

A Study to Evaluate the Diagnostic Accuracy of Ultrasonography in Detection of Retained Products of Conception in Correlation with Histopathology

Sushantak Suresh Wadate¹, Pradeep Shankarrao Patil²

¹Junior Resident 3rd Year, Dept. of Radio-diagnosis, Dr. D. Y. Patil Medical College, Hospital & Research Institute, Kadamwadi, D.Y. Patil Education Society (Deemed to be University ID - U-0294) Kolhapur, Maharashtra, India

²Professor, Head of Department, Dept. of Radio-diagnosis, Dr. D. Y. Patil Medical College, Hospital & Research Institute, Kadamwadi, D.Y. Patil Education Society (Deemed to be University ID - U - 0294) Kolhapur, Maharashtra, India

Received: 10-08-2026 / Revised: 04-09-2026 / Accepted: 12-10-2026

Corresponding Author: Dr. Sushantak Suresh Wadate

Conflict of interest: Nil

Abstract

Background: Retained products of conception (RPOC) are an important cause of post-abortion and postpartum bleeding, infection, and other reproductive complications. Ultrasonography is widely used as the first-line imaging modality, although its diagnostic accuracy may vary according to the technique and sonographic criteria used. This study evaluated the diagnostic accuracy of ultrasonography for detecting RPOC using histopathology as the reference standard.

Methods: A prospective observational study was conducted in the Department of Radiodiagnosis, D. Y. Patil Medical College, Hospital and Research Institute, Kolhapur, over 18 months. Women with clinical suspicion of RPOC following abortion or delivery underwent transabdominal ultrasonography (TAS), transvaginal ultrasonography (TVUS), or both including assessment of endometrial thickness, echogenic intrauterine mass, and Doppler vascularity. Sonographic findings were correlated with histopathological examination of evacuated tissue. Diagnostic performance was assessed using sensitivity, specificity, predictive values, accuracy, agreement, and ROC analysis.

Results: Among 98 participants, ultrasonography diagnosed RPOC in 93 (94.9%), while histopathology confirmed RPOC in 86 (87.8%). Overall ultrasound showed significant association with histopathology ($\chi^2=22.51$, $p<0.001$) with moderate agreement ($\kappa=0.429$). TAS demonstrated 100% sensitivity, 25% specificity, and 90.6% accuracy, while TVUS showed 97.6% sensitivity, 33.3% specificity, and 89.6% accuracy. Combined TAS+TVUS achieved 100% sensitivity, 50% specificity, 94.1% PPV, 100% NPV, and the highest accuracy of 94.4%, with substantial agreement ($\kappa=0.640$, $p=0.004$). ROC analysis showed the highest AUC for TAS (0.808).

Conclusion: Ultrasonography is a highly sensitive first-line modality for suspected RPOC. Combined TAS and TVUS provides the best overall diagnostic accuracy and agreement with histopathology. However, ultrasound findings should be interpreted comprehensively with clinical features, endometrial thickness, and Doppler vascularity, while histopathology remains the definitive reference standard.

Keywords: Retained products of conception; Ultrasonography; Transabdominal ultrasound; Transvaginal ultrasound; Doppler; Histopathology; Diagnostic accuracy.

DOI: 10.25258/ijcpr.18.10.73

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Retained products of conception (RPOC) refer to persistent intrauterine gestational or placental tissue following miscarriage, termination of pregnancy, or delivery and represent a clinically significant cause of secondary postpartum haemorrhage, sepsis, subinvolution, and later reproductive morbidity including intrauterine adhesions and infertility. Postpartum haemorrhage remains the leading direct cause of maternal mortality worldwide, affecting

~14 million women annually and accounting for ~70,000 deaths, predominantly in low- and middle-income countries; even where mortality is averted, women often require surgical interventions and may sustain long-term reproductive disability [1]. Within this landscape, timely recognition and accurate diagnosis of RPOC are pivotal because clinical presentation ranges widely—from minimal spotting to heavy or delayed haemorrhage, pelvic pain, fever,

foul-smelling discharge, and anaemia—while differential diagnoses (e.g., endometritis, subinvolution, arteriovenous malformations, gestational trophoblastic neoplasia, or intracavitary clots) overlap in symptoms and signs [2]. Histopathology of evacuated tissue is considered the reference standard to confirm chorionic villi or placental tissue; however, a purely surgical pathway risks over-treatment when imaging is equivocal, and conversely, conservative management in true RPOC risks ongoing bleeding or infection [3]. Ultrasonography has therefore become the first-line, bedside, and repeatable modality for evaluating suspected RPOC because it is non-invasive, widely available, cost-effective, and immediately actionable within obstetric and emergency workflows. Transabdominal sonography (TAS) provides an initial overview but is limited by body habitus, postoperative tenderness, and bladder filling requirements; transvaginal ultrasound (TVUS) offers superior near-field resolution of the endometrial cavity and endometrial-myometrial interface, enabling detection of echogenic masses, quantification of endometrial thickness, and assessment of intracavitary fluid or clots [4]. Color and power Doppler add crucial functional information by depicting internal vascularity within an echogenic endometrial mass or along the endometrial stripe, which markedly increases diagnostic confidence for viable retained tissue and helps distinguish RPOC from avascular clot or physiological postpartum debris. Despite these strengths, diagnostic criteria remain heterogeneous across studies and clinical settings, leading to variation in thresholds and management algorithms; a systematic scoping review demonstrated wide variability in definitions (e.g., use of any echogenic mass vs mass with Doppler flow), imaging parameters (e.g., endometrial thickness cut-offs), and composite clinical endpoints, underscoring the need for standardization and validation in real-world populations [5]. Commonly cited criteria include an echogenic intrauterine mass, endometrial thickness above context-specific thresholds, and/or demonstrable vascularity on Doppler within the mass or endometrium; yet the optimal cut-off for endometrial thickness is not universally agreed, with commonly used figures around 10–15 mm being sensitive but not specific and highly dependent on timing since pregnancy event and on hormonal milieu [6]. Importantly, physiological postpartum changes such as lochia, decidual tissue, or organized clots can appear echogenic and may persist into the early puerperium, and some RPOC—particularly fibrotic or necrotic residua—may be minimally vascular, thereby complicating interpretation if Doppler is used in isolation. Standardized scanning protocols are therefore recommended: TAS followed by TVUS when feasible; measurement of the thickest double-layer endometrium;

morphological characterization of any intrauterine mass (size, margins, shadowing); systematic Doppler interrogation with harmonized pulse repetition frequency and wall-filter settings; and contextual reporting that integrates clinical data such as time since abortion or delivery, mode of termination, parity, and symptoms [7]. Several cohort studies and practice frameworks have proposed pragmatic, tiered sonographic classifications to stratify risk and guide management; for instance, algorithms that combine morphology and vascularity categories have shown utility in identifying women who most benefit from intervention versus those suitable for observation, thereby reducing unnecessary curettage and its attendant risks (uterine perforation, infection, intrauterine adhesions). Beyond immediate management, accurate ultrasonographic triage aligns with contemporary goals of respectful, resource-aware maternity care, particularly in high-volume public hospitals where rapid decisions must balance haemorrhage control with preservation of future fertility [8]. Recent analyses continue to emphasize that Doppler findings, while useful, should be interpreted alongside grayscale features and clinical trajectory; vascularity exhibits good positive predictive value for viable tissue, but absence of flow does not exclude RPOC, and vascular patterns may overlap with arteriovenous malformations or subinvolution of placental bed vessels, conditions in which curettage may precipitate catastrophic bleeding. Consequently, the diagnostic question is not merely binary but probabilistic, motivating studies that estimate sensitivity, specificity, predictive values, and likelihood ratios for composite ultrasonographic definitions and that derive receiver-operating characteristic (ROC) thresholds for endometrial thickness tailored to the time elapsed since the index pregnancy event [9]. Parallel literature highlights the epidemiology and clinical burden: RPOC is among the common etiologies of secondary postpartum or postabortion haemorrhage and contributes significantly to readmissions and prolonged morbidity; observational cohorts suggest nontrivial rates of hypervascular residua and report that expectant or medical management is feasible in select, clinically stable patients with low-risk imaging features, although careful follow-up is essential. From a methodological perspective, diagnostic accuracy studies should address spectrum and partial verification biases, ensure histopathological confirmation where ethically and clinically indicated, and evaluate inter-observer agreement given operator dependence in measuring endometrial thickness and grading vascularity. In many centres, TVUS with Doppler is performed by radiologists or sonographers working closely with obstetrics and gynaecology teams; standardized operating procedures, calibration of Doppler

parameters, and explicit reporting templates improve reproducibility and facilitate audit and quality assurance [10]. The current study is embedded within this evidence base and seeks to provide robust, locally relevant estimates of the diagnostic accuracy of ultrasonography for RPOC using histopathology as the reference standard, while also comparing transabdominal and transvaginal approaches and evaluating the incremental value of Doppler vascularity. By quantifying sensitivity, specificity, predictive values, likelihood ratios, and ROC-derived thresholds within a prospective cohort of symptomatic postpartum or postabortion patients, the study aims to reduce both missed RPOC (with attendant haemorrhage, infection, and delayed recovery) and unnecessary surgical evacuations (with risks of perforation and adhesions), thereby informing context-appropriate clinical pathways in a tertiary care setting [11]. Ultimately, aligning imaging criteria with standardized management algorithms and histopathological correlation can improve maternal outcomes, optimize resource use, and support evidence-based, fertility-preserving care across the spectrum of post-pregnancy complications [12]

Methodology

A prospective, observational study was conducted to allowed systematic evaluation of ultrasonography findings in real-time clinical settings and direct correlation with histopathological results, which served as the reference standard in the Department of Radiodiagnosis, D. Y. Patil Medical College, Hospital and Research Institute, Kolhapur. The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical clearance was obtained from the Institutional Ethics Committee of D. Y. Patil Medical College, Hospital and Research Institute prior to commencement. The study was conducted over a period of 18 months. Participants were recruited from women referred to the Department of Radiodiagnosis with suspected retained products of conception following abortion (spontaneous or induced) or delivery. The sample size was 98. The inclusion and exclusion criteria were applied as follows:

Inclusion Criteria: Women of reproductive age presenting with clinical suspicion of RPOC, patients with symptoms such as persistent vaginal bleeding,

pelvic or abdominal pain, fever, foul-smelling discharge following delivery or abortion, patients willing to undergo transvaginal ultrasonography, patients referred from the obstetrics department for evaluation of incomplete evacuation or unexplained postpartum haemorrhage.

Exclusion Criteria: Patients who were haemodynamically unstable and required immediate surgical intervention, patients who were unwilling to undergo ultrasonography or declined consent, patients with pre-existing uterine pathology that could confound diagnosis, such as known large fibroids, endometrial polyps, or congenital uterine anomalies, patients who had undergone prior surgical evacuation for the same episode before ultrasonography.

Study Procedure: After obtaining informed consent, each participant underwent detailed clinical evaluation followed by ultrasonography. Transabdominal ultrasonography was performed initially using a curvilinear probe (2–5 MHz) with a moderately full bladder. Subsequently, transvaginal ultrasonography was performed using an endocavitary probe (4–9 MHz). Standardized protocols were followed for image acquisition, including measurement of endometrial thickness in the sagittal plane, assessment for intrauterine echogenic masses, and Doppler evaluation for vascularity. Doppler settings such as pulse repetition frequency, gain, and wall filters were kept uniform to avoid variability.

If ultrasonography findings suggested RPOC, the patient was referred back to the obstetrics department for further management, usually dilatation and curettage or suction evacuation. The products obtained were preserved in formalin and sent to the pathology department for histopathological examination. Pathologists were blinded to ultrasonography findings to minimize interpretation bias. The ultrasonography was performed by radiologists who were not aware of histopathological results at the time of imaging. This ensured blinding and strengthened the validity of the diagnostic accuracy estimates.

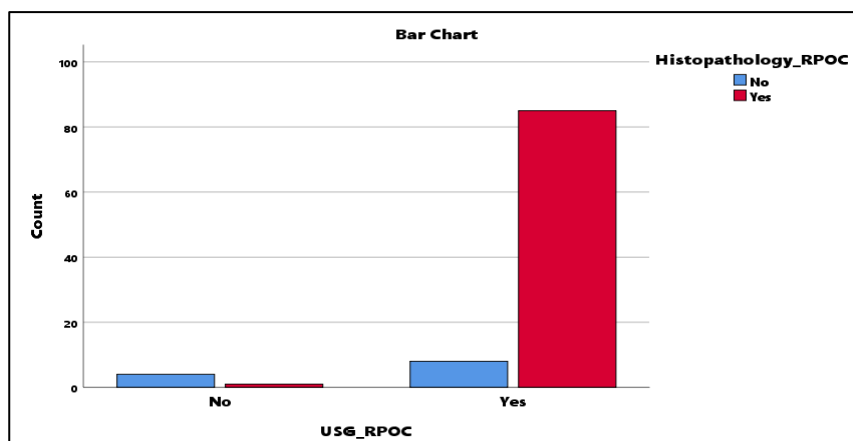
Result

Table 1: Crosstabulation of USG diagnosis with histopathology among study participants (n = 98)

USG RPOC	Histopathology RPOC: No	Histopathology RPOC: Yes	Total
No	4	1	5
Yes	8	85	93
Total	12	86	98
Chi-square test: Pearson Chi-Square = 22.51, df = 1, p < 0.001, κ = 0.429			

USG findings showed a significant association with histopathology-confirmed RPOC ($p < 0.001$).

USG correctly identified most RPOC cases, reflecting moderate diagnostic agreement ($\kappa \approx 0.43$) with the gold standard.



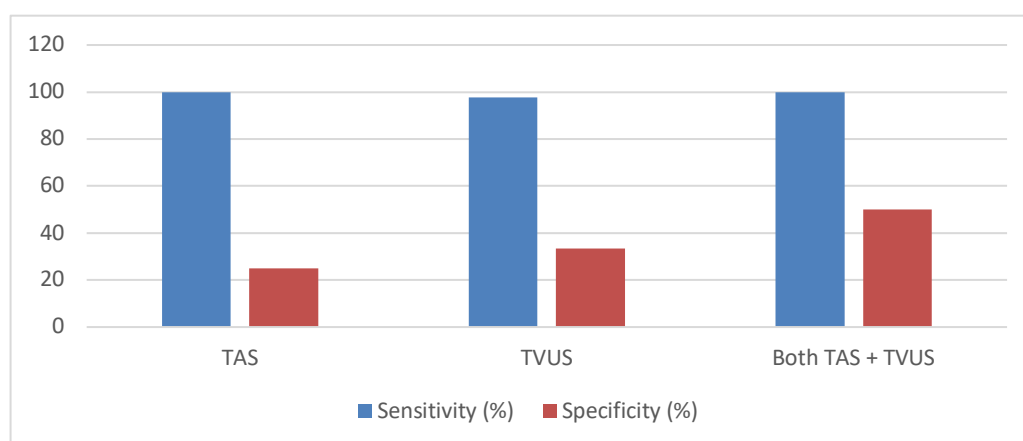
Graph 1: Crosstabulation of USG diagnosis with histopathology among study participants (n = 98)

Table 2: Diagnostic performance of different ultrasonography modalities for detecting histopathology-confirmed RPOC

USG Method	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	Kappa
TAS	100.0	25.0	90.3	100.0	90.6	0.368
TVUS	97.6	33.3	91.1	66.7	89.6	0.394
TAS + TVUS	100.0	50.0	94.1	100.0	94.4	0.640

Interpretation: Histopathology-confirmed RPOC was detected with high sensitivity by all ultrasonography modalities. TVUS and TAS combined exhibited the highest specificity (50.0%), overall diagnostic accuracy (94.4%), and agreement with histopathology ($\kappa = 0.640$). TAS exhibited

exceptional sensitivity but relatively lower specificity, while TVUS exhibited high sensitivity with fair agreement. In general, the best overall diagnostic performance for predicting histopathology-confirmed RPOC was achieved by the combined TAS + TVUS.



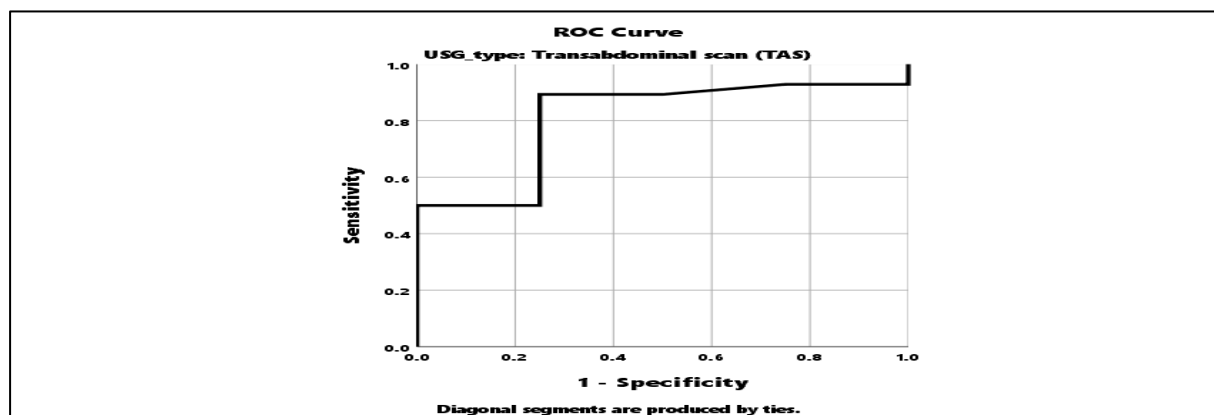
Graph 2: Bar graph showing the Diagnostic performance of different ultrasonography modalities for detecting histopathology-confirmed RPOC

Table 3: ROC analysis of endometrial thickness for predicting histopathology-confirmed RPOC

USG Method	AUC
TAS	0.808
TVUS	0.669
Both TAS + TVUS	0.766

Interpretation: Endometrial thickness performed best when used with TAS (AUC 0.808), followed by

combined imaging (AUC 0.766). TVUS alone showed moderate discrimination.



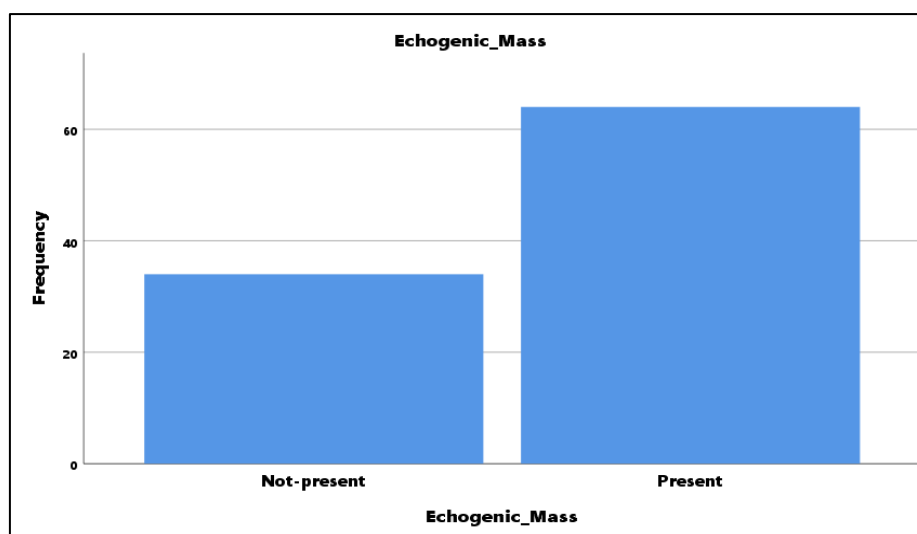
Graph 3: ROC analysis of endometrial thickness for predicting histopathology-confirmed RPOC

Table 4: Ultrasonography findings among the study participants (n = 98)

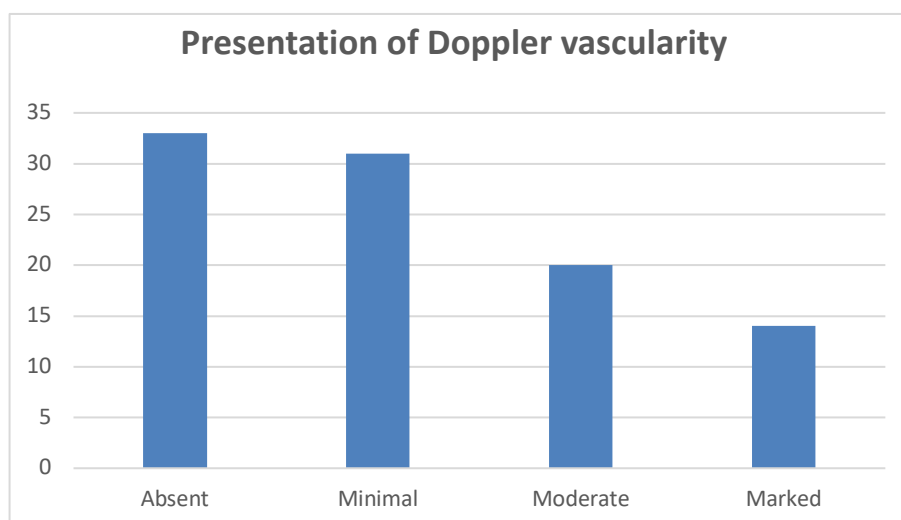
Variable	Category	Frequency (n)	Percent (%)
Echogenic mass	Present	64	65.3
	Not present	34	34.7
Doppler vascularity	Absent	33	33.7
	Minimal	31	31.6
	Moderate	20	20.4
	Marked	14	14.3
USG RPOC	Yes	93	94.9
	No	5	5.1
Histopathology RPOC	Yes	86	87.8
	No	12	12.2

Interpretation: Echogenic mass and Doppler vascularity were frequently detected on ultrasonography, and most patients were diagnosed with RPOC on both USG and histopathology.

However, echogenic mass alone did not show a statistically significant association with histopathology-confirmed RPOC.



Graph 4a: Distribution of echogenic mass among study participants (n =98)



Graph 4b: Distribution of Doppler vascularity among study participants (n = 98)

Table 5: Diagnostic accuracy of Transabdominal Scan (TAS) for detecting RPOC (n = 32) (USG method = TAS)

USG RPOC	Histopathology No	Histopathology Yes	Total
No	1	0	1
Yes	3	28	31
Total	4	28	32

p = 0.007 Kappa: 0.368 (fair agreement)

Interpretation: TAS demonstrated high sensitivity, meaning it detected nearly all RPOC cases, but had

low specificity, causing more false positives. Agreement with histopathology was fair.

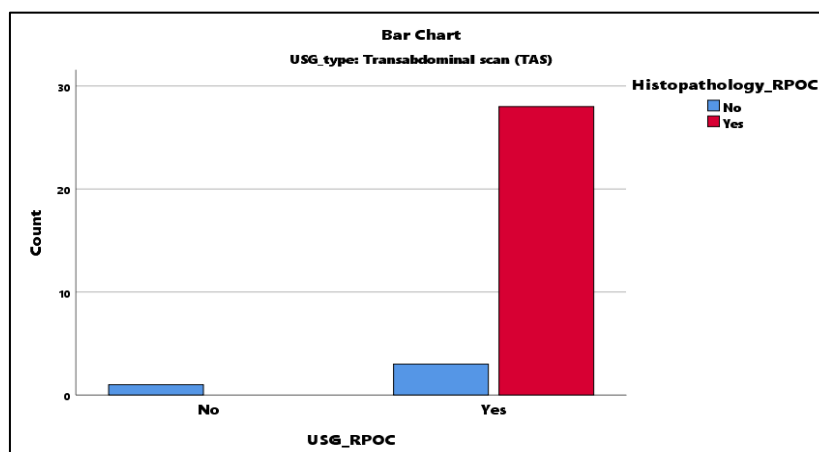


Figure 5: Diagnostic accuracy of Transabdominal Scan (TAS) for detecting RPOC (n = 32)

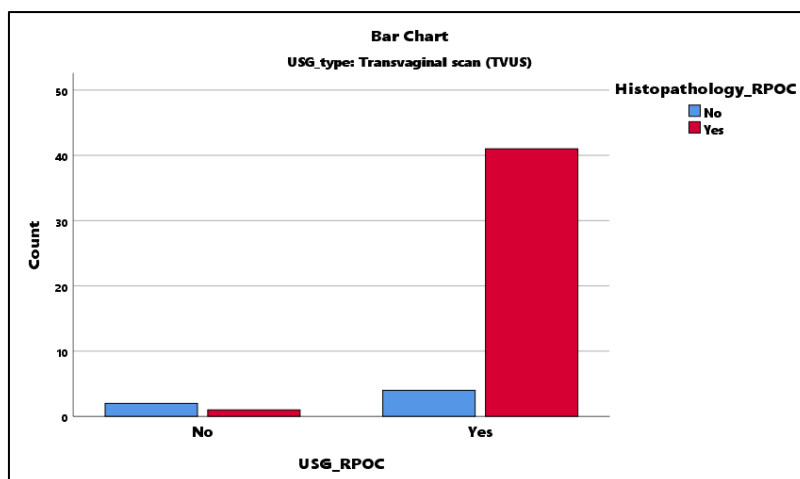
Table 6: Diagnostic accuracy of Transvaginal Scan (TVUS) for detecting RPOC (n = 48)

USG RPOC	Histopathology No	Histopathology Yes	Total
No	2	1	3
Yes	4	41	45
Total	6	42	48

p = 0.003, Kappa: 0.394 (fair-to-moderate agreement)

Interpretation: TVUS demonstrated high sensitivity with fair agreement with histopathology. Although specificity remained relatively low, TVUS

showed good overall diagnostic performance in detecting RPOC.



Graph 6: Diagnostic accuracy of Transvaginal Scan (TVUS) for detecting RPOC (n = 48)

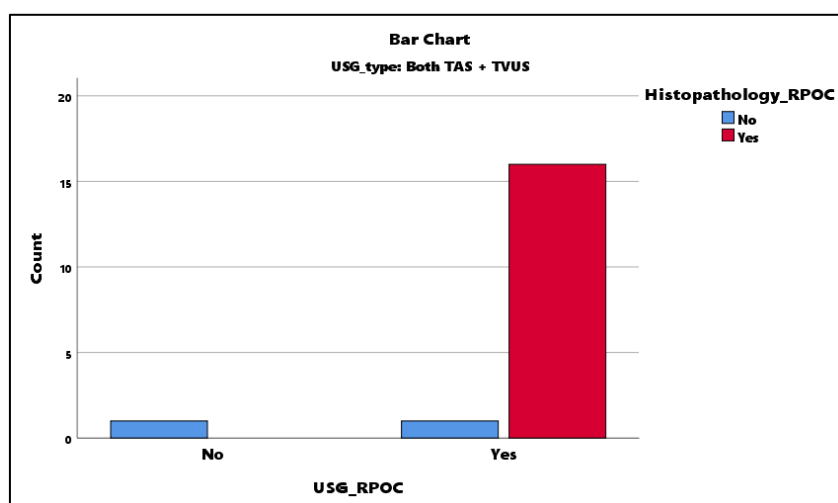
Table 7: Diagnostic accuracy of combined TAS + TVUS for detecting RPOC (n = 18)

USG RPOC	Histopathology No	Histopathology Yes	Total
No	1	0	1
Yes	1	16	17
Total	2	16	18

p = 0.004, Kappa: 0.640 (substantial agreement)

Interpretation: Using both TAS + TVUS together significantly improved diagnostic agreement with

histopathology, showing the highest kappa and best specificity among all methods.



Graph 7: Diagnostic accuracy of combined TAS + TVUS for detecting RPOC (n = 18)

Final Interpretation: In this prospective observational study of 98 women with suspected retained products of conception (RPOC), ultrasonography demonstrated high diagnostic utility in identifying RPOC, with findings strongly supported by histopathology. Most participants showed abnormal USG features such as increased endometrial thickness, echogenic intrauterine mass, and varying degrees of Doppler vascularity. Ultrasonographic diagnosis showed a significant correlation with histopathology ($p < 0.001$) and

moderate agreement ($\kappa = 0.43$), confirming its clinical reliability.

Among the ultrasonography modalities, both TAS and TVUS demonstrated good diagnostic utility with fair agreement with histopathology. The combined use of TAS and TVUS showed the highest overall diagnostic agreement ($\kappa = 0.64$) and diagnostic accuracy. ROC analysis demonstrated the highest area under the curve for TAS ($AUC = 0.808$), indicating superior discriminatory performance for endometrial thickness measurement.

Overall, ultrasonography demonstrated good diagnostic utility for detecting retained products of conception, particularly when TAS and TVUS were used together, supporting its role as a practical and reliable first-line imaging modality in women presenting with post-abortion or postpartum complications.

Discussion

The present study evaluated the diagnostic accuracy of ultrasonography for detecting retained products of conception (RPOC) by comparing transabdominal ultrasound (TAS), transvaginal ultrasound (TVUS), and combined TAS + TVUS with histopathology. Since RPOC may present with bleeding, pain, fever, foul discharge, and infection, timely and accurate diagnosis is essential. Ultrasonography provides a non-invasive and accessible first-line investigation, although individual ultrasound findings may have limited specificity.

In the present study, ultrasonography diagnosed RPOC in 93 of 98 participants (94.9%), whereas histopathology confirmed RPOC in 86 cases (87.8%). The USG–HPE comparison demonstrated 85 true positives, 4 true negatives, 8 false positives, and 1 false negative, with a statistically significant association ($\chi^2 = 22.51$, $p < 0.001$) and moderate agreement ($\kappa = 0.429$). These findings indicate that ultrasonography has high diagnostic sensitivity but may produce some false-positive diagnoses. Sundararajan et al. reported that ultrasound accuracy varies according to the sonographic marker, with echogenic mass showing 91.5% sensitivity and 84.3% specificity, while Doppler flow demonstrated 85.0% sensitivity and 40.6% specificity [12]. Thus, ultrasound findings should be interpreted in combination rather than in isolation.

Endometrial thickness was also evaluated as a diagnostic parameter. The mean endometrial thickness was 12.36 ± 4.08 mm. ROC analysis demonstrated the highest discriminatory performance with TAS (AUC = 0.808), followed by combined TAS + TVUS (AUC = 0.766) and TVUS (AUC = 0.669). Sundararajan et al. reported that endometrial thickness ≥ 10 mm had 66.7% sensitivity and 86.6% specificity for RPOC [12]. However, Singh, Waraich, and Sood emphasized that endometrial thickness alone is not specific because normal post-abortion changes, blood clots, and necrotic debris may mimic retained tissue [14]. Therefore, endometrial thickness should be assessed together with other ultrasound findings, particularly Doppler vascularity.

An echogenic mass was identified in 64 participants (65.3%), but its association with histopathologically confirmed RPOC was not statistically significant ($\chi^2 = 0.011$, $p = 0.916$). Although 56 of 64 women with an echogenic mass had RPOC, 30 of 34 women without an echogenic mass also had

histopathologically confirmed RPOC. This indicates that an echogenic mass alone cannot reliably exclude or confirm RPOC in the present study. In contrast, Sundararajan et al. identified an echogenic intrauterine mass as one of the strongest sonographic markers, with 91.5% sensitivity and 84.3% specificity [12]. Singh, Waraich, and Sood recommended interpreting an echogenic mass together with Doppler vascularity because avascular material may represent blood clots or debris [14].

The diagnostic performance of the individual ultrasound modalities demonstrated high sensitivity. TAS showed 100.0% sensitivity, 25.0% specificity, 90.3% PPV, 100.0% NPV, and 90.6% accuracy, with $\kappa = 0.368$ ($p = 0.007$). TVUS showed 97.6% sensitivity, 33.3% specificity, 91.1% PPV, 66.7% NPV, and 89.6% accuracy, with $\kappa = 0.394$ ($p = 0.003$). These findings indicate that both TAS and TVUS are highly sensitive for detecting RPOC, although their relatively low specificity indicates the possibility of false-positive findings. Singh, Waraich, and Sood emphasized the value of ultrasound, particularly with Doppler, in differentiating retained tissue from clots and other post-abortion changes [14].

Combined TAS + TVUS demonstrated the best overall diagnostic performance. It achieved 100.0% sensitivity, 50.0% specificity, 94.1% PPV, 100.0% NPV, and 94.4% accuracy, with the highest agreement with histopathology ($\kappa = 0.640$, $p = 0.004$). These findings indicate that combining the two approaches provides complementary visualization and improves diagnostic reliability compared with either modality alone. Singh, Waraich, and Sood reported that combining grayscale ultrasonography with Doppler assessment improves diagnostic confidence in suspected RPOC [14]. Similarly, Kurakazu et al. demonstrated that a combined assessment incorporating clinical and ultrasound parameters improved prediction of significant outcomes, with a c-statistic of 0.863 [15].

Overall, the present study demonstrates that ultrasonography is a highly sensitive first-line imaging modality for suspected RPOC. Among the evaluated approaches, combined TAS + TVUS provided the highest accuracy and strongest agreement with histopathology. However, the relatively limited specificity of ultrasound indicates that sonographic findings should not be interpreted in isolation. A comprehensive assessment incorporating clinical presentation, endometrial thickness, Doppler vascularity, and other ultrasound findings is therefore preferable, with histopathology serving as the definitive reference for confirmation [12–15].

Conclusion

Ultrasonography is a valuable, non-invasive first-line diagnostic tool for detecting retained products

of conception (RPOC). However, diagnosis should be based on a comprehensive assessment of clinical symptoms and sonographic parameters, including endometrial thickness, echogenic intrauterine mass, and Doppler vascularity. Combined TAS and TVUS demonstrated the highest overall diagnostic accuracy in this study, while histopathology remained the definitive standard for confirmation.

References

1. Chawla S, Sharma R. Retained products of conception (RPOC): diagnosis, complication & management. *The Journal of Obstetrics and Gynecology of India*. 2023 Oct;73(5):374-80.
2. Incognito GG, Ettore C, De Tommasi O, Tozzi R, Ettore G. Ultrasound Assessment of Retained Products of Conception (RPOC): Insights from the Current Literature. *Journal of Clinical Medicine*. 2025 Aug 19;14(16):5864.
3. Al Amri I, Al Aufi Z, Al Bash M, Jose S, Al Riyami N. Histopathological results and the outcome of women who underwent postpartum evacuation and pelvic ultrasound scan. *Oman Medical Journal*. 2023 Mar 31;38(2):e484.
4. Ashkar Majadla N, Abu Shqara R, Haj S, Sgayer I, Ghanem N, Lowenstein L, Odeh M. Sonographic evaluation of retained products of conception within 48 h following delivery: a retrospective cohort study. *Archives of Gynecology and Obstetrics*. 2025 Feb;311(2):367-73.
5. Kamaya A, Petrovitch I, Chen B, Frederick CE, Jeffrey RB. Retained products of conception: spectrum of color Doppler findings. *Journal of Ultrasound in Medicine*. 2009 Aug;28(8):1031-41.
6. Park YR, Lee SW, Kim Y, Bae IY, Kim HK, Choe J, Kim YM. Endometrial thickness cut-off value by transvaginal ultrasonography for screening of endometrial pathology in premenopausal and postmenopausal women. *Obstetrics & gynecology science*. 2019 Oct 7;62(6):445.
7. Yagur Y, Jurman L, Weitzner O, Arbib N, Markovitch O, Klein Z, Daykan Y, Schonman R. Ultrasound for diagnosis of postpartum retained products of conception—How accurate we are?. *BMC pregnancy and childbirth*. 2023 Aug 10;23(1):572.
8. Khan S, Panda S, NM Anupam Kapur, Sharma S. Correlation of transvaginal sonography and hysteroscopy in the detection of retained products of conception immediately after suction evacuation in first-trimester. *Journal of Marine Medical Society*. 2023 Jan 1;25(2):205–5.
9. Atri M, Rao A, Boylan C, Rasty G, Gerber D. Best predictors of grayscale ultrasound combined with color Doppler in the diagnosis of retained products of conception. *Journal of Clinical Ultrasound*. 2011 Mar;39(3):122-7.
10. Irahia Y, Okada M, Toguchi M, Azama K, Mekaru K, Kinjo T, Kudaka W, Aoki Y, Aoyama H, Matsuzaki A, Murayama S. Multimodality imaging in secondary postpartum or postabortion hemorrhage: retained products of conception and related conditions. *Japanese journal of radiology*. 2018 Jan;36(1):12-22.
11. Sharon A, Kalendaryov A, Sgayer I, Mikhail SM, Lowenstein L, Aiob A. Characteristics and Diagnostic Accuracy of Retained Products of Conception After Delivery vs. Abortion: A Retrospective Cohort Study. *Cureus*. 2025 Mar 11;17(3).
12. Sundararajan S, Roy S, Polanski LT. The accuracy of ultrasound scan in diagnosing retained products of conception: A systematic review and meta-analysis. *Am J Obstet Gynecol*. 2023;229(6):657-67. doi:10.1016/j.ajog.2023.11.1243.
13. Jamal S, Singh N. Challenging presentations of retained products of conception: A case series. *Journal of South Asian Federation of Obstetrics and Gynaecology*. 2023 Mar;15(2).
14. Singh A, Waraich HK, Sood MK. Role of ultrasonography in the evaluation of retained products of conception. *Indographics*. 2024;3(1):9-14. doi:10.1055/s-0044-1787690.
15. Kurakazu M, Kurakazu M, Kiyoshima C, Shigekawa K, Hirakawa T, Yoshikawa K, et al. Clinical prediction of retained products of conception: Combining obstetric history and ultrasound for improved accuracy in severe postpartum hemorrhage. *Cureus*. 2024;16(6):e53651. doi:10.7759/cureus.53651.