Comparison of Clinical and Reproductive Outcomes between Adenomyomectomy and Myomectomy

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ABSTRACT

Study Objective: Women with adenomyosis may show a lower pregnancy rate and a higher miscarriage rate than healthy women. There is also a general agreement that leiomyomas, either submucosal or intramural, negatively affect fertility, when compared with women without myomas. Some of these women may benefit from adenomyomectomy, however this cytoreductive procedure is considered invasive and technically challenging especially in severe diffuse cases. The study aimed to compare the clinical and reproductive outcomes of patients who underwent adenomyomectomy with those of patients who underwent intramural myomectomy.

Design: A retrospective study.

Setting: Department of Obstetrics & Gynecology, Center of Gynecological Endoscopy and Minimally Invasive surgery, First Faculty of Medicine, General University Hospital in Prague.

Patients: A total of 55 women who underwent surgical resection of uterine adenomyosis and 55 patients who underwent myomectomy for intramural uterine myomas were included in this study. All study participants wished to retain and possibly improve their reproductive potential.

Interventions: Between 2004 and 2019, 110 women underwent laparoscopic or open uterus-sparing surgery for clinically significant uterine adenomyosis (group A) or myomas (group B), respectively.

Measurements and Main Results: Two groups of women who underwent different fertility-saving procedures were compared. Although all women entering the study had declared their wish to conceive, only 28 patients in group A (group A1) and 24 women in group B (group B1) finally aimed toward pregnancy. The mean age and follow-up period was 35.0 years and 76.81 months, respectively, in group A and 34.8 years and 72.5 months, respectively, in group B. The pregnancy and delivery rates were 75.0% and 46.4%, respectively, in group A1 vs 96.0% and 70.8%, respectively, in group B1, with no significant differences between the 2 groups. The open surgical approach was significantly more frequently employed in group A (47.3% vs 16.4%; p < .01).

Conclusion: In this study, women who underwent surgery involving the uterine muscularity, including myomectomy or adenomyomectomy, had comparable reproductive outcomes, with no significant differences. Journal of Minimally Invasive Gynecology (2021) 00, 1–9. © 2021 AAGL. All rights reserved.

Keywords: Adenomyosis; Fertility saving procedure; Fertility outcome; Myoma

Study Objective

Adenomyosis and uterine myomas are noncancerous conditions usually affecting the uterine muscularity. Adenomyosis can mimic the many signs and symptoms of myomas and may be associated with endometriosis (both are estrogen dependent) and uterine myomas [1]. It can be categorized into diffuse adenomyosis, which involves most of the myometrium, and focal adenomyosis, which is present only in one part of the uterine wall and is better demarcated from the healthy myometrium. Several theories have been proposed to explain the pathogenesis of this process [2]; women who have undergone previous uterine surgery
may be at risk. The published prevalence of adenomyosis ranges from 5% to 8% to 40% to 70% of all uterine specimens [3].

Women with adenomyosis may show a lower pregnancy rate and a higher miscarriage rate than healthy women. There is also a general agreement that leiomyomas, either submucosal or intramural, negatively affect fertility, when compared with women without myomas [4–7].

Myomas and adenomyosis are usually diagnosed ultrasonographically (Supplemental Fig. 1). The ultrasonographic evaluation of adenomyosis and its distinction from leiomyomas is quite difficult and should be preferably performed by examiners with higher levels of ultrasound expertise [8]. These imaging assessments are also very useful for decision-making and identifying the scope of operative procedures (directions of hysterotomy, depth of incision, and site of the uterus) [9].

Adenomyosis treatment primarily depends on the severity of symptoms and the reproductive circumstances [10]. Some patients, especially women of reproductive age with severe symptoms that are nonresponsive to pharmacotherapy and with failure of infertility treatment, may be candidates for laparoscopic or open adenomyomectomy. The most radical alternative for such procedure, the Osada method, involves radical excision of the adenomyosis with the intended opening of uterine cavity and subsequent reconstruction of the uterine wall. The myometrial defect is closed using the triple-flap method. In the Osada study, 104 patients with a mean age of 38 years underwent adenomyomectomy. Twenty-six of them (25%) wished to conceive and 16 (61%) subsequently conceived. Fourteen women achieved a full term pregnancy and delivered via elective cesarean section (CS), and 2 women experienced spontaneous abortion [11].

Another cytoreductive procedure for adenomyosis is the double-flap method, which uses a serosal side flap for the reconstruction of the uterine wall [11]. The newly described method, published in 2020, used for performing laparoscopic adenomyomectomy in a patient with focal type adenomyosis, is called the four-petal method [12]. The definitive radical solutions (laparoscopic, vaginal or abdominal hysterectomy) should be reserved for women showing failure of conservative therapy and/or willingness to forgo fertility.

To date, the literature contains a limited number of reports describing the reproductive outcomes of patients after adenomyomectomy, most of which lack a control group. No such report has compared the reproductive, obstetric, and surgical outcomes between adenomyomectomy and myomectomy. Intramural myomectomy is a surgical procedure also performed laparoscopically or abdominally and affects the uterine muscularity, requiring a meticulous reconstruction of the uterine wall, especially in patients seeking improved reproductive performance. Therefore, this study aimed to investigate the safety, feasibility, and fertility outcomes of the 2 different uterus-sparing surgical treatments targeting adenomyosis and intramural myomas.

**Materials and Methods**

A total of 110 women underwent laparoscopic or open uterus-sparing surgery for clinically significant uterine adenomyosis (group A, N = 55) or myomas (group B, N = 55) between 2004 and 2019. All participants wished to retain and possibly improve their reproductive potential. A retrospective analysis of prospectively collected data was performed. Patients were identified through a manual search of the operating theatre records. For the 110 patients in the study, data were collected for demographic characteristics, indications of intervention, surgical data, coincidence of endometriosis, number of reinterventions, and number and outcome of pregnancies before and after surgery, including pregnancy loss and any obstetric complications. This study received the institutional review board’s approval (May 20, 2021, Hospital Ethical Committee agreement 108/21 S-IV), and informed written consent was obtained from each patient before participation. All women gave informed consent to participate in the follow-up and data collection.

Chi-square, Mann-Whitney U, and the Fisher exact tests were used for calculating significant intergroup differences in the frequencies of discrete variables; p <.01 was considered significant.

All patients who underwent transabdominal resection (laparoscopic or open) for either diffuse or focal adenomyosis were enrolled in the study (group A). A control group (group B) with the same number of patients was created using our surgical database with the following approach: each woman from group A was paired with a woman of closest similar age (± 2 years) at the time of procedure who was treated with myomectomy for intramural uterine myomas. These 2 groups with different uterine fertility-saving procedures were compared.

The inclusion criteria were as follows: age between 18 and 45 years, clinical and ultrasonographic evidence of focal or diffuse adenomyosis (group A) or intramural myomas (group B) with perioperative confirmation, presence of specific adenomyosis/myoma-related symptoms such as menorrhagia, dysmenorrhea, pelvic pain, or pressure; the desire to retain the uterus and fertility. The following parameters excluded women from the study: unexpected histological findings (other than uterine adenomyosis or leiomyoma), uterus preoperatively enlarged more than that in the 20th week of gestation, preoperative presence of endometrioma larger than 2 cm, and patient’s refusal to undergo uterus-saving surgery or regular follow-up at our department.

Group A included women with diffuse adenomyosis, who were further categorized as group AD1 (on the basis of ultrasound and perioperative findings), and were compared separately with the control group B.
Description of surgical interventions: all procedures were performed under general anesthesia with endotracheal intubation and in a low lithotomy position. Single-shot antibiotic prophylaxis with intravenous (i.v.) ampicillin and sulbactam (1 g + 500 mg i.v. (Istituto Biochimico Italiano, G. Lorenzini S. p. Aprilia, Italy) or 600 mg of i.v. Clindamycin Kabi 150 mg/mL (Fresenius Kabi s.r.o., Nusle, Prague, Czech Republic) in patients that are allergic to penicillin, was used before the induction of anesthesia. Before the first incision on the uterine surface, a vasoconstricting agent (4 mL of Supracain 4% Zentiva, K.S., Prague, Czech Republic, mixed with 16 mL of normal saline) was used to reduce intraoperative bleeding. No intrauterine manipulator was used for assistance during the procedures.

Laparoscopic procedures were started with the use of conventional 2- or 3-dimensional laparoscopy (Exera II CV-180w. or CH-S400-4K Autoclavable Camera Head; Full HD, Olympus), and some were converted to open access (from the transverse suprapubic incision) such as in cases with unmanageable difficulties with bleeding, complete tissue resection, or uterine reconstruction.

Laparoscopic resection of focal adenomyosis was performed as a radical excision of the adenomyotic pathologic tissue, with a meticulous 2 or more layered (number of layers related to the depth of the defect) suturing of the uterine musculature and serosa using 1 to 0 absorbable polyglactin suture (Vicryl; Ethicon Inc., Sommerville, NJ). The removal of the focal adenomyosis was performed while avoiding the opening of the uterine cavity.

In severe cases showing diffuse and bulky infiltration of the uterine wall all the way from the endometrium to the serosa, a primary open surgical approach was performed; a sagittal midline incision was made on the uterine serosal surface with the intended opening of the uterine cavity, and a 1 cm margin of tissues above the endometrium and below the serosal surface were left in situ with subsequent triple-flap reconstruction of the bisected uterus [11,13]. These procedures were performed with care to avoid damage to the interstitium of the fallopian tube, especially because of the patients’ desire for future conception [14]. Adenomyomectomy was still surgically challenging because of the tight boundaries between the healthy myometrium and adenomyotic tissue and the difficulties with suturing, since the dead space at the operation site needs to be eliminated [15]. All patients in group B underwent standard myomectomy. Myomas were enucleated, sparing the pseudocapsule, and the uterine wall was repaired with atraumatic 1to 0 absorbable poliglactin suture (Vicryl; Ethicon Inc., Sommerville, NJ) in at least 2 layers [16]. In cases of periprocedural opening of the uterine cavity, a Hyaluronic acid gel (Hyalobarrier, Anika Therapeutics S.r.I., Abano Terme, Italy) or a Foley’s catheter balloon was placed inside the cavity to prevent the formation of intrauterine adhesions. The catheter balloon was removed 5 days after surgery [17].

In cases requiring laparoscopic myomectomy, we used electric power morcellation. Since 2014, power morcellation has been performed inside a bag to evacuate the myomas from the peritoneal cavity and to prevent spillage of uterine tissue or cells [18]. The in-bag morcellation technique has proven feasibility and lowers the risk of malignant cells spreading during the procedure. In addition to malignant processes, parasitic leiomyoma or peritoneal adenomyosis have also been reported as a result of tissue dissemination [19]. Since power morcellation came under scrutiny after strong warnings by the Food and Drug Administration in 2014, in-bag morcellation was strictly performed [20].

If coexisting endometriosis was found, complete excision or coagulation of all visible endometriotic lesions was performed. Except for adhesiolysis, no further procedure on ovaries was performed [21]. All patients were prospectively followed-up with regular ultrasound and clinical examinations every 6 months. They were all instructed to avoid pregnancy for 6 months postoperatively. In case of gestation (spontaneous or artificial conception like in vitro fertilization [IVF] or intrauterine insemination), patients were instructed to report it, and ultrasound monitoring as well as labor management at our clinic were offered to them. Pregnancy results were collected with the help of reports from other hospitals and reports from patients’ local gynecologists.

Results

We performed 55 resections of adenomyosis (group A) through laparoscopy or laparotomy (Figs. 1 and 2). The control group included 55 women who underwent laparoscopic or open myomectomy for intramural myoma (group B). The mean follow-up period was 76.81 months in women who underwent resection of adenomyosis and 72.5 months in the control group. Overall, 44 (80%) and 11 (20%) patients from group A had diffuse and focal adenomyosis, respectively. Open resection was significantly more frequent among patients who underwentadenomyomectomy (47.3% vs 16.4% in the myomectomy group, p < 0.01). In group A, 1 patient required urgent perioperative hysterectomy because of the severity and extent of diffuse adenomyosis, and 3 patients required elective hysterectomy (2 laparoscopic and one open) 2, 3, and 8 years after adenomyosis resection because of disease recurrence and the patients’ willingness to forgo their fertility. Group B included only 1 case that required hysterectomy (laparoscopic) during the follow-up period, which was performed in a 37-year-old nulliparous woman with coincidental stage IA endometrial cancer.

Peritoneal, deep infiltrating endometriosis or both were significantly more frequent in the group with adenomyosis (36% vs 15% in the myomectomy group).

Around 3 months after the operation, second-look hysteroscopy was performed in 37 (67.3%) patients from group
A and 13 patients from group B (23.6%, p < .01) because of the evident perioperative opening of the endometrial cavity. Hysteroscopic synechiolysis was performed because of intrauterine adhesions in 13 patients who underwent adenomyomectomy (35.1%) and in 3 women after myomectomy (23.1%). The severity of intrauterine adhesions was assessed according to the American Fertility Society classification of intrauterine adhesions. The adhesions were

**Fig. 1**
Laparoscopic resection of focal type adenomyosis.

**Fig. 2**
Typical image of diffuse infiltrative disease during open adenomyomectomy.
classified as stage I (mild) in all cases [22]. All patients’ baseline and perioperative parameters and findings are summarized in Table 1.

The reproductive outcomes in the 2 groups were also compared. Cumulative fertility data were collected from all patients in both groups during the follow-up period, with no additional systematic infertility investigations being conducted as a part of this trial. Although all women entering the study had declared their future wish to conceive, only part of them finally aimed toward pregnancy, including 30 patients in group A (group A1), and 25 in group B (group B1). The women aged over 42 were excluded (2 of 30 from group A1 and 1 of 25 from group B1) from the evaluation of the fertility outcome. None of these 3 women, who attempted IVF (using their own oocytes) or tried to conceive spontaneously, became pregnant [23].

The pregnancy and delivery rates were 75% (21 of 28) and 46.4% (13 of 28) in group A1 and 96% (23 of 24) and 70.8% (17 of 24) in group B1. The 2 groups showed no significant differences in these 2 parameters. The proportion of miscarriages during pregnancy in group A1 and B1 were 28.6% and 26.1% (6 of 21 vs 6 of 23), respectively. There

### Table 1

Baseline and surgical data of patients who underwent resection of focal and diffuse adenomyosis (group A), diffuse adenomyosis (group AD) and myomectomy for intramural myomas (group B)

<table>
<thead>
<tr>
<th>Data/Results</th>
<th>Group A, N = 55</th>
<th>Group AD, n = 44</th>
<th>Group B, N = 55</th>
<th>p&lt;sup&gt;*&lt;/sup&gt;</th>
<th>p&lt;sup&gt;†&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at operation (yrs) Mean ± SD</td>
<td>35.0 ± 6.0</td>
<td>35.2 ± 5.7</td>
<td>34.8 ± 5.8</td>
<td>.760</td>
<td>.695</td>
</tr>
<tr>
<td>Range</td>
<td>21−45</td>
<td>21−44</td>
<td>21−47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline body mass index (kg/m&lt;sup&gt;2&lt;/sup&gt;) Mean ± SD</td>
<td>23.9 ± 5.0</td>
<td>23.6 ± 5.1</td>
<td>22.7 ± 3.9</td>
<td>.276</td>
<td>.528</td>
</tr>
<tr>
<td>Range</td>
<td>17−41</td>
<td>17−41</td>
<td>17.6−35.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Currently wished to become pregnant&lt;sup&gt;‡&lt;/sup&gt;</td>
<td>Yes</td>
<td>30</td>
<td>24</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>25</td>
<td>20</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laparoscopy, n</td>
<td>29 (52.7%)</td>
<td>18 (40.9%)</td>
<td>46 (83.6%)</td>
<td>.001</td>
<td>.001</td>
</tr>
<tr>
<td>Laparotomy, n</td>
<td>26 (47.3%)</td>
<td>26 (59%)</td>
<td>9 (16.4%)</td>
<td>.001</td>
<td>.001</td>
</tr>
<tr>
<td>Elective open surgery</td>
<td>18</td>
<td>18</td>
<td>9</td>
<td>.058</td>
<td></td>
</tr>
<tr>
<td>Conversion</td>
<td>8</td>
<td>8</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time of operation (min) Mean ± SD</td>
<td>111.6 ± 34.4</td>
<td>115.98 ± 35.27</td>
<td>87.2 ± 27.9</td>
<td>.001</td>
<td>.001</td>
</tr>
<tr>
<td>Range</td>
<td>43−195</td>
<td>43−195</td>
<td>32−170</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean estimated blood loss in mL</td>
<td>380.0 ± 235.4</td>
<td>419.32 ± 246.66</td>
<td>381.8 ± 260.6</td>
<td>.813</td>
<td>.380</td>
</tr>
<tr>
<td>Range</td>
<td>(50−1000)</td>
<td>(50−1000)</td>
<td>(50−1500)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cases with excessive bleeding (≥1000 mL), n (%)</td>
<td>3 (5.5%)</td>
<td>3</td>
<td>1 (1.8%)</td>
<td>.308</td>
<td>.320</td>
</tr>
<tr>
<td>Weight of the excised lesion (g) Mean ± SD</td>
<td>70.9 ± 75.1</td>
<td>82.45 ± 79.63</td>
<td>162.3 ± 159.1</td>
<td>.001</td>
<td>.001</td>
</tr>
<tr>
<td>Range</td>
<td>6−365</td>
<td>13−365</td>
<td>3−750</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Largest diameter of resected tissue (cm)&lt;sup&gt;§&lt;/sup&gt;</td>
<td>4.8 ± 1.6</td>
<td>5.14 ± 1.59</td>
<td>8.0 ± 4.5</td>
<td>.001</td>
<td>.001</td>
</tr>
<tr>
<td>Range</td>
<td>3−9</td>
<td>3−9</td>
<td>2−22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coincidence of endometriosis&lt;sup&gt;¶&lt;/sup&gt;</td>
<td>20 (34.6%)</td>
<td>17 (38.7%)</td>
<td>8 (14.5%)</td>
<td>.009</td>
<td>.006</td>
</tr>
<tr>
<td>Peritoneal endometriosis</td>
<td>11</td>
<td>9</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deep infiltrating endometriosis</td>
<td>9</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recurrence of disease&lt;sup&gt;†&lt;/sup&gt;</td>
<td>12 (23.1%)</td>
<td>11 (26.8%)</td>
<td>8 (14.8%)</td>
<td>.277</td>
<td>.189</td>
</tr>
<tr>
<td>Reoperation</td>
<td>6 (11.5%)</td>
<td>6 (14.6%)</td>
<td>3 (5.6%)</td>
<td>.226</td>
<td>.181</td>
</tr>
<tr>
<td>Reasons for reintervention</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Persistent clinical findings or symptoms&lt;sup&gt;‖&lt;/sup&gt;</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>*</sup> Difference between Group A and B  
<sup>†</sup> Difference between Group AD and B  
<sup>‡</sup> All women entering the study had declared their future wish to conceive, but only these women currently aimed to become pregnant (group A1 and B1)  
<sup>§</sup> Confirmed by ultrasonography preoperatively  
<sup>¶</sup> According to perioperative findings  
<sup>‖</sup>Confirmed by ultrasonography. Recurrence includes adenomyomastic or myomastic lesions > 2 cm in maximum diameter  
<sup>†</sup> Low grade serous ovarian cancer and low grade endometrial stromal sarcoma in group A, adenocarcinoma of the endometrium in group B
was no case of elective abortion as a result of unplanned pregnancy. All miscarriages occurred in the first trimester before the 12th week of pregnancy. In the assessments of perinatal data, we noticed 1 case of placenta previa in group A1 and, quite surprisingly, no cases of deep placental insertion, uterine rupture, or necessity of peripartum hysterectomy. The fertility outcomes of all included patients are summarized in Table 2. When 44 women with resection of a more severe form of adenomyosis (diffuse adenomyosis, group AD) were compared with patients who underwent myomectomy, the groups showed no significant differences in fertility outcomes, except for a lower pregnancy rate and higher proportion of post IVF pregnancies in the AD1 group. The fertility outcomes of all study patients are summarized in Table 2.

**Discussion**

It is well known that the incidence of adenomyosis and uterine myomas increases significantly with age. In times when the first pregnancy is postponed into the fourth or even fifth decade, there is a growing demand for fertility-saving procedures for these uterine diseases [24].

However, women aged ≥ 43 years who undergo IVF treatment with their own oocytes have poor reproductive outcomes, with the life birth rate below 5%, irrespective of normal or abnormal uterine anatomy. The likelihood of spontaneous pregnancy is less than 2% around the age of 42 year and almost 0% after 45 years [23]. Therefore, uterine sparing procedures should be primarily offered as a beneficial treatment for women of ages ≤ 42 years, as the chance of conceiving beyond this age with or without IVF is minimal. In contrast, women older than 42 years should also benefit from this radical procedure in case of undergoing embryo transfer with embryos derived from donor oocytes.

The etiology of both diseases, as well as their relationship to infertility remains uncertain.

Adenomyosis may impact the endometrial receptivity, affect the volume and the shape of the uterine cavity, and also provoke some changes in the inflammatory response of the myometrium. Cytoreductive surgery might result in enhancing the response of the remaining foci to hypoestrogenic agents and restoring normal immunity [25,26]. In addition, myomas could alter the shape and spaciousness of the endometrial cavity and impair its receptivity [27].

Adenomyosis is often associated with pelvic endometriosis. However, not all patients with adenomyosis have endometriosis, which corresponds with our results (Table 1) as well as with different theories regarding the etiology and pathogenesis of these 2 entities. It is unsure how much the surgical resection of endometriosis modifies the reproductive prognosis. However, it is usually accepted that women desiring future fertility who suffer from pain may benefit from the surgical management [28]. In our approach to all the patients, if endometriosis was found, it was resected (as a part of adenomyomectomy or myomectomy) to minimize its influence on fertility.

<table>
<thead>
<tr>
<th>Characteristics/Results</th>
<th>Group A1</th>
<th>Group AD1</th>
<th>Group B1</th>
<th>p*</th>
<th>p†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients, n</td>
<td>28</td>
<td>23</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nulliparous women, n/n (%)</td>
<td>23</td>
<td>19</td>
<td>23</td>
<td>.123</td>
<td>.142</td>
</tr>
<tr>
<td>Previous spontaneous abortions, n</td>
<td>10</td>
<td>14</td>
<td>7</td>
<td>.616</td>
<td>.029</td>
</tr>
<tr>
<td>Previous failure of IVF infertility treatment, n</td>
<td>16</td>
<td>13</td>
<td>11</td>
<td>.416</td>
<td>.463</td>
</tr>
<tr>
<td>Age at operation (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>35.0 ± 5.3</td>
<td>35.0 ± 3.8</td>
<td>32.5 ± 5.1</td>
<td>.055</td>
<td>.101</td>
</tr>
<tr>
<td>Range</td>
<td>22−42</td>
<td>28−40</td>
<td>21−40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pregnancy rate, n/n (%)</td>
<td>21/28 (75%)</td>
<td>12/23 (52%)</td>
<td>23/24 (96%)</td>
<td>.038</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>All pregnancies, n</td>
<td>21</td>
<td>12</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spontaneous pregnancy, n</td>
<td>6</td>
<td>3</td>
<td>15</td>
<td>.015</td>
<td>.024</td>
</tr>
<tr>
<td>ART pregnancy, n</td>
<td>15</td>
<td>9</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abortion rate, n/n (%)</td>
<td>6/21 (28.6%)</td>
<td>2/12 (17%)</td>
<td>6/23 (26.1%)</td>
<td>.853</td>
<td>.528</td>
</tr>
<tr>
<td>Spontaneous abortion</td>
<td>6</td>
<td>2</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delivery rate, n/n (%)</td>
<td>13/28 (46.4%)</td>
<td>10/23 (43.5%)</td>
<td>17/24 (70.8%)</td>
<td>.076</td>
<td>.058</td>
</tr>
<tr>
<td>Spontaneous delivery, n/n (%)</td>
<td>1/13 (7.7%)</td>
<td>0/10 (0%)</td>
<td>4/17 (23.5%)</td>
<td>.249</td>
<td>.264</td>
</tr>
<tr>
<td>Cesarean section, n/n (%)</td>
<td>12/13 (92.3%)</td>
<td>10/10 (100%)</td>
<td>13/17 (76.5%)</td>
<td>.249</td>
<td>.264</td>
</tr>
</tbody>
</table>

* Difference between Group A and B.
† Difference between Group AD and B.
‡ Women after previous failure of in vitro fertilization (IVF) treatment.
§ Assisted reproductive technology was used to achieve pregnancy.
IVF = in vitro fertilization.
The diagnosis should be made by highly educated and well-experienced sonographers. Ultrasound is accepted, as the most widespread modality for the diagnosis of adenomyosis and myomas, with magnetic resonance imaging suitable for further investigation of ambiguous cases [29]. In our study, where transvaginal ultrasound was performed preoperatively in all cases, adenomyosis was recognized in only 37 cases (67.3%), which could be explained by the learning curve since the study had started back in 2004. Back in 2015, we had adopted a Van den Bosch adenomyosis scoring system that grades the type of adenomyosis and its extension inside the uterus [8].

There is no standard protocol for the optimal treatment of adenomyosis and uterine myomas, particularly in pregnancy-seeking or infertile women. The role of cytoreductive surgery in extensive uterine adenomyosis is still controversial because adenomyosis often diffusely involves the whole uterus. These debulking procedures are undoubtedly difficult and often incomplete (in terms of clearing up of all pathologic tissue) while maintaining a functional uterus for future fertility [30,31]. Currently, there is no evidence indicating the best operation technique for patients undergoing cytoreductive resection of adenomyosis. It is unknown whether different surgical approaches (robotic assisted, laparoscopic or abdominal) could influence the outcomes [6]. It also appears that surgical treatment with gonadotropin releasing hormone agonists may increase the rate of spontaneous pregnancy in women with adenomyosis. However, the lack of well-designed prospective comparative studies still dominates the topic [27,32].

From the surgical point of view, it is critical to reconstruct the uterine wall and the cavity properly without the extensive use of electrocoagulation to ensure appropriate embryo implantation and fetal growth following postoperative conception [11].

In patients who undergo any kind of intervention on the uterine musculature, including both myometomy and adenomyomectomy, uterine rupture can occur at any point during pregnancy. Dubuisson et al [33] reported 3 cases of ruptures following laparoscopic myomectomies, which represented 1% of the patients in their series [34]. The frequency of uterine rupture seems to be much higher (up to 6%) in patients undergoing adenomyomectomy [30,35]. There was no case of uterine rupture in our groups, most likely owing to the small number of study participants.

In contrast with large or multiple myomectomies, elective open surgery in the most severe cases of diffuse adenomyosis seems to be safer and more appropriate than laparoscopy. It is probably owing to the better control over the extent of resection, as well as the easier way of reconstruction by the surgeon’s dexterity [30]. In our experience with postmyomectomy pregnancies for over 20 years, uterine rupture seems to occur at a comparable or rather lower frequency than in women after CS. Nevertheless, a literature review suggested that the risk of uterine rupture is less than 1% in women attempting vaginal delivery [36].

All the patients in our study who underwent radical resection for adenomyosis (group A) were delivered via elective CS because of the higher risk of uterine rupture, and the only woman who delivered via spontaneous labor had undergone a focal adenomyosis resection. Surely, there is more room for vaginal delivery in postmyomectomy patients, also seen in study group B1, who could probably be managed similarly to women delivering after a previous CS.

In this study we tried to compare 2 groups of patients with different types of fertility sparing uterine surgeries and evaluate their reproductive outcomes. While myomectomy (the control group) can be considered as a well-established procedure with standardized surgical steps and predictable fertility outcomes, resection of severe adenomyosis represents a newer, and more controversial alternative to conservative therapy. This difference was actually the reason why we decided to verify and compare the reproductive potential of adenomyomectomy with a different kind of uterine surgery, namely myomectomy.

Our data analysis demonstrated no significant difference in pregnancy and delivery rates between the 2 groups. The perinatal outcomes of the groups were also comparable, including the low frequency of severe peripartum complications, such as the abruption or abnormal invasion of the placenta. In contrast, when comparing the subgroup of women who underwent radical adenomyomectomy for severe diffuse adenomyosis (AD1) with those who underwent myomectomy (group B1), the pregnancy rate was significantly lower in the former group. Therefore, it appears, that the severity of the disease and the extent of the surgical resection of the uterus may influence the likelihood of a successful gestation.

We also observed a small chance for spontaneous conception in the group with adenomyomectomy. In 23 women with severe diffuse adenomyosis, the pregnancy rate was 52%, but only 3 of these women conceived naturally. This might be explained by the patients’ age (above 35 years in average), coexisting endometriosis (39%, higher than in other subgroups), and also close proximity to the site of radical resection of the fallopian tubes. This phenomenon together with the well-known tendency of recurrence could indicate that extensive cytoreduction of diffuse adenomyosis with subsequent IVF should be a reason for no hesitation, especially in older women with preexisting infertility. However, the study population is too small for making clear proposals.

This study has several strengths. Technically challenging procedures on the uterus belong, undoubtedly, to the main topics in the field of reproductive surgery, which urgently need more answers and solutions for more and more patients. To the best of our knowledge, this is the first report comparing surgical therapy for adenomyosis and uterine myomas with a primary focus on subsequent fertility. Although the results of our study could be considered controversial because of the different disease characteristics affecting the uterus, the findings are interesting and could
provide hope for a carefully selected group of patients with severe adenomyosis who experienced failed pharmacotherapy and IVF treatment.

There are some limitations in our study. First, our study was retrospective in nature. Second, the number of patients in both study groups was low, especially regarding the comparison of reproductive results. In addition, some heterogeneity in both study populations, the absence of complete information on other infertility-related factors, nonidentical way of infertility treatment, unequal frequency and severity of coincidental endometriosis in the groups, and different extent of the disease in patients with adenomyosis could also limit the significance of our results. Certainly, much stronger conclusions and recommendations could arise only from prospective trials with higher numbers of participants based on an appropriate power calculation. In contrast, although the incidence of adenomyosis seems to be high, especially in infertile women, just a small group of them are probably eligible for a challenging procedure such as adenomyomectomy. In the future, most-likely multicenter studies will need to investigate further to build onto the findings of our work, which should be regarded as a preliminary study.

Conclusions

This study, a novel one, aimed to investigate the safety, feasibility, and fertility outcomes of patients who underwent a uterus-sparing surgical treatment for adenomyosis compared with those who underwent myomectomy. Despite the technical challenges necessitating longer operative time, resection of adenomyosis seems to be a feasible option for women with severe adenomyosis having future reproductive plans, with more cases involving the opening of the uterine cavity and higher conversion rates compared with standard myomectomy. In this study, women who underwent surgery on the uterine musculature, including both myomectomy and adenomyomectomy, had comparable reproductive outcomes, with no significant differences. Nevertheless, our study is limited by the small number of participants involved; hence, the need for larger prospective, randomized trials to validate the results.

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References


Supplementary materials

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