


Original Research

Management of women presenting with vaginal bleeding with enhanced myometrial vascularity and suspected retained products of conception

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Abstract

Background: To describe the clinical course of women with acute vaginal bleeding and a finding of uterine enhanced myometrial vascularity (EMV) with suspected retained products of conception (RPOC) on vaginal ultrasound examination. **Methods:** A retrospective cohort study including women with EMV and suspected RPOC attending a single tertiary medical center between April 2018 to May 2020. Women with uterine EMV were identified from medical records of the ultrasound clinics. Demographic and clinical characteristics were retrieved from women's medical files. **Results:** During the study period nine women met inclusion criteria. The preceding event in seven and in two of the women was first and second trimester abortions, respectively. Of those who underwent first trimester abortion, three were surgical, two were medical and two were spontaneous. Suspected RPOC and EMV were observed by ultrasound in all cases. Six of nine women (67%) underwent uncomplicated operative hysteroscopy with removal of RPOC, and three (33%), who had severe active bleeding due to vascular malformations (arterio-venous malformation-1, pseudo-aneurysm of uterine artery-1, other vascular malformation-1) were treated with uterine artery embolization prior to operative hysteroscopy. **Conclusions:** Work-up of women with episodes of uterine bleeding following curettage or abortion should include color/power Doppler ultrasonography for the detection of EMV. Although in most cases EMV is a benign sonographic finding that accompany RPOC and disappear after the removal of RPOC, in women who present with acute vaginal bleeding it might hint for the presence of vascular malformations that might cause life-threatening bleeding during additional surgical interventions.

Keywords: uterine enhanced myometrial vascularity; uterine arteriovenous malformation; retained products of conception; color Doppler ultrasonography

1. Introduction

Retained products of conception (RPOC) are a relatively common cause of enhanced myometrial vascularity (EMV) and a treatable complication following miscarriage or delivery [1]. The reported incidence depends on the gestational age of pregnancy [2], reaching up to 17% after abortions [2].

The presence of RPOC is usually suspected based on clinical signs (abnormal vaginal bleeding, abdominal pain or fever) or incidental ultrasound findings detected on routine follow-up visit, suggesting residual gestational tissue in the uterine cavity [3]. Early diagnosis is critical for directing the clinical management and preventing associated immediate complications, such as uterine infection, as well as late obstetric complications, including: intrauterine adhesions, infertility and abnormal placentation [1,4].

Gray scale ultrasound (US) combined with color Doppler is the first-line imaging modality for the diagnosis of suspected RPOC. It allows real-time assessment of the uterine structures and its related blood flow [1,5]. An area of focal increased vascularity with or without a mass is con-

sidered the best predictor for the presence of RPOC, with high sensitivity (79%) and specificity (89%) [6,7]. When a tortuous rich vascular network within the myometrium is observed, it is termed enhanced myometrial vascularity (EMV) [8]. The incidence of EMV following first trimester miscarriage is 1.5% [9]. A peak systolic velocity (PSV) of ≥ 20 cm/sec within the collection of vessels has been objectively considered EMV [8,9]. The aforementioned color Doppler ultrasound characteristics findings may also be seen in other conditions, such as arterio-venous malformation (AVM) [8,10]. In cases of uncertainty in color Doppler ultrasound, magnetic resonance angiography (MRA) and computed tomography angiography (CTA) may also be performed [11].

Uterine AVM is a rare potentially life-threatening lesion characterized by uterine bleeding [12]. There are two types of AVM: (1) congenital AVM, that is thought to develop from a failure of embryologic differentiation leading to abnormal vascular connection [13]; (2) acquired AVM, mostly following uterine surgery or trauma (e.g., dilatation and curettage (D&C), cesarean delivery, or myomectomy)



Table 1. Clinical characteristics of patients with EMV.

Patient	Age, (years)	Gravidity, parity	Type of abortion	Week of gestation	Uterine intervention	History of CS	Time to diagnosis after abortion, (months)	Therapy
1	41	G2P0SA2	Artificial	15	D&E	0	2	Hysteroscopy
2	33	G3P2SA1	Missed	10	Misoprostol	1	2.5	Hysteroscopy
3	28	G5P4AB1	Missed	11	D&C	1	2.5	UAE + laparoscopy
4	32	G8P5	Missed	10	Misoprostol	0	3	Hysteroscopy
5	35	G1P0AB1	Missed	6	Spontaneous	0	1.5	UAE
6	19	G1P0AA1	Artificial	7	Misoprostol	0	3	Hysteroscopy
7	43	G1P0AB1	Missed	10	D&C	0	1.5	Hysteroscopy
8	32	G3P0SA3	Missed	10	Spontaneous	0	1.5	Hysteroscopy
9	32	G3P1AB1EUP1	Artificial	14	D&E	0	0.75	UAE + Hysteroscopy

G, gravidity; P, parity; AB, abortions (spontaneous and/or artificial); EUP, extrauterine pregnancy; D&C, dilatation and curettage; D&E, dilatation and evacuation (D&E); UAE, uterine artery embolization.

[14,15]. Accurate diagnosis allows planning appropriate treatment and avoiding hysterectomy, especially in women who wish to retain their reproductive capacity [12]. Maintaining high level of suspicion is critical, especially in cases when bleeding is exacerbated by invasive procedure (e.g., endometrial biopsy, curettage).

The aim of this study was to share our experience in the management of women who presented with acute vaginal bleeding after abortion with sonographic finding of enhanced myometrial vascularity.

2. Materials and methods

This is a retrospective study of all women who were diagnosed with EMV at a single tertiary hospital between April 2018 and May 2020. Ultrasound examination was conducted due to acute vaginal bleeding following abortion, or due to earlier suspicion of RPOC by ultrasound. Women who were referred to the emergency room (ER) due to recurrent bouts of profuse bleeding underwent initial clinical assessment at the ER and ultrasound examination was completed by the ultrasound unit team afterwards.

Ultrasound examination was performed by two experienced examiners (MZ and EK). Patients were examined with Voluson E6, Voluson E8 or Voluson E10 systems (GE Medical Systems Kretz, Zipf, Austria), using 5 to 9MHz vaginal probe. Grayscale mode, color/power Doppler and spectral Doppler were used (Fig. 1). The diagnosis of EMV was made following subjective assessment of unusually rich vascularity within the myometrium, with multidirectional flow. Peak systolic velocity was recorded. Uterine cavity was assessed for RPOC, and the size of the retained tissue was measured.

If clinical presentation or evaluation raised a suspicion of AVM, additional imaging studies were conducted including pelvic CTA or MRA. CT angiography helps define the extent of uterine involvement, rules out extrauterine involvement, differentiate between congenital and acquired uterine AVM non-invasively and delineates the feeder vessel/uterine arteries [16]. Magnetic resonance imaging

(MRI) shows the presence of flow voids in the region of vascular malformation and MR angiography provides details regarding the vascular supply and drainage [17]. To date, there are no accepted diagnostic criteria for uterine AVM by CTA and MRA nor guidelines for the preference use of each modality. The decision is usually based on resources, availability and physician discretion.

If CTA or MRA suggested AVM, uterine artery embolization using gel foam particles was performed by the invasive radiology team, and diagnosis was made accordingly. Hysteroscopy for the removal of RPOC was performed in all cases, and tissue was sent to histological analysis. Myometrial vascularity was re-examined by ultrasound following the hysteroscopic examination.

Clinical data including: patient age, gynecological and obstetrical history, presenting symptoms, results of ultrasound and other diagnostic procedures, surgical management and follow up visits were retrieved from the institutional medical files.

3. Results

During the study period nine women were diagnosed with EMV (Table 1), of whom six had first trimester spontaneous miscarriages, one had medical first trimester termination of pregnancy, one had termination of pregnancy at 15 weeks of gestation due to trisomy 21 and one had termination of pregnancy at 14 weeks of gestation due to fetal malformations on ultrasound examination. Four women (Patients no. 1, 3, 7, 9) underwent surgical intervention, either dilatation and curettage (D&C) or dilatation and evacuation (D&E). The clinical characteristics of the women are presented in Table 1.

During the initial treatment, two women lost a significant amount of blood and presented with hemodynamic instability. Blood products were given as part of the initial treatment. One of the women (Patient no. 3) had severe vaginal bleeding during D&C, which resolved after the procedure. The other woman (Patient no. 8) was hospitalized with imminent abortion and heavy bleeding and finally

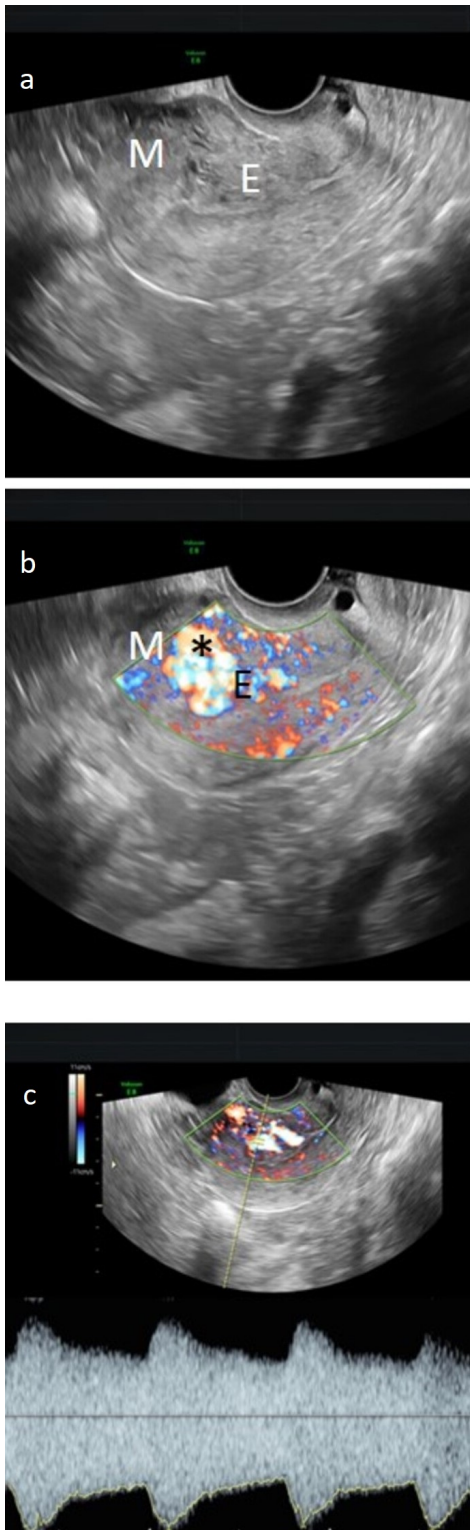


Fig. 1. Transvaginal ultrasound of Patient 8, sagittal plane of the uterus. (a) Gray scale ultrasound image shows inhomogeneous endometrium (E) and irregular myometrium (M). (b) Power Doppler reveals enhanced myometrial vascularity with multidirectional flow (asterisk). (c) Spectral Doppler shows low-resistance flow with PSV = 73 cm/sec.

aborted in hospital. The bleeding resolved immediately after the expulsion of the embryo and she did not undergo D&C.

The symptoms, clinical management and outcomes of the patients are summarized in Table 2. The presenting symptom was bleeding in eight of nine women. Three women were referred to the ER for recurrent bouts of profuse bleeding and one was referred for active arterial bleeding observed during diagnostic hysteroscopy performed for intermittent bleeding in the presence of suspected RPOC on US. Four women were evaluated for intermittent vaginal bleeding and one was asymptomatic. The time interval between the abortion and the diagnosis of EMV ranged from three weeks to three months.

Ultrasound detected RPOC in eight of nine women. The ninth woman had small residual tissue at diagnostic hysteroscopy performed before her arrival, but this was not observed upon admission. Doppler was performed in all cases and the median peak systolic velocity was 40 cm/sec (Range 20–92 cm/sec).

Fig. 2 shows the Doppler imaging of EMV of women with and without AVM. AVM was clinically suspected in four cases (Patients 3, 5, 7, 9) with unusual bleeding, and all of the women underwent additional imaging studies. In Patient no. 3, AVM was suspected in CTA and was later ruled out during uterine artery embolization (UAE), which was carried on for the treatment of myometrial hyper-vascularity. After the procedure, the woman continued to bleed and a persistent vascular lesion was observed by MRA. The woman underwent hysteroscopy and hysterotomy. Following the interventions, bleeding resolved and follow-up ultrasound and hysteroscopy were unremarkable except for uterine niche. Patient no. 5 underwent diagnostic hysteroscopy for intermittent vaginal bleeding and RPOC with active arterial bleeding (Video 1). Due to this unusual finding, MRA was performed and AVM was detected that was treated by UAE. After the UAE, an uneventful hysteroscopic removal of RPOC was conducted. In the third case (Patient no. 7), MRA detected vascular lesion which could not be classified. The woman underwent hysteroscopy and RPOC was removed uneventfully. Patient no. 9 was referred to the ER because of vaginal bleeding and suspected large RPOC. Doppler examination revealed an unusual large myometrial vessel and she was hospitalized. CTA was conducted due to massive bleeding and revealed abnormal entangled enlarged myometrial artery. Selective UAE was conducted. During the procedure a pseudo-aneurysm of uterine artery was detected and treated. After the procedure hysteroscopy was performed, and the RPOC were removed.

Tissue was sent to histological analysis in all cases, and in seven of the nine women, products of conception were confirmed in specimens. In two of the patients who had true myometrial vascular malformations (Patients no. 3, 5) the tissue did not confirm products of conception.

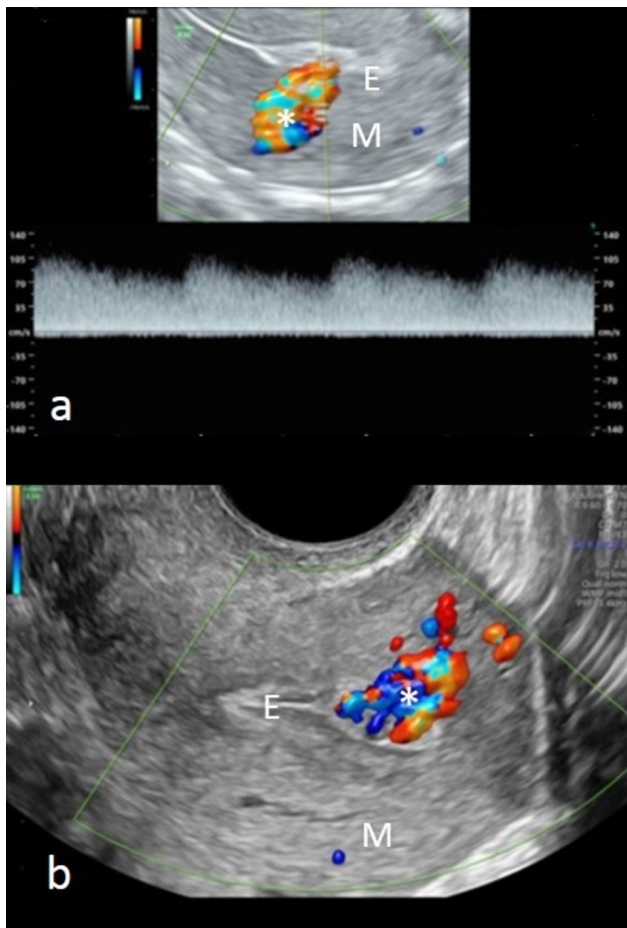


Fig. 2. Power Doppler imaging of uterus of two different women presented with intermittent bleeding. The images show enhanced myometrial vascularity (asterisk) with vessels entering from the myometrium (M) to the endometrial cavity (E). In both cases RPOC was suspected. (A) The woman underwent diagnostic hysteroscopy which showed RPOC, followed by uneventful operative hysteroscopy (Patient 4). (B) Diagnostic hysteroscopy detected a tissue suspected as RPOC with active arterial bleeding. MRA was conducted and raised the suspicion of AVM. AVM was treated by UAE. After the embolization uneventful operative hysteroscopy was conducted (Patient 5).

Ultrasound examination performed after surgical treatment in all patients but one, showed resolution of EMV. On follow-up, all of the women were free of symptoms.

4. Discussion

Acute vaginal bleeding in women with RPOC and underlying EMV could be critical and in some cases, a life-threatening condition. The presence of EMV in addition to suspected RPOC should be carefully assessed prior to a surgical intervention upon admission to the ER or to the outpatient clinic, particularly in patients with perfused vaginal bleeding. Upon the diagnosis of EMV, woman should be

referred to a well-equipped tertiary center to avoid catastrophic life-threatening bleeding.

In our study, uterine EMV was diagnosed using color Doppler US. Color Doppler is unanimously the first line modality for the diagnosis of EVM, but it doesn't accurately distinguish between different types of vascular malformations [18–20]. A retrospective study by Huang *et al.* [21] described the sonographic features of uterine AVM in 10 patients. They concluded that Doppler US features should allow noninvasive diagnosis of uterine AVM, however, they also mentioned that the color Doppler features of uterine AVMs may overlap with other causes of arteriovenous shunting, such as abnormal placentation with RPOC [22]. Rufener *et al.* [22] claimed that color Doppler flow of uterine abnormalities has not been found reliable in distinguishing between AVM and RPOC. Timmerman *et al.* [23] conducted a prospective observational study including 30 women with uterine vascular malformations detected by color doppler. They concluded that Peak systolic velocity (PSV) values appear to be useful in distinguishing between low- and high-risk patients.

Management of uterine EMV/AVM depends on the degree of vaginal bleeding, hemodynamic stability, and the desire for future fertility. Hysterectomy is considered as the primary treatment and is usually performed in cases of excessive bleeding [24]. Recently, the option of successful conservative treatment has been reported, making this option feasible especially for women interested in future fertility [25–27]. Medical treatment including methylergometrine [28], gonadotropin-releasing hormone agonists (GnRHa) [18], and danazol [29], were all found to effectively reduce uterine EMV/AVM blood flow. Since the first report in 1982 of UAE as an effective treatment for AVMs, this technique has been increasingly used. High clinical success rates and low complication rates have been reported using UAE [13,25–27]. Another possibility is only follow-up, that in certain cases leads to the resolution of the uterine EMV/AVM findings [19,20].

In our study, after establishing the diagnosis and completing the investigation of uterine EMV/AVM characteristics, successful UAE was performed in four of the patients. No complications were noted during or after the procedure and complete resolution of the bleeding was reported on follow up. Our results coincide with previous reports supporting UAE treatment when uterine EMV/AVM is highly suspected due to high success rate and low complication rate.

In some cases, UAE may be required for immediate intervention to cease the active bleeding, as performed in three women (33%) in our study. Grewal *et al.* [9] studied 40 women with RPOC and EMV, diagnosed at routine follow-up examination after first trimester miscarriage. 22 (55%) women were managed surgically and 18 (45%) expectantly. Blood loss was mild to moderate in both groups and none of the women required emergent surgical procedure, angiography or embolization. The different outcomes

Table 2. The symptoms, management and outcome of patients.

Case no.	Referred for	Ultrasound findings	Additional imaging	Primary intervention	Outcome	Additional interventions
1	Heavy bleeding. At a different hospital AVM was suspected	EMV + RPOC	No	Hysteroscopic removal of RPOC	Uneventful	None
2	Routine ultrasound revealed RPOC + EMV	EMV + RPOC	No	Hysteroscopic removal of RPOC	Uneventful	None
3	Heavy bleeding	EMV	CTA–Suspected AVM	UAE (AVM ruled out) + Hysteroscopy	Bleeding continued MRA revealed myometrial vascular lesion	Laparoscopic hysterotomy
4	Intermittent bleeding. At a different hospital AVM was suspected Active arterial bleeding observed during diagnostic hysteroscopy	EMV + RPOC	No	Hysteroscopic removal of RPOC	Uneventful	None
5	performed for Intermittent bleeding and RPOC	EMV + RPOC	MRA–Showed AVM	UAE	Uneventful	Hysteroscopic removal of tissue
6	Intermittent bleeding and RPOC on ultrasound	EMV + RPOC	No	Hysteroscopic removal of RPOC	Uneventful	None
7	Intermittent bleeding and RPOC on ultrasound	EMV + RPOC AVM cannot ruled out	MRA–Vascular lesion	Diagnostic Hysteroscopy + removal of RPOC	Uneventful	None
8	Heavy bleeding	EMV + RPOC	No	Hysteroscopic removal of RPOC	Uneventful	None
9	Heavy bleeding	EMV + RPOC AVM cannot ruled out	CTA–Pseudoaneurism of uterine artery	UAE (Pseudoaneurism) + Diagnostic Hysteroscopy	Uneventful	Hysteroscopic removal of RPOC

AVM, arterio-venous malformation; EMV, enhanced myometrial malformation; RPOC, retained products of conception; CTA, computed tomography angiography; UAE, uterine artery embolization; MRA, magnetic resonance angiography.

of our study can be explained by different clinical presentations. While 6 of the 9 women (66%) in our study presented with unusual or heavy bleeding, Grewal *et al.* [9] included women who were diagnosed at routine follow-up.

Life threatening vascular malformations in addition to RPOC were found in three women in our study (arterio-venous malformation-1, pseudo-aneurysm of uterine artery-1, other vascular malformation-1). CTA or MRA were conducted due to unusual/massive bleeding in all.

The existence of abnormal uterine vessels may have been overlooked in two of the women who lacked severe symptoms (C4, C5). These women had been falsely diagnosed with RPOC and finally underwent treatment with hysteroscopy for the removal of the RPOC. Although UAE was not performed, the bleeding ceased with no need for additional intervention. This management strengthens previous reports suggesting that uterine EMV/AVM that develop after abortion, might resolve spontaneously in certain cases [19,20].

5. Limitation and strength

This study is a case series consisting of only 9 patients. Characteristics of the abortion preceding the suspected diagnosis were diverse. Furthermore, neither the investigation nor the treatment was unanimous in all women. Nevertheless, our study has merits that should be mentioned. All women were diagnosed during a relatively short period in a single medical center and evaluated by the same team. All women were diagnosed with suspected RPOC after abortion and additional evaluation was due to abnormal acute bleeding. The combination of color Doppler US and hysteroscopy was performed in all of the women enabling better evaluation of the content in the uterus and based on the findings, the appropriate treatment was offered.

6. Conclusions

Although our recognition and understanding of this condition remains limited, it is important to suspect uterine EMV in any woman with episodes of unexplained acute uterine bleeding, particularly after an abortion. It is of utmost importance to diagnose these lesions prior any operative intervention. The use of color Doppler US performed by an experienced sonographer followed by hysteroscopy might facilitate accurate diagnosis and appropriate management, avert dangerous unnecessary repeat curettage, and prevent progression to more severe conditions. Although hysterectomy was considered the gold standard treatment in the past, we demonstrated in this study that conservative management of uterine EMV/AVM, including UAE, may be possible in those who desire future fertility. UAE appears to be effective with relatively low complication rate. This information should be of value to physicians and patients alike. Further investigation in a larger cohort of patients is needed to validate our findings.

Abbreviations

RPOC, retained products of conception; EMV, enhanced myometrial vascularity; AVM, arterio-venous malformation.

Author contributions

AMS, MZ—carrying out, analyzing and writing up; RO—carrying out, writing; ZT, EK, RM, YI—carrying out; SBC—conception, planning and writing up.

Ethics approval and consent to participate

The study protocol was approved by the "Sheba Medical Center" ethical committee Review Board (ID 6588-19-SMC) on the 3 of December 2019 before the study has begun.

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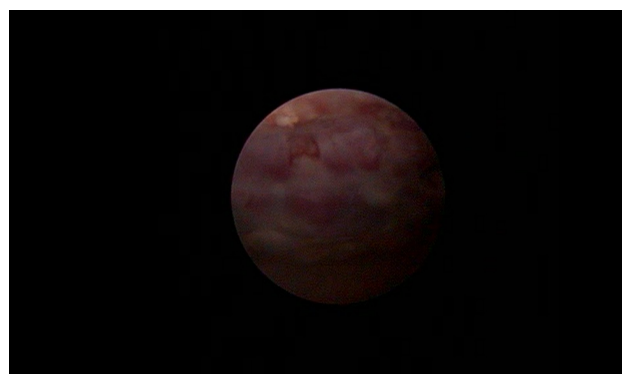
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Conflict of interest

The authors declare no conflict of interest. RO is serving as one of the Editorial Board members of this journal. We declare that RO had no involvement in the peer review of this article and has no access to information regarding its peer review. Full responsibility for the editorial process for this article was delegated to AT.

Appendix

See Video 1.



Video 1. Work-up of women with episodes of acute uterine bleeding following curettage or abortion should include color/power Doppler ultrasonography for the detection of enhanced myometrial vascularity. The embedded movie may also be viewed at <https://doi.org/10.31083/j.ceog4904095>.

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