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Natural history of endometriosis in pregnancy: ultrasound study of morphology of deep endometriosis and ovarian endometrioma

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CONTRIBUTION

What are the novel findings of this work?
For the majority of women, both ovarian endometrioma and deep endometriotic nodules regress during pregnancy. We describe a common behavior of endometriotic lesions in pregnancy, applicable to both ovarian endometrioma and nodules, whereby an increase in size and morphological features of decidualization are observed in the first and second trimesters, followed by regression in later pregnancy.

What are the clinical implications of this work?
The appearance of endometriosis in pregnancy can raise suspicion of malignancy, leading to surgical intervention and subsequent morbidity to the mother and fetus. Better understanding of the behavior of endometriosis in pregnancy is vital to reduce unnecessary procedures and provide accurate counseling to women regarding their condition.

ABSTRACT

Objective *To assess the morphological appearance of deep endometriosis and ovarian endometrioma in pregnancy using pelvic ultrasound examination.*

Methods *This was a prospective observational cohort study conducted over 3 years at University College London Hospital, which is a tertiary level referral unit for early pregnancy complications and an accredited endometriosis center. All women who participated provided written consent and were invited for surveillance ultrasound examination at the time of their routine scans in pregnancy. All scans were performed by a single operator to eliminate interobserver variability. The change in size of ovarian endometrioma and nodules was reported as change in their mean diameter. Ovarian endometrioma with irregular thick inner walls, hyperechoic papillary projections and/or high vascularity and hyperechoic nodules with moderate to high vascularity were reported as decidualized.*

Results *Sixty-five women with a live, normally sited pregnancy and concomitant ultrasound features of deep and/or ovarian endometriosis were included in the study. The median age of the study population was 34 (range, 23–44) years, and the median gestational age at presentation was 7 + 6 (range, 3 + 6 to 18 + 0) weeks. From the cohort, 47/65 (72%) were nulliparous, 48/65 (74%) had a previous diagnosis of endometriosis and 19/65 (29%) conceived via* in-vitro *fertilization. There were 10/65 (15% (95% CI, 7–24%)) women with ovarian endometrioma alone, 28/65 (43% (95% CI, 31–55%)) with endometriotic nodules alone and the remaining 27/65 (42% (95% CI, 30–54%)) had both. Of the women with ovarian endometrioma who underwent follow-up, 29/34 (85% (95% CI, 73–97%)) experienced cyst regression, 2/34 (6% (95% CI, 0–14%)) experienced cyst growth, and in 3/34 (9% (95% CI, 0.0–18%)) women, cyst size was unchanged. In 10/34 (29% (95% CI, 14–45%)), there was complete resolution of all cysts. Of the women with nodules who underwent follow-up, 43/51 (84% (95% CI, 74–94%)) experienced nodule regression, 2/51 (4% (95% CI, 0–9%)) experienced nodule growth and, in 6/51 (12% (95% CI, 3–21%)) women, nodule size was unchanged. In 4/51 (8% (95% CI, 0–15%)) women, there was complete resolution of all nodules.*

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In 5/37 (14% (95% CI, 3–25%)) women who attended postnatal follow-up, complete resolution of all endometriotic lesions occurred during pregnancy. In 10/34 (29% (95% CI, 14–45%)) women with ovarian endometrioma and 27/51 (53% (95% CI, 39–67%)) women with nodules, a pattern of growth was observed in the first and second trimesters, followed by regression later in pregnancy. Features of decidualization were observed in 17/34 (50% (95% CI, 33–67%)) women with ovarian endometrioma, most commonly in the first trimester, and in 25/51 (49% (95% CI, 35–63%)) women with nodules, most commonly in the second trimester.

Conclusions *For the majority of women, despite features of decidualization being common in the first and second trimesters, ovarian endometrioma and deep nodules regress during pregnancy. Morphological changes of endometriosis in pregnancy are difficult to differentiate from characteristics of malignant lesions. Better understanding of the appearance of endometriosis in pregnancy is vital to minimize intervention and help counsel women regarding their condition.* © *2023 The Authors. Ultrasound in Obstetrics & Gynecology published by John Wiley & Sons Ltd on behalf of International Society of Ultrasound in Obstetrics and Gynecology.*

INTRODUCTION

Endometriosis is a common benign gynecological condition that is estrogen-dependent and characterized by the presence of endometrial-like tissue outside of the endometrial cavity. Endometriosis can be subdivided into peritoneal endometriosis, deep endometriosis (DE) and endometrioma[1]. Endometriosis can be associated with severe pain symptoms and, in some women, has adverse effects on their quality of life[2]. Ovarian endometrioma accounts for 4–5% of ovarian lesions detected in early pregnancy[3]. DE and endometrioma are thought to affect approximately 5% of women in pregnancy, with up to 50% of them being unaware of their condition[4].

Pregnancy has been shown to have a major effect on the size and morphological features of ovarian endometrioma. Pateman *et al.* described the natural history of ovarian endometrioma in 24 pregnant women, demonstrating features of decidualization in 12% of cases and a tendency of the lesion to decrease in size during pregnancy[5]. Decidualization of endometriotic lesions is thought to be due to hormonally induced pregnancy-related modifications leading to rapid development of vascularized intracystic excrescences. Decidualization of an endometriotic cyst during pregnancy was first described by Miyakoshi in 1998[6], and sonographic features of decidualized endometrioma in pregnancy have been well-described in the literature, as this phenomenon may raise the suspicion of ovarian malignancy[7]. The first description of decidualized DE was provided by Chertin *et al.* in 2007[8]. Although decidualized DE was originally thought to be relatively rare, our recent study on the prevalence of endometriosis in pregnancy demonstrated ultrasound features of decidualization in one-third of women with DE attending for early pregnancy care[4]. The aim of this study was to describe the morphological appearance of endometriotic lesions in pregnancy, including change in size of lesions and frequency of decidualization.

METHODS

This was a prospective observational cohort study performed in a dedicated early pregnancy unit at University College London Hospital between September 2017 and September 2020. Women between the ages of 18 and 50 who presented with ultrasound features of DE and/or endometrioma in early pregnancy and consented to participate in the study were included. Patients were excluded if they were unable to provide written consent, tolerate transvaginal ultrasound or commit to follow-up. Patient demographic data, indication for attendance at the early pregnancy unit and detailed medical history were recorded. Age, ethnicity, body mass index (kg/m^2), smoking status, gravidity and parity were reported. We also recorded gynecological history, including previous diagnoses, such as endometriosis. All scans were performed in a standard fashion using a 7.5-MHz probe (Voluson E8; GE Healthcare, Zipf, Austria). First, assessment of the location, gestational age and viability of the pregnancy was performed. The adnexa, and anterior and posterior compartments of the pelvis were examined in accordance with the systematic approach described by the International Deep Endometriosis Analysis (IDEA) consensus[9]. Women were considered to have a diagnosis of endometriosis if they had evidence of ovarian endometriotic cysts (endometrioma) and/or deep endometriotic nodules on pelvic ultrasound scan. Ovarian endometriotic cysts were defined as thick-walled and well-circumscribed cysts with low-level internal echogenicity ('ground glass')[10]. Cysts were described as decidualized if they demonstrated an irregular thick inner cyst wall, hyperechoic papillary projections and/or high vascularity on Doppler examination[7]. Endometriotic nodules were defined as hypoechoic or isoechoic solid lesions with irregular borders that were fixed to the surrounding pelvic structures[9,11]. They were described as located either within the posterior compartment of the pelvis, anterior compartment of the pelvis, rectosigmoid colon or as extrapelvic. Nodules were described as decidualized if they appeared hyperechoic with moderate to high vascularity on color Doppler examination[12,13]. Women were invited to undergo surveillance ultrasound assessment of their endometriotic lesions at the same time as their routine antenatal scans in each trimester of pregnancy. In instances in which women had previously been known to the reproductive medicine or endometriosis teams, the findings of ultrasound examinations performed prior to their pregnancy were also included in the analysis. Some women opted to return 3 months following delivery for a further ultrasound assessment.

All examinations were performed by a single operator (E.B.) to eliminate interobserver variability[14].

Endometriotic cysts and nodules were measured in three orthogonal planes and the mean diameter was then calculated and reported. Changes in size of cysts and nodules were reported as change in mean diameter (mm). Surrounding ovarian tissue and cyst capsule were not included in the measurements of the ovarian cyst.

Statistical analysis was performed using SPSS software (SPSS Inc., Chicago, IL, USA). All clinical findings were stored in a clinical database that facilitated data entry and retrieval (PIA-Fetal Database; ViewPoint Bildverarbeitung GmbH, Wessling, Germany). The Kolmogorov–Smirnov test was used to test for normal distribution of continuous variables. Age and endometriotic lesion dimensions were not normally distributed and were expressed as median (range). Proportions were expressed as % (95% CI).

Ethical approval was obtained from the West Midlands – Coventry & Warwickshire Research Ethics Committee on 26 September 2017 (reference: 17/WM/0315). The study was registered in the Research Registry (unique identifying number: researchregistry4569). The study was performed as a planned secondary analysis of the original study entitled 'The prevalence of endometriosis in pregnancy and its impact on maternal and fetal health', in which sample size calculation was performed according to the risk of preterm birth in women with pelvic endometriosis. Recruitment of participants was limited to the time period in which the single operator was employed as the clinical research fellow in the department of gynecology at University College London Hospital. All women who were included in the study provided written consent.

RESULTS

The study cohort consisted of 65 women who attended the early pregnancy unit with suspected early pregnancy complications and were found to have a live, normally sited (eutopic) pregnancy and concomitant ultrasound features of endometriosis. Forty-three of these women were also included in our previous study[4]. Patient demographics and clinical characteristics are shown in Table 1. Primary indications for attendance at the early pregnancy unit are shown in Table 2. Over the study period, two patients suffered a first-trimester miscarriage and two patients opted for termination of pregnancy, one due to a diagnosis of trisomy 21 and the other due to recurrent hemorrhage in the first trimester. A further two patients declined transvaginal scan at their follow-up appointments. All women were managed expectantly during the study period. One woman who had a Cesarean section scar nodule underwent excision of the lesion during elective Cesarean section. Histological examination of the specimen demonstrated fibroadipose tissue containing foci of endometriosis. A flowchart outlining patient selection and follow-up is presented in Figure 1.

Of the 65 women included in the study, 10 (15.4% (95% CI, 6.6–24.2%)) had endometrioma alone, 28 (43.1% (95% CI, 31.1–55.1%)) had deep endometriotic nodules alone and the remaining 27 (41.5% (95% CI, 29.5–53.5%)) had evidence of both endometrioma and deep nodules. Of the 37 women with endometrioma, 26 (70.3% (95% CI, 55.6–85.0%)) had a single cyst and 11 (29.7% (95% CI, 15.0–44.4%)) had multiple cysts. The size of endometriotic lesions at the first attendance in pregnancy is shown in Table 3.

Thirty-four women with endometriotic cysts attended for a follow-up assessment. When comparing the initial scan findings with the final follow-up assessment, 29/34 (85.3% (95% CI, 73.4–97.2%)) women experienced cyst regression, 2/34 (5.9% (95% CI, 0.0–13.8%)) experienced cyst growth and, in 3/34 (8.8% (95% CI, 0.0–18.4%)) women, cyst size was unchanged. In 10/34 (29.4% (95% CI, 14.1–44.7%)) women, there was complete resolution of all endometriotic cysts. For the majority of women who had multiple cysts, a similar pattern of change was observed in all cysts. In 8/11 (72.7% (95% CI, 46.4–99.0%)) women, regression of all cysts was observed, while in the remaining three women, the largest cyst was unchanged or slightly increased in size, but the smaller of the cysts regressed. Figure 2a demonstrates the change in size of endometriotic cysts over advancing gestation. In women who had multiple

Table 1 Demographic and clinical characteristics of women included in study ($n = 65$)

Characteristic	*Value*
Age (years)	34 (23–44)
BMI (kg/m^2)	23.5 (16.1–36.2)
Smoker	2 (3.1)
Ethnicity	
Caucasian	39 (60.0)
South Asian	10 (15.4)
Afro-Caribbean	6 (9.2)
East Asian	6 (9.2)
Mixed/other	4 (6.2)
Parity	
0	47 (72.3)
1	12 (18.5)
2+	6 (9.2)
Gravidity	
1	37 (56.9)
2	15 (23.1)
3+	13 (20.0)
GA at presentation (weeks)	7 + 6 (3 + 6 to 18 + 0)
Previous diagnosis of endometriosis	48 (73.8)
Conceived via IVF	19 (29.2)

Data presented as median (range) or *n* (%). BMI, body mass index; GA, gestational age; IVF, *in-vitro* fertilization.

Table 2 Primary indication for attendance at early pregnancy unit ($n = 65$)

Indication	n *(%)*
Vaginal bleeding	21 (32.3)
Pelvic pain	19 (29.2)
Reassurance scan	17 (26.2)
Referral for suspected adnexal mass	5 (7.7)
Pain and bleeding	2 (3.1)
Referral for enlarging umbilical lesion	1 (1.5)

cysts, the largest cyst was used to demonstrate change in size over advancing gestation. For 10/34 (29.4% (95% CI, 14.1–44.7%)) women, there was a pattern of cyst growth during the first and second trimesters, followed by cyst regression during the remainder of the pregnancy and the postnatal period. In all women who experienced this phenomenon, ultrasound scans showed features of decidualized endometriotic cysts.

A total of 17/34 (50.0% (95% CI, 33.2–66.8%)) women experienced decidualization of endometriotic cysts during pregnancy. For the majority of women with multiple cysts and features of decidualization, a similar pattern was seen in all cysts. In 6/7 (85.7% (95% CI, 42.1–99.6%)) women with multiple cysts and features of decidualization, all cysts were affected. Decidualization of cysts during pregnancy was most commonly seen during the first-trimester dating scan. Table 4 shows the location of endometriotic lesions and proportion that demonstrated sonographic features of decidualization during the study period.

In the 55 women with evidence of endometriotic nodules, the most common site was the posterior pelvic compartment. The median number of nodules was 2 (range, 1–7)) per woman. Bowel involvement was diagnosed in 17/65 (26.2% (95% CI, 15.5–36.9%)) women with endometriosis and 2/65 (3.1% (95% CI, 0.0–7.3%))

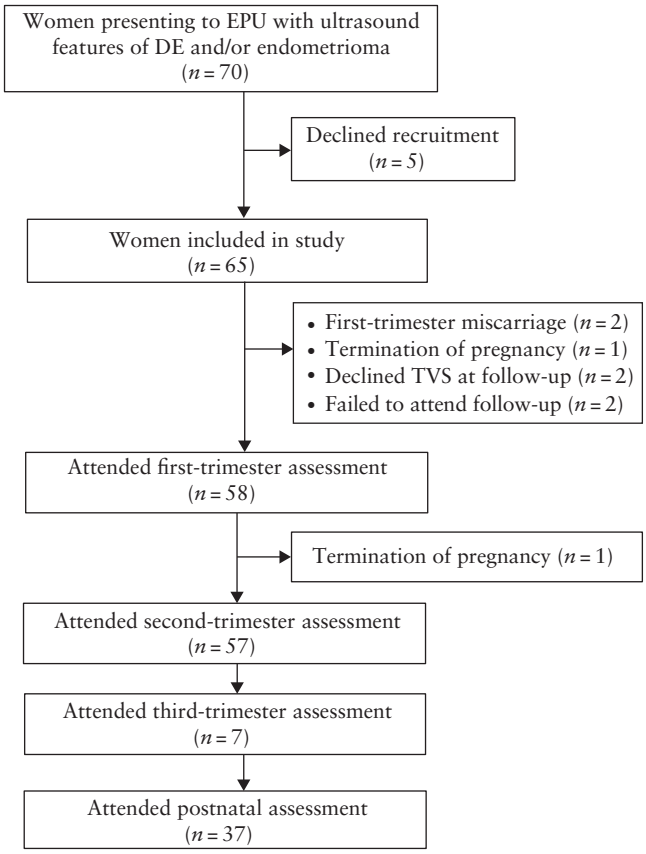

Figure 1 Flowchart summarizing inclusion and follow-up of women presenting to early pregnancy unit (EPU) with ultrasound features of deep endometriosis (DE) and/or ovarian endometrioma. TVS, transvaginal ultrasound.

Table 3 Size of endometriotic lesion on ultrasound at initial examination in pregnancy ($n = 65$)

Lesion	*Mean diameter (mm)*
Endometriotic cyst	29.5 (11.3–82.3)
Endometriotic nodule	
Posterior pelvis	10.0 (3.0–32.3)
Rectosigmoid colon	11.7 (6.3–21.7)
Anterior pelvis	18.0 (16.7–19.3)
Extrapelvic*	14.5 (8.3–20.7)

Data presented as median (range). *Umbilical and Cesarean section scar nodules.

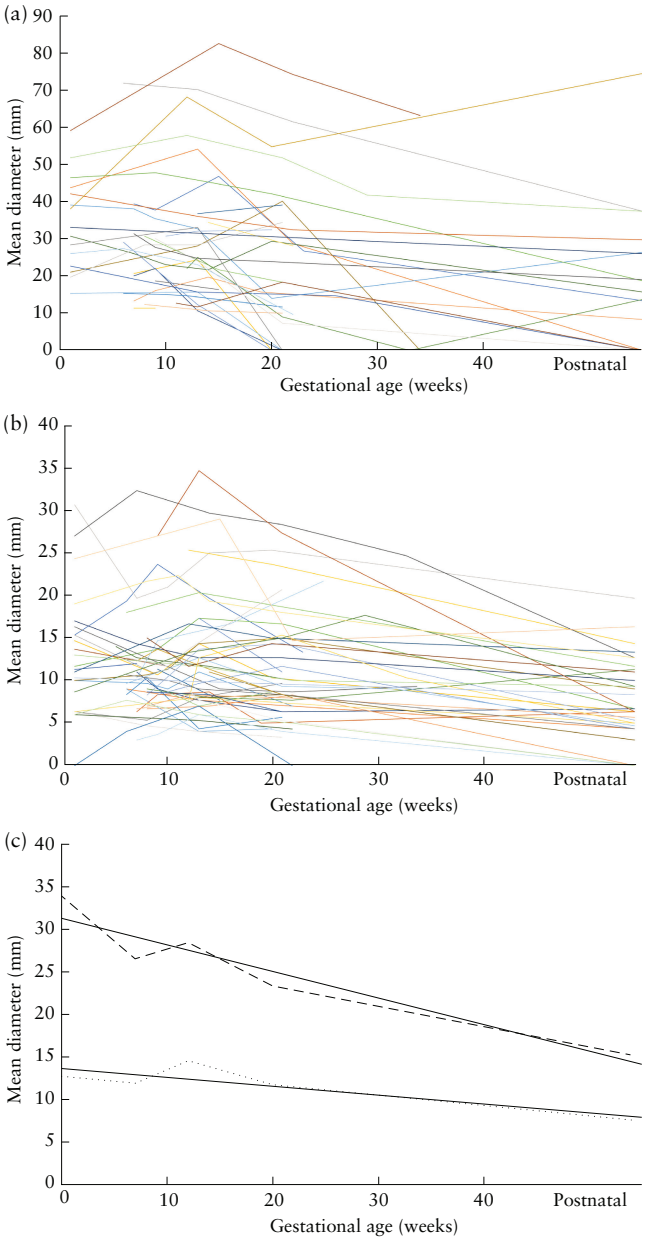

Figure 2 (a,b) Change in size of endometriotic cysts (a) and nodules (b) per woman with advancing gestation. (c) Mean change in size for all women of endometriotic cysts (– –) and nodules (·····) with advancing gestation, with linear trend line for each (——). Largest cyst was used to demonstrate change in size with advancing gestation.

Table 4 Proportion of endometriotic lesions that demonstrated features of decidualization on ultrasound, according to location and time of assessment

Lesion	*Overall*	*Prepregnancy*	*EPU scan**	*First-trimester dating scan*	*Second-trimester anomaly scan*	*Third-trimester growth scan*	*Postnatal*
Endometriotic cyst	25/52 (48.1)	0/31 (0)	4/35 (11.4)	22/47 (46.8)	15/36 (41.7)	1/2 (50.0)	0/19 (0)
Endometriotic nodule							
Posterior pelvis	45/92 (48.9)	0/41 (0)	5/70 (7.1)	34/86 (39.5)	38/80 (47.5)	4/9 (44.4)	0/55 (0)
Rectosigmoid colon	12/21 (57.1)	0/11 (0)	2/17 (11.8)	10/17 (58.8)	9/17 (52.9)	0/0 (0)	0/16 (0)
Anterior pelvis	3/4 (75.0)	0/4 (0)	3/4 (75.0)	3/4 (75.0)	0/4 (0)	0/0 (0)	0/3 (0)
Extrapelvic†	1/2 (50.0)	0/2 (0)	0/1 (0)	0/1 (0)	1/2 (50.0)	1/1 (100)	0/0 (0)

Data presented as *n*/*N* (%). *Scan at early pregnancy unit (EPU) prior to 10 + 6 weeks. †Umbilical and Cesarean section scar nodules.

had evidence of bladder/vesicouterine involvement. One woman had an endometriotic nodule within her Cesarean section scar and another woman had a nodule in the region of her umbilicus.

Fifty-one women with nodules attended for a follow-up assessment. When comparing the initial scan findings with the final follow-up assessment, 43/51 (84.3% (95% CI, 74.3–94.3%)) experienced nodule regression, 2/51 (3.9% (95% CI, 0.0–9.2%)) experienced nodule growth and, in 6/51 (11.8% (95% CI, 2.95–20.7%)) women, nodule size was unchanged. In 6/51 (11.8% (95% CI, 2.95–20.7%)) women, there was complete resolution of at least one nodule, which included 4/51 (7.8% (95% CI, 0.0–15.2%)) women who experienced complete resolution of all nodules. In almost all women with multiple nodules, the pattern of change was similar in all nodules, irrespective of their location. The only exception to this was one woman who demonstrated growth of a bowel nodule on her second-trimester anomaly scan while all other nodules appeared to regress. However, we were unable to evaluate the progression in later pregnancy and the postnatal period, as she did not attend the postnatal follow-up.

Figure 2b demonstrates the change in size of endometriotic nodules over advancing gestation. In women who had multiple nodules, the largest nodule was used to demonstrate change in size over advancing gestation. Similar to the phenomenon observed in endometriotic cysts, in 27/51 (52.9% (95% CI, 39.2–66.6%)) women, there was a pattern of endometriotic nodule growth in early pregnancy, followed by nodule regression during later pregnancy and the postnatal period. In 16/27 (59.3% (95% CI, 40.8–77.8%)) women who experienced this phenomenon, ultrasound scans showed features of decidualized endometriotic nodules. A total of 25/51 (49.0% (95% CI, 35.3–62.7%)) women experienced decidualization of endometriotic nodules during pregnancy, and these findings were most commonly seen during the second-trimester anomaly scan.

Among the 37 women who attended for a postnatal follow-up ultrasound, 5/37 (13.5% (95% CI, 2.5–24.5%)) experienced complete resolution of all endometriotic lesions. Figure 2c shows the change in mean size of endometriotic cysts and nodules over the study period. Trend lines demonstrated a similar pattern and tendency of both endometriotic cysts and nodules to regress in size during pregnancy.

Figures 3 and 4 illustrate the changing appearance of ovarian endometrioma and endometriotic nodules during pregnancy, respectively. Figure 5 shows the sonographic appearance of nodules in the urinary bladder and rectosigmoid colon, and a decidualized lesion involving the Fallopian tube. Figure 6 shows the sonographic and corresponding macroscopic appearance of a decidualized umbilical endometriotic nodule (Villar's nodule).

DISCUSSION

The principal finding of this study is that the behavior of endometriosis in pregnancy is variable in nature. For most women, both cysts and nodules regress in size over advancing gestation, with some experiencing complete regression of all lesions. The phenomenon of decidualization is common, and lesions frequently grow during early pregnancy before regressing in later pregnancy and the postnatal period.

The effect of pregnancy on the morphology of endometriotic cysts is well-described in the existing literature[15]. This is the first prospective observational study to describe the morphology of both endometriotic cysts and nodules in pregnant women, including size and frequency of decidualization, in which all women were managed expectantly.

The relationship between pregnancy and endometriotic cysts was first described in the work of Meigs, who reported cyst regression and even disappearance during pregnancy[16]. The theory of pregnancy-related hormonal changes resulting in endometriotic cyst regression has been well-described in the literature[17–21]. Ueda *et al.* observed that, during pregnancy, the size of endometriotic cysts decreased in 52%, was unchanged in 28% and increased in 20% of cases[22]. Similar findings were also reported by Benaglia *et al.*[23]. In our study, we observed cyst regression in 85% and complete resolution of all cysts in 29% of women, which supports published findings that cyst regression tends to occur in the majority of women during pregnancy. We were also able to report on the behavior of deep nodules and found that 84% of women experienced nodule regression, and in 8% of women, there was complete resolution of all nodules.

Decidualization of endometriotic lesions results from changes in the hormonal milieu associated

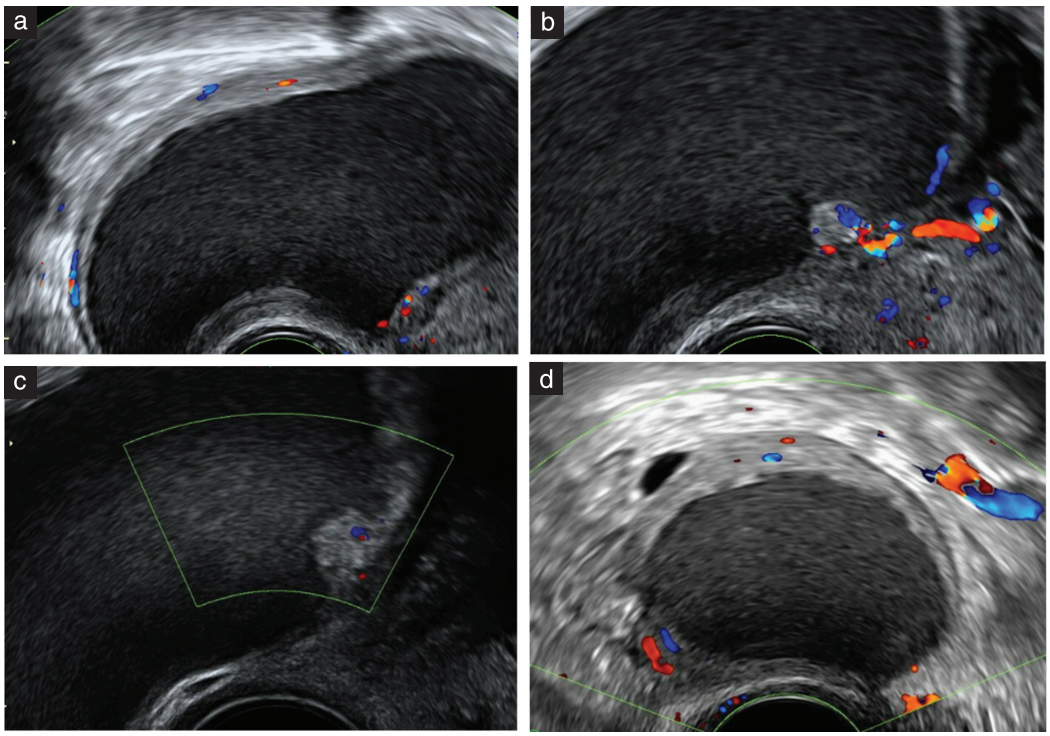

Figure 3 Transvaginal color Doppler images showing transverse view of left ovary in 42-year-old primigravida presenting with light vaginal bleeding. (a,b) Examination at presentation at 9 + 6 weeks' gestation revealed unilocular thick-walled cyst containing hypoechoic fluid, measuring 72 mm in mean diameter (a) and containing prominent solid papillary projection that demonstrated high vascularity (b), consistent with decidualized endometrioma. (c) At 12 weeks' gestation, cyst was reduced in size, measuring 70 mm in mean diameter, and papillary projection was less prominent with weaker color Doppler signal. (d) At postnatal follow-up, cyst measured 37 mm in mean diameter, appearance was typical of ovarian endometrioma and all features of decidualization had resolved.

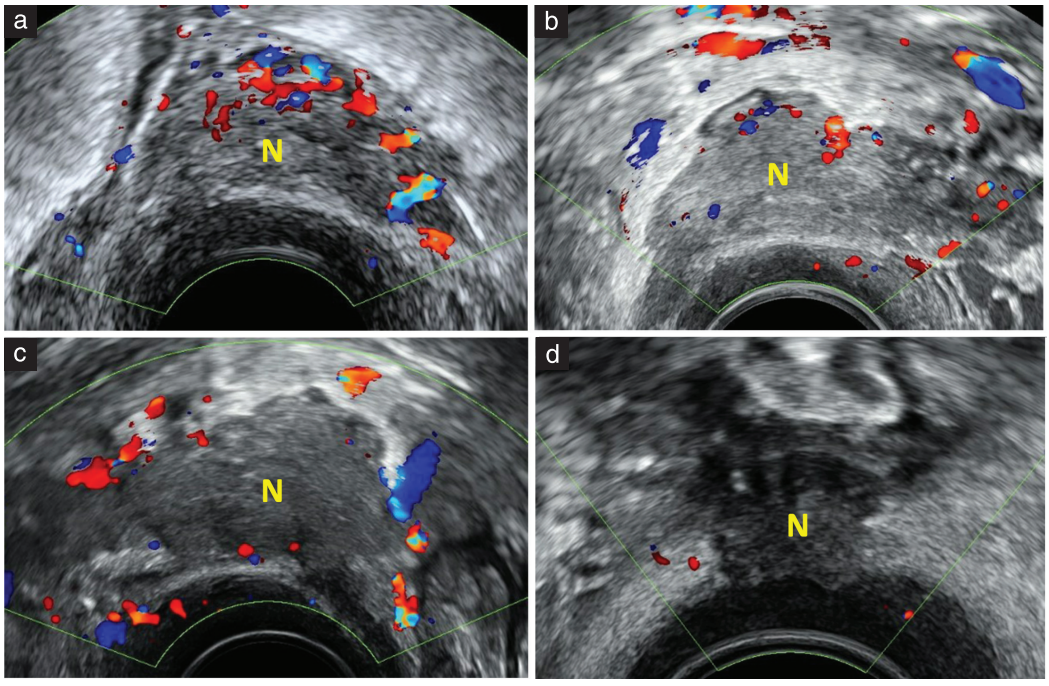

Figure 4 Transvaginal color Doppler images showing longitudinal view of posterior pelvic compartment in 32-year-old multiparous patient with known history of pelvic endometriosis and rectovaginal nodule (27 mm mean diameter) that was managed expectantly prior to pregnancy. (a) Examination at 12 weeks' gestation revealed solid hyperechoic lesion with irregular blurred borders measuring 30 mm in mean diameter that was fixed to neighboring bowel and demonstrated increased vascularity, in keeping with decidualized endometriotic nodule (N). (b,c) As pregnancy progressed, nodule reduced in size, measuring 28 mm in mean diameter at 20 weeks (b) and 25 mm at 32 weeks (c). (d) At postnatal follow-up, nodule measured 13 mm in mean diameter and all features of decidualization had resolved.

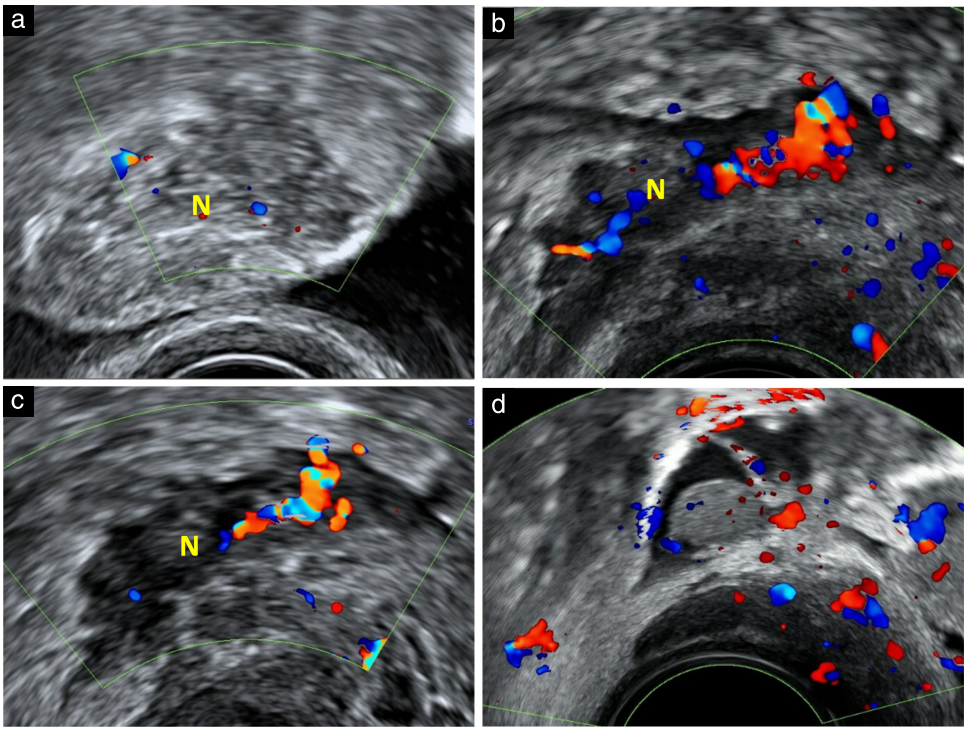

Figure 5 Transvaginal color Doppler images of endometriotic lesions. (a) Transverse section of anterior pelvic compartment demonstrating decidualized endometriotic nodule (N) in bladder wall at 10 weeks' gestation. (b,c) Longitudinal sections of posterior pelvic compartment demonstrating decidualized endometriotic nodule (N) in anterior muscularis of rectosigmoid colon at 12 (b) and 20 (c) weeks' gestation. (d) Tubular cystic structure in right adnexa containing anechoic fluid, incomplete septations and solid smooth walled papillary projection that demonstrated increased vascularity, in keeping with decidualized endometriosis involving hydrosalpinx.

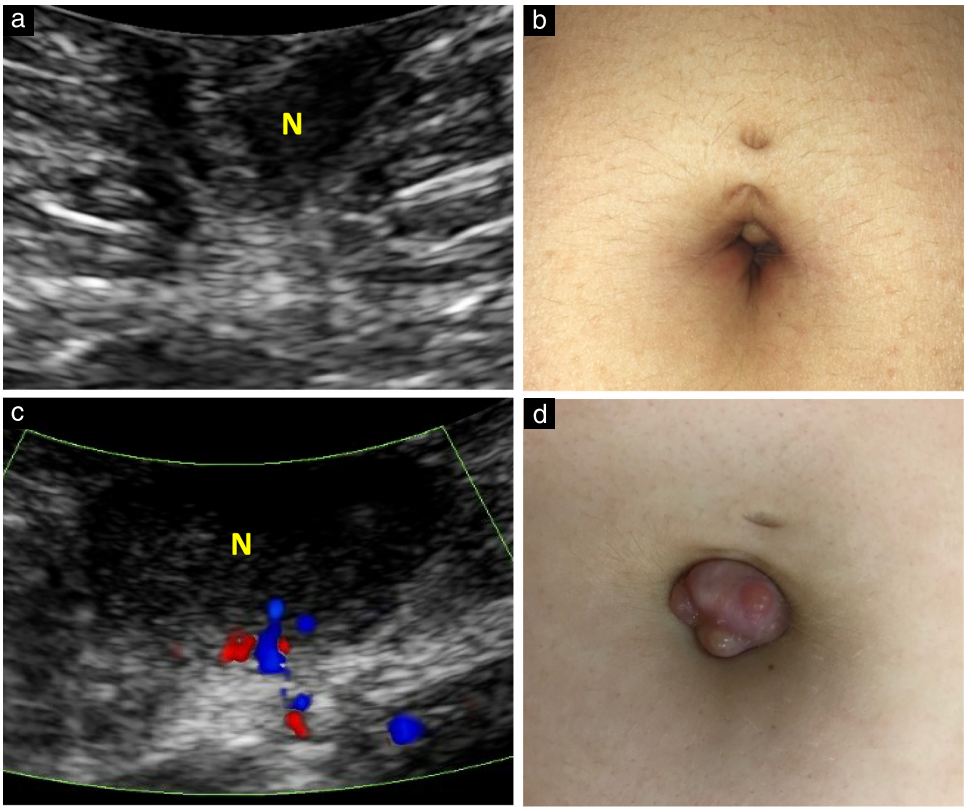

Figure 6 Images in 33-year-old patient with 3-year history of umbilical endometriotic nodule, which caused cyclical bleeding and was confirmed to be endometriosis on biopsy. (a,b) Transabdominal grayscale ultrasound image of umbilicus demonstrating endometriotic nodule (N) measuring 7 mm in mean diameter (a) and corresponding macroscopic appearance (b) prior to pregnancy. (c,d) Transabdominal color Doppler ultrasound image demonstrating increase in nodule size to 21 mm and increased vascularity, in keeping with decidualization (c) and corresponding macroscopic appearance (d) at 18 weeks' gestation.

with pregnancy[24–27]. Pregnancy-induced stromal decidualization of ectopic endometrium (endometriosis) results from progesterone action. Microscopic features include an increase in glandular epithelial secretion, vascular remodeling, stromal vascularity and edema, accumulation and adaption of immune cells and differentiation of stromal fibroblasts into secreting epithelioid decidual cells[28–30]. Histological findings are similar to those found in eutopic endometrium in pregnancy, in which distension of capillaries and numerous lymphocytes are typically found with glandular atrophy resulting in fibrosis and necrosis of decidual cells[31]. Data on the effect of pregnancy on atrophy and necrosis of endometriotic lesions remain controversial, but this has been suggested as the cause of lesion regression in late pregnancy and postpartum[32].

The frequency of decidualization of endometriotic lesions is well-described in the literature, with previous studies reporting this in 12–33% of endometriotic cysts and 32% of nodules[4,5]. This study demonstrates gestational-age-related decidualization occurring in approximately half of the women with endometriotic cysts and nodules. Previous studies have suggested that only those endometriotic cysts that are covered in endometrium are prone to initial enlargement as a result of decidualization and infiltration with immune cells, and that this precedes regression and complete disappearance in some cases[22,23,29,33]. We also observed this pattern of initial growth in the first and second trimesters, followed by regression in later pregnancy and postpartum in 29% of women with endometriotic cysts and 53% of women with nodules.

Sonographic morphological changes of endometriotic lesions in pregnancy are sometimes difficult to differentiate from those associated with malignant lesions. Features of decidualized endometrioma on ultrasound include thick and irregular inner cyst walls, solid papillary projections and high vascularity on color Doppler examination[5,7]. However, papillary projections observed in decidualized endometrioma appear rounded and smooth-walled as opposed to irregular papillary projections in malignant lesions[34]. Concurrent presence of pelvic adhesions and endometriotic nodules, in the absence of ascites and clinical symptoms of malignancy, supports a diagnosis of endometriosis.

Features of decidualized nodules have not been described as extensively in the literature, but changes include increased echogenicity and size, accompanied by moderate to high vascularity[12,13]. Decidualized endometriotic nodules in the rectosigmoid colon may also raise suspicion of malignancy. However, endometriotic nodules typically present as focal lesions located in the anterior wall of the bowel, while malignant tumors in the left colon tend to cause circumferential segmental thickening[35]. Metastatic peritoneal implants appear as irregular, papillary lesions on the peritoneal surface accompanied by ascites[36], while the surface of decidualized nodules is smooth, they tend to be covered with adhesions and there is no visible fluid in the pouch of Douglas, which is often obliterated with adhesions.

A limitation of this study is the lack of long-term follow-up. Regression of endometriotic lesions in the early postnatal period may be temporary, and further assessment of lesion size and patient symptoms should be performed to establish the long-term impact of pregnancy, breastfeeding and postnatal contraception on the behavior of endometriosis.

It is important to acknowledge the absence of histological confirmation of endometriosis in our study group, which may be considered a limitation of our study. It is also important to consider the accuracy of measurements used to detect changes in lesion size. However, ultrasound is now considered to be the first-line assessment tool for women with endometriosis. Previous studies have demonstrated that ultrasound is highly reproducible[14] and reported good concordance with laparoscopy for the detection of moderate and severe pelvic endometriosis (kappa, 0.76)[1,37].

Decidualized endometriosis may be an incidental finding during routine ultrasound in pregnancy and can be mistaken for malignancy. Leone Roberti Maggiore *et al.* reported on management of decidualized ovarian endometriosis in 60 cases, the majority of which underwent oophorectomy or cystectomy in pregnancy[38]. In our study, pattern recognition was used to diagnose endometriotic lesions and all women were managed expectantly. Better understanding of the behavior of endometriosis in pregnancy and its typical appearance is vital to reduce unnecessary surgical procedures with associated morbidity to the mother and growing fetus.

In conclusion, our study supports the theory that pregnancy has a positive impact on the macroscopic appearance of endometriosis in the majority of women. The behavior of endometriotic cysts and DE is similar. Endometriotic lesions commonly exhibit features of decidualization, which is often accompanied by lesion growth in early pregnancy followed by regression in later pregnancy and the postnatal period. It remains uncertain how this behavior impacts pain symptoms in affected women and whether any positive impact of pregnancy is sustained in the long term.

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