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The role of ultrasound imaging in the management of partial placental retention after third trimester livebirth

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The role of ultrasound imaging in the management of partial placental retention after third trimester livebirth

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Running head: Ultrasound imaging and partial placental retention

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Abbreviations: RPOC= retained products of conception; D&C= Dilatation & Curettage; CDI= Colour Doppler Imaging; MROP= Manual removal of the placenta.

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Abstract

Objectives: To evaluate the impact of different ultrasound signs in the management and the role of ultrasound guidance in the surgical evacuation of retained placental tissue.

Methods: This is an observational cohort study and retrospective case assessment of 82 patients with clinical symptoms of partial placental retention following a third trimester singleton livebirth between January 2013 and May 2019. The ultrasound signs were recorded using a standardised protocol and the outcome of the management strategy and the use of ultrasound guidance during any surgical procedure was evaluated.

Results: Out of the 64 patients who had a vaginal birth, 25 (39.1%) had a manual removal of the placenta at delivery. Fifteen patients were confirmed as not having retained placental tissue and did not require further treatment. Four patients were referred after failed surgical management and four after failed conservative management. All surgical procedures were vacuum aspiration and forceps removal under continuous ultrasound guidance. A significantly lower gestational age at delivery (p<.05), shorter interval between delivery and ultrasound diagnosis (p<.05) and lower number of patients presenting with heavy bleeding was found in the conservative compared to the surgical management subgroups (p<.05). The incidence of feeding vessels was significantly (p<.05) higher in the surgical than in the conservative management subgroups and associated with increased myometrial vascularity. Six patients developed intra-uterine adhesions. In four of these cases, ultrasound examination showed a

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hyperechoic mass surrounded by normal myometrial vascularity and no feeding vessel.

Conclusions: Ultrasound imaging accurately differentiated between patient with and without partial placental retention after third trimester livebirth. Ultrasound-guided vacuum aspiration is safe and efficient in these cases.

Key Words: Ultrasound imaging; placental retention; surgical management; conservative management.

Introduction

Retention of placenta tissue complicates 0.1% of all vaginal deliveries in low-income countries and 3.0% in middle- and high-incomes countries [1-3]. Variations in its incidence may be due to use of different definitions, diagnostic criteria, access to ultrasound imaging and management protocols. Overall, there has been a rise in rate of manual removal in the UK from a mean of 0.66% in the 1920s to 2.34% births in the 1980s [2]. It has been estimated that placental retention accounts for 10-20% of all cases of postpartum haemorrhage worldwide but its impact on maternal mortality and morbidity varies widely depending on access to preventative measures and active treatment [2,3]. There are no specific data on the epidemiology of partial placental retention.

The etiologies of placental retention include: uterine atony, "trapped" placenta due to closure of the cervix after the birth of the baby and abnormal placental adherence [1,4]. The main risks factors for whole placental retention are preterm birth, grand multiparity, multiple pregnancy, congenital uterine anomalies [1,4,5] and prior placental retention [5-7]. Placental retention is also associated with prior uterine curettage, pre-eclampsia, fetal growth restriction, stillbirth and chorioamnionitis [8,9]. Human placentation is almost unique amongst mammals in that it is physiologically highly invasive [5] but placentation retention has also been described in other mammal species [11,12] suggesting that the main causes of whole placental retention are uterine atony and entrapment. Anomalies of the placental shape and in particular placenta presenting with a succenturiate lobe, loosely connected or not at all connected

(spuria cotyledon) to the main placenta [13] can theoretically also lead to partial placental retention. The main cause of partial retention is failed spontaneous expulsion or incomplete manual removal of a normally shaped placenta.

The diagnosis of complete placental retention is clinical and it is made during the third stage of labour [1,4]. Partial placental retention can lead to heavy bleeding in the immediate post-partum period. If not diagnosed immediately after birth retained placental tissue is associated with persistent vaginal bleeding for more than 14 days after the birth but there is no consensus about the degree and length of vaginal bleeding that is clinically suggestive of placental retention. Common clinical symptoms of placental retention also include lower abdominal pain and persistent cervical dilatation. Fever and leukorrhea suggest the development of endometritis which, if left untreated, can lead to severe maternal morbidity and mortality. Ultrasound examination has been used to identify women with retained products of conception in all three trimesters of pregnancy but there are limited data on the role of ultrasound imaging in the management of partial placental retention. The purpose of the present study was to evaluate the impact of different ultrasound signs in determining the management approach and the role of ultrasound guidance in the surgical evacuation of retained placental tissue.

Materials and methods

Our study group included 82 patients referred to the Early Pregnancy Assessment and Emergency Gynaecology Units at University College London

and King's College Hospital with clinical symptoms of partial placental retention

i.e. persistent unsettling bleeding following a third trimester singleton livebirth

between January 2013 and May 2019. Demographic and clinical characteristics

of the patients, comprising age, parity, gestational age at delivery, mode of

delivery, placental retention, number of days between delivery and ultrasound

examination, amount of vaginal bleeding and management. The amount of

vaginal bleeding was the EPU team as "moderate" or "heavy", with "moderate"

defined as vaginal bleeding exceeding the normal (mild) lochia characteristics, in

amount or duration and "heavy" bleeding as heavier than period-like bleeding,

with or without the presence of blood clots.

In all cases, an ultrasound examination was carried out by experienced

operators using a high-resolution ultrasound equipment (Voluson 730 and E8

expert, GE, USA; Acuson XP/128, Siemens, Mountain View, CA, USA). In most

cases both transvaginal and transabdominal examinations were performed. The

following ultrasound criteria were used to diagnose retained placental tissue: a

well-defined tissue mass within the uterine cavity which was fixed and non-

compressible on palpation. The volume of the retained tissue was calculated

using the formula for an ellipsoid and its echogenicity was defined as normal

when similar to that of placental tissue at term (Figures 1-2) or hyperechogenic

(Figure 2). Colour Doppler imaging (CDI) was used to assess the vascularity of

the retained placental tissue and of the surrounding myometrium. The amount of

blood flow was described semi-quantitatively using Colour Doppler score (1= no

flow; 2= minimal flow; 3= moderate flow; 4= high vascular flow) with the maximal

pulse repetition frequency (PRF) adjusted to the depth of the sample volume.

Women diagnosed with placental tissue retention in our units are offered a

surgical evacuation of the uterus or expectant management depending on their

clinical symptoms and personal preferences. Our selection criteria for expectant

management are hemodynamically stable patient with no or minimal bleeding

and/or abdominal pain and no signs of infection. Patients who did not fulfil the

criteria for expectant management and those who requested surgical evacuation

had the tissue removed in the operating theatre using vacuum aspiration with

forceps extraction when required for large tissue masses under continuous

ultrasound guidance.

Statistical analysis

Statistical analyses were conducted using SPSS (IBM Corp. Released 2017. IBM

SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.). Normality

of distribution was tested using Shapiro-Wilk test. A standard Kurtosis analysis

indicated that some values were not normally distributed and the data are

therefore presented as median and interquartile range (IQR). Categorical

variables were compared between the surgical and conservative management

subgroups using the Pearson's chi-square test or Fisher's exact test when

samples sizes were small. Continuous variables were compared using a Mann-

Whitney (Wilcoxon) W rank test at the 95% confidence interval (CI). Multivariable

logistic regression analysis was conducted to investigate the predictor of surgical

management, to with the outcome coded as 1 for surgery and 0 for conservative treatment. The Hosmer-Lemeshow test for goodness of fit for the regression model was used to evaluate the risk prediction for variables with significant differences between the surgical and conservative management subgroups. A *P* value <0.05 was considered significant.

The protocol and a waiver of consent were approved by the NHS Health Research Authority (REC 18/WM/0328) and the local institutional review boards for each participating site. All ultrasound images were anonymised for the analysis.

Results

We examined the records of a total of 82 patients who were referred for an ultrasound examination for suspected retained placental tissue during the period of the study. Seven patients were referred because of suspicion of abnormally adherent placenta accreta. Overall, there were 45 (54.9%) primiparous, 28 (34.2%) with a maternal age over 35 years, eight (9.8%) patients had a preterm delivery including two who had prolonged premature rupture of the membranes (at 28 and 32 weeks, respectively) and seven (8.5%) had post-term deliveries. Sixty-four (78.1%) patients had a vaginal birth including 25 who had undergone manual removal of a retained placenta (MROP) at delivery. The remaining 18 (21.8%) patients had a cesarean delivery including 13 elective and five emergency procedures.

Out of 82 patients included in the study, 15 were confirmed as not having retained placental tissue on ultrasound examination and did not require further treatment. In patients with partial placenta retention confirmed by ultrasound, 37 had successful primary surgical management, 21 had a successful conservative management, four presented with failed conservative management after MROP, three were referred from other units with previous failed dilatation & curettage (D&C) and two with prior unsuccessful hysteroscopic resection.

Table 1 compares the demographic data and ultrasound features of the patients who had a successful primary surgical or conservative management. Five patients in the surgical management presented with heavy bleeding, pelvic pain and signs of sepsis. In all cases in the surgical management subgroup, the diagnosis of retained placental tissue was confirmed by post-procedure histopathologic examination. All surgical procedures were uncomplicated. A significant lower gestational age at delivery (p<p.05), shorter interval between delivery and ultrasound diagnosis (p<p.05) and lower number of patients presenting with heavy bleeding was found in the conservative compared to the surgical management subgroups (p<.05). The incidence of feeding vessels was significantly (p<.05) higher in the surgical than in the conservative management subgroups. In both subgroups, a feeding vessel was found to be associated with normal placental tissue echogenicity and moderate to high myometrial vascularity around the area of retained placental tissue (Figures 2 & 3). In nine of these cases, all in the surgical management subgroup, the patient presented with heavy bleeding. There was no significant difference between the two subgroups

for the other variables. The univariable logistic regression analysis for each of the covariates significant at the 10% level in the multivariable analysis indicated a significant (p=.048) result at the 5% level for the severity of bleeding at the time of the ultrasound examination. There was no relationship between the volume of retained products and gestational age at delivery or the number of days between delivery and referral for ultrasound examination.

Table 2 displays the characteristics of six patients from the study group who were subsequently diagnosed with secondary oligomenorrhea or amenorrhea due to intra-uterine adhesions (IUAs). In two cases, the patient had had a previous failed hysteroscopic resection and D&C. Two patients had an incomplete vacuum aspiration, one a failed D&C and one patient had a failed conservative management following a diagnosis of partial placental retention nine days after delivery. All patients presented with moderate bleeding and all those who had a failed surgical procedure had it without ultrasound guidance. In four cases of these cases, the ultrasound examination showed a dense hyperechogenic tissue mass containing echogenic spots surrounded by normal (minimal) myometrial vascularity (Figure 2). No feeding vessels were found in any of these cases. All patients were successfully managed with vacuum suction and forceps removal under ultrasound guidance and histopathology confirmed retained placental tissues in all cases. All patients were discharged on the same as the surgical procedure and did not require additional care.

Discussion

The results of our study generally confirm previous findings showing that a MROP is the main predisposing factor leading to patients being referred for an ultrasound examination. It also confirms that ultrasound imaging is accurate at identifying partial placental retention after third trimester delivery and in excluding patients who do not have retained tissue. Our study shows that in addition to a change in the vascularity of the myometrium, CDI can identify feeding vessels and that these are more frequently found in patients in surgical management subgroup. Overall, we found that ultrasound features are not directly correlated with gestational age at delivery and the number of days between delivery and the ultrasound examination. There were no case of uterine perforation in the subgroup managed surgically indicating that ultrasound guided suction aspiration of retained placental tissue is efficient and safe.

The primary limitations of our cohort study lie in its retrospective nature and the lack of population data. In particular, we could not assess why around one fifth of the patients included in our study had placental retention after cesarean delivery without any evidence of placenta accreta spectrum. In addition, the decision to perform or not a surgical procedure was based on both patient clinical symptoms and individual patient choice at the time of diagnosis and not exclusively on ultrasound criteria. This can explain why patients in the surgical management subgroup had a significantly (p<.005) higher incidence of prolonged heavy bleeding with median of 35 days between delivery and

ultrasound diagnosis as this probably contributed to the patient's decision to have a surgical procedure.

The first studies on the use of ultrasound imaging in the diagnosis of retained products of conception (RPOC) were published in the early 1970s by Robinson [14] on first trimester incomplete miscarriage and Malvern et al [15] on partial placental retention after term deliveries. The advent of high-resolution ultrasound and CDI has allowed the accurate diagnosis of retained placental tissue in all three trimesters of pregnancy [15-29]. The aim of ultrasound diagnosis is to prevent unnecessary surgical procedures, which can lead to uterine perforation and increase the risk of development of IUAs [30,31]. Most authors [16,17,20,21,23,25,26,28] have described partial placental retention as an endometrial mass of varying size on grey-scale ultrasound, with a with sensitivity range of 28.5–100% and positive predictive value (PPV) of 47–87.5%. The description of the retained tissue's echogenic profile varies widely in the international literature including terminology such as echogenic retained fragments [20] or mass [21,23], mixed-echo residual trophoblastic tissue [18,20] or pattern [23], heterogeneous mass [16] and endometrial stripe [25]. The addition of CDI features and in particular of the presence of increased or marked myometrial vascularity around the retained tissue mass has been shown to improve the accuracy of ultrasound imaging to around 60-70% [20,21,25,26,29] and thus reduced the need for surgical intervention in patients without these characteristics [24]. Three-dimensional (3D) ultrasound has been found to add little or no diagnostic power compared to 2D ultrasound [28].

Several authors of cohort studies on the use of ultrasound in the diagnosis of retained tissue have included data from mainly from first and second trimester miscarriages [21,24,25,29]. This could explain the wide variation in the ultrasound detection rate of retained product in these studies. In first- and early second-trimester miscarriages, the RPOC is essentially made of decidua and blood clots and relatively small amount of degenerative villous tissue [32]. Our study is one of the few studies focussed on partial placental retention after third trimester livebirth. The main mechanism leading to early pregnancy failure is the premature entry of maternal blood into the placenta and thus the retained tissue mass is often heterogeneous on ultrasound imaging depending on the amount of blood clots [33]. By contrast, the fully formed third trimester retained placental cotyledon is often homogeneous and of normal echogenicity in over two-third of the cases as shown in the present study (Table 1). The presence of feeding vessels and increased surrounding myometrial vascularity in 18 out of the 58 cases (32.1%) suggest that villous tissue in the retained placental mass can remain biologically active for several weeks after delivery. With time after delivery, fibrin accumulates within and around the mass increasing its echogenicity and its vascularity disappear. The presence of degenerative fibrotic tissue and chronic uterine bleeding almost certainly induces a permanent local inflammatory reaction impairing the normal re-epithelisation of the uterine cavity and increasing the formation of intra-uterine adhesions (Asherman's syndrome) [34], in particular in patients who have undergone repeat surgical procedures

with the additional mechanical trauma and sub-clinical and prolonged endometritis (Table 2).

Most studies on the management of retained placental tissue have focused on RPOC after first trimester miscarriage. Blind vacuum aspiration for first trimester incomplete miscarriage has been found to be faster and associated with less bleeding and less pain that blind sharp metal curettage [30]. A recent systematic review found that hysteroscopic resection is associated with fewer IUAs and incomplete evacuation of RPOC than medical therapy with misoprostol or D&C [31]. The same authors also found that intrauterine application of auto-crosslinked hyaluronic acid (ACP) gel reduces the incidence and severity of IUAs [35] but these data are limited by small numbers and lack of correlation between ultrasound features and outcome. Our study confirms that ultrasound-guided vacuum aspiration is safe, quick to perform and efficient as the primary option for partial placental retention after third trimester livebirth but also after failed surgical or conservative management including in patients suspect of placenta accreta.

In conclusion, technical advances in ultrasound imaging and increased expertise has enabled greater accuracy in diagnosing RPOC after miscarriage or stillbirth delivery and partial placental retention after third-trimester livebirth. As the ultrasound features of first trimester RPOC are different from those of third-trimester retained placental tissue there is a need to use tailored standardised ultrasound diagnostic protocols. At least a third of patients are referred for suspected placental retention after MROP and thus basic ultrasound training of

delivery suite staff should include the diagnosis of retained placental tissue.
There is a need for prospective studies to further evaluate the time cut-off
between delivery and referral of the patient for ultrasound examination, the use of
standardised ultrasound imaging signs on management options for
haemodynamically stable patient and on the long-term reproductive outcome.

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Disclosure statement

No potential conflict of interest is reported by the authors.

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Figure legends

Fig.1: Transvaginal longitudinal views of the ultrasound cavity showing retained placental tissue: Left (*) surrounded by normal myometrial vascularity; Right (*) with a large feeding vessel surrounded by moderate myometrial vascularity

Fig 2: Transvaginal longitudinal view of the ultrasound cavity showing retained placental tissue : Left (*) with large feeding vessels surrounded by high myometrial vascularity; Right (*) surrounded by minimal myometrial vascularity.

Table 1. Comparison of maternal demographics and ultrasound characteristics of the surgical and conservative subgroups. Numerical data are presented as median (interquartile range) and categorical data as n (%).

Variable	Surgical management (n=37)	Conservative management (n=21)	P
Maternal age (years)	34.0 (31.0;37.0)	34.0 (31.0;37.0)	0.564
Parity	1.0 (1.0;2.0)	2.0 (1.0;2.0)	0.185
Gestational age at delivery (weeks)	40.0 (39.0-40.0)	39.0 (38.0-40.0)	**0.019**
Vaginal delivery	28 (75.7%)	14 (66.7%)	0.461*
Caesarean delivery	9 (24.3%)	7 (33.3%)	
MROP	12 (32.4%)	4 (19.1%)	0.273*
Interval delivery-ultrasound diagnosis (days)	35.0 (17.0;49.0)	14.0 (10.0;28.0)	**0.031**
Bleeding - Moderate - Heavy	24 (64.9%) 13 (35.1%)	20 (95.2%) 1 (4.8%)	**0.022***
Tissue volume (cm³)	7.5 (2.5;16.0)	5.0 (1.1;8.0)	0.074
Tissue echogenicity - Normal - Hyperechoic	26 (70.3%) 11 (29.7%)	14 (66.7%) 7 (33.3%)	0.776*
Myometrial vascularity - Minimal to moderate - High	18 (48.6%) 19 (51.4%)	15 (71.4%) 6 (28.6%)	0.159*
Feeding vessel - No - Yes	22 (59.5%) 15 (40.5%)	18 (85.7%) 3 (14.3%)	**0.038***

*Chi-square statistics.

Table 2: Characteristic of 6 patients who were diagnosed with intrauterine adhesions following partial placental retention.

Variable	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6
History	Failed hysteroscopy & D&C	Failed D&C	Incomplete primary vacuum aspiration	Failed conservative	Incomplete primary vacuum aspiration	Failed hysteroscopy & D&C
Maternal age (years)	31	34	44	36	33	30
Parity	2	3	1	1	1	2
Gestational age at delivery (weeks)	35 (PROM at 27 weeks)	39	38	38	38	40
Mode of delivery	VD and MROP	CS	VD	VD	VD	CS
Interval delivery-ultrasound diagnosis (days)	150	90	22	9 + 32	28	125
Amount of bleeding	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Tissue volume (cm^3)	30	16	3	19	13	15
Tissue echogenicity	Hyperechoic	Hyperechoic	Normal	Hyperechoic	Normal	Hyperechoic
Myometrial vascularity	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal
Feeding vessel	No	No	No	No	No	No

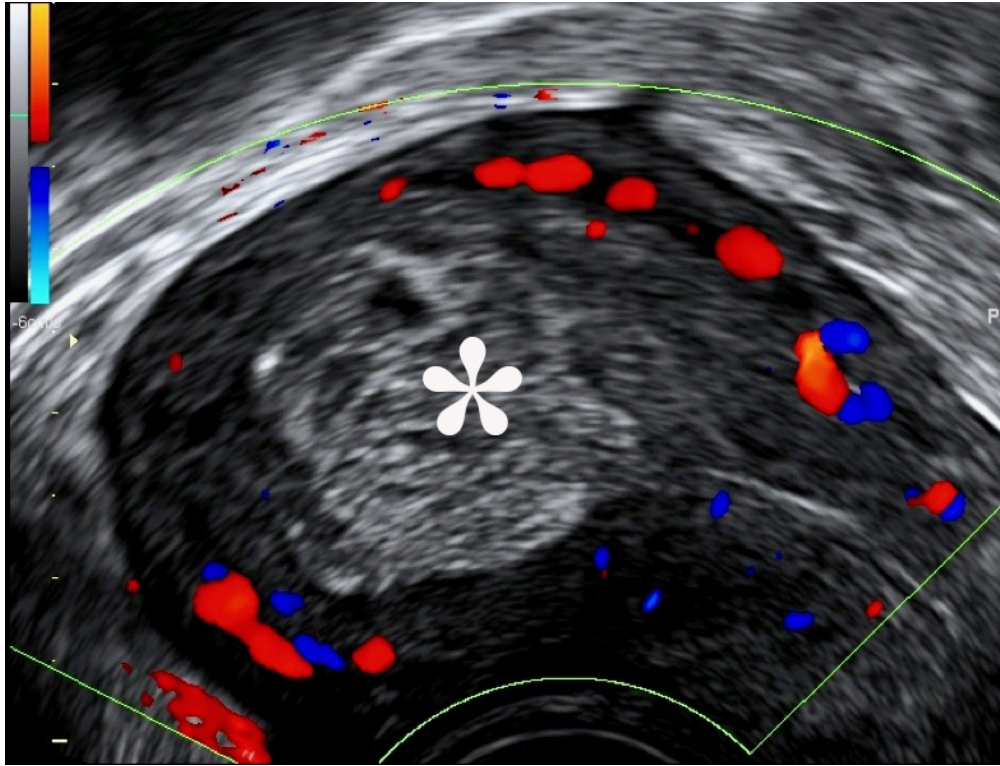D&C= dilatation & curettage; MROP= manual removal of a retained placenta.

Figure 1 Left

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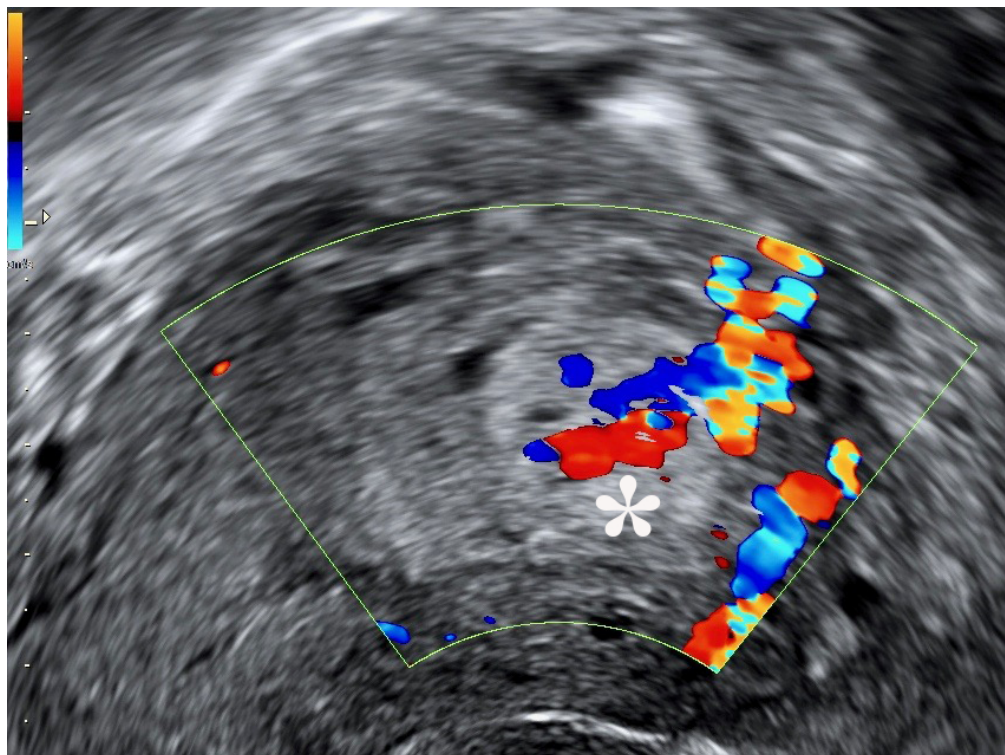44
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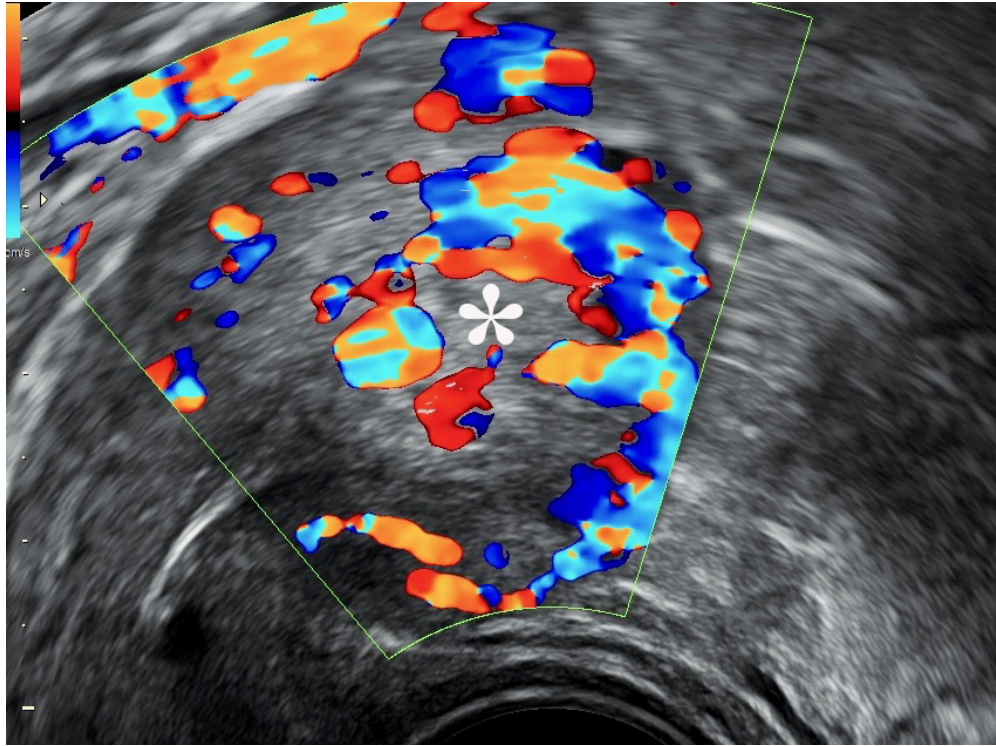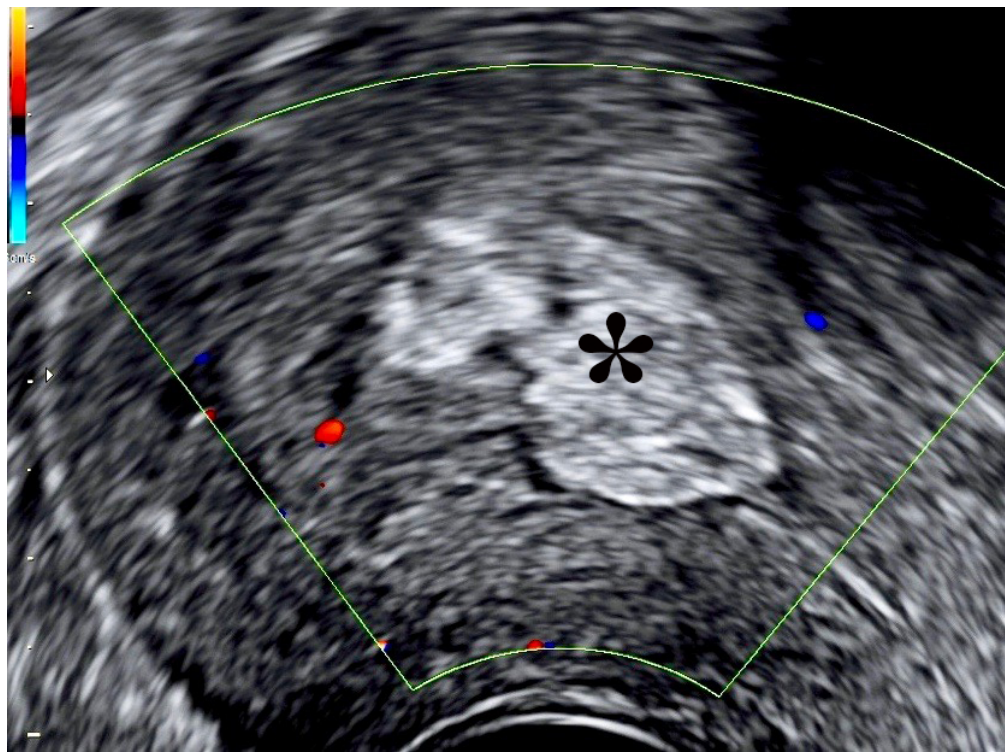54
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Figure 1 right

Figure 2 left

Figure 2 Right