the power to detect statistically significant associations for individual predictors. The observational nature of the study precludes causal inference. Additionally, long-term neonatal outcomes beyond NICU admission were not assessed, limiting evaluation of the broader impact of preterm birth in this population.

Future Research Recommendations

Future research should focus on larger, multicenter prospective studies to improve generalizability and statistical power. Stratification based on severity, frequency, and timing of antepartum bleeding may help clarify its role in preterm birth risk. Incorporation of detailed neonatal morbidity and mortality outcomes, as well as long-term developmental follow-up, would further enhance understanding of the consequences of preterm delivery in placenta previa.

Conclusion:

In conclusion, this study demonstrates a substantial burden of preterm birth among pregnancies complicated by placenta previa, with no identifiable maternal or obstetric predictors within the studied cohort. These findings reinforce the concept that placenta previa itself constitutes a high-risk condition for preterm delivery, necessitating vigilant antenatal care and delivery planning for all affected women. By contributing context-specific evidence from a tertiary care setting, this study adds to the growing body of literature informing clinical management and underscores the importance of proactive obstetric care in pregnancies complicated by placenta previa.

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