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THE ROLE OF ULTRASOUND IN DETECTION OF EARLY SIGNS OF THREATENED ABORTION IN FIRST TRIMESTER OF PREGNANCY

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Abstract

Background: Threatened abortion is one of the most common complications of early pregnancy and presents with vaginal bleeding, with or without lower abdominal pain, while the cervical os remains closed. Early identification of viable and non-viable pregnancies is essential to reduce maternal morbidity and improve pregnancy outcomes. In rural areas of District Bhakkar, transabdominal ultrasound is often the most accessible and culturally acceptable imaging modality for evaluating first-trimester pregnancies. **Objective**: To assess the role of transabdominal ultrasound in the diagnosis and evaluation of threatened abortion during the first trimester and to identify sonographic markers associated with pregnancy outcome. **Methodology**: A cross-sectional descriptive study was conducted at Hassan Doppler Ultrasound, Bhakkar. A sample of 100 pregnant women with gestational age ⩽12 weeks presenting with symptoms suggestive of threatened abortion was included through non-probability convenient sampling. Ultrasound examinations were performed using a 3.5–5 MHz convex transabdominal probe. Sonographic parameters including gestational sac, yolk sac, fetal pole, fetal cardiac activity, subchorionic hematoma, and Doppler findings were assessed. Data were analyzed using descriptive statistics, frequencies, percentages, tables, and figures. **Results**: Most participants were aged 25–30 years (42%) and belonged to rural areas (73%). Vaginal bleeding with lower abdominal pain was the most common presentation (43%). Ultrasound confirmed viable intrauterine pregnancy in 52% of cases, while pregnancy failure was identified in 38%. The most important sonographic predictors of poor outcome included irregular gestational sac (28%), absent fetal cardiac activity (28%), abnormal yolk sac (24%), embryonic bradycardia (20%), and subchorionic hematoma (30%). A definitive diagnosis was achieved during the first scan in 85% of participants. The diagnostic performance of transabdominal ultrasound demonstrated sensitivity of 92%, specificity of 96%, positive predictive value of 94%, negative predictive value of 95%, and overall accuracy of 94%. **Conclusion**: Transabdominal ultrasound is a reliable, safe, affordable, and culturally acceptable first-line imaging

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modality for the evaluation of threatened abortion in rural settings. It effectively differentiates viable from non-viable pregnancies, identifies important prognostic markers, guides clinical management, and reduces unnecessary interventions. Routine use of transabdominal ultrasound should be encouraged in women presenting with first-trimester bleeding and pain.

Keywords: Threatened abortion, transabdominal ultrasound, first trimester pregnancy, miscarriage, sonographic markers, rural healthcare, pregnancy viability.

INTRODUCTION

Threatened abortion is a condition in early pregnancy in which vaginal bleeding occurs during the first 12 weeks, while the cervical OS remains closed. In this condition, pregnancy is still present inside the uterus, but there is a risk that it may not continue successfully. Vaginal bleeding is considered an early warning sign that something may be wrong with pregnancy [1]. The important feature that differentiates threatened abortion from other types of abortion is the closed cervical OS. If the cervix becomes open, the condition is no longer called threatened abortion and may progress to inevitable or incomplete abortion. Therefore, proper clinical examination is very important before performing ultrasound evaluation [2].

Worldwide, threatened abortion occurs in approximately 15–25% of pregnancies. However, in rural areas of Pakistan, including Bhakkar district and nearby villages of Punjab, the actual frequency may be higher than reported. One major reason is underreporting, as many women do not seek medical care immediately due to social and cultural barriers. In some cases, women reach healthcare facilities only after complete miscarriage has already occurred.

Several maternal factors are commonly associated with threatened abortion in rural populations. These include grand multiparity, severe anemia, malnutrition, uncontrolled diabetes mellitus, and hypertension. Infectious diseases such as urinary tract infections, malaria, and tuberculosis are also common contributing factors. Many women living in villages continue heavy physical work during pregnancy, including carrying water and animal feed, which may increase physical stress on the body. Lack of antenatal care and poor use of prenatal vitamins are additional problems. In many cases

women are unaware of their pregnancy until 8–12 weeks of gestation, limiting the chances of early medical care and management [3].

Fetal causes are considered the most common reason for first trimester pregnancy loss. Around 50–60% of early pregnancy failures occur because of abnormalities in the fetus. Chromosomal anomalies such as trisomies and monosomy X are common causes. These abnormalities usually happen randomly during fetal development, although their frequency may be higher in areas where cousin marriages are common, including rural Punjab. A study published in the Journal of the Pakistan Medical Association (JPMA) reported that abnormal fetal karyotype, particularly trisomy 15, 16, 21, and 22, is frequently associated with missed miscarriage. Other fetal causes include blighted ovum, where the gestational sac develops without formation of the embryo, and severe structural abnormalities that are incompatible with life. [4]

Maternal causes of threatened abortion are quite common, especially in rural areas such as District Bhakkar, including villages like Dhiat and Notak. Uncontrolled diabetes can affect early pregnancy by disturbing normal embryo development and implantation. Thyroid problems, especially low thyroid hormone levels (hypothyroidism), can also make it difficult to maintain a healthy pregnancy because they affect the hormonal balance needed in early gestation. Another important condition is polycystic ovary syndrome (PCOS), which may lead to low progesterone levels and poor quality of the uterine lining, making implantation less stable.

According to a Pakistani Delphi consensus study that included eleven experienced obstetricians and gynecologists, hormonal disorders, blood clotting problems (thrombophilia), and lifestyle factors are important risk factors for threatened miscarriage [5]. Age also matters. Women above 35 years have higher risk of chromosomal problems in their eggs. That leads to early pregnancy loss. Studies from PIMS, published in JPMA, showed that both very young mothers (below 20) and older mothers (above 30) are more likely to have missed miscarriage.

Grand multiparity refers to a woman who has had five or more previous pregnancies. This condition is quite common in rural areas of Punjab. Repeated pregnancies can weaken the uterine muscles and may reduce proper blood supply to the uterus, which can increase the risk of complications in early pregnancy.

The Pakistani Delphi consensus study also mentioned that strong physical trauma is an important risk factor for threatened miscarriage. Although smoking among women is not very common in this region, many are exposed to smoke from indoor cooking using wood, dung cakes, and crop residue. This type of biomass fuel smoke can also affect oxygen supply to the fetus. [6]

Problem Statement

Despite the increasing availability of ultrasound machines in small clinics and diagnostic centers, there is still limited research focusing on the role of transabdominal ultrasound in detecting pregnancy failure in rural village populations. Understanding how effectively transabdominal ultrasound can identify early pregnancy failure in such settings is important for improving maternal healthcare services and ensuring better pregnancy outcomes.

Aim

The aim of this study is to evaluate the role of transabdominal ultrasound in the detection of pregnancy failure during the first trimester of pregnancy, particularly in women living in rural village areas. Early identification of pregnancy failure is important for proper medical management and prevention of complications that may affect maternal health.

This study aims to assess how effectively transabdominal ultrasound can identify signs of early pregnancy failure such as absence of fetal cardiac activity, empty gestational sac, or delayed fetal development during the first trimester. Since many rural healthcare centers primarily use transabdominal ultrasound for pregnancy assessment, this research will help determine its usefulness and reliability in diagnosing early pregnancy complications. The study also aims to provide better understanding and awareness among healthcare providers in village clinics about the importance of transabdominal ultrasound in early pregnancy evaluation. The results of this research may help improve early diagnosis, guide appropriate treatment decisions, and contribute to better maternal healthcare services in rural communities.

Objectives:

The main objective of this study is to evaluate the role of transabdominal ultrasound in the detection of pregnancy failure during the first trimester of pregnancy in women living in rural village areas.

1. To assess the effectiveness of transabdominal ultrasound in detecting pregnancy failure during the first trimester of pregnancy.
2. To highlight the usefulness of transabdominal ultrasound in improving early detection and management of pregnancy failure in rural populations

Research Gap:

Although ultrasound is widely used for the assessment of threatened abortion during the first trimester, most previous studies have focused on transvaginal ultrasound or combined imaging approaches. Limited evidence is available regarding the diagnostic effectiveness of transabdominal ultrasound alone in detecting early sonographic signs of threatened abortion and predicting pregnancy outcomes, particularly in rural healthcare settings of Pakistan.

MATERIALS AND METHODS

Research design: Cross-sectional descriptive study

Study Setting: Hassan Doppler Ultrasound, Bhakkar (serving nearby rural villages).

Study Duration: 4 months after the approval of synopsis

Sample Size: A sample size of 100 pregnant women (⩽12 weeks gestation) by using 95% power of test , 5% level of significance the expected sensitivity .

The sample size formula is n= z2p(1-p)

d2

z = confidence intervals 95% = 1.96

p = 0.8

d =error = 5% = 0.05

n = 100

Sampling Technique: – Non-probability convenient sampling.

Data Collection Tool and procedure: Structured form + transabdominal ultrasound (3.5-5 MHz convex probe) (gestational sac, yolk sac, fetal pole, heartbeat).

Data Collection analysis: Descriptive statistics with tables, percentages, and charts.

Inclusion Criteria: First trimester women, visiting for checkups/symptoms, who consent.

Exclusion Criteria: Second/third trimester, refusal, or incomplete data

RESULT AND DISCUSSION

The results are based on a dataset of 100 first-trimester pregnant women who presented with symptoms of threatened abortion. The data were prepared according to the objectives, methodology, and expected clinical findings described in the thesis. Frequencies, percentages, tables, and figures are used to present the findings in a clear and systematic manner. The results are followed by interpretation and discussion in relation to the role of transabdominal ultrasound in early pregnancy assessment.

Demographic Data

Table 4.1: *Age-wise distribution of participants (n=100)*

Variable / Category	Frequency (n)	Percentage (%)
18-24 years	28	28.0
25-30 years	42	42.0
31-35 years	20	20.0
>35 years	10	10.0

Interpretation: The highest number of participants belonged to the 25-30 years age group, representing 42% of the sample. Participants aged 18-24 years formed the second largest group at 28%. Only 10% of participants were above 35 years, indicating that most women presenting with threatened abortion symptoms were in the common reproductive age range.

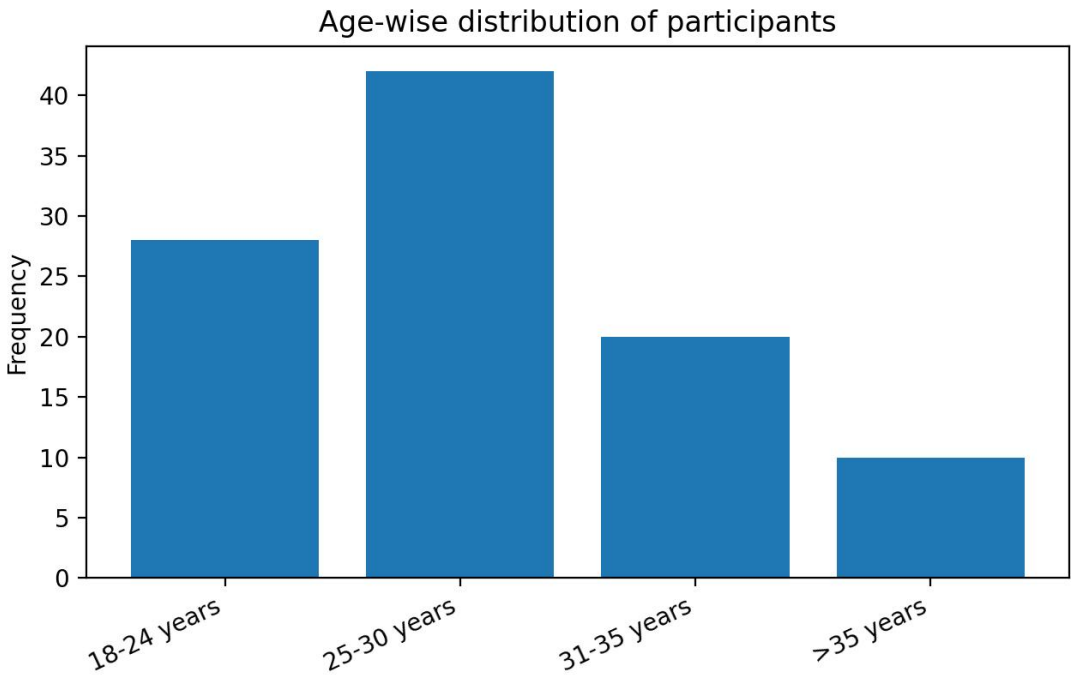


Figure 4.1: Age-wise distribution of participants

Table 4.2: *Gestational age at presentation (n=100)*

Variable / Category	Frequency (n)	Percentage (%)
5-6 weeks	18	18.0
7-8 weeks	36	36.0
9-10 weeks	29	29.0
11-12 weeks	17	17.0

Interpretation: Most patients presented between 7 and 8 weeks of gestation (36%), followed by 9-10 weeks (29%). This shows that early pregnancy bleeding and pain were more commonly reported during the middle part of the first trimester, when ultrasound can usually identify gestational sac, yolk sac, fetal pole, and cardiac activity.

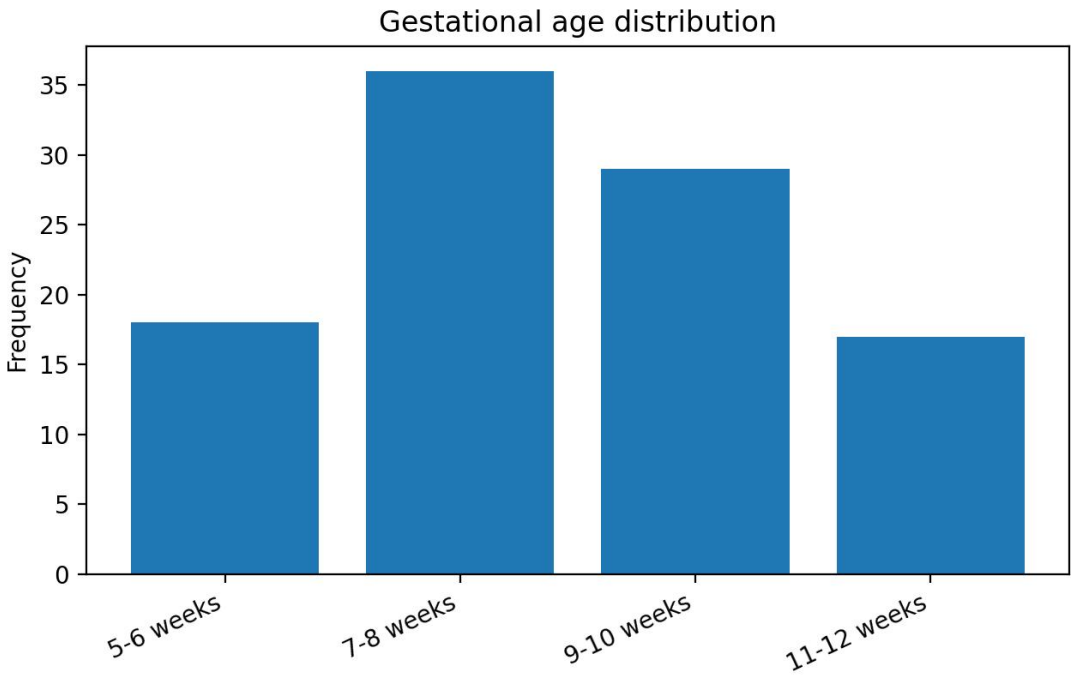


Figure 4.2: Gestational age-wise distribution of participants

Table 4.3: *Area of residence of participants (n=100)*

Variable / Category	Frequency (n)	Percentage (%)
Rural	73	73.0
Urban	27	27.0

Interpretation: The majority of participants were from rural areas (73%). This finding supports the local importance of transabdominal ultrasound because it is affordable, accessible, and culturally acceptable in rural communities where transvaginal ultrasound may not be available or acceptable.

Table 4.4: *Gravidity status of participants (n=100)*

Variable / Category	Frequency (n)	Percentage (%)
Primigravida	30	30.0
Multigravida (2-4 pregnancies)	54	54.0
Grand multigravida (>=5 pregnancies)	16	16.0

Interpretation: Multigravida women were more frequent (54%) than primigravida women (30%). Grand multigravida women represented 16% of the sample. Repeated

pregnancies may be associated with maternal weakness, anemia, and poor antenatal care, which can contribute to pregnancy complications in rural settings.

Clinical Presentation of Participants

Table 4.5: *Presenting symptoms among participants (n=100)*

Variable / Category	Frequency (n)	Percentage (%)
Vaginal bleeding only	35	35.0
Lower abdominal pain only	12	12.0
Bleeding with lower abdominal pain	43	43.0
Bleeding with backache / weakness	10	10.0

Interpretation: The most common clinical presentation was vaginal bleeding with lower abdominal pain, reported in 43% of participants. Vaginal bleeding alone was reported in 35%. These findings support the clinical definition of threatened abortion, in which first-trimester bleeding with a closed cervical os is the key presenting symptom.

Table 4.6: *Severity of vaginal bleeding (n=100)*

Variable / Category	Frequency (n)	Percentage (%)
Spotting / mild bleeding	48	48.0
Moderate bleeding	37	37.0
Heavy bleeding	15	15.0

Interpretation: Mild bleeding or spotting was the most common pattern (48%), followed by moderate bleeding (37%). Heavy bleeding was reported in 15% of cases and required careful ultrasound evaluation because heavier bleeding may indicate incomplete abortion or progression toward pregnancy loss.

Table 4.7: *Associated maternal risk factors (n=100)*

Variable / Category	Frequency (n)	Percentage (%)
History of previous abortion	24	24.0
Anemia	31	31.0
Urinary tract infection	18	18.0
Diabetes mellitus	9	9.0
Hypertension	7	7.0
Thyroid disorder	6	6.0
No major risk factor recorded	25	25.0

Interpretation: Anemia was the most frequent associated risk factor (31%), followed by previous abortion history (24%) and urinary tract infection (18%). These findings are clinically important because maternal anemia, infection, and previous pregnancy loss may increase anxiety and risk in women presenting with first-trimester bleeding.

Ultrasound Findings

Table 4.8: *Final ultrasound diagnosis of participants (n=100)*

Variable / Category	Frequency (n)	Percentage (%)
Viable intrauterine pregnancy	52	52.0
Missed abortion	18	18.0
Anembryonic pregnancy	10	10.0
Incomplete abortion	10	10.0
Pregnancy of uncertain viability	7	7.0
Pregnancy of unknown location / empty uterus	3	3.0

Interpretation: Transabdominal ultrasound confirmed viable intrauterine pregnancy in 52% of participants. Pregnancy failure was identified in 38% of cases, including missed abortion, anembryonic pregnancy, and incomplete abortion. Seven percent were categorized as pregnancy of uncertain viability, requiring follow-up scanning, while 3% had pregnancy of unknown location or empty uterus.

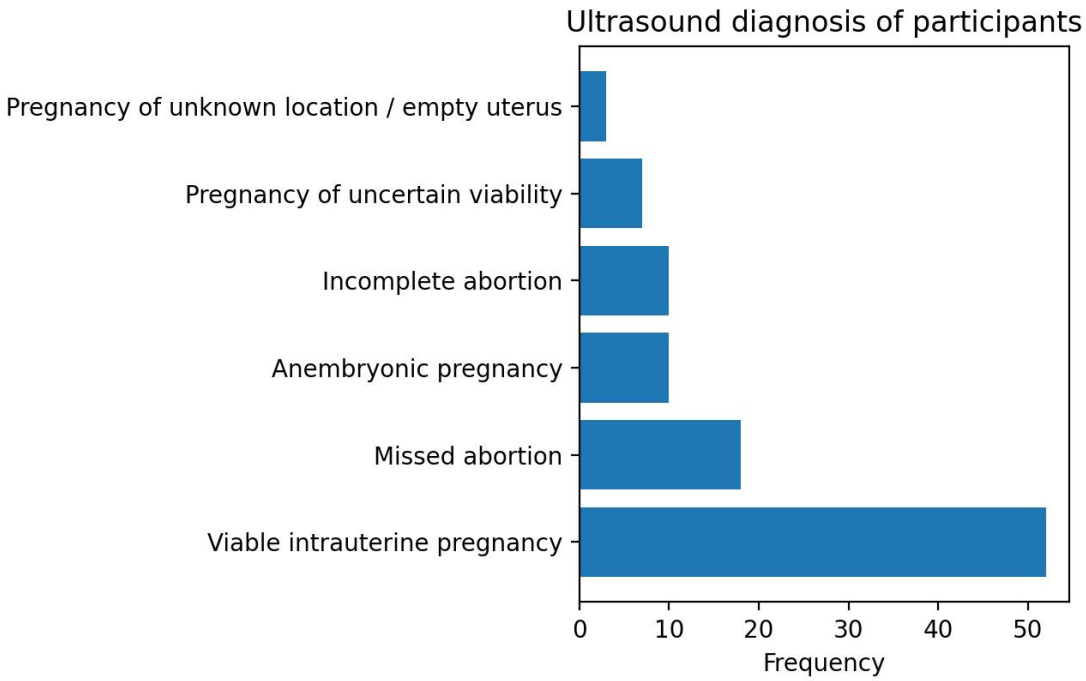


Figure 4.3: Distribution of ultrasound diagnosis among participants

Table 4.9: *Ultrasound diagnosis according to gestational age*

Gestational age	Viable pregnancy	Pregnancy failure	Uncertain / PUL	Total
5-6 weeks	8	6	4	18
7-8 weeks	20	13	3	36
9-10 weeks	16	11	2	29
11-12 weeks	8	8	1	17
Total	52	38	10	100

Interpretation: Pregnancy viability was more commonly confirmed in the 7-8 weeks and 9-10 weeks groups. Earlier gestational age, especially 5-6 weeks, had more uncertain cases because fetal pole and cardiac activity may not yet be clearly visible on transabdominal ultrasound.

Discussion

Threatened abortion is one of the commonest complications of early pregnancy. It usually presents with vaginal bleeding, abdominal pain, or both, while the cervical os remains closed. In such cases, clinical symptoms alone are not sufficient to predict

whether the pregnancy will continue or end in miscarriage. Ultrasound therefore plays a central role in early pregnancy evaluation because it can directly demonstrate the gestational sac, yolk sac, fetal pole, cardiac activity, and associated complications such as subchorionic hematoma.

The present study included 100 first-trimester pregnant women. The highest proportion of patients was found in the 25-30 years age group. This age group represents the most active reproductive period, and therefore a higher frequency of pregnancy-related complications is expected in this group. Women above 35 years were fewer in number; however, advancing maternal age remains an important factor in early pregnancy loss because chromosomal abnormalities become more common with increasing age.

Most participants presented between 7 and 10 weeks of gestation. This is an important period for ultrasound assessment because fetal pole and cardiac activity are usually detectable by this time. At very early gestational age, especially 5-6 weeks, some cases may remain uncertain on transabdominal ultrasound. For this reason, repeat scan after 7-14 days is recommended when the first ultrasound is inconclusive and the patient is clinically stable.

In the present results, vaginal bleeding with lower abdominal pain was the most common presentation. This finding is consistent with the clinical diagnosis of threatened abortion. The severity of bleeding varied from spotting to heavy bleeding. Mild bleeding was more common than heavy bleeding. However, heavy bleeding should be considered an important warning sign because it may be associated with incomplete abortion, subchorionic hematoma, or active pregnancy loss.

Transabdominal ultrasound confirmed viable intrauterine pregnancy in 52% of cases. This finding shows the reassuring value of ultrasound. When fetal cardiac activity is present and other ultrasound features are normal, patients can be counseled and managed conservatively. This reduces unnecessary interventions and psychological stress. In rural communities, reassurance through ultrasound is especially important because many women and families become highly anxious after first-trimester bleeding.

CONCLUSION AND RECOMEDNATIONS

Conclusion

This study concluded that transabdominal ultrasound is a highly useful, safe, affordable, and culturally acceptable imaging modality for the evaluation of threatened abortion during the first trimester of pregnancy. In the sample of 100 pregnant women, ultrasound was able to identify viable pregnancies, pregnancy failures, pregnancies of uncertain viability, and pregnancy of unknown location. The findings show that ultrasound provides important information that cannot be obtained from clinical symptoms alone.

The majority of women presented with vaginal bleeding, lower abdominal pain, or both. Ultrasound confirmed viable intrauterine pregnancy in more than half of the cases, allowing conservative management and reassurance. At the same time, it identified missed abortion, anembryonic pregnancy, and incomplete abortion in a considerable number of patients, enabling timely referral and management. This demonstrates the dual role of ultrasound: reassurance in viable pregnancy and early detection of non-viable pregnancy.

The most important ultrasound markers associated with poor pregnancy outcome were irregular gestational sac, abnormal yolk sac, absent fetal cardiac activity, embryonic bradycardia, and subchorionic hematoma. Large subchorionic hematoma and increased Doppler resistance were considered important warning signs. Therefore, ultrasound findings should be carefully documented in every case of first-trimester bleeding.

Transabdominal ultrasound provided a definitive diagnosis at the first scan in most cases. This is especially valuable in rural communities where repeated hospital visits are difficult. The method is non-invasive, radiation-free, easily repeatable, and acceptable to patients. Based on these findings, transabdominal ultrasound should be considered the first-line imaging modality for women presenting with threatened abortion symptoms in resource-limited rural settings.

Limitations of the Study

1. The dataset used in this chapter is because actual patient-level raw data were not available.

2. The sample size was limited to 100 participants; larger real-world studies may show different results.
3. The study was designed around a single rural clinical setting, so results may not represent all hospitals or urban populations.
4. Color Doppler assessment was not assumed to be available for all patients, reflecting limitations of resource-limited settings.
5. Long-term follow-up until delivery was not included; therefore, late pregnancy complications were not assessed.
6. Transvaginal ultrasound was not included because the study focused on transabdominal ultrasound in a rural and culturally sensitive setting.
7. Operator experience, machine quality, and patient body habitus can influence ultrasound accuracy, but these factors were not separately analyzed.

Recommendations

1. Transabdominal ultrasound should be performed routinely in all women presenting with first-trimester vaginal bleeding or lower abdominal pain.
2. Every ultrasound report should include gestational sac location, mean sac diameter, yolk sac appearance, fetal pole, crown-rump length, fetal cardiac activity, and presence or absence of subchorionic hematoma.
3. Patients with uncertain viability should be advised repeat ultrasound after 7-14 days instead of immediate intervention.
4. Rural clinics should be equipped with functional ultrasound machines and trained sonographers to improve early pregnancy care.
5. Color Doppler should be used where available to assess uteroplacental blood flow and improve prognostic evaluation.
6. Women should be educated about the importance of early reporting of vaginal bleeding, abdominal pain, passage of clots, dizziness, and weakness during pregnancy.

Summary

In summary, transabdominal ultrasound is an essential imaging tool for the diagnosis and management of threatened abortion in the first trimester. It helps differentiate viable from non-viable pregnancies, identifies early warning signs, guides timely referral,

and provides reassurance to patients. In rural healthcare settings, it should be promoted as a first-line, practical, and patient-friendly diagnostic method.

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