

COMPARISON BETWEEN TRANSABDOMINAL AND TRANSVAGINAL SONOGRAPHY IN DETECTION OF RETAINED PRODUCTS OF CONCEPTION

Original Research

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ABSTRACT

Background: Retained products of conception (RPOC) refer to placental or fetal tissue remaining in the uterus after delivery or miscarriage, potentially leading to complications such as abnormal bleeding, infection, and infertility. The incidence of RPOC varies, occurring in 17% of cases after the first trimester, 40% after the second trimester, and 3–5% following normal delivery. Accurate and timely diagnosis is crucial, with ultrasonography serving as a primary diagnostic tool.

Objective: To determine the diagnostic accuracy of transabdominal sonography (TAS) and transvaginal sonography (TVS) in detecting retained products of conception, using histopathology as the gold standard.

Methods: This cross-sectional validation study was conducted from May 1, 2022, to November 1, 2022, at the Department of Diagnostic Radiology, PAF Hospital, Islamabad. A total of 345 women aged 18–40 years with clinical suspicion of RPOC were included. TVS was performed using an endocavity transducer, with RPOC defined as echogenic or heterogeneous material in the endometrial cavity with a thickness >10 mm. TAS was conducted using a convex probe with a diagnostic criterion of an irregular mass measuring ≥10 mm within the endometrial cavity. All findings were compared against histopathological results as the reference standard. Statistical analysis was performed using SPSS.

Results: The mean age of participants was 29.61 ± 2.40 years, with a mean gestational age of 15.96 ± 1.68 weeks, mean parity of 1.93 ± 1.34 , and mean abortion duration of 17.09 ± 5.77 days. TVS exhibited a sensitivity of 89%, specificity of 74.5%, diagnostic accuracy of 87%, positive predictive value (PPV) of 95.2%, and negative predictive value (NPV) of 54.3%. TAS demonstrated a sensitivity of 88.4%, specificity of 54.9%, diagnostic accuracy of 83%, PPV of 91.87%, and NPV of 45%.

Conclusion: Transvaginal sonography demonstrated superior diagnostic accuracy, sensitivity, and specificity compared to transabdominal sonography, confirming its utility as the preferred imaging modality for diagnosing retained products of conception.

Keywords: Abortion, Diagnosis, Endometrial thickness, Retained products of conception, Sensitivity and specificity, Transabdominal sonography, Transvaginal sonography.

INTRODUCTION

Retained products of conception (RPOC) refer to placental or fetal tissue that remains within the uterus following childbirth or abortion. The incidence of RPOC varies significantly, occurring in approximately 17% of cases after the first trimester, 40% following the second trimester, and 3–5% after normal delivery. If not identified and managed promptly, RPOC can lead to serious complications such as endometritis, intrauterine adhesions, abnormal vaginal bleeding, fever, and abdominal pain, all of which may ultimately impair fertility. While RPOC can often resolve spontaneously, conservative management and close monitoring are generally recommended. In cases where symptoms persist or complications arise, invasive gynecological interventions may become necessary, although these carry inherent risks, including heavy bleeding(1, 2). Ultrasonography plays a pivotal role in the diagnosis of RPOC and is widely regarded as the primary imaging modality due to its accessibility, cost-effectiveness, and diagnostic utility. This non-invasive technique aids clinicians in confirming the presence of RPOC in suspected cases and in guiding the allocation of patients to either conservative or surgical treatment pathways. Certain sonographic findings, such as the presence of an endometrial mass, thickened endometrium, hypoechoic areas in the myometrium, and complex endometrial fluid, are suggestive of RPOC. Among these, endometrial thickness is frequently utilized as a key diagnostic parameter. However, the sonographic appearance of RPOC can vary significantly, with reported sensitivity ranging from 44% to 85% and specificity between 88% and 94%. Despite its utility, clinicians often encounter cases where patients with sonographically suspected RPOC later exhibit negative histopathological results, underscoring the need for refined diagnostic approaches(3-5).

Although transvaginal sonography (TVS) is predominantly utilized in the evaluation of RPOC due to its superior resolution and ability to provide detailed views of the endometrial cavity, there remains a paucity of data comparing the diagnostic accuracy of TVS and transabdominal sonography (TAS). TAS, despite being less invasive and more widely accepted by patients, is underexplored in this context, leaving a significant gap in the literature. Addressing this gap is crucial, as establishing the comparative efficacy of TAS and TVS could enhance diagnostic strategies for RPOC, ensuring more accurate and patient-centered care. This study aims to address this critical gap, providing evidence to support improved diagnostic modalities for the detection and management of retained products of conception(6-8).

METHODS

This cross-sectional validation study was conducted at the Department of Diagnostic Radiology, PAF Hospital, Islamabad, from May 1, 2022, to November 1, 2022. The study included a sample size of 345 patients, determined using the sensitivity of transabdominal ultrasound at 81% and specificity at 33% for detecting retained products of conception (RPOC). The calculations were based on a 95% confidence interval, precision for sensitivity and specificity set at 10%, and an estimated prevalence of 75%. Patients aged 18 to 40 years, presenting with RPOC and a gestational age of less than 20 weeks based on their last menstrual period (LMP), were recruited for the study, irrespective of parity. However, unmarried women with a history of amenorrhea of 11 weeks or more, those with no history of uterine bleeding, and patients diagnosed with ectopic pregnancy on ultrasound were excluded(9-11). All participants underwent transvaginal sonography (TVS) using either an endocavity or convex transducer, with RPOC identified according to predefined operational criteria. Additionally, transabdominal sonography (TAS) was performed using ultrasound equipment with convex probes operating at frequencies between 2.75 and 6.0 MHz. Ultrasonographic criteria for diagnosing RPOC included the presence of an echogenic, hypoechoic, or mixed echogenicity irregular mass measuring 10 mm or more within the endometrial cavity. Measurements of the endometrium included both layers, taken at the midsagittal plane. Images were evaluated by a senior consultant radiologist to ensure diagnostic accuracy(12-14).

Following ultrasonographic evaluations, patients underwent surgical uterine evacuation, and the specimens obtained were subjected to histopathological analysis, which served as the reference standard. The results of TAS and TVS, categorized as positive or negative for RPOC, were compared to histopathological findings to calculate sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy. Statistical analysis was conducted using IBM SPSS version 23. Quantitative variables, including age, gestational age, parity, and duration of abortion, were expressed as means and standard deviations, while categorical variables, such as age groups, were presented as frequencies and percentages(15-17). Effect modifiers such as age, gestational age,

parity, and duration of abortion were controlled through stratification, and diagnostic accuracy post-stratification was computed. This comprehensive methodology ensured a robust analysis of the comparative diagnostic performance of transabdominal and transvaginal sonography for the detection of RPOC(18, 19).

RESULTS

The age range of participants in this study was 18 to 40 years, with a mean age of 29.61 ± 2.40 years. The mean gestational age was 15.96 ± 1.68 weeks, mean parity was 1.93 ± 1.34 , and the mean duration of abortion was 17.09 ± 5.77 days. Among the total patients, 45.2% had a gestational age of ≤ 15 weeks, while 54.8% had a gestational age of >15 weeks. The majority of the participants (69.6%) were between 18 and 30 years of age, while the remaining 30.4% were aged 31 to 40 years. Regarding parity, 62.6% of the participants had parity between 0 and 2, and 37.4% had a parity greater than 2. A larger proportion (71.3%) had an abortion duration of more than 14 days, while 28.7% had an abortion duration of 1–14 days. Transvaginal sonography identified retained products of conception in 79.7% of patients, while transabdominal sonography diagnosed 82% of cases. Histopathological examination, the gold standard, confirmed RPOC in 85.2% of the enrolled patients. Transvaginal sonography demonstrated a sensitivity of 89%, specificity of 74.5%, diagnostic accuracy of 87%, positive predictive value (PPV) of 95.2%, and negative predictive value (NPV) of 54.3%. In comparison, transabdominal sonography showed a sensitivity of 88.4%, specificity of 54.9%, diagnostic accuracy of 83%, PPV of 91.87%, and NPV of 45%.

When stratified based on gestational age, transvaginal sonography demonstrated slightly better performance in cases with gestational age ≤ 15 weeks, with a sensitivity of 91.5%, specificity of 77.0%, accuracy of 89%, PPV of 95%, and NPV of 64.5%. For gestational age >15 weeks, sensitivity was 87%, specificity was 72%, accuracy was 85%, PPV was 95%, and NPV was 46%. Transabdominal sonography showed similar trends, with sensitivity, specificity, and accuracy slightly reduced compared to transvaginal sonography. Stratification by age revealed that transvaginal sonography was more effective in the younger age group (18–30 years), where sensitivity, specificity, and accuracy were 92.3%, 75.7%, and 90%, respectively. For patients aged 31–40 years, sensitivity decreased to 81.6%, specificity to 72%, and accuracy to 80%. Transabdominal sonography had lower specificity and accuracy in both age groups, with minimal variation in sensitivity.

Parity-based stratification showed that transvaginal sonography had higher sensitivity (94%), specificity (78.5%), and accuracy (92%) in participants with parity between 0 and 2. For those with parity greater than 2, sensitivity decreased to 80%, specificity to 69.5%, and accuracy to 78%. Transabdominal sonography showed similar trends, with marginally lower sensitivity and accuracy values. Duration of abortion also influenced diagnostic performance. Transvaginal sonography demonstrated better sensitivity (90%) and accuracy (86%) in patients with a shorter duration of abortion (1–14 days). For durations longer than 14 days, sensitivity was 88.6%, specificity was 80%, and accuracy was 87%. Transabdominal sonography had lower sensitivity and specificity in both groups but maintained moderate diagnostic performance, with PPV remaining above 90% in most cases.

Table 1 Demographic and clinical details of the study subjects (n=345)

Variable	Frequency	Percentage
Gestational Age		
≤15 Weeks	156	45.22
>15 Weeks	189	54.78
Age Groups		
18-30 Years	240	69.6%
31-40 Years	105	30.4%
Parity		
0-2	216	62.61

Variable	Frequency	Percentage
>2	129	37.39
Duration of Abortion		
1-14 Days	99	28.70
>14 Days	246	71.30

Table 2 Overall results of Transvaginal sonography, transabdominal sonography and histopathology in diagnosis of RPOC

RPOC	Transvaginal Sonography	Transabdominal Sonography	Histopathology
Positive	275 (79.7%)	283 (82%)	294 (85.2%)
Negative	70 (20.3%)	62 (18%)	51 (14.8%)
Total	345 (100%)	345 (100%)	345 (100%)

Table 3 Diagnostic accuracy of transvaginal and transabdominal sonography for diagnosis of RPOC keeping histopathology findings as gold standard

RPOC on Transvaginal Sonography		RPOC on Histopathology		
		POSITIVE	NEGATIVE	TOTAL
POSITIVE		262 (True Positives)	13 (False Positives)	275
NEGATIVE		32 (False Negatives)	38 (True Negatives)	70
Total		294	51	345
Sensitivity	Specificity	Accuracy	PPV	NPV
89%	74.5%	87%	95.2%	54.3%
RPOC on Transabdominal Sonography		RPOC on Histopathology		
		POSITIVE	NEGATIVE	TOTAL
POSITIVE		260 (True Positives)	23 (False Positives)	283
NEGATIVE		34 (False Negatives)	28 (True Negatives)	62
Total		294	51	345
Sensitivity	Specificity	Accuracy	PPV	NPV
88.4%	54.9%	83%	91.87%	45%

PPV: Positive Predictive Value, NPV: Negative Predictive Value

Table 4 Diagnostic accuracy of transvaginal sonography for diagnosis of RPOC keeping histopathology findings as gold standard (stratification analysis for various effect modifiers)

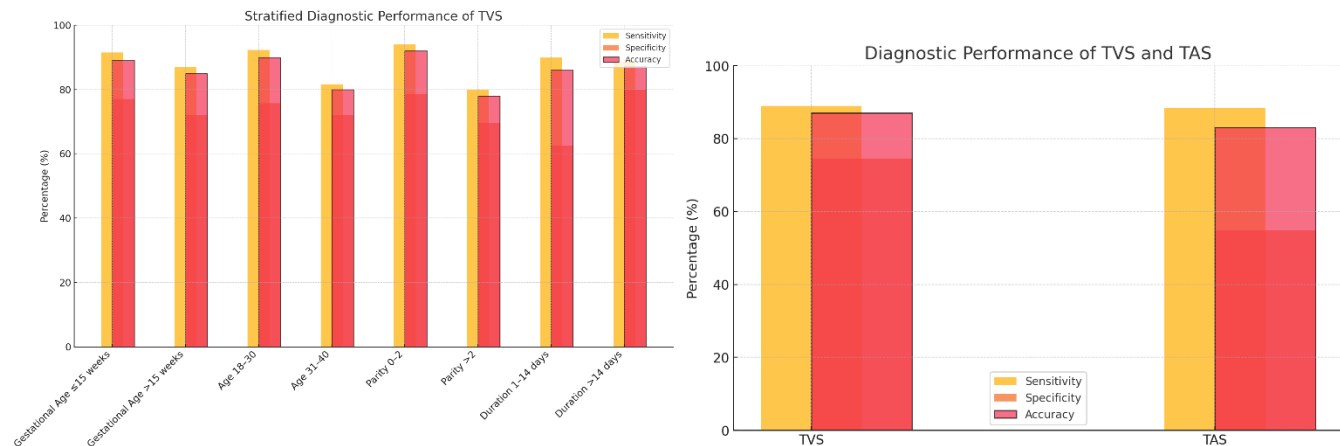
Effect Modifiers	Sensitivity (%)	Specificity (%)	Accuracy (%)	PPV (%)	NPV (%)
Gestational Age					
≤15 Weeks	91.5	77.0	89.0	95.0	64.5
>15 Weeks	87.0	72.0	85.0	95.0	46.0
Age Groups					
18-30 Years	92.3	75.7	90.0	96.0	61.0
31-40 Years	81.6	72.0	80.0	93.0	44.8
Parity					
0-2	94.0	78.5	92.0	96.7	66.7
>2	80.0	69.5	78.0	92.0	43.0
Duration of Abortion					
1-14 Days	90.0	62.5	86.0	92.6	55.6
>14 Days	88.6	80.0	87.0	96.0	53.8

PPV: Positive Predictive Value, NPV: Negative Predictive Value

Table 5 Diagnostic accuracy of transabdominal sonography for diagnosis of RPOC keeping histopathology findings as gold standard (stratification analysis for various effect modifiers)

Effect Modifiers	Sensitivity (%)	Specificity (%)	Accuracy (%)	PPV (%)	NPV (%)
Gestational Age					
≤15 Weeks	89.0	57.6	84.0	91.0	51.7
>15 Weeks	87.8	52.0	83.0	92.0	39.0
Age Groups					
18-30 Years	88.0	51.5	83.0	92.0	41.0
31-40 Years	88.5	61.0	84.0	91.6	52.4
Parity					
0-2	87.2	50.0	82.0	92.0	36.8
>2	90.5	60.8	85.0	91.0	58.0
Duration of Abortion					
1-14 Days	91.6	18.7	80.0	85.0	93.0
>14 Days	87.0	71.0	85.0	94.8	48.1

PPV: Positive Predictive Value, NPV: Negative Predictive Value



DISCUSSION

The ultrasound assessment of a hyperechoic or mixed echogenicity mass within the endometrial cavity remains one of the most reliable indicators for diagnosing retained products of conception (RPOC). The absence of such a mass, coupled with an endometrial thickness of less than 10 mm, strongly reduces the likelihood of RPOC. This study compared the diagnostic accuracy of transvaginal sonography (TVS) and transabdominal sonography (TAS), using histopathology as the reference standard. While both modalities demonstrated high sensitivity, TVS consistently outperformed TAS in specificity and overall diagnostic accuracy. These findings underscore the importance of selecting the most suitable imaging technique based on clinical scenarios, adding valuable evidence to the growing body of research on this subject(20-22). The diagnostic superiority of TVS in detecting RPOC was reflected in its higher specificity and positive predictive value compared to TAS. Previous studies have documented variable sensitivities and specificities for both modalities due to differences in diagnostic criteria, operator expertise, and equipment quality. Some research highlighted TVS's enhanced ability to detect subtle findings such as echogenic endometrial masses and specific thickness thresholds. By contrast, TAS was found to be less precise, particularly in distinguishing RPOC in cases with confounding uterine or abdominal factors, such as obesity or excessive intestinal gas(23-25).

The incorporation of Doppler sonography into diagnostic protocols has been debated. While some studies have established correlations between endometrial vascularity and RPOC, others have suggested that vascularity alone is insufficient for accurate diagnosis. This study did not incorporate Doppler assessments as a standard component but emphasized that TVS remains the more reliable modality for identifying RPOC, even in the absence of vascularity. This further highlights the additive role of Doppler rather than its independent diagnostic utility(26-28). Stratified analysis in this study revealed critical variations in diagnostic performance across gestational age, parity, age groups, and duration of abortion. TVS demonstrated higher sensitivity and specificity for patients with gestational ages of ≤15 weeks, as well as for those with earlier post-abortion durations. This suggests that TVS may be particularly beneficial for diagnosing RPOC in the early stages, where its ability to delineate endometrial features is superior. In patients with higher parity or delayed diagnosis, both modalities showed reduced specificity, although TVS maintained higher sensitivity, making it a more reliable option in challenging cases(28-30).

The findings also demonstrated that younger patients (aged 18–30 years) and those with lower parity (0–2) benefited from TVS's enhanced diagnostic accuracy, while TAS performed less reliably across these groups. The ability of TVS to maintain accuracy in patients with extended post-abortion durations further underscores its utility in clinical practice, particularly in resource-limited settings where delayed presentation is common(31). Despite the strengths of this study, including its robust sample size and use of histopathology as the gold standard, certain limitations should be acknowledged. The single-center design restricts the generalizability of the findings to broader populations. Additionally, variations in operator expertise and sonographic equipment were not accounted for, potentially influencing the results. Addressing these limitations in future multicenter studies with standardized operator training and reproducible methodologies would further validate the findings and optimize diagnostic protocols(2).

The study highlights the higher accuracy and clinical utility of TVS compared to TAS for detecting RPOC, particularly in earlier gestational ages and delayed diagnoses. The findings reinforce the importance of incorporating TVS into routine diagnostic workflows for RPOC, ensuring timely and accurate identification of cases to guide appropriate management. Optimizing the application of TVS while exploring adjunctive roles for other sonographic techniques could further enhance patient outcomes and reduce complications associated with undiagnosed RPOC(6).

CONCLUSION

This study establishes that transvaginal sonography is a more reliable and accurate diagnostic tool than transabdominal sonography for detecting retained products of conception. Its superior sensitivity, specificity, and diagnostic precision make it the preferred imaging modality, particularly in early gestational weeks and cases with delayed presentation or associated complications. These findings reinforce the use of transvaginal sonography as the primary screening method in clinical practice, ensuring timely and accurate diagnosis to guide effective management of suspected retained products of conception.

AUTHOR CONTRIBUTIONS

Author	Contribution
Aamna Javaid*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Nafees	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Faryal Qureshi	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Syeda Maryam Tirmizi	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Khashia Mamoon	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

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