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## Original Article

## Pregnancy and delivery outcomes in the women who have received adenomyomectomy: Performed by a single surgeon by a uniform surgical technique

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## ABSTRACT

**Objective:** Although adenomyomectomy for fertility-sparing is an expanding procedure worldwide, there is no guideline or consensus about how to manage the pregnant women who have previously received conservative surgery for adenomyosis. The aim of this study is to evaluate antenatal care and delivery outcomes in pregnant women after adenomyomectomy.

**Materials and methods:** Between May 2011 and May 2019, the medical record was reviewed in all delivery of pregnant women received adenomyomectomy performed by a single surgeon by a uniform surgical technique. The evaluating parameters consisted of antenatal care outcomes, delivery outcomes, intrapartum outcome, and neonatal outcomes.

**Results:** Twenty-two patients were evaluated to monitor pregnancy and delivery outcomes after the adenomyomectomy. Mean age of delivery was 37.0 years old (SD = 3.1, range 32–45, median 37). All were delivered by cesarean section. Mean gestational age was 36.2 weeks (SD = 3.6, range 27.4–39.4, median 37.3). The mean birth weight was 2560.9 g (SD = 771.8, range 1100–3920, median 2550) and the number of preterm births admitted for prematurity care was seven (31.8%, 7/22). Placental abnormality was found in the four cases, which included two placenta accreta and two previa. However, there were no cases of hysterectomy or intervention. We identified one case of uterine rupture during pregnancy (4.5%, 1/22) at 27 weeks of gestation. Except for preterm birth, adverse neonatal outcomes were not found in this study.

**Conclusion:** Delivery of pregnant women who received adenomyomectomy can obtain safe perinatal outcomes under close monitoring of preterm labor and surveillance of catastrophic pregnancy related complications.

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## Introduction

Adenomyosis is defined as endometrial tissue invaded into the uterine myometrium. The pathogenesis of adenomyosis is not well understood, however, it is related to events which can disrupt the boundary between endometrial tissue and the myometrium [1]. Because of recent trends to delay childbearing and the requirements associated with assisted reproductive procedures, the rate of diagnosis of adenomyosis has increased. Major problems associated with adenomyosis are profuse vaginal bleeding,

dysmenorrhea, pelvic pain, and infertility. For patients with uterine adenomyosis who are refractory to medical treatment, hysterectomy has been performed finally as a standard surgical treatment. However, for women who want to preserve fertility and who are expecting to become pregnant, an effective conservative surgery has become required. We have previously published articles on clinical outcomes of conservative adenomyomectomy via laparoscopic and laparoscopic approach in both of focal and diffuse adenomyosis under transient occlusion of uterine arteries (TOUA) [2,3]. In these reports, conservative surgery for adenomyosis was effective for symptom improvement and we had mentioned the need for an examination of fertility results that were still needed to follow-up [4].

At present, there are very few reports about fertility [5,6] and pregnancy outcomes [7,8] following the conservative surgical

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treatment of adenomyosis performed by diverse surgical techniques. Due to the lack of data, we report our perinatal strategy to maximize live delivery rate and our promising outcomes of 22 babies and to suggest that how to manage pregnant women who have previously received conservative surgery for adenomyosis. To address this need we have gathered results on maternal and perinatal outcomes for pregnant women who have a history of adenomyomectomy and the practices of antenatal care and delivery, after experiencing adenomyomectomy by a uniform technique produced by a single surgeon.

**Materials and methods**

We retrospectively reviewed data on 22 deliveries between May 2011 and May 2019 in our surveillance of 466 patients who received adenomyomectomy under TOUA, by a single surgeon between May 2011 and August 2018. We reviewed 22 verified patients who had antenatal care and delivery records. To assess maternal outcomes, parity before the adenomyomectomy, patients' age when they received adenomyomectomy, age of delivery, and interval between conservative surgery and delivery were calculated. Surgical technique and operative result were previously published and the ethical committee approved study Files No. 2013-09-621 and No. 2013-08-618 on 5th December 2014. Data analysis was performed using MedCalc statistical software version 18.11.6 (MedCalc version 9.6, Ostend, Belgium; <https://www.medcalc.org;1993-2016>).

Pregnant women who had received adenomyomectomy were provided a detailed consultation and we clearly explained the need to come immediately if they recognized contractions, abdominal pain or vaginal bleeding. When they came to the clinic and a contraction was noted, patients were admitted for close monitoring and use of tocolytics to control contraction. Tocolytic agent was started when four or more uterine contractions were observed by external tocography within a period of 30 min regardless of cervical change. Magnesium was administered for neuroprotection. Tocolytics was administered during 48 h of admission and if there were no contraindications such as uncontrolled diabetes or arrhythmia, beta-agonist was used first. When tachycardia was noted more than 120 bpm or they had tachypnea, other tocolytic agent was chosen. If uterine contraction was not controlled within 2 h, betamethasone was administered to reduce fetal respiratory morbidity when the pregnancy age was below 37 weeks [9]. Cesarean delivery was performed when the patient had abdominal pain or uncontrolled contractions with cervical effacement of at least 50% or cervical dilatation.

To evaluate delivery outcomes, age at delivery, placental abnormality, and history of admission with premature contractions were reviewed. To assess intrapartum outcomes, we reviewed cesarean delivery duration, blood loss during the operation and transfusion volumes. In order to evaluate neonatal outcomes, 1-minute and 5-minute Apgar scores, weight of the neonates, NICU (neonatal intensive care unit) admission, and complications related to preterm birth were monitored.

**Results**

Until May 2019, 22 patients were confirmed to have delivered. Five patients conceived by natural, and 17 patients received assisted reproductive techniques, and of these, all by in vitro fertilization (IVF). Three patients had their babies delivered at another hospital because of the distance from their residence. Nineteen patients received prenatal care at our clinic from the first trimester, at a hospital where the surgeon who performed the adenomyomectomy works to monitor pregnancy outcomes following conservative surgery for adenomyosis (Table 1).

Among the twenty-two cases, one case was a confirmed monochorionic twin pregnancy and its report was published [10]. Mean age at adenomyomectomy was 35.4 years old (SD = 3.0, range 30–43, median 35) and the mean age at delivery was 37.0 year old (SD = 3.1, range 32–45, median 37). Eighteen patients had a diffuse type of adenomyosis and received laparotomic surgery. Four patients had a focal type of adenomyosis and received laparoscopic surgery. All four patients who received laparoscopic adenomyomectomy became pregnant naturally. Interval between adenomyomectomy and pregnancy was 605 days (SD = 425.8, range 109–1458, median 643) (Table 2).

Mean gestational age of the twenty-two deliveries was 36.2 weeks (SD = 3.6, range 27.4–39.4, median 37.3). All deliveries were performed by cesarean section. Eight of the twenty-two patients were admitted before delivery because of premature uterine contractions and for closed observation of abdominal discomfort. Seven among the eight patients decided to deliver because of uncontrolled preterm labor accompanied with cervical change. The other one patient was discharged three days after admission and delivered with elective cesarean section at full term, at 39 weeks of gestation. We met one case of uterine rupture, which was scar dehiscence found at 27 weeks of gestation and the neonate was admitted to NICU. Placental abnormality was found in four cases, which included accrete in two and previa in the other two. There was no case of any intraoperative intervention due to abnormal placental bleeding except transfusion and oxytocin infusion and intravenous carbetocin injection. There were no cases of Cesarean hysterectomy or postpartum hemorrhage which needed an intervention such as uterine artery embolization. There were also no cases of uterine atony during hospital stay or delayed postpartum hemorrhage after discharge (Table 3).

Mean weight of 23 births was 2560.9 g (SD = 771.8, range 1100–3920, median 2550). There was no case of fetal growth restriction and no case of oligohydramnios during antenatal care. No fetal anomaly was detected. The mean value of one-minute Apgar score was 7.0 (SD = 1.9, range 3–9, median 7) and five-minute Apgar score was 8.63 (SD = 0.9, range 6–10, median 9). There were two cases of one-minute Apgar score below 5. One was the first baby of the twins. One-minute Apgar score was 3 and five-minute Apgar score was 6, of gestation. However, the neonate recovered after initial resuscitation in ten minutes without long-term adverse outcomes. The other case was born from a ruptured uterus at 27 weeks of gestation, and the Apgar score was three in one minute and seven in five minutes (Table 4). The preterm neonates admitted at NICU had no acute complications. All neonates were discharged without significant preterm sequela.

**Discussion**

There are several published reports on fertility outcomes after conservative adenomyosis surgery [8], however we were unable to determine safety of antenatal care and neonatal, delivery, and perinatal outcomes because of the lack of documented data,

**Table 1**  
Verified patients who conceived after adenomyomectomy.

Total numbers of delivery	22
IVF	17
Natural	5
Delivery Hospital	
At the Hospital where the authors works	19
At another hospital	3

IVF, In vitro fertilization.

**Table 2**  
Maternal characteristics of patients who received adenomyomectomy (N = 22).

Maternal age at adenomyomectomy (years)		35.4 ± 3.0, 35 [30–43]
Maternal age at delivery (years)		37.0 ± 3.1, 37 [32–45]
Parity <sup>a</sup>		0.42 ± 0.7, 0 [0–2]
Volume of adenomyosis (cm <sup>3</sup> ) <sup>b</sup>		747.5 ± 643, 673 [92.1–2110]
Weight of the adenomyosis (g) <sup>c</sup>		76.4 ± 50.7, 80 [20–140]
Interval <sup>d</sup> (days)		605 ± 425.8, 643 [109–1485]
Mode of adenomyomectomy (number of patients)	laparotomy	18
	laparoscopy	4

Data expressed as mean ± standard deviation, median [range] and definite number of cases.

- <sup>a</sup> Number of births before adenomyomectomy.
- <sup>b</sup> Volume of adenomyosis measured by transvaginal (or transrectal) ultrasonography.
- <sup>c</sup> The weight of the specimen was checked in the 7 cases.
- <sup>d</sup> Between operation and last menstruation period before pregnancy.

**Table 3**  
Pregnancy outcomes of the patients who had received adenomyomectomy (N = 22).

Gestational age of neonates	36.2 ± 3.6, 37.3 [27.4–39.4]
Preterm delivery (20–37 wks)	7
Full term delivery (>37 wks)	15
Duration of cesarean delivery (min) <sup>d</sup>	61.05 ± 13.1, 60 [45–93]
EBL during cesarean delivery (ml)	1489 ± 790.0, 1600 [600–3000]
Transfusion (RBC unit)	1.49 ± 2.2, 2 [0–6]
Placenta abnormalities	accreta <sup>b</sup> 2 previa 2 abruption 0
Uterine atony	0
Uterine rupture	1
Extraperitoneal Cesarean delivery <sup>c</sup>	2
Postpartum hysterectomy	0

EBL, Estimated blood loss; RBC, Red blood cell.

Data expressed as mean ± standard deviation, median [range] and definite number of cases.

- <sup>a</sup> Time taken during Cesarean section.
- <sup>b</sup> Placenta was not completely removed but remnant was spontaneously resolved.
- <sup>c</sup> Extraperitoneal cesarean delivery was performed because of severe intraperitoneal adhesion.

**Table 4**  
Neonatal outcomes for babies born of mothers who received adenomyomectomy (N = 23).<sup>a</sup>

Birth weight (g)	2560.9 ± 771.8, 2550 [1100–3920]
Apgar score <sup>b</sup>	
1 min	7.0 ± 1.9, 7 [3–9]
5 min	8.63 ± 0.9, 9 [6–10]
Preterm birth <sup>c</sup>	8
NICU admission <sup>d</sup>	8
FGR	0
Neonatal death	0

Data expressed as mean ± standard deviation, median [range] and definite number of cases.

NICU, Neonatal intensive care unit; FGR, Fetal growth restriction.

- <sup>a</sup> Among 22 pregnancies, 1 case was twin pregnancy. Total of 23 neonates were reviewed.
- <sup>b</sup> A case of 1-minute Apgar score was 3 and 5-minute Apgar score was 6, the first baby of the twin at 31 + 6 weeks of gestation recovered after initial resuscitation in ten minutes without long-term adverse outcomes. In the case of uterine rupture, 3 in 1 min and 7 in 5 min.
- <sup>c</sup> There were 7 deliveries and 8 babies were born because one was twin pregnancy.
- <sup>d</sup> All neonates were admitted for prematurity care without complications.

therefore clinicians could not strongly recommend conservative surgery to infertile women due to severe uterine adenomyosis, which has been refractory to medical treatment and ART.

There is little data available on pregnancy outcomes after adenomyomectomy, with the exception that we know of an increased

risk of uterine rupture. Several case reports informed us of the need to be cautious during antenatal care of women who had received an adenomyomectomy [10]. One study reported on the relationship between uterine rupture and uterine wall thickness after surgery [11]. However, there is currently no consensus regarding prevention of uterine complications like rupture.

To restore the uterus after adenomyomectomy, we used gonadotropin-releasing hormone (GnRH) agonist treatments for 3–4 months administered 3–4 weeks before the surgery to prevent menstruation after adenomyomectomy. The patients were permitted to make their efforts to be pregnant at least three months after surgery.

In the present study, we suggest that one remedy to avoid uterine rupture might be conservation of fresh myometrium during the conservative operation, which means to avoid electrocoagulation, permanent ligation or embolization of uterine vessels, and irreversible destructive sequela of myometrium. In our study, TOUA can reduce the overuse of electrocauterization and be helpful in preserving the uterine vascular architectures during regeneration after surgery. Although interventional therapy was not required, more estimated blood loss (EBL) was due to postpartum hemorrhage from the 4 cases of adherent placenta (Table 3). It suggests that intra-uterine scar lesion increase the possibility of placental abnormalities that can make profuse bleeding so that thorough preparation for blood transfusion is needed when preparing Cesarean delivery of the patients who have history of adenomyomectomy.

One case of uterine rupture was reported in the present study. The patient had a history of high intensity focused ultrasound (HIFU) treatment which occurred nine years previously and she had also received robotic adenomyomectomy two years earlier, before she came to our clinic for re-operation of adenomyosis. Repeated manipulation could have made myometrial tissue deformation and scar which can cause spontaneous uterine rupture during second or third trimester of pregnancy due to limited expandability of the destructive myometrium. Under clinical diagnosis of uterine wall dehiscence, emergent cesarean delivery was performed and the neonate was admitted to the neonatal intensive care unit for premature care. We found smooth and round shape dehiscence at the anterior body of the uterus, which was measured as 5 × 7 cm with intact amniotic membrane. Uterus was repaired after the baby was taken out from the uterus.

The symptoms related with uterine rupture are severe abdominal pain between contractions, cessation of previously efficient uterine activity, tenderness at the site of previous uterine scar, fetal heart rate abnormalities, abnormal vaginal bleeding, hematuria, loss of station of the presenting part and maternal hypotension or shock [12]. When patients are admitted because of contractions or abdominal discomfort, fetal heart rate and tocography should be strictly monitored. In our experience if there are continuous uterine

contractions, we administer tocolytics without hesitation. Although it is known that maintenance use of tocolytics is ineffective for preventing preterm birth and it cannot improve neonatal outcomes [13], in most cases of the present study, abdominal discomfort was improved when tocolytics were used.

The limitations of this study are small number of delivery cases because not all patients who received adenomyomectomy tried to conceive after the surgery.

Despite our recommendation of ART, especially IVF for becoming pregnant, some patients preferred waiting to become pregnant naturally, and others postpone their plan to become pregnant. Moreover, reproductive procedures were performed at diverse clinics and methods were not identical. For fertility considerations including ART, cooperation between gynecologic surgeon and ART specialists could be essential. Also, for safe delivery after conception, it will be necessary to build a protocol under the consultation of experts for women who become pregnant after conservative adenomyosis surgery.

Because fetal growth restriction or preeclampsia was not found in this study, it is supposed that feto-uterine environment of the uterus might be tolerable during the pregnancy even after adenomyomectomy with TOUA. To reduce preterm delivery, the more informed antenatal care and the documented strategy of treating of these complications should be established for women who received adenomyomectomy.

In the future, more cases should be acquired to prove safe outcomes in pregnancy after conservative surgery of adenomyosis. Moreover, surgical technique of conserving uterus should be advanced which can reduce pregnancy related complications and improve reproductive outcomes.

#### Declaration of competing interest

All authors declare that they have no conflicts of interest or conflicting financial ties.

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