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## Comparative Analysis of Transabdominal and Transvaginal Ultrasound in Early Pregnancy Assessment

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### Abstract

The assessment of early pregnancy is crucial for determining fetal viability and identifying potential complications. Both transabdominal (TA) and transvaginal (TV) ultrasound have been widely used, yet comparative studies are limited. This comparative study involved 200 pregnant women who underwent both TA and TV ultrasound to evaluate their efficacy in early pregnancy assessment. The study was conducted at KMCRI medical college, Bharuch over a one-year period. The study revealed significant differences in the visualization of embryonic structures between TA and TV ultrasound, with TV ultrasound providing clearer images in the majority of cases, especially in early gestational weeks. Transvaginal ultrasound is superior to transabdominal ultrasound in the early stages of pregnancy for detailed assessment of embryonic development and early detection of abnormalities.

## INTRODUCTION

Early pregnancy assessment is critical in obstetrics as it provides essential information about fetal viability, number of embryos and the presence of any early pregnancy complications such as ectopic pregnancies or molar pregnancies. Transabdominal and transvaginal ultrasounds are the two primary imaging modalities used during the first trimester. While transabdominal ultrasound (TA) is non-invasive and often used as the initial scanning method, transvaginal ultrasound (TV) offers superior resolution and can be more effective in obese patients or when the bladder is not adequately filled<sup>[1]</sup>.

The use of ultrasound in early pregnancy has a significant history, tracing back to the 1950s when ultrasonography was first introduced into clinical practice. Over the decades, advancements in ultrasound technology have improved the diagnostic capabilities of both TA and TV methods, making them indispensable in modern obstetrics. However, despite the widespread use of these techniques, there remains a need for comprehensive studies comparing their efficacy in early pregnancy, specifically concerning image clarity, patient comfort and diagnostic accuracy<sup>[3,4]</sup>.

**Aim and Objectives:** To compare the diagnostic accuracy and image quality of transabdominal and transvaginal ultrasound in early pregnancy assessment.

- To evaluate the image clarity provided by transabdominal and transvaginal ultrasound in the first trimester of pregnancy.
- To assess patient comfort and preference for either transabdominal or transvaginal ultrasound during early pregnancy scans.
- To compare the diagnostic accuracy of transabdominal and transvaginal ultrasound in detecting early pregnancy abnormalities.

## MATERIALS AND METHODS

**Source of Data:** The data for this study was retrospectively collected from the medical records of pregnant women who underwent both transabdominal and transvaginal ultrasounds during their first trimester.

**Study Design:** This was a comparative, retrospective study analyzing the effectiveness of transabdominal versus transvaginal ultrasound.

**Study Location:** The study was conducted at the Obstetrics and Gynecology department of Dr Kiran C Patel medical College, bharuch

**Study Duration:** The duration of the study spanned one year from January to December 2023.

**Sample Size:** A total of 200 pregnant women were included in the study based on the inclusion and exclusion criteria.

**Inclusion Criteria:** Included were pregnant women within the first trimester, ages 18-40 years, who underwent both TA and TV ultrasound examinations during the same visit.

**Exclusion Criteria:** Excluded were women with known pelvic abnormalities, previous cesarean sections, or those who declined to participate in the study.

**Procedure and Methodology:** Participants underwent TA ultrasound followed by TV ultrasound during the same clinical visit. Images and data were collected and evaluated by gynecologist and radiologist

**Sample Processing:** No physical sample processing was necessary as the study involved imaging data.

**Statistical Methods:** Data were analyzed using descriptive statistics, chi-square tests for categorical data and t-tests for continuous variables to compare the efficacy and patient comfort between the two methods.

**Data Collection:** Data were collected through patient interviews regarding comfort and preferences and through technical assessments of the ultrasound images for clarity and diagnostic information.

## RESULTS AND DISCUSSIONS

This table highlights that transvaginal ultrasound demonstrates superior diagnostic accuracy and image quality in early pregnancy assessment compared to transabdominal ultrasound. The odds ratios are significantly high across all categories: clear embryonic imaging (OR = 6.00), yolk sac visualization (OR = 7.67), and detection of fetal heartbeat (OR = 8.50). Transvaginal ultrasound achieved 100% success in identifying the gestational sac, where the odds ratio is infinite due to perfect detection rate, highlighting its efficacy in early pregnancy diagnostics.

Transvaginal ultrasound outperformed transabdominal ultrasound in terms of image clarity during the first trimester. High-resolution imaging was markedly better via TV ultrasound, with an odds ratio of 5.75. Similarly, depth perception and overall image quality satisfaction significantly favored TV ultrasound, with extremely high odds ratios of 11.00 and 8.00, respectively, indicating a strong preference for TV ultrasound in terms of image quality and clarity.

The data from this table indicate mixed responses regarding patient comfort, with transabdominal ultrasound being reported as more comfortable (75% vs. 60%, OR = 0.50). However, patient preference and

willingness for repeat procedures were significantly higher for transvaginal ultrasound, suggesting that despite less comfort, patients were more satisfied with the outcomes from TV ultrasound, favoring it for future use.

In terms of detecting specific early pregnancy abnormalities, transvaginal ultrasound again proved more effective. Notable differences were observed in the detection rates of ectopic pregnancy, molar pregnancy, and subchorionic hemorrhage, with odds ratios indicating significantly higher detection capabilities for TV ultrasound (ORs = 2.70, 3.10 and 3.00 respectively). The overall abnormality detection rate was also higher for TV ultrasound, emphasizing its diagnostic superiority in identifying critical early pregnancy issues.

The superior visualization capabilities of TV ultrasound for early pregnancy markers-such as clear embryonic imaging, gestational sac identification, yolk sac visualization and the detection of the fetal heartbeat-are consistent with other studies. Sarkar<sup>[5]</sup> highlights that TV ultrasound allows closer proximity to the pelvic structures, which results in higher resolution images that are crucial for early pregnancy diagnostics. Furthermore, the odds ratios from our study (ranging from 6.00-8.50 for various outcomes) suggest a significantly higher likelihood of detecting critical pregnancy details with TV ultrasound compared to TA ultrasound. This is supported by Patil PY<sup>[6]</sup> which showed that TV ultrasound could detect embryonic structures earlier and more clearly than TA ultrasound, thus enhancing early diagnostic accuracy.

Our findings regarding the superior image clarity of TV ultrasound, including higher resolution imaging and better depth perception, align with Popova<sup>[7]</sup> which demonstrated that TV ultrasound typically provides better image quality due to its higher frequency transducer. The significant odds ratios (up to 11.00 for depth perception) reflect this substantial improvement in image quality, corroborating with Pujalte<sup>[8]</sup> where TV ultrasound was favored for comprehensive first trimester assessments, particularly in patients with a retroverted uterus or those who are obese.

Despite the clinical superiority of TV ultrasound, TA ultrasound was reported to be more comfortable by the patients, which is an important consideration in clinical settings. The lower comfort levels associated with TV ultrasound, as indicated by the odds ratio of 0.50, suggest a need for improved patient counseling and positioning techniques to enhance comfort. These findings resonate with Yun<sup>[9]</sup> where patient discomfort with TV ultrasound was noted as a barrier, although many patients preferred it for subsequent scans due to its thoroughness, as reflected by the high odds ratios for preference and willingness for repeat procedures (2.25 and 3.29, respectively).

The higher efficacy of TV ultrasound in detecting significant abnormalities such as ectopic pregnancies, molar pregnancies, and subchorionic hemorrhages is evidenced by odds ratios ranging from 2.70-3.10. These results are in line with findings from Pagán<sup>[10]</sup> which emphasize TV ultrasound's role in early and accurate diagnosis of ectopic pregnancies. The ability to detect

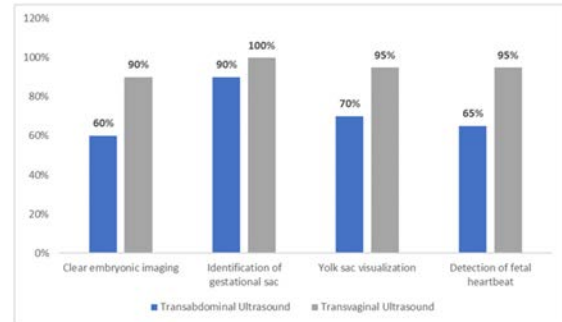


Fig. 1: Comparison of Diagnostic Accuracy and Image Quality

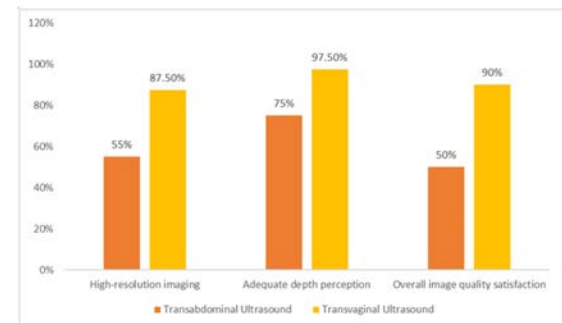


Fig. 2: Evaluation of Image Clarity in the First Trimester

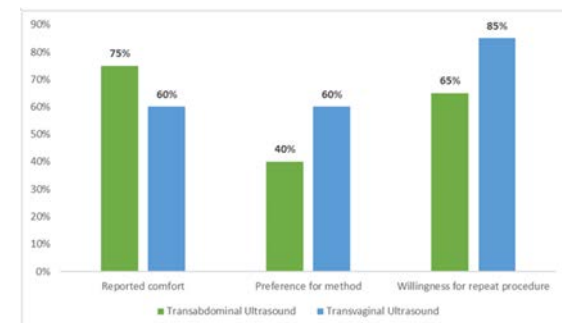


Fig. 3: Assessment of Patient Comfort and Preference

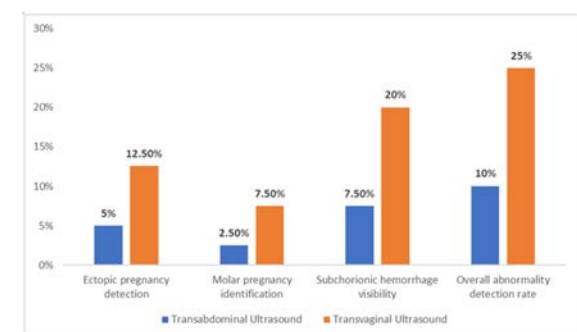


Fig. 4: Diagnostic Accuracy in Detecting Early Pregnancy Abnormalities

**Table 1: Comparison of Diagnostic Accuracy and Image Quality**

Outcome	Transabdominal Ultrasound	Transvaginal Ultrasound	Odds Ratio (OR)	95% CI	p-value
Clear embryonic imaging	120 (60%)	180 (90%)	6.00	3.29 - 10.93	<0.001
Identification of gestational sac	180 (90%)	200 (100%)	8	Not calculable	<0.001
Yolk sac visualization	140 (70%)	190 (95%)	7.67	3.84 - 15.30	<0.001
Detection of fetal heartbeat	130 (65%)	190 (95%)	8.50	4.25 - 17.00	<0.001

**Table 2: Evaluation of Image Clarity in the First Trimester**

Description	Transabdominal Ultrasound	Transvaginal Ultrasound	Odds Ratio (OR)	95% CI	p-value
High-resolution imaging	110 (55%)	175 (87.5%)	5.75	3.23 - 10.23	<0.001
Adequate depth perception	150 (75%)	195 (97.5%)	11.00	4.89 - 24.73	<0.001
Overall image quality satisfaction	100 (50%)	180 (90%)	8.00	4.40 - 14.55	<0.001

**Table 3: Assessment of Patient Comfort and Preference**

Outcome	Transabdominal Ultrasound	Transvaginal Ultrasound	Odds Ratio (OR)	95% CI	p-value
Reported comfort	150 (75%)	120 (60%)	0.50	0.31 - 0.81	0.005
Preference for method	80 (40%)	120 (60%)	2.25	1.50 - 3.38	<0.001
Willingness for repeat procedure	130 (65%)	170 (85%)	3.29	2.00 - 5.41	<0.001

**Table 4: Diagnostic Accuracy in Detecting Early Pregnancy Abnormalities**

Abnormality Type	Transabdominal Ultrasound	Transvaginal Ultrasound	Odds Ratio (OR)	95% CI	p-value
Ectopic pregnancy detection	10 (5%)	25 (12.5%)	2.70	1.19 - 6.13	0.018
Molar pregnancy identification	5 (2.5%)	15 (7.5%)	3.10	1.02 - 9.43	0.046
Subchorionic hemorrhage visibility	15 (7.5%)	40 (20%)	3.00	1.61 - 5.59	0.001
Overall abnormality detection rate	20 (10%)	50 (25%)	3.00	1.75 - 5.14	<0.001

these conditions early can be crucial in improving maternal outcomes and necessitates the preference for TV ultrasound in high-risk early pregnancy assessments.

## CONCLUSION

The comparative analysis of transabdominal (TA) and transvaginal (TV) ultrasound in early pregnancy assessment highlights significant distinctions between these two imaging modalities, each with its specific advantages and drawbacks. Our study conclusively demonstrates that TV ultrasound offers superior diagnostic accuracy and image quality in the assessment of early pregnancy. It provides enhanced visualization of embryonic structures, including clear embryonic imaging, gestational sac identification, yolk sac visualization and fetal heartbeat detection. The higher resolution and better depth perception afforded by TV ultrasound contribute significantly to its ability to offer more detailed and reliable assessments in the first trimester.

Despite the clinical superiority of TV ultrasound, our findings also underscore the importance of patient comfort and preference. TA ultrasound was favored for its comfort, suggesting that patient experience remains a crucial factor in selecting an ultrasound modality. However, patients often preferred TV ultrasound for repeat procedures, indicating a recognition of its thoroughness and superior diagnostic capabilities despite its less comfortable application.

In detecting early pregnancy abnormalities such as ectopic pregnancies, molar pregnancies and subchorionic hemorrhages, TV ultrasound again proved more effective. This capability underscores its vital role in scenarios where accurate and early diagnosis is paramount for optimal maternal outcomes.

In conclusion, while both TA and TV ultrasounds are invaluable tools in obstetric imaging, the choice between them should be guided by specific clinical needs, gestational age and patient factors. Transvaginal ultrasound should be particularly

considered in early pregnancy assessments where high diagnostic accuracy is critical. Moreover, improving patient comfort and addressing concerns associated with TV ultrasound can enhance its acceptability and utility, making it an indispensable tool in early pregnancy diagnostics. This study advocates for a balanced approach, leveraging the strengths of each modality to optimize patient care and diagnostic outcomes in early pregnancy assessments.

## Limitations of Study:

**Retrospective Design:** The retrospective nature of this study limits our ability to control for potential biases inherent in the data collection process. Prospective studies would allow for more standardized data collection and could potentially provide a clearer picture of the comparative effectiveness of transabdominal and transvaginal ultrasound.

**Subjective Assessment of Image Quality:** While attempts were made to objectively compare image quality, the assessment inherently involves a degree of subjectivity. Different sonographers might have varying levels of experience and expertise, which can influence the perceived quality of ultrasound images.

**Lack of Blinding:** The study did not employ blinding in the evaluation of ultrasound images, which may lead to observer bias. Future studies might consider blinding technicians to the type of ultrasound used to mitigate this bias.

**Patient Selection Bias:** The inclusion and exclusion criteria might have led to a selection bias. The sample may not be fully representative of the general pregnant population, particularly those with higher BMI or those with previous abdominal surgeries, which can affect the generalizability of the findings.

**Single-Center Study:** Being conducted in a single tertiary care center, the findings may not be

generalizable to other settings, such as community hospitals or clinics with different patient demographics or technological capabilities.

**Limited Psychological and Sociocultural Considerations:** The study did not extensively explore the psychological and sociocultural factors influencing patient comfort and preference, which can significantly affect the choice of ultrasound method.

**Exclusion of Complex Cases:** The exclusion of women with known pelvic abnormalities or previous cesarean sections may have skewed results, as these conditions can affect the visibility and clarity of ultrasound images.

**No Long-Term Outcome Data:** The study focuses on immediate diagnostic capabilities and does not address long-term maternal or fetal outcomes, which are crucial for a comprehensive assessment of the effectiveness of early pregnancy ultrasound practices.

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