

# Sonographic Appearances of the Endometrium After Termination of Pregnancy in Asymptomatic Versus Symptomatic Women

Rachael L. McEwing, MBChB, FRANZCR, Nigel G. Anderson, MBChB, FRANZCR, Jeremy B. A. Meates, MBChB, FRANZCOG, MRCOG, Richard B. Allen, DMU, Greg T. M. Phillipson, MBChB, FRANZCOG, J. Elisabeth Wells, BSc (Hons), PhD

**Objective.** The purpose of this study was to describe normal sonographic appearances of the endometrium in asymptomatic women after elective termination of pregnancy (TOP) and to determine whether sonographic findings are discriminatory in symptomatic women after TOP. **Methods.** Sonographic parameters were compared in prospectively recruited women after elective TOP. The first 38 were asymptomatic. In a later group, 105 had symptoms suggestive of retained products of conception (RPOC). Endometrial thickness, cavity irregularity, echogenicity of cavity contents, color Doppler flow, and resistive indices (RIs) were assessed. In the symptomatic group, sonographic findings were correlated with symptoms and histologic results. **Results.** There was a marked overlap in sonographic appearances between the groups. The endometrial cavity is commonly irregular and thickened and may show prominent color Doppler flow in women with an uneventful course as well as in women with histologically proven RPOC. Differences between asymptomatic and symptomatic women were only seen for: endometrial thickness (10.8 mm [range, 1–29 mm] versus 15.3 mm [range, 1.8–34 mm];  $P = .0005$ ), and cavity irregularity was greater in symptomatic women ( $P = .001$ ). Color Doppler flow mean RIs were similar. Symptoms were similar in women proceeding to curettage versus no curettage; no significant relationship was found between individual symptoms and sonographic parameters. Chorionic villi were seen in 47 of 56 women (84%) with positive histologic results. **Conclusions.** Sonographic appearances and symptoms correlate poorly with each other and with histologic results. Sonography has limited benefits in triaging women with suspected RPOC after TOP in the first trimester. Our findings support a more conservative approach to suspected RPOC after TOP. **Key words:** retained products; sonography; termination of pregnancy.

## Abbreviations

RI, resistive index; RPOC, retained products of conception; TOP, termination of pregnancy

Received November 10, 2008, from the Departments of Radiology (R.L.M.) and Obstetrics and Gynecology (G.T.M.P.), Christchurch Women's Hospital, Christchurch, New Zealand; Departments of Radiology (N.G.A.) and Public Health and General Practice (J.E.W.), University of Otago, Christchurch, New Zealand; Department of Obstetrics and Gynecology, Hawke's Bay Hospital, Hastings, New Zealand (J.B.A.M.); and Department of Radiology, Flinders Medical Center, Adelaide, South Australia, Australia (R.B.A.). Revision requested December 8, 2008. Revised manuscript accepted for publication January 20, 2009.

Address correspondence to Rachael L. McEwing, MBChB, FRANZCR, Department of Radiology, Christchurch Hospital, Private Bag 4710, Christchurch 8140, New Zealand.

E-mail: rachaelm@cdhb.govt.nz

After termination of pregnancy (TOP), acute presentation with symptoms of pelvic pain, bleeding, and fever is not uncommon and may signify endometritis, retained products of conception (RPOC), or a combination of these. An earlier study from our institution reported a 5.8% admission rate of women with complications after TOP, of whom 84% underwent repeated curettage for presumed RPOC. However, only 55% had histologically confirmed RPOC, suggesting an unnecessarily high rate of curettage.<sup>1</sup> Sonographic evaluation is commonly requested before curettage at our hospital to assist in the diagnosis and subsequent management of

RPOC. We postulated that RPOC may be difficult to differentiate from normal postoperative appearances after TOP. Bar-Hava et al<sup>2</sup> showed that the endometrial cavity frequently is distended with variable-echogenicity material 1 week after first-trimester abortion. Debby et al<sup>3</sup> described similar findings after first-trimester evacuation of the uterus.

The objective of this study was therefore to describe the range of normal sonographic appearances of the endometrium in asymptomatic women after TOP and to compare these with those of symptomatic women with and without positive histologic results.

### Materials and Methods

Our study was performed in 2 stages. First, women undergoing elective TOP in the first trimester were recruited before surgery to establish the usual sonographic appearances of the uterus 1 week after TOP. Second, we recruited another group of women who had symptoms of possible RPOC after elective TOP.

#### *Asymptomatic Women*

A total of 50 consecutive women undergoing elective first-trimester TOP were prospectively recruited between February 1993 and June 1994. The mean age of the 50 asymptomatic women was 27.1 years (range, 17–43 years; SD, 6.9 years). Enrollment into the study occurred after TOP had been booked, and patients were reassured that participation in the study would not alter their treatment. Informed consent was obtained. The mean gestational age was 9.2 weeks (range, 7–12 weeks) on the basis of the last menstrual period and clinical examination. Termination of pregnancy was performed by suction in each case. Sonography was performed transabdominally and transvaginally (5-MHz transvaginal probe, Acuson XP10; Siemens Medical Solutions, Mountain View, CA) at a mean of 7.6 days (range, 5–12 days) after TOP.

Sonographic features prospectively assessed included the endometrial cavity thickness (millimeters), uniformity of the cavity outline, and endometrial content echogenicity (hypoechoic, moderately echogenic, very echogenic, or mixed). Color flow parameters were evaluated in the last

25 patients (presence or absence of color flow in the endometrium/inner myometrium and resistive index [RI]). Color flow was defined as absent, minimal (1 or 2 areas with a poor color signal), moderate (1 or 2 areas with prominent color), or marked (intense and generalized color flow) after optimization for low velocity. A subset of color flow labeled peritrophoblastic-type flow was defined as widespread, intense color flow associated with an RI of 0.7 or less. All scans were performed by 1 experienced qualified sonographer (R.B.A.), blinded to the clinical history, and recorded by 1 radiologist (N.G.A.). The sonographic report was not made available to the medical practitioner. The patients attended their general practitioner for routine follow up 2 weeks after TOP and completed a questionnaire regarding their clinical course. Thirty-eight women had a normal postoperative course and were included in the study. Two women subsequently were lost to follow-up, and 10 women who subsequently had symptoms suggestive of RPOC were excluded.

#### *Symptomatic Women*

A total of 105 women consecutively going to a regional acute women's hospital with symptoms suggesting RPOC after elective first-trimester TOP (performed by suction in each case) were prospectively recruited between September 1995 and November 1998. The mean age of the 105 symptomatic women was 24.5 years (range, 14–41 years; SD, 6.5 years). Recruitment occurred after clinical examination but before sonography. Sonography was performed at a mean of 9.9 days (range, 1–41 days) after TOP. Sonographic parameters were prospectively recorded as for the asymptomatic group. Presenting symptoms, complications or readmissions, and subsequent surgical and histologic results were recorded from later review of case notes. The sonographic report was made available to the treating medical team.

#### *Demographic Differences Between the Groups*

The asymptomatic women (mean, 27.1 years; SD, 6.9 years) averaged nearly 3 years older than the symptomatic women (mean, 24.5 years; SD, 6.5 years;  $P = .04$ ; 95% confidence interval, 0.14–5.11), but this difference was not likely to have influenced the results. As expected, there

were observable differences between asymptomatic and symptomatic women for the period between TOP and sonography. The study protocol required asymptomatic women to undergo follow-up sonography about 1 week after termination (mean, 7.6 days; SD, 1.4 days), whereas symptomatic women underwent sonography when symptoms became manifest (mean, 10 days; SD, 9.3 days;  $P = .01$ , taking account of unequal variances;  $t = 2.5$ ;  $df = 115.8$ ). However, within the symptomatic group, the average time to sonography was misleading because of the large range (1–41 days), and 55% (58 of 105) of the symptomatic women sought care within the first 6 days, compared with only 11% (4 of 38) of the asymptomatic women ( $\chi^2 = 22.71$ ;  $df = 1$ ;  $P < .0001$ ). It was impossible to correct for these differences, and it is unlikely that they influenced the observed results.

Ethical Committee consent was obtained before commencement of the study. Informed consent was obtained from all participants in the study.

### Statistical Methods

Comparisons between the asymptomatic and symptomatic women were performed with  $t$

tests for continuous variables and  $\chi^2$  tests for categorical variable contingency tables, except where the Fisher exact test was required. Analyses were performed in SAS version 8.2 (SAS Institute Inc, Cary, NC).

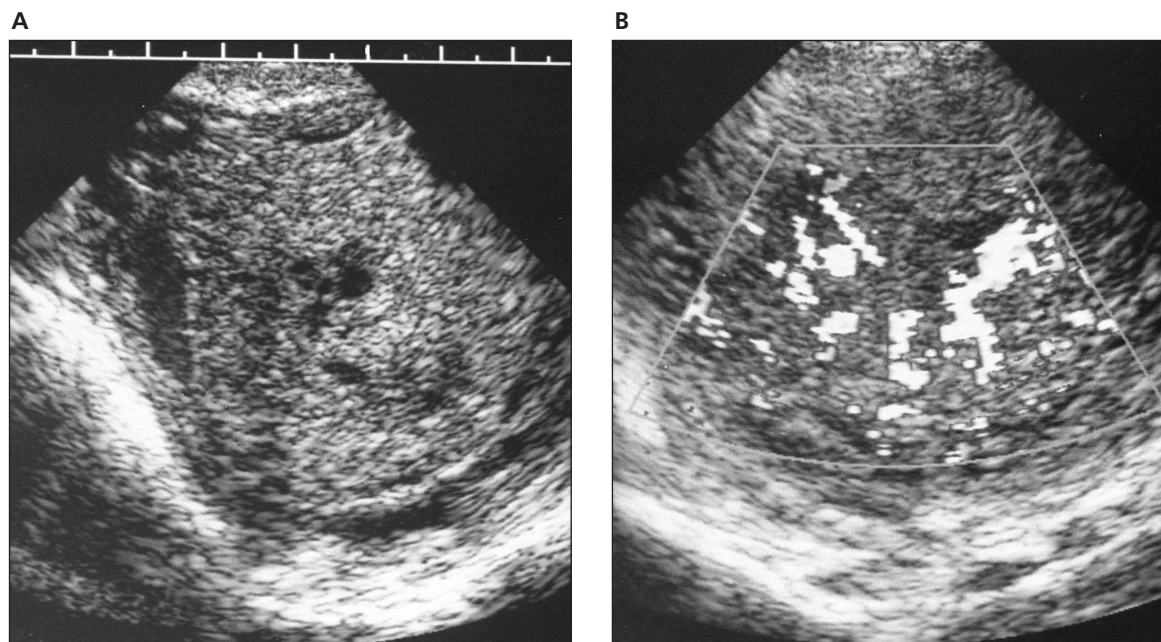
### Results

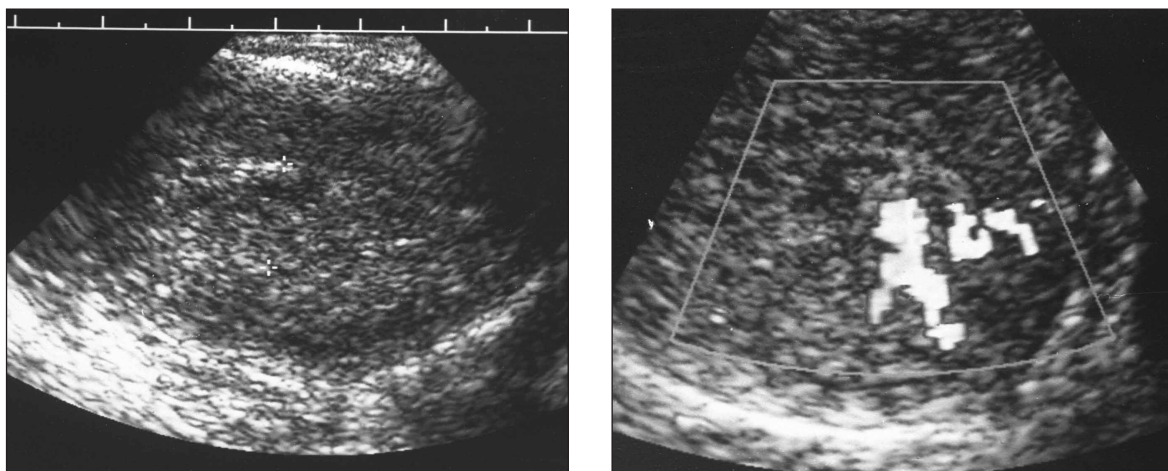
The principal results were that many asymptomatic women had sonographic findings typical of RPOC; sonographic findings correlated poorly with symptoms or histologic results, and symptoms also correlated poorly with histologic results (Figures 1–3).

### Asymptomatic Women

Color Doppler flow was included in the sonographic data set after the first 13 women had been examined; color flow was present in 22 of the 25 women evaluated with Doppler imaging (88%). The mean RI was 0.5 (range, 0.27–0.86; SD, 0.19); the RI was 0.7 or less in 17 cases (68%) and 0.4 or less in 12 (48%). Color Doppler patterns were consistent with peritrophoblastic flow (defined as generalized intense color flow and an RI  $\leq 0.7$ ) in 6 women (24%).

**Figure 1.** Transvaginal sonograms without (A) and with (B) color Doppler imaging from a 24-year-old asymptomatic woman 10 days after TOP showing a heterogeneous, thickened, and irregular endometrium with increased color Doppler flow, findings normally associated with RPOC.





**A** **B**  
**Figure 2.** Transvaginal sonograms without (A) and with (B) color Doppler imaging from a 23-year-old asymptomatic woman 7 days after TOP showing a poorly defined 13-mm endometrium of mixed echogenicity with prominent color Doppler flow entering the endometrial cavity.

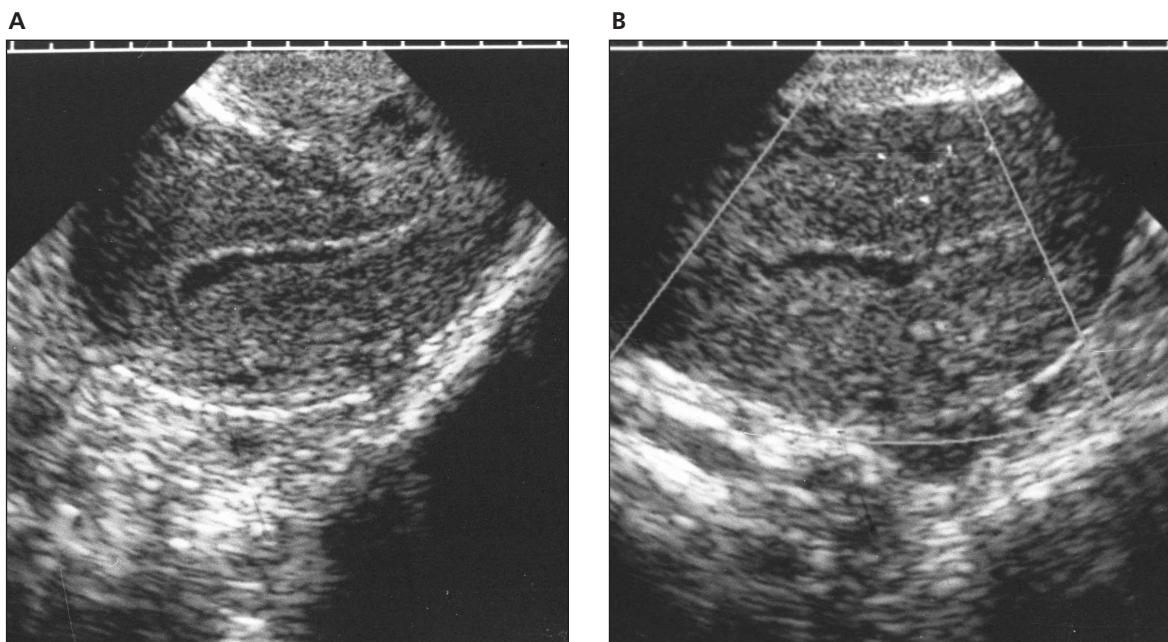
In the 10 women excluded because of later development of symptoms, color flow was present in 9 (90%); the mean RI was 0.41 (range, 0.31–0.67); and peritrophoblastic-type flow was present in 3 women (30%), very similar to the results in the group who remained asymptomatic.

The sonographic features and comparison with the symptomatic group are detailed in Table 1.

### Symptomatic Women

Figure 4 shows a flow diagram of outcomes in the symptomatic women based on endometrial cavity thickness. Endometrial thickness is a poor discriminator. The mean RI was 0.42 (range, 0.16–0.89; SD, 0.19); the RI was 0.7 or less in 60 women (58%) and 0.4 or less in 31 (30%); and peritrophoblastic type flow was documented in 23 women (22%).

**Figure 3.** Transvaginal sonograms without (A) and with (B) color Doppler imaging from a 19-year-old woman 2 weeks after TOP who had abdominal cramps, vaginal discharge and bleeding, and lower abdominal tenderness. The scans show a thin, relatively uniform endometrium, a small amount of simple fluid within the cavity, and no color Doppler flow.



There was no difference in the number or pattern of symptoms in the 72 women who underwent curettage compared with the 33 who were treated conservatively (Table 2). Seventy-two symptomatic women (69%) proceeded to curettage. The sonographic report seemed to strongly influence treatment because sonographic features were reported as consistent with RPOC in 67 cases, and 64 of these (94%) proceeded to curettage. Thirty-seven cases were reported as unlikely to represent RPOC, and 8 of these (22%) proceeded to curettage (Figure 4).

Fourteen of the 72 women (19%) who had curettage had postoperative symptoms again suggesting RPOC; 9 had positive histologic results at the initial operation. Five women had a subsequent surgical procedure. Four of the 35 women (12%) treated conservatively returned for additional care, but none of these underwent subsequent surgery.

There was a significant difference between the endometrial thickness and cavity outline between the groups, but no other sonographic variables reached significance (Table 1). On average,

symptomatic women had endometrial cavities about 5 mm (95% confidence interval, 2–8 mm) greater than those of asymptomatic women, a persistent finding when the thickness was classified as 12 mm or less or greater than 12 mm. Color flow parameters were not recorded in the first 13 of the 38 asymptomatic patients (34%); however, no statistically significant difference was evident between the 25 asymptomatic women evaluated with color Doppler imaging and symptomatic patients. There was a trend for RI values to be lower within the symptomatic group, but this did not reach statistical significance.

Comparison of the 10 women excluded from the asymptomatic group because of later development of symptoms and those 38 who remained asymptomatic was difficult because the numbers were too small to detect anything other than very large differences. However, peritrophoblastic-type flow (2-tailed Fisher exact test,  $P = .69$ ) and the presence or absence of color Doppler flow did not differ significantly between these 2 groups of women ( $P > .99$ ).

**Table 1.** Sonographic Features of Asymptomatic and Symptomatic Women

Sonographic Finding	Asymptomatic Women (n = 38)	Symptomatic Women (n = 105)	Comparison		
			Test Statistic	df	P
Endometrial thickness, mm					
Mean	10.8	15.3	$t = 3.56$	141	.0005
Range	1–29	1.8–34			
SD	6.8	7.5			
Cavity >12 mm, n (%)	12 (31.6)	74 (70.5)	$\chi^2 = 11.01$	1	.0009
Cavity irregularity, n (%)	13 (34.2)	67 (63.8)	$\chi^2 = 10.75$	1	.001
Cavity echo pattern, n (%)		n = 104			
Mixed	21 (55)	68 (65)	$\chi^2 = 4.09$	2	.13
Hypochoic	8 (21)	9 (9)			
Moderately echogenic	9 (24)	27 (26)			
Very echogenic	0	0			
Color Doppler flow present, n (%)	n = 25	n = 104			
	22 (88)	75 (72)	$\chi^2 = 2.73$	1	.1
Color flow pattern, n (%)	n = 25	n = 104			
Minimal	9 (36)	24 (23.1)	$\chi^2 = 0.86$	2	.65
Moderate	7 (28)	25 (24)			
Marked	6 (24)	26 (25)			
Peritrophoblastic color flow, n (%)	n = 25	n = 104			
	6 (24)	23 (22)	$\chi^2 = 0.47$	1	.49
RI					
Mean	0.5	0.4	$t = 1.83$	94	.07
Range	0.27–0.86	0.16–0.8			
SD	0.19	0.19			
RI $\leq 0.7$ , n (%)	n = 25	n = 104			
	17 (68)	60 (58)	$\chi^2 = 0.89$	1	.35

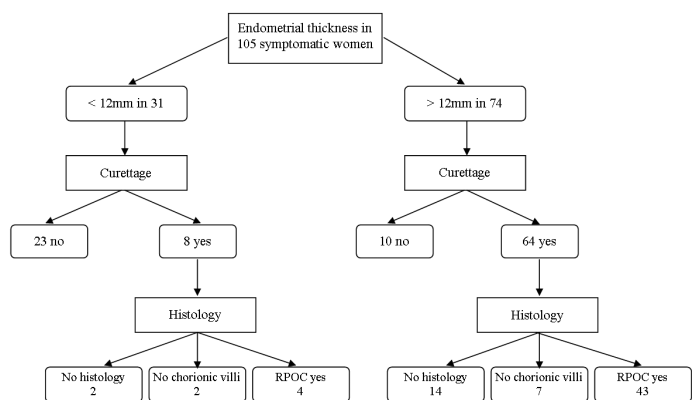


Figure 4. Management and outcome related to endometrial thickness on sonography in 105 women with suspected RPOC after TOP.

There was no significant relationship between individual symptoms and sonographic parameters, in part because some symptoms were either extremely common or very uncommon (Table 2). However, there was a trend among women who had passed tissue (n = 8) to have a greater cavity thickness than women without this symptom (mean thickness, 19.1 versus 15 mm; SD, 7 mm; P = .12). There was no difference in the number of symptoms among women treated surgically or conservatively.

**Histologic Correlation**

Seventy-two symptomatic women (69%) were treated by curettage. Chorionic villi were identified in 47 cases (65%) and absent in 9 (13%); histologic examinations were not performed for 16 women (22%). A sonographic comparison of the women with positive and negative histologic results is presented in Table 3. Comparisons of sonographic variables between the women with

positive and negative histologic results were not statistically significant, largely because of the small number of women with negative histologic results. However, women with positive histologic results tended to have a thicker endometrium (P = .48) and a lower RI (P = .13; Table 3). The remaining variables were not assessed because there was no clear difference, and the numbers were too small for meaningful analysis.

**Discussion**

There were 3 important findings in our study of women undergoing elective TOP. First, many asymptomatic women had sonographic findings usually associated with RPOC. Second, sonographic findings in symptomatic women correlated poorly with symptoms or histologic results. Third, the sonographic findings and symptoms were very similar in symptomatic women whether treated conservatively or surgically.

Retained products of conception complicate up to 3% of first-trimester terminations and may lead to late complications such as intrauterine adhesions and impaired fertility.<sup>4</sup> Accurate differentiation of RPOC from other acute post-termination complications may prevent unnecessary repeated curettage, with its associated increased rate of complications. Indeed, Maslovitz et al<sup>5</sup> reported that most re-evacuation samples taken for suspected RPOC after early TOP were negative for chorionic villi, and an earlier study from our institution found only 55% women undergoing evacuation to have histologically confirmed RPOC.<sup>1</sup>

The diagnosis of RPOC is often difficult on clinical grounds alone,<sup>2</sup> and sonography has traditionally played a role. A fluid collection within the uterine cavity after TOP is normal and likely represents blood, which may be observed as moving on real-time imaging. Retained products have been reported as typically more solid in appearance, but blood clots and necrotic decidua within the cavity may mimic residual tissue.<sup>6,7</sup> When the uterus is sonographically “empty” or contains simple fluid, an uneventful recovery is reported in up to 100% of cases.<sup>6</sup>

Bar-Hava et al<sup>2</sup> examined the uterine cavity in women after uncomplicated first-trimester TOP and concluded that in the week after first-

Table 2. Comparison of Symptoms: Women Undergoing Curettage Versus No Curettage

Symptom	Curetage (n = 72)	No Curettage (n = 33)
Vaginal bleeding, n (%)	68 (94.4)	27 (81.8)
Abdominal/pelvic pain, n (%)	65 (90.3)	30 (90.9)
Fevers/rigors, n (%)	16 (22.2)	6 (18.2)
Nausea, n (%)	10 (13.8)	4 (12.1)
Tissue passed, n (%)	6 (8.3)	2 (6.1)
Backache, n (%)	2 (2.8)	3 (9.1)

trimester abortion the uterine cavity was seldom empty, and thick heterogeneous material should be an expected finding (in 77% of their patients) and should lead to fewer unnecessary invasive evacuation procedures. The results of our study confirm these findings. Different authors have adopted differing cutoff values for endometrial thickness, between 5 and 13 mm, as suggestive of RPOC, with sensitivities of 87% to 100% and specificities reported between 21% and 80%.<sup>6-11</sup> In a retrospective study, Sadan et al<sup>12</sup> made the diagnosis of RPOC when hyperechoic or hypoechoic material was seen in any part of the uterine cavity or the endometrial stripe was thickened to greater than 8 mm, which they did not appear to distinguish from intracavitary blood. Their false-positive rate for sonographic diagnosis after TOP was 28.9%. They concluded that reliance on common symptoms and signs suggestive of RPOC and the use of sonography are associated with an unacceptably high false-positive rate and suggested a conservative approach to treatment.<sup>12</sup>

Sawyer et al<sup>13</sup> found no clear cutoff value for endometrial thickness or volume to differentiate between RPOC and decidua in a group including 43 post-TOP women. They concluded that sonographic measurements of endometrial thickness or volume are not good tests for diagnosis of complete miscarriage.<sup>13</sup>

The mean value for endometrial thickness in asymptomatic women in our group was 10.8 mm. If we had adopted a cutoff of 8 mm, a large number of women would potentially have been subjected to an unnecessary procedure. For this reason also, we do not advocate routine sonography immediately after TOP as some groups suggest.<sup>4,13</sup>

Durfee et al<sup>14</sup> reported that an endometrial mass was the most sensitive (79%) and specific (89%) feature for RPOC. Color Doppler flow was present more often when RPOC were present than in the absence of RPOC (75% versus 40%). They concluded that RPOC are extremely unlikely in the absence of an endometrial mass or fluid with an endometrium of less than 10 mm.<sup>14</sup> Conversely, in a small study of 19 patients, Dillon et al<sup>15</sup> agreed with the findings of our study that color Doppler flow and intrauterine material are frequently observed after termination and do not necessarily indicate clinically important RPOC.

**Table 3.** Sonographic Features in Symptomatic Women: Positive Versus Negative Histologic Results

Sonographic Finding	Positive Histologic Results (n = 47)	Negative Histologic Results (n = 9)
Endometrial thickness, mm		
Mean	18.5	16.7
Range	3.3–34	3.9–28
SD	6.8	7.9
Color Doppler flow present, n (%)	n = 46 44 (93.6)	7 (77.8)
Color flow pattern, n (%)	n = 46	
Minimal	11 (23.9)	1 (11.1)
Moderate	17 (37)	2 (22.2)
Marked	16 (34.8)	4 (44.4)
RI		
Mean	0.42	0.53
Range	0–0.78	0.37–0.73
Cavity echo pattern, n (%)	n = 46	
Mixed	37 (78.7)	7 (77.8)
Hypoechoic	0	1 (11.1)
Moderately echogenic	9 (19.1)	1 (11.1)

Doppler assessment of RIs has been used for assessment of RPOC. Although 1 study showed a low RI (<0.35) to be associated with a 100% probability of having residual trophoblast and an RI of greater than 0.45 virtually excluding RPOC,<sup>6</sup> there were no statistically significant differences between the symptomatic versus asymptomatic and histologically positive versus negative groups in our series. Fever and endometritis, rather than RPOC, after evacuation may cause the uterus to become hyperemic with increased Doppler flow, which may falsely suggest RPOC. False-positive rates of 25% to 30% have been reported for Doppler sonography in the detection of RPOC in post-termination patients.<sup>6,15</sup>

It is apparent that thickened, heterogeneous endometrial contents, with or without increased color Doppler flow, should be considered part of the normal spectrum of post-termination sonographic findings. We support a more conservative approach to reporting suspected RPOC after TOP. Any sonography report suggesting RPOC should be qualified with a comment that these findings are commonly seen in asymptomatic women after TOP.

### References

1. Sykes P. Complications of termination of pregnancy: a retrospective study of admissions to Christchurch Women's Hospital 1989 and 1990. *NZ Med J* 1993; 106:83–85.
2. Bar-Hava I, Aschkenazi S, Orvieto R, et al. Spectrum of normal intrauterine cavity sonographic findings after first-trimester abortion. *J Ultrasound Med* 2001; 20:1277–1281.
3. Debby A, Golan A, Sadan O, Rotmensch S, Malinger G. Sonographic characteristics of the uterine cavity following first-trimester uterine evacuation. *Ultrasound Obstet Gynecol* 2008; 31:555–559.
4. Debby A, Malinger G, Harow E, Golan A, Glezerman M. Transvaginal ultrasound after first-trimester uterine evacuation reduces the incidence of retained products of conception. *Ultrasound Obstet Gynecol* 2006; 27:61–64.
5. Maslovitz S, Almog B, Mimouni GS, Jaffa A, Lessing JB, Many A. Accuracy of diagnosis of retained products of conception after dilation and evacuation. *J Ultrasound Med* 2004; 23:749–756.
6. Achiron R, Goldenberg M, Lipitz S, Mashiach S. Transvaginal duplex Doppler ultrasonography in bleeding patients suspected of having residual trophoblastic tissue. *Obstet Gynecol* 1993; 81:507–511.
7. Haddad S, Ruach M, Ohel G. Sonographic demonstration of endometrial fluid collection following termination of pregnancy. *Obstet Gynecol* 1992; 79:703–704.
8. Ustunyurt E, Kaymak O, Iskender C, Ustunyurt OB, Celik C, Danisman N. Role of transvaginal sonography in the diagnosis of retained products of conception. *Arch Gynecol Obstet* 2008; 277:151–154.
9. Caserta L, Labriola D, Torella M, Di Caterina B. The use of transvaginal ultrasound following voluntary interruption of pregnancy to reduce complications due to incomplete curettage [in Italian]. *Minerva Ginecol* 2008; 60:7–13.
10. Ben-Ami I, Schneider D, Maymon R, Vaknin Z, Herman A, Halperin R. Sonographic versus clinical evaluation as predictors of residual trophoblastic tissue. *Hum Reprod* 2005; 20:1107–1111.
11. Leung SW, Pang MW, Chung TK. Retained products of gestation in miscarriage: an evaluation of transvaginal ultrasound criteria for diagnosing an "empty uterus." *Am J Obstet Gynecol* 2004; 191:1133–1137.
12. Sadan O, Golan A, Girtler O, et al. Role of sonography in the diagnosis of retained products of conception. *J Ultrasound Med* 2004; 23:371–374.
13. Sawyer E, Ofuasie E, Ofili-Yebovi D, Helmy S, Gonzalez J, Jurkovic D. The value of measuring endometrial thickness and volume on transvaginal ultrasound scan for the diagnosis of incomplete miscarriage. *Ultrasound Obstet Gynecol* 2007; 29:205–209.
14. Durfee SM, Frates MC, Luong A, Benson CB. The sonographic and color Doppler features of retained products of conception. *J Ultrasound Med* 2005; 24:1181–1186.
15. Dillon EH, Case CQ, Ramos IM, Holland CK, Taylor KJ. Endovaginal US and Doppler findings after first-trimester abortion. *Radiology* 1993; 186:87–91.