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Original Research Article

Diagnostic performance of ultrasound parameters in identifying retained products of conception

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ABSTRACT

Background: Although several studies have examined individual ultrasound findings associated with retained products of conception (RPOC), no single ultrasound parameter has been shown to reliably diagnose or exclude RPOC across different clinical settings. This study aims to evaluate the diagnostic performance of ultrasound parameters for identifying RPOC.
Methods: this retrospective study was conducted in Alsahel Teaching Hospital during the period from June 2023 to May 2026 and included 30 patients with spontaneous first-trimester miscarriage who were managed surgically. We only included cases with ultrasound reporting no RPOC and commenting on endometrial thickness, cavity regularity and echo-pattern.
Results: The patients were divided according to the histopathology report in 2 groups: group A included 18 patients positive for RPOC and group B which included 12 patients negative for RPOC. Among the studied ultrasound parameters, endometrial thickness was the only significant parameter to identify RPOC. The best cutoff value for endometrial thickness=10.5 mm at which the sensitivity was 88.9% and specificity was 83.3%.
Conclusions: endometrial thickness at cutoff=10.5 mm has an excellent performance to identify RPOC in first trimester miscarriage. Endometrial cavity regularity and echo-pattern were not significant in such cases.

Keywords: Miscarriage, Ultrasound, Products of conception, Endometrial thickness, Accuracy

INTRODUCTION

Miscarriage is a highly common pregnancy complication having a reported incidence ranging between 10 and 25% of pregnancies with the majority occurring in the first-trimester before 12 weeks' gestation.[1] Current management options of first-trimester miscarriage include expectant, medical, and surgical treatment. Several factors affect the outcome of the treatment including retained products of conception (RPOC) which remains a common complication for all treatment alternatives.[2] Following miscarriage, persistence of trophoblastic tissue within the uterine cavity defines RPOC.[3] It is estimated that RPOC may complicate up to 15% of cases who underwent medical abortion.[4] RPOC has been shown to result in prolonged vaginal bleeding, pelvic pain, infection, unplanned hospital admission, and the need for subsequent uterine evacuation. In addition to the formation of intrauterine adhesions in cases with inadequate management which may negatively impact fertility.[5] These outcomes certainly may affect the initial management strategy chosen for such cases.[2,6] When RPOC is suspected, the primary imaging modality remains ultrasound scan although the optimal sonographic criteria for diagnosis are still considerably uncertain.

Studies have shown that endometrial thickness, intracavitary echogenic mass, endometrial heterogeneity in addition to Doppler assessment of endometrial or intracavitary vascularity are findings that can distinguish cases with RPOC.[7-9] In 2 recent systematic reviews, none of the proposed ultrasound parameter has been proven reliable to diagnose or exclude RPOC.[10,11] Furthermore, limited evidence exists regarding direct comparison between the diagnostic performance of multiple sonographic parameters in women presenting after spontaneous first-trimester miscarriage.[2,10-12]

The evolution of ultrasound technologies and inter-observer variability have been proposed as an explanation for the absence of definitive diagnostic criteria.[13] In a study analysing 69 cases, Maslovitz et al emphasized the crucial role of the operator's skill in the interpretation of ultrasound findings.[14] The aim of this study was to evaluate the diagnostic performance of ultrasound parameters for identifying RPOC in women presenting following spontaneous first-trimester miscarriage.

METHODS

This study is a retrospective study which was conducted at Alsahel Teaching Hospital, and included patients who were admitted in the hospital over 3 years from June 2023 to May 2026. The study aimed to assess and compare different ultrasound parameters suggesting retained products of conception in patients presented with spontaneous first trimester miscarriage. The study was approved by the research ethics committee, Badr University in Cairo (BUC). Patients' consent was fully waived as the study did not include any contact with the patients and all data were only extracted from the patients' records.

The study included patients presented with spontaneous first trimester miscarriage who underwent surgical management with a preoperative ultrasound examination showing no retained products of conception. The study excluded patients who were hemodynamically unstable, suspected sepsis and ultrasound scan directly reporting RPOC and also excluded patients who underwent medical or conservative management.

The hospital database was reviewed and for records that fulfilled the selection criteria; the following data were extracted: age, parity, gestational age, and the ultrasound parameters: endometrial thickness, cavity irregularity and echo pattern and finally the conclusion of the histopathology report. Records with incomplete data were excluded from the study.

Statistical analysis was done using SPSS as follows: qualitative data were presented by number and percent; quantitative variables were presented by mean and standard deviation (SD); compare between the two groups: t-student test was used to compare quantitative variables and Chi square test was used for qualitative variables.

Receiver operator characteristic (ROC) curve was drawn to assess the diagnostic value of endometrial thickness in diagnosing retained products of conception, and to assess validity of such diagnosis. The best cutoff was determined with sensitivity and specificity. In all tests, p value was considered significant if less than 0.05.

RESULTS

After reviewing the hospital database over a period of 3 years, we found 30 records fulfilling the selection criteria and were included for the final analysis. The patients were then divided in 2 groups: group A included 18 patients with RPOC proved histopathologically and group B which included 12 patients with negative histopathology for RPOC.

The mean±standard deviation (SD) of age in group A was 25.39±3.9 years compared to 25±4.77 in group B, the mean±SD of gestational age was 7.78±1.63 weeks compared to 7.33±1.67 weeks in group A and B respectively while the mean±SD of parity was 1.22±1.12 versus 1.42±1.24 in group A and B respectively. The difference in all demographic data was statistically insignificant (Table 1).

Regarding ultrasound parameters, as shown in Table 2: the mean of endometrial thickness was 16.06 ± 4.8 mm (rane8-25 mm) in the positive RPOC group compared to 8.08±2.68 mm (range=5-13 mm) in the negative RPOC group and this difference was highly significant statistically ($p<0.001$). Irregular endometrial cavity was reported in 7 patients (38.89%) in the positive RPOC group compared to 7 patients (58.33%) in the negative RPOC group which was insignificant ($p>0.05$).

Regarding endometrial cavity echo pattern: hypoechoic echogenecity was reported in 2 patients (11.11%) versus zero and echogenic pattern in 6 patients (33.34%) versus 3 patients (25%) while mixed echogenecity was reported in 10 patients (55.56%) versus 9 patients (75%) in the positive and negative RPOC groups respectively and this difference was also not significant ($p>0.05$).

Table 1: Demographic data of the studied groups.

	Positive RPOC (n=18)	Negative RPOC (n=12)	Sig. (2-tailed)
Age (years)	25.39±3.9	25±4.77	0.81
Gestational age (weeks)	7.78±1.63	7.33±1.67	0.48
Parity	1.22±1.12	1.42 ±1.24	0.66

Data is presented as mean±standard deviation. Analysis done using independent t test.

Table 2: Comparison between both groups regarding ultrasound parameter.

Ultrasound parameter		Positive RPOC (n=18)	Negative RPOC (n=12)	Sig. (2-tailed)
Endometrial thickness (mm)		16.06±4.8	8.08±2.68	<0.001*
Cavity irregularity		7 (38.89)	7 (58.3)	0.3
Cavity echo pattern	Hypoechoic	2 (11.11)	0	0.39
	Echogenic	6 (33.34)	3 (25)	
	Mixed	10 (55.56)	9 (75)	

Data is presented as mean±standard deviation or number (%). Analysis done using independent t test and chi square test. (*) denotes significance

The ROC Curve for endometrial thickness discriminating between positive and negative RPOC demonstrates good to excellent performance. It showed an area under the curve=0.931 indicating excellent diagnostic accuracy. The best cutoff value for endometrial thickness=10.5 mm at which the sensitivity was 88.9% and specificity was 83.3% (Figure 1).

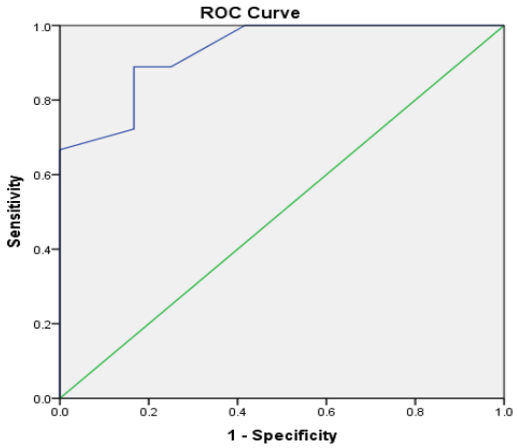


Figure 1: ROC curve for endometrial thickness.

DISCUSSION

The current guidelines recommend that ultrasound findings should be interpreted alongside the patient's clinical presentation, rather than relying on a single imaging parameter alone as there is no agreement on specific criteria for diagnosis.[2,6] The lack of standardized diagnostic criteria for RPOC in miscarriage cases has important clinical implications. Over-diagnosis may expose women to unnecessary surgical evacuation with associated risks including uterine perforation, hemorrhage, infection and intrauterine adhesions, whereas under-diagnosis may delay treatment of persistent tissue and increase morbidity. We restricted this study to a group with no direct report of RPOC to test if other ultrasound findings could be of diagnostic value, obviously this subgroup would be the most challenging for assigning the diagnosis (complete versus incomplete miscarriage) in addition to planning management.

This study assessed the diagnostic performance of ultrasound parameters for identifying RPOC in women presenting following spontaneous first-trimester miscarriage. We investigated endometrial thickness, endometrial cavity irregularity and echo pattern but the only significant parameter to identify RPOC was endometrial thickness. Several studies have demonstrated that endometrial thickness is a valuable sonographic parameter for diagnosing RPOC, with diagnostic performance comparable to that observed in the current study but research has not reached agreement on the best diagnostic cutoff value. In the current study, endometrial thickness at 10.5 mm showed sensitivity of 88.9% and specificity of 83.3% to discriminate between positive and negative RPOC with an area under the curve=0.931 indicating excellent diagnostic accuracy.

In line with the current results, Sellmyer and colleagues in a comprehensive review, reported that a thickened endometrium 10 mm or more is highly suggestive of RPOC, especially when accompanied by increased vascularity on Doppler examination.[7] Similarly, Durfee and colleagues showed that an endometrial thickness of 10 mm provided good sensitivity for detecting RPOC, although specificity improved with the addition of Doppler.[9] In addition, a systematic review by Sundararajan et al concluded that an endometrial thickness threshold of 10 mm is one of the most widely accepted ultrasound criteria for RPOC.[10] In agreement with our results, Matijevic and colleagues studied 93 women and reported that diagnosis of RPOC is infrequent with endometrial thickness <10 mm.[15] In another study, ultrasound examination demonstrated a sensitivity of 93.8% and a specificity of 73.9% for histologically confirmed RPOC in cases with endometrial thickness >10 mm.[16] Other studies defined different endometrial thickness cutoff to identify RPOC with the most frequently reported is 15 mm.[12]

Contrary to our results, a lower sensitivity and specificity has been shown for endometrial thickness to predict RPOC even when using larger cutoff value. In a previous study, a sensitivity of 69.8% and specificity of 59.6% was reported using a 14.9 mm cutoff for endometrial thickness to predict RPOC and the authors concluded that the likelihood of RPOC confirmation significantly increased with an endometrial thickness above 14.9 mm.[17] In a previously published scoping review this cutoff was also suggested for RPOC diagnosis based on the included studies although robust evidence supporting this threshold was lacking.[12]

An endometrial mass has been previously reported as a good tool for diagnosing RPOC which disagree with the current results. Supporting our finding, it has been demonstrated that ultrasound showing an echogenic mass may be reported in asymptomatic women without actual RPOC.[18] In another study, Neill et al reported that hyperechoic foci have a good sensitivity (93%) but lower specificity (62%) for identifying RPOC suggesting highly reassuring negative report but a relatively low (46%) positive predictive value which partially agrees with the current results.[19] In disagreement with our findings, other studies showed that an endometrial mass was the most sensitive ultrasound criterion for RPOC.[15,20]

Therefore, while the present findings reinforce the clinical utility of a cutoff close to 10 mm, endometrial thickness should not be interpreted in isolation as recent reviews have highlighted the lack of standardized ultrasound criteria for RPOC diagnosis. Integration of grayscale findings, color Doppler vascularity, and the patient's clinical presentation is likely to provide the highest diagnostic accuracy and reduce unnecessary surgical intervention.

A point of strength in the current study is highlighting a subgroup that may be overlooked as an ultrasound report showing no sac or mass may suggest no RPOC when actually 60% of the included patients were histopathologically proven positive for RPOC. This may provide more data for counseling these patients.

This study has several limitations. First, the retrospective nature of the study and the relatively small sample size may have resulted in imprecise estimates of diagnostic performance and limits the generalizability of the findings. Second, the endometrial thickness cutoff was derived and evaluated within the same study population, which may have resulted in an optimistic estimate of its diagnostic performance. External validation in an independent cohort is therefore required before this threshold can be considered for wider clinical application. In addition, ultrasound assessment may be influenced by operator experience, measurement technique, and the timing of examination, and interobserver variability was not assessed.

Color Doppler vascularity was not incorporated into the diagnostic analysis, despite evidence that vascularity may provide additional discriminatory value when combined with endometrial thickness. Further prospective, multicenter studies with larger cohorts and standardized ultrasound protocols are warranted to validate these findings and establish clinically applicable diagnostic criteria for RPOC.

CONCLUSION

Endometrial thickness demonstrated significant diagnostic performance for RPOC in women following spontaneous first-trimester miscarriage, showing good sensitivity and specificity and excellent discriminatory ability. However, this threshold should not be considered a definitive diagnostic criterion, and endometrial thickness should be interpreted alongside the clinical presentation and other ultrasound findings.

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