Possible risks and benefits of adenomyomectomy on pregnancy outcomes: a retrospective analysis

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BACKGROUND: Adenomyosis is associated with unfavorable perinatal outcomes; however, the effect of an adenomyomectomy on pregnancy outcomes remains unclear. Pregnancy following an adenomyomectomy has been reported to be associated with a high risk for uterine rupture; however, the actual incidence remains unknown.

OBJECTIVE: This study aimed to evaluate the effect of an adenomyomectomy on pregnancy outcomes by retrospectively comparing the pregnancy outcomes of women who underwent an adenomyomectomy with those of women with adenomyosis.

STUDY DESIGN: This was a single-center retrospective study in which the pregnancy outcomes of women who underwent an adenomyomectomy and for whom complete resection of the affected tissue under laparotomy was achieved were compared with those of women with adenomyosis. The following pregnancy outcomes were examined: second-trimester miscarriage, preterm prelabor rupture of membranes, preterm delivery, spontaneous preterm delivery, preeclampsia, rate of cesarean delivery, blood loss during cesarean delivery, incidence of placenta accreta spectrum, neonatal body weight, and small for gestational age infants.

RESULTS: A total of 18 pregnant women who underwent an adenomyomectomy and 105 pregnant women with adenomyosis were included in this study. All women who underwent an adenomyomectomy delivered via cesarean delivery, and among them, 1 had a uterine rupture at 30 weeks of gestation. Although there was no significant difference between pregnant women who underwent an adenomyomectomy and those with adenomyosis in the incidence of second-trimester miscarriage (0% [0/18] vs 7.6% [8/105], respectively; P=.22), preterm delivery (50% [9/18] vs 32% [34/105], respectively; P=.15), and spontaneous preterm delivery (6% [1/18] vs 15% [16/105], respectively; P=.26), a significant decrease in preterm prelabor rupture of membrane (0% [0/18] vs 12% [13/105], respectively; P<.05), preeclampsia (0% [0/18] vs 12% [13/105], respectively; P<.05), and small for gestational infants (0% [0/18] vs 15% [16/105], respectively; P<.05), as well as a significant increase in the incidence of placenta accreta spectrum (50% [9/18] vs 0% [0/105], respectively; P<.01) and blood loss during cesarean delivery (1748 mL vs 1330 mL, respectively; P<.05) were observed.

CONCLUSION: Uterine rupture following an adenomyomectomy may occur because of the high incidence of placenta accreta spectrum. However, an adenomyomectomy may reduce adverse pregnancy outcomes associated with adenomyosis, such as preterm prelabor rupture of membranes, preeclampsia, and small for gestational age infants. An adenomyomectomy may be a viable option for women among whom the procedure is inevitable before conception.

Key words: adenomyosis, cesarean delivery, placenta accreta spectrum, preeclampsia, small for gestational age infants, uterine rupture

Introduction

Uterine adenomyosis is a benign disorder in which the endometrial tissues are present within the myometrium, and it is associated with heavy menses, dysmenorrhea, chronic pelvic pain, and infertility.[1,2] Histopathologic diagnosis used to be required, but recent studies have found that adenomyosis can be diagnosed using noninvasive techniques such as magnetic resonance imaging (MRI) and ultrasound. Adenomyosis is also known to be associated with unfavorable pregnancy outcomes, such as an increased incidence of second-trimester miscarriages, preterm prelabor rupture of membrane (pPROM), preterm delivery, preeclampsia, and small for gestational age infants (SGA).[3–7]

With an increase in the number of women diagnosed with adenomyosis and the delay in childbearing age, some women choose to undergo an adenomyomectomy to mitigate the associated symptoms.[8,9] Because adenomyosis is reported to have a detrimental effect on pregnancy rates among women who use assisted reproductive technology

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AJOG MFM at a Glance

Why was this study conducted?

Although it has been proposed that there is a risk for uterine rupture after adenomyomectomy, the actual risks and benefits of adenomyomectomy on pregnancy outcomes remain unclear. We compared the pregnancy outcomes of women following adenomyomectomy with those of women with adenomyosis to determine how adenomyomectomy affects pregnancy outcomes.

Key findings

Among 18 pregnancies following an adenomyomectomy, the incidences of preterm prelabor rupture of membranes, preeclampsia, and small for gestational age infants were lower than for 105 pregnancies with adenomyosis, but there was increased blood loss during cesarean delivery, incidence of placenta accreta spectrum, and 1 case of uterine rupture.

What does this add to what is known?

An adenomyomectomy may decrease the adverse pregnancy outcomes associated with adenomyosis and may be a reasonable option for women with adenomyosis.

(ART), an adenomyomectomy is sometimes performed to improve the success rate.[6,10] It is unknown how the removal of the adenomyotic lesion affects pregnancy outcomes, and the only 2 studies that followed pregnancies after an adenomyomectomy and other case reports and case series suggested that these women are at risk for uterine rupture and early miscarriage.[7,11,12] However, the actual risk for uterine rupture has not been elucidated because of the lack of previous reports and nor has the effects of adenomyomectomy on pregnancy outcomes, such as pPROM, preeclampsia, and SGA, in comparison with women with adenomyosis. To evaluate the effects of an adenomyomectomy on pregnancy outcomes, we retrospectively compared the pregnancy outcomes of women who underwent adenomyomectomy before conception with those of women with adenomyosis.

Material and Methods

This study was approved by the institutional review board of the University of Tokyo Hospital (Japan) (3053-1), and clinical information was retrospectively obtained from the medical records of pregnant women who underwent an adenomyomectomy and those with adenomyosis who were managed from the 12th week of pregnancy and who delivered at the University of Tokyo Hospital between January 2010 and August 2022. Women with multiple pregnancies, fetal abnormalities, or uterine malformations were excluded.

The diagnosis of adenomyosis was based on transvaginal ultrasonography and/or an MRI performed before conception and/or during the first trimester of pregnancy and on the following criteria: adenomyosis was diagnosed using transvaginal ultrasonography based on the Morphological Uterine Sonographic Assessment (MUSA) criteria first established in 2015, which include asymmetrical thickening, cysts, hyperechoic islands, fan-shaped shadowing, echogenic subendometrial lines and buds, translesional vascularity, irregular junctional zone, and interrupted junctional zone.[13−15] Regarding cases before 2015, the diagnosis of adenomyosis was retrospectively confirmed from the medical records according to the MUSA criteria. When MRI was used, adenomyosis was diagnosed when 1 of the following 2 diagnostic criteria was met: (1) presence of a myometrial mass with indistinct margins and primarily low signal intensity or (2) diffuse or focal thickening of the junctional zone, forming an ill-defined area of low signal intensity on T2-weighted images.[16] The surgical approach to adenomyosis can be divided into partial reduction and complete excision; however, we only included adenomyomectomy cases that underwent complete excision with either the triple flap method or asymmetric dissection during a laparotomy, which enables direct digital confirmation of a complete surgery.[8,9] Every woman who underwent an adenomyomectomy delivered via cesarean delivery with the indication of a history of adenomyomectomy to avoid possible uterine rupture.

The following pregnancy outcomes were examined: second-trimester miscarriage, pPROM, preterm delivery, spontaneous preterm delivery, preeclampsia, rate of cesarean delivery, blood loss during cesarean delivery, incidence of placenta accreta spectrum (PAS), neonatal body weight, and SGA. Second-trimester miscarriage was defined as delivery between 12+0 and 21+6 weeks of gestation. Spontaneous preterm delivery was defined as delivery after the spontaneous onset of labor or prelabor rupture of membrane.[17] Preeclampsia was diagnosed based on the diagnostic criteria of the International Society for the Study of Hypertension in Pregnancy.[18] PAS was confirmed pathologically by findings of placenta accreta, increta, or percreta. SGA was defined as a birth weight below the 10th percentile.

Statistical analyses were performed using the JMP Pro 16 software (SAS Institute Inc., Cary, NC). The frequencies of obstetrical complications and other categorical variables were analyzed using Fisher's exact tests, whereas blood loss and other continuous variables were analyzed using the Mann−Whitney U test. Statistical significance was set at $P<.05$.

Results

Maternal background

A total of 18 pregnant women who underwent an adenomyomectomy and 105 pregnant women with adenomyosis were included in this retrospective analysis; the maternal characteristics of the 18 women are shown in Table 1. The indication for adenomyomectomy was dysmenorrhea for all the women; among those, women who wished to conceive first underwent ART (13 women [72%]), and an adenomyomectomy was performed after repeated ART failure. There were no significant

TABLE 1
Maternal characteristics of women following an adenomyomectomy

Repeated ART failure before adenomyomectomy	13 (72%)
Weight of the adenomyosis[a] (g), median (IQR)	94 (43–173)
Age at surgery (y), median (IQR)	37.5 (32.8–40)
Age at delivery (y), median (IQR)	39.5 (35–42)
Interval[b] (mo), median (IQR)	13.5 (10–30)
Primiparity	17 (94%)
ART	13 (72%)

ART, assisted reproductive technology; *IQR*, interquartile range.

[a] The data for n=14 patients were reported;; [b] Interval between adenomyomectomy and last menstrual period.

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differences observed between the groups in maternal age, percentage of ART (*P*=.14 and *P*=.11, respectively), or the use of low-dose aspirin; however, the number of nulliparous women was significantly higher in the adenomyomectomy group than in the adenomyosis group (94% [17/18] vs 67% [71/105], respectively; *P*<.05).

Pregnancy outcomes

The pregnancy outcomes in the adenomyomectomy and adenomyosis groups are shown in Table 2. All women in the adenomyomectomy group underwent a cesarean delivery. Although there was no significant differences between the adenomyomectomy and adenomyosis groups in the incidence of second-trimester miscarriage (0% [0/18] vs 7.6% [8/105], respectively; *P*=.22), preterm delivery (50% [9/18] vs 32% [34/105], respectively; *P*=.15), and spontaneous preterm delivery (6% [1/18] vs 15% [16/105], respectively; *P*=.26), a significant decrease in pPROM (0% [0/18] vs 12% [13/105], respectively; *P*<.05), preeclampsia (0% [0/18] vs 12% [13/105], respectively; *P*<.05), and SGA (0% [0/18] vs 15% [16/105], respectively; *P*<.05), as well as a significant increase in PAS (50% [9/18] vs 0% [0/105], respectively; *P*<.01) and blood loss during cesarean delivery (1748 mL vs 1330 mL, respectively; *P*<.05) were observed.

Of the 9 women with PAS, 1 had placenta percreta that required an emergency cesarean delivery because of a massive hemoperitoneum from a disrupted vessel on the uterine serosa derived from the placenta percreta. The patient was managed starting from the 13th week of gestation when the minimum thickness of the uterine myometrium was 4 mm at the uterine fundus. She had sudden onset of severe abdominal pain with massive amounts of intraperitoneal fluid at 30 weeks and 6 days of gestation, and emergency surgery revealed uterine rupture at the uterine fundus. She required a cesarean hysterectomy with blood loss of 5380 mL, and the neonate was born at 1680 g with Apgar scores of 8 and 9 and an umbilical artery pH of 7.35. She was discharged on day 43 uneventfully.

TABLE 2
Characteristics and pregnancy outcome of women following an adenomyomectomy and women with adenomyosis

Characteristics and outcomes	Adenomyomectomy (n=18)	Adenomyosis (n=105)	*P* value
Age (y), median (IQR)	39.5 (35–42)	37.5 (35–40)	.14
Primiparity (%)	17 (94%)	71 (67%)	.02[a]
ART (%)	13 (72%)	55 (52%)	.11
Use of LDA for preeclampsia prophylaxis (%)	5 (28%)	40 (38%)	.29
Delivery week, median (IQR)	36 (35.8–37)	37 (35–39)	.06
Late miscarriage (%)	0 (0%)	8 (7.6%)	.22
pPROM (%)	0 (0%)	13 (12%)	.04[a]
Preterm delivery (%)	9 (50%)	34 (32%)	.15
Spontaneous preterm delivery (%)	1 (6%)	16 (15%)	.26
Preeclampsia (%)	0 (0%)	13 (12%)	.03[a]
CD rate (%)	18 (100%)	55 (56%)	<.01[a]
Blood loss during CD (mL), median (IQR)	1748 (1110–3079)	1330 (940–1927) (55 cases)	.04[a]
Placenta accreta spectrum (%)	9 (50%)	0 (0%)	<.001[a]
Neonatal weight (g), median (IQR)	2714 (2279–2969)	2643 (2207–3073)	.87
SGA (%)	0 (0%)	16 (15%)	.02[a]

ART, assisted reproductive techniques; *CD*, cesarean delivery; *IQR*, interquartile range; *LDA*, low-dose aspirin; *pPROM*, preterm prelabor rupture of membrane; *SGA*, small for gestational age infants.

[a] Indicates a *P* value of <.05.

Sayama. Impact of adenomyomectomy on pregnancy outcomes. Am J Obstet Gynecol Glob Rep 2023.

Comment

Principal findings

This study demonstrated that an adenomyomectomy may reduce the incidence of pPROM, preeclampsia, and SGA associated with adenomyosis, but it may possibly increase blood loss during cesarean delivery and the incidence of pathologically confirmed PAS. Among the 18 women who underwent an adenomyomectomy, 1 case of placenta percreta that led to uterine rupture and that required an emergency cesarean hysterectomy at 30 weeks of gestation was confirmed.

Results in the context of what is known

There is limited evidence regarding the pregnancy outcomes of women who underwent an adenomyomectomy with only 2 studies and 1 case series with a total of 55 deliveries emphasizing the incidence of uterine rupture.[11,12,19] Before these studies, several case reports had reported a higher risk for uterine rupture following an adenomyomectomy, but these 3 reports showed that the incidence was 8.7% (2/23), 4.5% (1/22), and 0% (0/10).[11,12,19] Our cohort had 1 case of massive hemoperitoneum, representing spontaneous uterine rupture, in the case with placenta percreta.[20] One uterine rupture among 18 cases was similar to the previous 3 reports with a cumulative incidence of 4 of 73 deliveries (5.5%).[11,12,19] Of the 3 reports, only 1 reported the incidence of PAS in 2 of 22 (9.1%) deliveries,[12] which showed a discrepancy with our result of 9 of 18 (50%) deliveries. This disparity may be related to the method of data collection in that every placenta from the 18 women in the adenomyomectomy group in this study was sent for pathologic examination, whereas the previous study reported on clinically diagnosed PAS. The incidence of uterine rupture is 5.5% from evidence known to date, but that of PAS is inconclusive because of how data are collected and the lack of data.

Clinical implications

With the increasing number of women with adenomyosis trying to conceive, the number of women who undergo an adenomyomectomy is also on the rise. However, the effects of an adenomyomectomy on pregnancy outcomes have not been studied thoroughly, and safety concerns regarding whether surgery should be performed before conception may have been a limiting factor for some clinicians and patients. This study showed that an adenomyomectomy may improve unfavorable pregnancy outcomes associated with adenomyosis, such as pPROM, preeclampsia, and SGA, but with a possible risk of uterine rupture of approximately 5.5%. Considering the detrimental consequences of this phenomenon and the high incidence of PAS and hemorrhage during cesarean delivery, careful perinatal care at an experienced tertiary center should be considered when caring for women following an adenomyomectomy. Although the surgical indication for an adenomyomectomy was dysmenorrhea, 72% of the women first underwent repeated ART before surgery. Considering that these women failed to conceive with ART before an adenomyomectomy, adenomyosis may have been associated with infertility. After a thorough preconception discussion with the patient and shared decision-making, an adenomyomectomy seems to be a reasonable option for women with adenomyosis who cannot conceive despite using ART.

There is no established method for predicting uterine rupture in women who have undergone an adenomyomectomy. However, Otsubo et al[11] showed that a minimum myometrial thickness of <7 mm was associated with uterine rupture. Because our case of uterine rupture was managed only after conception, we lacked data for the period after the adenomyomectomy. However, because the minimum myometrial thickness was 4 mm at the 13th week of gestation, the patient was considered to be at high risk for uterine rupture and was carefully managed thereafter, which allowed early diagnosis and prompt surgery soon after the onset of uterine rupture. Measuring the residual minimum myometrial thickness in women following an adenomyomectomy may allow the stratification of patients for uterine rupture, which may be done as preconception care. It is vital to rule out uterine rupture in women following an adenomyomectomy when they complain of abdominal pain or vaginal bleeding, because uterine rupture often leads to detrimental maternal and neonatal outcomes.

Research implications

Although 17 of the 18 women (94%) in the adenomyomectomy group were primiparous, there were no cases of preeclampsia in this group, which is consistent with a previous report.[12] Adenomyosis reportedly causes placental inflammation, which may lead to the onset of preeclampsia.[21,22] Hashimoto et al[23] showed that women with diffuse adenomyotic lesions had a higher incidence of preeclampsia and pPROM than those with focal adenomyosis, implying that the detrimental effects of adenomyosis may be associated with the extent of the disease. In this regard, an attempt to reduce the number of pathologic lesions as much as possible may improve pregnancy outcomes. The adenomyomectomy group, which only included those with complete resection, had lower incidences of preeclampsia and SGA. However, it has been reported that adenomyosis may take up uterine blood flow over the placenta in cases of fetal growth restriction with adenomyosis[24]; thus, preconception removal may secure sufficient placental perfusion. Although the reason for the decrease in the incidence of preeclampsia and SGA is unclear, the removal of adenomyosis may aid in ameliorating inflammation and improving uterine perfusion for subsequent placentation. The exact mechanism of the underlying pathophysiology that causes preeclampsia and SGA in women with adenomyosis is unclear and requires further research.

Strengths and limitations

The strength of our study is that it compared the maternal characteristics and pregnancy outcomes of women who underwent an adenomyomectomy with those of women with adenomyosis, and it reported the pregnancy outcomes of women following an adenomyomectomy.[25] It has been reported that adenomyosis is associated with adverse pregnancy outcomes, such as preterm delivery, preeclampsia, and SGA; however, our study showed that removal of the adenomyosis site may decrease these adverse pregnancy outcomes. Another strength of our study was that the cohort was exclusively limited to women who underwent complete resection of adenomyosis via laparotomy.

One limitation of our study is that although perinatal management was performed at a single institution, this was a retrospective study with a small

number of cases. Thus, a prospective study assigning women with adenomyosis to undergo surgery and evaluating their pregnancy outcomes is necessary to judge how an adenomyomectomy may affect pregnancy outcomes in women with adenomyosis. Moreover, how the mode of surgery or the extent and locality of the adenomyosis before surgery affects the incidence of PAS is of concern as well. Another limitation is that because we only examined the outcome after 12 weeks of pregnancy, we lacked data on early pregnancy loss, which has been reported to be increased among women with adenomyosis. Another limitation is that, although controversial, a previous report suggested that there is an increased risk for preeclampsia among women with uterine fibroids, whereas a myomectomy reduces the risk.[26] Because our database lacked the data on fibroids, possible coexistence of fibroids may have affected the results.

Conclusion

Women who underwent an adenomyomectomy had significantly lower incidences of pPROM, preeclampsia, and SGA than those with adenomyosis, but they had increased incidences of PAS and blood loss during a cesarean delivery. An adenomyomectomy may decrease adverse pregnancy outcomes associated with adenomyosis; however, the provider must consider the risks for PAS, hemorrhage, and possible uterine rupture. Accurate presurgical diagnosis of PAS and preparation for hemorrhage are mandatory in the prenatal management of women following an adenomyomectomy. Under careful management at an experienced center, the pregnancy outcomes of women after an adenomyomectomy with complete excision seem manageable, and the procedure seems to be a reasonable option for women who cannot conceive despite using ART because of adenomyosis. ■

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