

## Original Research Article

# ULTRASONOGRAPHIC EVALUATION OF FIRST-TRIMESTER VAGINAL BLEEDING: DIAGNOSTIC AND CLINICAL CORRELATIONS

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Received : 10/01/2025  
Received in revised form : 28/02/2025  
Accepted : 15/03/2025

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DOI: 10.70034/ijmedph.2025.2.25

Source of Support: Nil,  
Conflict of Interest: None declared

Int J Med Pub Health  
2025; 15 (2); 133-138

## ABSTRACT

**Background: Aim:** The study aims to evaluate the role of ultrasonography in assessing first-trimester vaginal bleeding, identifying potential risk factors, and correlating ultrasound findings with clinical and laboratory parameters to predict pregnancy outcomes.

**Materials and Methods:** This prospective observational study was conducted on 120 pregnant women aged 18–40 years presenting with first-trimester vaginal bleeding at a tertiary care hospital. Inclusion criteria included gestational age between 5–13 weeks confirmed by the last menstrual period (LMP) and/or ultrasound. Patients with ectopic or molar pregnancies, uterine anomalies, or hemodynamic instability were excluded. All participants underwent transabdominal and/or transvaginal ultrasound evaluation for gestational sac, fetal pole, cardiac activity, subchorionic hematoma, cervical length, and adnexal structures. Laboratory investigations included serum  $\beta$ -hCG levels, hemoglobin levels, Rh typing, and inflammatory markers. Statistical analysis was performed using SPSS 25.0, with significance set at  $p < 0.05$ . **Results:** The majority of participants were in their late twenties, with a mean gestational age of approximately 9 weeks. Ultrasonographic assessment confirmed the presence of a gestational sac in most cases, with fetal cardiac activity detected in over 70% of cases. Subchorionic hematoma and cervical length abnormalities were notable findings. Patients were categorized into viable intrauterine pregnancies, threatened abortion, inevitable abortion, incomplete abortion, missed abortion, complete abortion, and molar pregnancy. Laboratory findings revealed elevated  $\beta$ -hCG in most cases, with a significant proportion exhibiting anemia and inflammatory markers. While over half of the pregnancies continued successfully, a substantial number resulted in miscarriage, necessitating surgical intervention in some cases. **Conclusion:** Ultrasonography is a crucial tool in the evaluation of first-trimester bleeding, allowing for early detection of pregnancy complications. Laboratory investigations complement ultrasound findings in predicting pregnancy outcomes. Early identification of high-risk pregnancies enables timely medical intervention, improving maternal and fetal outcomes. A multidisciplinary approach involving obstetricians, radiologists, and laboratory specialists is recommended for optimal patient management.

**Keywords:** Ultrasonography, First-trimester bleeding, Pregnancy outcomes, Subchorionic hematoma, Foetal viability.

## INTRODUCTION

First-trimester bleeding is one of the most common clinical concerns encountered in early pregnancy. It

affects a significant proportion of pregnant women and can be a source of considerable anxiety. The presence of vaginal bleeding in the first 12 weeks of pregnancy may indicate a range of conditions, from

benign causes to serious complications that could threaten the viability of the pregnancy. Given the clinical importance of early pregnancy bleeding, accurate diagnosis and timely intervention are crucial to optimizing maternal and foetal outcomes. In this context, ultrasound imaging has emerged as the primary diagnostic modality for evaluating first-trimester bleeding, providing valuable insights into the underlying causes and guiding appropriate clinical management.<sup>[1,2]</sup> The first trimester is a critical period of embryonic and foetal development, characterized by rapid cellular proliferation, organogenesis, and hormonal changes necessary for the maintenance of pregnancy. Any disruption during this phase, including abnormal bleeding, can have significant implications. The causes of first-trimester bleeding can vary widely, ranging from normal physiological processes such as implantation bleeding to more concerning conditions such as miscarriage, ectopic pregnancy, or gestational trophoblastic disease. Distinguishing between these causes based on clinical presentation alone is often challenging, necessitating the use of diagnostic imaging techniques such as ultrasonography to enhance diagnostic accuracy.<sup>[3]</sup>

Ultrasound has revolutionized obstetric care by enabling non-invasive and real-time assessment of the developing pregnancy. It plays a pivotal role in determining foetal viability, identifying structural abnormalities, and assessing potential complications associated with first-trimester bleeding. The two primary ultrasound techniques employed in early pregnancy evaluation are transabdominal and transvaginal ultrasound. While transabdominal ultrasound provides an overview of the pelvic structures and is commonly used as an initial assessment tool, transvaginal ultrasound offers higher resolution and greater clarity in evaluating early gestational development, particularly in cases where first-trimester bleeding is present.<sup>[4]</sup>

One of the key objectives of ultrasound in cases of first-trimester bleeding is to ascertain the viability of the pregnancy. The presence of a gestational sac, yolk sac, and fetal heartbeat within the uterine cavity are reassuring signs that suggest a viable pregnancy. However, when these structures are absent or abnormal, further evaluation is required to determine the potential for miscarriage or other complications. The identification of embryonic or fetal demise, blighted ovum, or abnormal embryonic growth patterns is crucial for guiding clinical decision-making and counselling patients on the appropriate course of action.<sup>[5]</sup>

Another critical application of ultrasound in first-trimester bleeding is the detection of ectopic pregnancy, a potentially life-threatening condition in which the fertilized ovum implants outside the uterine cavity. Ectopic pregnancy most commonly occurs in the fallopian tube but can also be found in the cervix, ovary, or abdominal cavity. The timely diagnosis of ectopic pregnancy using ultrasound is essential, as delayed recognition can lead to

complications such as tubal rupture and haemorrhage, posing significant risks to maternal health. Ultrasound findings suggestive of ectopic pregnancy include the absence of an intrauterine gestational sac, the presence of an adnexal mass, and free fluid in the pelvis, which may indicate internal bleeding.<sup>[6]</sup>

In addition to diagnosing miscarriage and ectopic pregnancy, ultrasound is instrumental in identifying other causes of first-trimester bleeding, including subchorionic haemorrhage, gestational trophoblastic disease, and cervical or uterine abnormalities. Subchorionic haemorrhage, which results from bleeding between the chorion and the uterine wall, is a relatively common finding on ultrasound and may be associated with an increased risk of pregnancy complications. Gestational trophoblastic disease, a rare but serious condition involving abnormal trophoblastic proliferation, can also present with first-trimester bleeding and requires ultrasound assessment to differentiate it from normal intrauterine pregnancy.<sup>[7]</sup> The integration of ultrasound findings with clinical history and laboratory investigations enhances the accuracy of diagnosing first-trimester bleeding and facilitates appropriate management. In cases where ultrasound reveals normal intrauterine pregnancy with no significant abnormalities, reassurance and expectant management may be sufficient. However, when ultrasound findings indicate complications such as incomplete miscarriage or retained products of conception, medical or surgical intervention may be necessary to ensure maternal well-being.<sup>[8]</sup>

Recent advancements in ultrasound technology have further improved the diagnostic capabilities of early pregnancy assessment. The advent of three-dimensional ultrasound, Doppler imaging, and contrast-enhanced ultrasound techniques has provided clinicians with additional tools for evaluating blood flow, placental function, and embryonic development in cases of first-trimester bleeding. These advancements hold promise for refining the diagnostic approach to early pregnancy complications and improving patient outcomes.

## MATERIALS AND METHODS

This prospective observational study was conducted on 120 pregnant women presenting with first-trimester bleeding in the department of Radiology and Gynaecology at Mallareddy Institute of Medical Sciences and Mallareddy Medical College for Women during the period from July 2024 to December 2024. Ethical approval was obtained from the Institutional Review Board, and informed consent was taken from all participants. Patients were recruited during the study period and met the following inclusion and exclusion criteria:

### Inclusion Criteria

- Pregnant women aged 18–40 years

- Gestational age between 5 -13 weeks, confirmed by last menstrual period (LMP) and/or ultrasound
- Clinical presentation with first-trimester vaginal bleeding

#### **Exclusion Criteria**

- Known history of uterine anomalies or previous uterine surgery
- Ectopic pregnancy
- Hemodynamically unstable patients requiring immediate intervention

All participants underwent transabdominal and/or transvaginal ultrasonography using Voluson S8, P8 and Philips EPIQ Elite ultrasound machines. The ultrasound evaluation included an assessment of the gestational sac for its presence, location, shape, and size; evaluation of the yolk sac and fetal pole along with their measurements; and assessment of fetal cardiac activity using M-mode. Additionally, the presence and size of subchorionic hematoma were documented, as well as cervical length measurements to assess the risk of pregnancy loss. The ovarian and adnexal regions were also examined to rule out any abnormalities such as ectopic pregnancy or corpus luteum cysts.

Each patient underwent a comprehensive clinical examination, which included the assessment of vital signs, abdominal palpation, and speculum examination to evaluate the cervical status. Laboratory tests were performed as part of the diagnostic workup, including serum  $\beta$ -hCG levels to correlate with ultrasound findings, a complete blood count (CBC) to assess hemoglobin levels, and blood grouping with Rh typing in Rh-negative patients.

Patients were categorized based on ultrasound findings into different diagnostic groups, including viable intrauterine pregnancy, threatened abortion, inevitable abortion, incomplete abortion, missed abortion, complete abortion, or molar pregnancy if identified. Follow-up ultrasounds were conducted after one week for patients with indeterminate findings or ongoing pregnancies at risk. Clinical outcomes were recorded, and cases were managed according to standard obstetric protocols.

#### **Statistical Analysis**

Data were analyzed using SPSS 25.0, and statistical significance was set at  $p < 0.05$ . Continuous variables were expressed as mean  $\pm$  standard deviation (SD), and categorical variables as percentages. Chi-square or Fisher's exact test was used for categorical data, while t-tests or ANOVA were applied to continuous variables.

## **RESULTS**

The study analyzed 120 pregnant women who presented with first-trimester bleeding, assessing their demographic characteristics, ultrasound findings, clinical diagnosis, laboratory parameters, and pregnancy outcomes. The findings are discussed in detail below.

#### **Demographic and Clinical Characteristics**

The mean age of the study population was  $28.78 \pm 6.69$  years, with an age range between 19 - 41 years. Most participants were in their late twenties or early thirties, aligning with the reproductive age group commonly affected by first-trimester complications. The mean gestational age was  $9.63 \pm 2.21$  weeks, with a range of 6 to 13 weeks, indicating that the cases included a broad spectrum of early pregnancy stages. The mean gravida was  $2.88 \pm 1.45$ , and the parity was  $1.50 \pm 1.08$ , suggesting that many participants had previous pregnancies, with some having a history of miscarriage. The mean BMI was  $26.68 \pm 3.03$  kg/m<sup>2</sup>, classifying most participants within the overweight category, a known risk factor for pregnancy complications. Additionally, 40.83% of the participants reported a history of previous miscarriage, indicating a significant proportion had prior pregnancy losses, which may increase the risk of complications in the current pregnancy.

#### **Ultrasound Findings**

Ultrasonography played a crucial role in assessing the viability and status of the pregnancies. Gestational sac presence was confirmed in 107 cases (89.17%), indicating intrauterine pregnancies, while fetal pole presence was detected in 102 cases (85.00%), signifying a further stage of embryonic development. Cardiac activity, a crucial marker of fetal viability, was observed in 87 cases (72.50%), suggesting that more than a quarter of pregnancies had absent cardiac activity, which is concerning for missed abortion or early pregnancy loss. Subchorionic hematoma (Figure 1) a known risk factor for pregnancy complications, was identified in 49 cases (40.83%), showing a relatively high prevalence among patients with first-trimester bleeding. Cervical length abnormalities, which may predispose to pregnancy loss, were found in 52 cases (43.33%). Additionally, ovarian or adnexal abnormalities were seen in 27 cases (22.50%), which included findings such as corpus luteum cysts or ovarian masses that could impact pregnancy viability.

#### **Clinical Diagnosis Distribution**

Based on ultrasound and clinical assessments, patients were categorized into different pregnancy outcomes. The most common diagnosis was viable intrauterine pregnancy, observed in 32 cases (26.67%), indicating that a portion of women presenting with bleeding had ongoing pregnancies without immediate risk. Threatened abortion, defined by vaginal bleeding with a closed cervix and viable fetus, was diagnosed in 24 cases (20.00%), suggesting a need for close monitoring and medical intervention. Inevitable abortion occurred in 22 cases (18.33%), characterized by an open cervix, indicating that these pregnancies were progressing toward miscarriage. Incomplete abortion was noted in 14 cases (11.67%), requiring medical or surgical intervention to complete the pregnancy loss. Missed abortion, where the fetus had no cardiac activity (Figure 2) but was retained in the uterus, was

diagnosed in 13 cases (10.83%). Complete abortion, where all pregnancy tissues were expelled, was identified in 9 cases (7.50%), while molar pregnancy, a rare but serious trophoblastic disease, was diagnosed in 6 cases (5.00%).

### Laboratory Findings

Laboratory investigations helped in identifying additional risk factors and biochemical markers related to pregnancy outcomes. Beta-hCG levels were elevated in 99 cases (82.50%), consistent with ongoing or abnormal pregnancies such as molar pregnancy. Anemia (Hb <10 g/dL) was present in 53 cases (44.17%), indicating that nearly half of the patients had reduced hemoglobin levels, which could be due to excessive bleeding. Rh negativity was identified in 15 cases (12.50%), necessitating Rh immunoglobulin administration to prevent isoimmunization in future pregnancies. Leukocytosis (WBC >11,000/mm<sup>3</sup>) was found in 36 cases (30.00%), potentially indicating an inflammatory or infectious process. Low platelet count (<150,000/mm<sup>3</sup>) was observed in 15 cases (12.50%), which may be associated with underlying hematological disorders or pregnancy-induced conditions. Low serum progesterone (<10 ng/mL) was noted in 29 cases (24.17%), a concerning finding as progesterone is essential for maintaining pregnancy. C-reactive protein (CRP) elevation (>10 mg/L) was found in 29 cases (24.17%), suggesting possible inflammation or infection.

### Outcome Measures

At the conclusion of the study, ongoing pregnancies were noted in 70 cases (58.33%), indicating that more than half of the women presenting with first-trimester bleeding continued their pregnancies successfully. Miscarriage was confirmed in 40 cases (33.33%), showing that a significant proportion of patients ultimately experienced pregnancy loss. Surgical management, including dilation and curettage or evacuation for incomplete or missed abortion, was required in 29 cases (24.17%),

highlighting the necessity of medical intervention in a subset of patients.



Figure 1: Early intrauterine gestation with subchorionic haematoma



Figure 2: Early intrauterine gestation with CRL corresponding to 7 weeks 2 days with absent cardiac activity

Table 1: Demographic and Clinical Characteristics

Parameter	Value
Mean Age (Years)	28.78 ± 6.69
Age Range (Years)	19 - 41
Mean Gestational Age (Weeks)	9.63 ± 2.21
Gestational Age Range (Weeks)	6 - 13
Gravida (Mean ± SD)	2.88 ± 1.45
Parity (Mean ± SD)	1.50 ± 1.08
Mean BMI (kg/m <sup>2</sup> ) ± SD	26.68 ± 3.03
History of Previous Miscarriage (%)	40.83

Table 2: Ultrasound Findings

Finding	Number	Percentage (%)
Gestational Sac Present	107	89.17
Fetal Pole Present	102	85.00
Cardiac Activity Detected	87	72.50
Subchorionic Hematoma Present	49	40.83
Cervical Length Abnormal	52	43.33
Ovarian/Adnexal Abnormalities	27	22.50



**Table 3: Clinical Diagnosis Distribution**

Diagnosis	Number	Percentage (%)
Viable Intrauterine Pregnancy	32	26.67
Threatened Abortion	24	20.00
Inevitable Abortion	22	18.33
Incomplete Abortion	14	11.67
Missed Abortion	13	10.83
Complete Abortion	9	7.50
Molar Pregnancy	6	5.00

**Table 4: Laboratory Findings**

Finding	Number	Percentage (%)
Beta-hCG Elevated	99	82.50
Anemia Present (Hb <10 g/dL)	53	44.17
Rh Negative	15	12.50
Leukocytosis (WBC >11,000/mm <sup>3</sup> )	36	30.00
Platelet Count <150,000/mm <sup>3</sup>	15	12.50
Serum Progesterone <10 ng/mL	29	24.17
CRP Elevated (>10 mg/L)	29	24.17

**Table 5: Outcome Measures**

Outcome	Number	Percentage (%)
Ongoing Pregnancy	70	58.33
Miscarriage Confirmed	40	33.33
Surgical Management Required	29	24.17

## DISCUSSION

First-trimester bleeding is a critical concern in obstetric practice, often associated with variable pregnancy outcomes. This study analyzed 120 pregnant women with first-trimester bleeding, evaluating their demographic characteristics, ultrasound findings, clinical diagnoses, laboratory parameters, and pregnancy outcomes.

In this study, the mean age of participants was 28.78 ± 6.69 years, with a range of 19 to 41 years. This aligns with findings from a study by Weiss et al. (2004), which reported a mean age of 29.5 years among women presenting with first-trimester bleeding.<sup>[8]</sup> The mean gestational age in our cohort was 9.63 ± 2.21 weeks, similar to the 9 weeks reported in a study by Bharadwaj (2016).<sup>[9]</sup> The average gravida was 2.88 ± 1.45, and parity was 1.50 ± 1.08, indicating that many participants had previous pregnancies. Notably, 40.83% had a history of prior miscarriage, higher than the 25% reported by Dighe et al. (2008), suggesting a potential selection bias or regional variation in our study population.<sup>[10]</sup>

Ultrasound assessment revealed that 89.17% of cases had a detectable gestational sac, while a fetal pole was present in 85.00%. This is in line with findings by Kumar et al. (2021), who reported a gestational sac in 88.5% and a fetal pole in 83.6% of cases.<sup>[11]</sup> Cardiac activity was detected in 72.50% of cases, which is slightly lower than the 75.8% found in a study by Roberts et al. (2016), suggesting that a notable proportion of pregnancies in this cohort were non-viable.<sup>[12]</sup> The presence of subchorionic hematoma in 40.83% of cases is significantly higher than the 25.4% reported by Lee et al. (2019), indicating a potentially higher risk of adverse

outcomes in this study population.<sup>[13]</sup> Cervical length abnormalities were detected in 43.33% of cases, which is higher than the 35.2% reported by Silva et al. (2020), reinforcing the importance of cervical length assessment in predicting pregnancy loss.<sup>[14]</sup> The incidence of ovarian or adnexal abnormalities (22.50%) was also higher compared to the 15.3% reported by Huang et al. (2021), possibly due to differences in patient selection criteria or ultrasound detection techniques.<sup>[15]</sup>

In this study, 26.67% of cases were classified as viable intrauterine pregnancies, while 20.00% were diagnosed with threatened abortion. This is comparable to the study by Johnson et al. (2018), who reported 27.1% and 18.9%, respectively.<sup>[16]</sup> Inevitable abortion was observed in 18.33% of cases, slightly lower than the 20.5% reported by Clark et al. (2017).<sup>[17]</sup> Incomplete abortion was present in 11.67% of cases, similar to the 12.2% reported by Baker et al. (2019).<sup>[18]</sup> The incidence of missed abortion (10.83%), complete abortion (7.50%), and molar pregnancy (5.00%) were comparable to the findings by Tran et al. (2020), who reported rates of 9.8%, 6.9%, and 4.8%, respectively. The relatively high percentage of non-viable pregnancies in this study underscores the need for early detection and monitoring.<sup>[19]</sup>

Laboratory investigations revealed that 82.50% of patients had elevated beta-hCG, consistent with findings by Wilson et al. (2019), who reported elevated levels in 80.7% of cases with viable pregnancies.<sup>[20]</sup> Anemia (Hb <10 g/dL) was present in 44.17%, which is slightly higher than the 38.9% reported by Lopez et al. (2018), likely due to the severity of bleeding in this cohort.<sup>[21]</sup> Rh negativity was observed in 12.50% of cases, similar to the 11.8% found in a study by Brown et al. (2020).<sup>[22]</sup>

Leukocytosis (30.00%) was detected at a rate similar to the 29.4% reported by Dawson et al. (2021), potentially indicating inflammation or infection.<sup>[23]</sup> Low platelet count (<150,000/mm<sup>3</sup>) was seen in 12.50%, aligning with the 13.1% found in a study by Kim et al. (2017).<sup>[24]</sup> Serum progesterone <10 ng/mL was present in 24.17% of cases, close to the 22.9% reported by Mitchell et al. (2019), supporting the role of progesterone deficiency in pregnancy loss. CRP elevation (>10 mg/L) in 24.17% of cases mirrors the findings of Roberts et al. (2020), who found elevated CRP levels in 23.5% of pregnancies complicated by first-trimester bleeding.<sup>[26]</sup>

Among the study participants, 58.33% had ongoing pregnancies, while 33.33% experienced miscarriage. This is comparable to the 56.2% and 34.8% reported by Anderson et al. (2020).<sup>[27]</sup> Surgical management, including dilation and curettage, was required in 24.17% of cases, similar to the 23.4% reported by McCarthy et al. (2016). The findings suggest that while a significant proportion of pregnancies continued successfully, nearly a third resulted in miscarriage, highlighting the importance of close monitoring and appropriate interventions.<sup>[28]</sup>

## CONCLUSION

This study underscores the clinical significance of first-trimester bleeding and its association with varied pregnancy outcomes. Ultrasonography remains a crucial tool in assessing fetal viability and identifying risk factors for pregnancy loss. Laboratory investigations further aid in diagnosing underlying conditions that may influence prognosis. Early identification of high-risk cases allows for timely medical intervention, improving maternal and fetal outcomes. A multidisciplinary approach involving obstetricians, radiologists, and laboratory specialists is essential for optimal patient management.

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