# First Trimester Vaginal Bleeding as a Predictor of Preterm Birth: A Case-Control Study in Islamabad

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**ABSTRACT**

**Objective**: To assess the relationship between early pregnancy bleeding and preterm birth in a tertiary hospital setting.
**Study design**: Retrospective case–control study
**Place and duration**: Department of Obstetrics & Gynecology, Pakistan Atomic Energy Commission (PAEC) General Hospital, Islamabad, between January 1, 2023 and July 31, 2023.
**Methodology**: Data from 103 singleton pregnancies were analyzed, including 50 spontaneous preterm cases and 53 term controls. Only pregnancies with complete records and first-trimester ultrasound confirmation were included. Statistical analysis was performed in SPSS v.26 after verifying data normality using the Shapiro–Wilk test. Group comparisons were made using chi-square and t-tests with effect sizes (Cramer's V, Cohen's d) reported.
**Results**: First-trimester bleeding occurred in 36% of preterm cases and 11.3% of controls ($p = 0.003$). Mean gestational age and birth weight were significantly lower in cases (34 weeks; 2110 g) than controls (38 weeks; 2964 g), both $p < 0.001$. NICU admission and low APGAR (< 7 at 5 min) were also more common among cases (38% vs 9.4% and 24% vs 5.7%, respectively).
**Conclusion**: First-trimester vaginal bleeding is a significant indicator of preterm birth, low birth weight, and neonatal morbidity. Early identification and closer surveillance may improve perinatal outcomes in high-risk pregnancies.
**Keywords**: First-trimester bleeding, Preterm birth, Subchorionic Hematoma, Neonatal outcome, Retrospective study.

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## INTRODUCTION

Preterm birth defined as delivery before 37 completed weeks of gestation remains one of the leading causes of neonatal morbidity and mortality globally.[1] Despite advances in obstetric care, the rate of preterm delivery continues to rise, particularly in low- and middle-income countries where access to early prenatal surveillance is often limited.[2] The World Health Organization estimates that approximately 15 million babies are born preterm every year, with a disproportionate burden in South Asia and sub-Saharan Africa. Understanding early warning signs is essential to guide prevention and optimize neonatal outcomes.[3,4]

Vaginal bleeding during the first trimester is one of the most frequent complications encountered in early pregnancy, reported in up to 20–25% of pregnancies.[5] While many cases progress uneventfully, mounting evidence indicates that early bleeding may reflect subtle placental or decidual pathology.[6] Disruption of trophoblastic implantation, subchorionic hematoma formation, or inflammatory changes within the decidua have all been implicated as possible mechanisms leading to preterm labor and fetal growth restriction later in gestation.[7]

7Recent international studies have produced mixed results on this association. Some have demonstrated that first-trimester bleeding increases the risk of preterm birth, low birth weight, and neonatal intensive care admission, whereas others found no significant relationship once confounding factors were adjusted.[8,9] These inconsistencies underscore the need for contextualized data, particularly from developing countries where maternal nutritional status, healthcare access, and perinatal monitoring differ from high-income settings.

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In Pakistan, data exploring the prognostic value of early pregnancy bleeding are scarce. Identifying whether first-trimester bleeding predicts preterm delivery can aid clinicians in prioritizing high-risk pregnancies for closer monitoring and timely intervention. The present study was therefore designed to evaluate the relationship between first-trimester vaginal bleeding and subsequent pregnancy outcomes among women delivering at a tertiary care hospital in Islamabad.

## METHODOLOGY

This retrospective case–control study was conducted at the Department of Obstetrics and Gynaecology, Pakistan Atomic Energy Commission (PAEC) General Hospital, Islamabad. Medical records of women who delivered at the hospital between January 1, 2023 and July 31, 2023 were reviewed. The objective was to determine whether first-trimester vaginal bleeding was associated with an increased risk of preterm birth and adverse neonatal outcomes.

Ethical clearance was obtained from the Institutional Ethical Committee of PAEC General Hospital, Islamabad PGHI-IRB (DME)-RCD-06-099 during a full-board meeting held on 5th September 2025. The committee reviewed and approved the study under its standard ethical framework for retrospective record-based research. All data were anonymized prior to analysis, and patient confidentiality was strictly maintained in accordance with institutional and national ethical guidelines.

The study included records of women who delivered at PAEC General Hospital during the specified period. The hospital caters to a mixed population from Islamabad and adjoining regions, ensuring diversity in the study sample.

The sample size was determined using the OpenEpi sample size calculator for unmatched case–control studies. Based on previous literature indicating an approximate 30% frequency of first-trimester bleeding among preterm deliveries and 10% among term births,[10] with a 95% confidence level and 80% power, the required sample size was at least 100 participants. To ensure adequate statistical strength and compensate for incomplete records, 103 cases were finally included (50 cases and 53 controls).

A non-probability purposive sampling method was used due to the retrospective design. Cases: Women who delivered preterm (<37 completed weeks of gestation). Controls: Women who delivered at term (≥37 weeks) during the same period and had no history of first-trimester bleeding. For each case, a control was selected from the same hospital records to minimize potential confounding related to temporal variations in obstetric management.

The study included women with singleton pregnancies that had been confirmed by first-trimester ultrasound and whose antenatal and delivery records were complete and available for review. Among these, cases were defined as women who experienced spontaneous preterm delivery, whereas controls were women who delivered at term without any obstetric complications that could have influenced gestational age. Women were excluded if they had multiple gestations, congenital fetal anomalies, or medically indicated preterm deliveries such as those due to pre-eclampsia, placenta previa, or intrauterine growth restriction (IUGR). Records with incomplete or missing details about first-trimester bleeding or delivery outcomes were also omitted from the final analysis to maintain data accuracy and consistency.

Data were extracted from hospital obstetric records using a pre-designed structured proforma. Information collected included Demographic details: maternal age, residence, socio-economic status, and occupation. Obstetric history: gravidity, parity, inter-pregnancy interval, previous miscarriage or preterm birth. Current pregnancy variables: first-trimester bleeding history, severity and duration of bleeding, associated pain, ultrasound findings (presence of subchorionic hematoma), serum progesterone level, and cervical length. Outcome variables: gestational age at delivery, birth weight, APGAR score, NICU admission, mode of delivery, and neonatal survival.

Data abstraction was independently performed by two obstetrics residents and reviewed by the principal investigator for accuracy. A pilot extraction of ten random records (not part of the main sample) was conducted to ensure clarity and consistency of the data form. All laboratory and ultrasound findings were verified from hospital diagnostic reports. Any discrepancies were resolved by consensus, ensuring both reliability and internal validity of the dataset.

**Data Analysis:** Data were entered into IBM SPSS Statistics version 26.0 for analysis. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Prior to analysis, data normality was assessed using the Shapiro–Wilk test and inspection of histograms and Q–Q plots.

For normally distributed continuous variables, comparisons between cases and controls were made using the Independent Samples t-test. For non-normal distributions, the Mann–Whitney U test was applied.

Categorical variables were compared between groups using Pearson's Chi-square ($\chi^2$) test for variables with sufficient expected cell counts, including socioeconomic status, residence, occupation, gravidity, parity, severity of bleeding, mode of delivery, and neonatal outcomes. Fisher's Exact test was applied for 2×2 tables with small expected frequencies (<5), such as history of miscarriage, preterm birth, interpregnancy interval <18 months, first-trimester bleeding, presence of subchorionic hematoma, associated abdominal pain, NICU admission, and APGAR **<7**. Effect sizes were calculated to evaluate the strength of associations: Cohen's d for mean differences and Cramer's V for categorical variables. A p-value < 0.05 was considered statistically significant.

## RESULTS

A total of 103 pregnant women were included in the study, comprising 50 cases and 53 controls. Baseline characteristics, obstetric history, exposure variables, and pregnancy outcomes were compared between groups. The findings are summarized in Tables I–III. The two groups did not differ significantly in most demographic characteristics (Table I). The mean maternal age

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was slightly higher in the case group (29.0 ± 1.43 years) compared to controls (28.47 ± 1.14 years), but this difference was not statistically significant ($p = 0.058$), as determined by the Mann–Whitney U test. No significant associations were observed for socio-economic status, residence, or occupation.

Previous miscarriage was significantly more frequent among cases (30%) than controls (13.2%), with a moderate association ($p = 0.038$, Cramer's V = 0.205). First-trimester vaginal bleeding was also more common in cases (36%) than controls (11.3%, $p = 0.003$, Cramer's V = 0.292). Subchorionic hematoma on ultrasound was identified in 20% of cases versus 3.8% of controls ($p = 0.010$). Other variables, such as gravidity, parity, inter-pregnancy interval, gestational age at bleeding, progesterone level, and cervical length, showed no significant differences (Table II).

**Table I. Baseline Demographic Characteristics of Participants (N = 103)**

| Variable | Category | Cases (n = 50) | Controls (n = 53) | Test Applied | p-value |
|---|---|---|---|---|---|
| **Maternal Age (yrs)** | Mean ± SD | 29.0 ± 1.43 | 28.47 ± 1.14 | Mann–Whitney U = 1045.0 | 0.058 |
| **Socio-economic Status** | Low | 32 (64.0%) | 29 (54.7%) | $\chi^2 = 0.92$ (df = 1) | 0.338 |
| | High | 18 (36.0%) | 24 (45.3%) | | |
| **Residence** | Rural | 9 (18.0%) | 11 (20.8%) | $\chi^2 = 0.13$ (df = 1) | 0.724 |
| | Urban | 41 (82.0%) | 42 (79.2%) | | |
| **Occupation** | Housewife | 40 (80.0%) | 41 (77.4%) | $\chi^2 = 0.11$ (df = 1) | 0.744 |
| | Employed | 10 (20.0%) | 12 (22.6%) | | |

**Table II. Obstetric and Current Pregnancy Characteristics (N = 103)**

| Variable | Category/ Statistic | Cases (n = 50) | Controls (n = 53) | Test Applied | p-value | Effect Size |
|---|---|---|---|---|---|---|
| **Gravidity** | ≤ 2 | 26 (52.0%) | 27 (50.9%) | $\chi^2 = 0.02$ (df = 1) | 0.89 | — |
| | ≥ 3 | 24 (48.0%) | 26 (49.1%) | | | |
| **Parity** | 0–1 | 38 (76.0%) | 39 (73.6%) | $\chi^2 = 0.04$ (df = 1) | 0.85 | — |
| | ≥ 2 | 12 (24.0%) | 14 (26.4%) | | | |
| **Previous Miscarriage** | Yes | 15 (30.0%) | 7 (13.2%) | $\chi^2 = 4.32$ (df = 1) | 0.038 | 0.205 |
| **History of Preterm Birth** | Yes | 10 (20.0%) | 4 (7.5%) | $\chi^2 = 3.40$ (df = 1) | 0.065 | — |
| **Inter-pregnancy Interval** | <18 months | 14 (28.0%) | 8 (15.1%) | $\chi^2 = 2.55$ (df = 1) | 0.110 | — |
| **First-Trimester Bleeding** | Yes | 18 (36.0%) | 6 (11.3%) | $\chi^2 = 8.77$ (df = 1) | 0.003 | 0.292 |
| **Associated Pelvic Pain** | Yes | 11 (22.0%) | 4 (7.5%) | $\chi^2 = 4.32$ (df = 1) | 0.038 | 0.205 |
| **Subchorionic Hematoma** | Present | 10 (20.0%) | 2 (3.8%) | $\chi^2 = 6.58$ (df = 1) | 0.010 | 0.253 |
| **Duration of Bleeding (days)** | Mean ± SD | 2.80 ± 1.74 | 2.87 ± 1.72 | U = 1295.0 | 0.840 | — |
| **Gestational Age at Bleeding (wks)** | Mean ± SD | 6.06 ± 3.51 | 6.06 ± 3.56 | U = 1306.0 | 0.897 | — |
| **Progesterone Level (ng/mL)** | Mean ± SD | 14.46 ± 1.13 | 14.51 ± 1.12 | U = 1292.0 | 0.822 | — |
| **Cervical Length (cm)** | Mean ± SD | 3.22 ± 0.28 | 3.21 ± 0.28 | U = 1295.0 | 0.840 | — |

Women with first-trimester bleeding delivered significantly earlier (mean = 34.0 weeks) than controls (mean = 38.3 weeks, $p < 0.001$). Birth weights were also significantly lower in cases (2110 ± 150 g) versus controls (2964 ± 184 g, $p < 0.001$). NICU admission and low APGAR score (<7 at 5 min) were more common among cases, with strong and moderate associations respectively. Mode of delivery and neonatal survival (Fisher's Exact) did not differ significantly between groups (Table III, Figure I).

The rates of NICU admission and low APGAR scores (< 7 at 5 minutes) were significantly higher among cases compared to controls. Cases showed a 38% NICU admission rate versus 9.4% in controls, and 24% had low APGAR scores compared to 5.7% among controls ($p < 0.05$ for both).

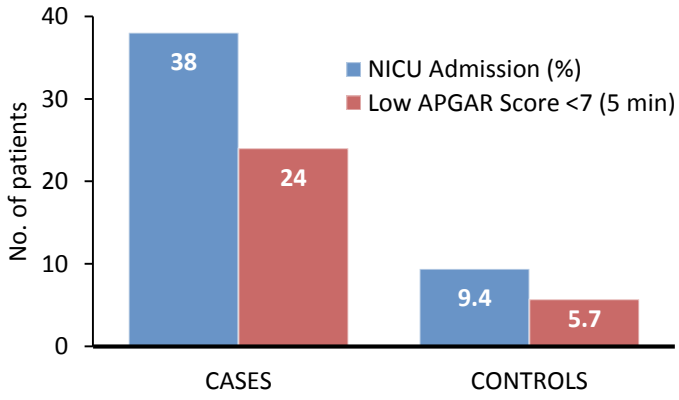


**Figure I. Comparison of neonatal outcomes between cases and controls (N = 103).**


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**Table III. Pregnancy and Neonatal Outcomes (N = 103).**

| Outcome Variable | Cases (n = 50) | Controls (n = 53) | Test Statistic | p-value | Effect Size |
|---|---|---|---|---|---|
| **Gestational Age at Delivery (weeks)** | 34.04 ± 0.28 | 38.28 ± 0.34 | t(101) = -68.31 | < 0.001* | d = 13.6 |
| **Birth Weight (g)** | 2110 ± 150 | 2964 ± 184 | t(101) = -25.75 | < 0.001* | d = 5.1 |
| **NICU Admission** | 19 (38%) | 5 (9.4%) | $\chi^2(1) = 11.75$ | 0.001 | V = 0.34 |
| **APGAR < 7 at 5 min** | 12 (24%) | 3 (5.7%) | $\chi^2(1) = 6.96$ | 0.008 | V = 0.26 |
| **Mode of Delivery** | CS: 21 (42%) | CS: 23 (43%) | $\chi^2(1) = 0.02$ | 0.886 | V = 0.01 |
| **Neonatal Survival** | 47 (94%) alive | 52 (98%) alive | Fisher's Exact | 0.353 | V = 0.06 |

## DISCUSSION

This study demonstrated that first-trimester vaginal bleeding was significantly associated with preterm delivery and adverse neonatal outcomes. Women who experienced early bleeding delivered at a mean gestational age of 34 weeks compared to 38 weeks in controls, and their infants had a markedly lower mean birth weight (2110 g vs. 2964 g). Importantly, subchorionic hematoma (SCH) was observed in 20% of cases versus only 3.8% of controls, reinforcing its potential role in mediating adverse outcomes. These findings suggest that SCH may not simply be an incidental finding on ultrasound but a marker of underlying placental instability. Such findings echo the growing body of evidence suggesting that early pregnancy bleeding may serve as a marker of underlying placental or uteroplacental abnormalities rather than a benign event alone.[11,12]

For instance, Karimi et al. (2024) found that first-trimester bleeding significantly increased the risk of preterm birth, low birth weight, and PROM (pregnancy-premature rupture of membranes).[13] The presence of first-trimester vaginal bleeding was also shown to correlate with subchorionic hematomas (SCH) and earlier delivery in a large retrospective cohort.[14] In a study examining the size of SCH, Yoshihara et al. (2024) established that larger hematomas were more commonly associated with pregnancy complications, reinforcing the hypothesis of underlying placental dysfunction.[15]

Beyond bleeding, our data showed neonatal morbidity in 38% of cases requiring NICU admission and 24% having an APGAR score <7 at 5 minutes, compared to just 9.4% and 5.7%, respectively, in controls. This aligns with other studies, such as those by V. Sangeetha et al. (2025), which reported a 38.5% NICU admission rate among women with first-trimester bleeding, particularly when bleeding was heavy**.**[16]

The plausible pathophysiological mechanism may reflect early compromised maternal–fetal interface, as described in a review by Spandidos et al. (2024), which outlined how SCH might signal trophoblast invasion defects, decidual injury or early placental separation.[17] The higher prevalence of SCH in our study's case group (20% vs. 3.8%) directly supports this mechanism and highlights the potential value of ultrasound-diagnosed SCH as a risk marker.

However, conflicting results exist. In IVF pregnancies, SCH alone was not significantly associated with adverse outcomes.[18] Similarly, a nationwide Iranian cohort (Tahmasebifard et al., 2025) described varying risks depending on demographic and clinical factors.[19] These inconsistencies may stem from variations in populations, bleeding severity, detection protocols, and antenatal care.

Recent evidence suggests that the "dose effect" of bleeding including volume, timing, and SCH size may further modify risk. A retrospective graded SCH study found that medium to large SCHs detected at 12–20 weeks were strongly associated with preterm birth and fetal growth restriction.[20] Another analysis (2025) developed a nomogram predicting fetal growth restriction (FGR) in women with first-trimester SCH, indicating that both SCH and bleeding were independent predictors (OR 4.30).[21] Taken together, these findings suggest that early bleeding is more than a symptom it may be an early warning of placental compromise.

In practical obstetric care, these findings underscore the need for heightened surveillance in women presenting with first-trimester bleeding, especially when SCH is detected. Early ultrasounds (to assess cervical length and placental morphology), serial growth monitoring, and neonatal planning may mitigate adverse outcomes. This approach may be particularly relevant in low-resource settings such as Pakistan, where targeted management could improve perinatal outcomes.

## CONCLUSION

First-trimester vaginal bleeding is a significant indicator of preterm birth, low birth weight, and neonatal morbidity. Early identification and closer surveillance may improve perinatal outcomes in high-risk pregnancies.

## AUTHOR'S CONTRIBUTION

**Ghazi L:** Conceived Idea, Designed Research Methodology
**Sher Z:** Literature Search, Data Collection
**Ashraf M:** Literature Review
**Sultana M:** Data Interpretation, Statistical Analysis
**Zahra S:** Manuscript Writing
**Rasheed F:** Manuscript final reading, Manuscript approval

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