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Laparoscopic Surgery for Focal Adenomyosis

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ABSTRACT

Background and Objectives: For conservative surgical treatment of focal uterine adenomyosis, laparoscopic adenomyomectomy has been increasingly performed, so that reassessment to determine the safety and efficacy of the laparoscopic surgical technique in a larger number of cases and reevaluation for reproducibility for laparoscopic adenomyomectomy is needed. We evaluate the clinical outcomes of laparoscopic adenomyomectomy with transient occlusion of uterine arteries (TOUA) for focal uterine adenomyosis performed by a single surgeon at a single institute.

Methods: Patients (N = 105) with symptomatic focal uterine adenomyosis underwent laparoscopic adenomyomectomy with TOUA by a single surgeon at Ulsan University Hospital from May 1, 2011, through September 30, 2016. Surgical outcomes included operative time; intraoperative injury to blood vessels, nerves, and pelvic organs; and intraoperative blood loss. We assessed the degree of improvement in dysmenorrhea and menorrhagia and relapsing or remnant adenomyosis lesion by ultrasonography at the 7-momth follow-up after the operation. Then, all patients were followed up at 6-month intervals at the outpatient clinic.

Results: The mean patient age was 41.98 ± 4.73 years. The mean TOUA and operative times were 4.46 ± 2.68 and 75.14 ± 20.56 min, respectively. The mean estimated blood loss was 148.19 ± 101.69 mL. No conversion to laparotomy or major complications occurred. At the 7-month follow-up, complete remission of dysmenorrhea and menorrhagia had occurred in 93.02% and 76.92% of patients, respectively.

Conclusions: Laparoscopic adenomyomectomy with TOUA is a safe and effective surgical treatment modality for women with symptomatic focal uterine adenomyosis who want to preserve fertility.

Key Words: Focal uterine adenomyosis, Laparoscopic adenomyomectomy, Transient occlusion of uterine arteries.

INTRODUCTION

Uterine adenomyosis is a benign gynecological disease, defined as ectopic endometrial gland invasion into the myometrium. The disease is usually categorized as diffuse or localized adenomyosis, according to the extent of the lesion. However, there is no definite parameter for distinguishing between the 2 types. Conservative surgical adenomyomectomy should be planned in patients with uterine adenomyosis after considering several factors. One of these factors is the type of uterine adenomyosis and lesion area. It is very important to plan and treat patients with uterine adenomyosis who desire fertility preservation via a laparoscopic or laparotomic approach. Usually, in patients with focal uterine adenomyosis, conservative surgical adenomyomectomy has advanced in the technical respect, the trend of the operative approach has gradually shifted from a laparotomic to laparoscopic.

Although conservative surgical treatment of uterine adenomyosis is regarded as having several limitations because of the obscure boundary between normal myometrium and adenomyotic lesion and intraoperative complications that make it difficult to perform the operation, since 2004, there have been several reports that support the safety and efficacy of laparoscopic adenomyomectomy in patients with focal uterine adenomyosis via a laparotomic or laparoscopic approach.[1–8]

For conservative surgical treatment of focal uterine adenomyosis, laparoscopic adenomyomectomy has been increasingly performed universally, but the cases have been few, and the laparoscopic techniques used for conservative adenomyomectomy have been diverse. The various techniques must be reassessed to determine the safety and

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efficacy of the laparoscopic surgical technique in a large number of cases and frequent reproducibility of each technique used for laparoscopic adenomyomectomy. Therefore, we should report the results obtained in a large number of cases of laparoscopic adenomyomectomy performed with a uniform technique, to determine the safety and efficacy of this surgical treatment modality.

METHODS

From May 1, 2011, to September 30, 2016, 105 patients undergoing laparoscopic adenomyomectomy with TOUA were enrolled in this study. The patients were selected consecutively. Inclusion criteria were the presence of a symptomatic adenomyoma (diagnosed by ultrasonographic examination) that was refractory to conservative medical treatment and the patient's strong desire for preservation of the uterus. All patients with diffuse adenomyosis were excluded at out-patient base preoperatively. Patients with postoperative negative pathological findings of adenomyoma were also excluded. Laparoscopic adenomyomectomy with TOUA was preoperatively suggested for all the patients who fulfilled the inclusion criteria, and it was performed by a single surgeon (Y.S.K.). The operating time was defined as the period from skin incision to closure. The size of the adenomyoma was defined as the maximum diameter of the adenomyoma on ultrasonography. In the last 20 cases, the weight of the adenomyoma was estimated by the total weight of the excised lesion during the operation, in the cases in which the weight of the adenomyoma as a parameter of the operation outcome was added late in the current study. Estimated blood loss (EBL) was assessed by subtracting the rinse volume from the blood volume that was collected in the suction apparatus. This study was approved by the Ulsan University Hospital Institutional Review Board, Ulsan, Korea.

Surgical Technique

The surgical technique has been described in a published report.[1] The patient was placed in the dorsal lithotomy position under general anesthesia with endotracheal intubation. A uterine manipulator (Hangzhou Shikonghou Medical Equipment Co. Ltd., Shanghai, China) was placed in the uterine cavity to allow placement of the uterus into the optimal position during excision and suturing. Intra-abdominal pressure was maintained at 13 mm Hg with carbon dioxide gas. Once the pneumoperitoneum was created, videolaparoscopy (laparoscopic camera; Karl Storz GmbH & Co. KG, Tuttlingen, Germany) was performed with a 10-mm trocar that was introduced through the umbilicus. Furthermore, 3 trocars were needed for the operation: a 12-mm trocar for placement of the endoscopic vascular clip on the left side, a 5-mm trocar was placed on the right side of the lower abdomen, and another 5-mm trocar was placed on the median line just above the pubic hairline. These ports were inserted for introducing surgical instruments. The first step was to identify the uterine arteries. The peritoneum was incised with a monopolar electrode through the triangular area (consisting of the round ligament, the ovarian ligament, the infundibulopelvic ligament, and the psoas muscle). First, the umbilical artery was isolated, and the assistant moved it upward in a lateral direction. The second step was to identify the course of the ureter. We observed the point where the uterine artery crossed the ureter on the lateral side of the umbilical artery. The isolated uterine artery was occluded with an endoscopic vascular clip (temporary atraumatic endovessel clips; B. Braun Korea Co., Ltd., Seoul, Korea). The average time spent for occluding both uterine arteries was about three minutes (**Figure 1**).

The uterus was incised with a monopolar cutting electrode until the underlying margin was visually exposed. The adenomyoma was completely excised with endoscopic scissors. The operator distinguished the adenomyoma from the normal myometrium by using tactile and visual sensations for complete cytoreductive excision. The serosal surface covering the adenomyoma was maintained at a minimum 5-mm depth, to enable easy suturing of excisional defects. The endometrium was spared as much as possible to preserve fertility. The defect area after excision of the adenomyoma was sutured in 3 layers, including a wide, deep, single interrupted suture, a continuous nonlocking running suture, and a continuous interlocking suture (**Figure 2**). Depending on the shape of the uterus, the method was modified. The first assistant held the stitch to maintain suture tension throughout the repair process. Finally, both endoscopic vascular clips were removed safely, and the excised tumor was removed.

There was a single change in the surgical technique used in these 105 extended cases compared with that used in the previous 34 cases, which was the suture technique. To reduce or obliterate the dead space created by excision of the adenomyotic lesion in the uterine myometrium, modified suture techniques were required on a case-by-case basis according to the extent, severity, and location of the lesion.

The latest suturing method for the uterine serosa was a continuous interlocking running suture, placed layer by

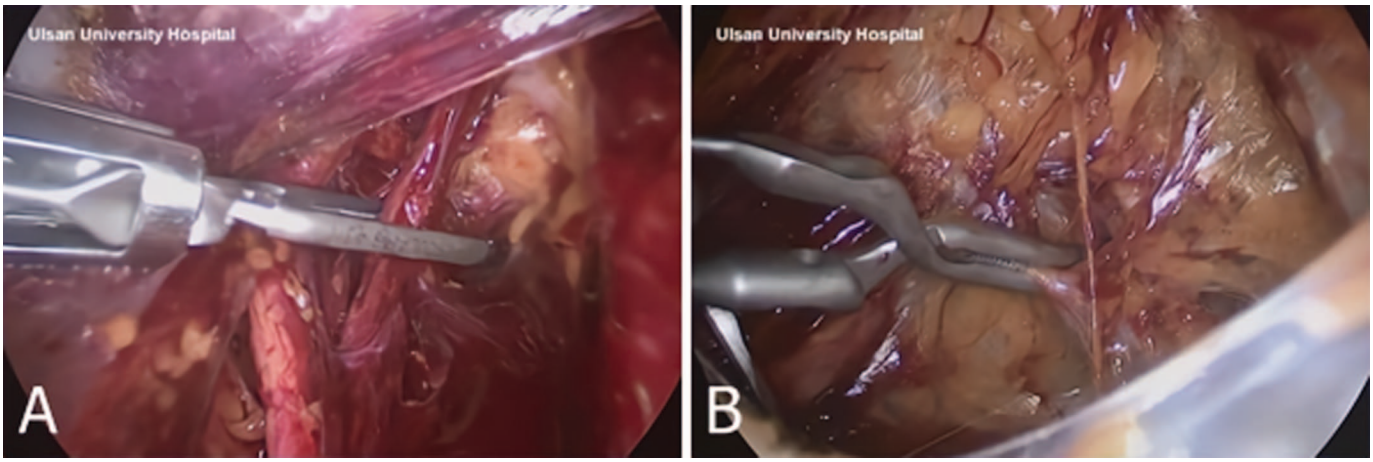

Figure 1. Transient occlusion of the uterine arteries with use of endoscopic vascular clips. (A) Left side; (B) right side.

layer. Suturing of the inner myometrium was performed by fully penetrating from the serosa of the anterior body to the serosa of the other side, the posterior body of the uterus, in a continuous nonlocking running suture, layer by layer, and the innermost myometrium was sutured by the full penetrating simple interrupted technique.

Postoperative Follow-up

At the 7-month follow-up, we assessed the improvement in symptoms, including dysmenorrhea and menorrhagia, by questionnaire, and we performed ultrasonography to monitor the patients for recurrence. The questionnaire, which focused on specific pelvic symptoms, included items to evaluate the presence and severity of dysmenorrhea and menorrhagia. The questionnaire was completed in a clinical interview. An 11-point numerical rating scale was used to evaluate the intensity of pain during menstruation (from 0 = no pain to 10 = excruciating pain).[9] The Mansfield-Voda- Jorgensen (MVJ) menstrual bleeding scale, used to evaluate menorrhagia, is a subjective Likert-type scale from 1 (spotting) to 6 (very heavy bleeding or gushing).[10] Complete remission of dysmenorrhea was defined as 0 on the numerical rating scale, and complete remission of menorrhagia was defined as 2.3 on the MVJ scale at 7 months after the procedure. Partial remission was defined as >50% improvement in symptoms at 7 months after laparoscopic adenomyomectomy with TOUA. Transvaginal sonography was performed by the same physician, who was not involved in this study and was blinded to preoperative ultrasonographic findings before and after surgery. Criteria for adenomyosis were the presence of a myometrial cyst, distorted, heterogeneous myometrial echotexture, poorly defined focus of abnormal myometrial echotexture, and a globular or asymmetric uterus.[11] The maximum diameter of the adenomyotic lesion was used for analysis. The criteria for recurrence were increasing size of residual lesions or development of new lesions, as detected by ultrasonography during the follow-up period. Statistical Package for Social Sciences software (SPSS, Inc., Chicago, IL, USA) was used for the statistical analysis. Data are expressed as the mean (SD) or absolute number and percentage of the total group. $P < .05$ indicated statistical significance.

RESULTS

From May 1, 2011, through June 30, 2016, 105 patients underwent laparoscopic adenomyomectomy by a single surgeon (Y.S.K.). The mean age was 41.98 ± 4.73 years. The major site of the adenomyoma was the posterior uterine body (54.8%), and the most common symptom associated with uterine adenomyoma was dysmenorrhea combined with menorrhagia (**Table 1**). Coexistent endometriosis was found in 12 of the 105 patients (11.4%) in this study. Although dyspareunia is one of the symptoms of adenomyosis, we could not objectively evaluate it in our clinic, because there are no criteria for measuring this symptom.

The mean ± SD diameter of the adenomyoma was 4.36 ± 0.99 cm, and the mean weight of the excised lesion was 26.18 ± 8.33 g (range, 15–40 g). The mean total surgical time was 75.14 min (20.56). Mean estimated blood loss was 148.19 mL (101.69); no injury to the uterine arteries or pelvic nerves occurred.

The mean TOUA time was 4.46 ± 2.68 min. Mean hospital stay was 3.58 ± 1.05 days (**Table 2**). No conversion to laparotomy or major complications requiring reoperation

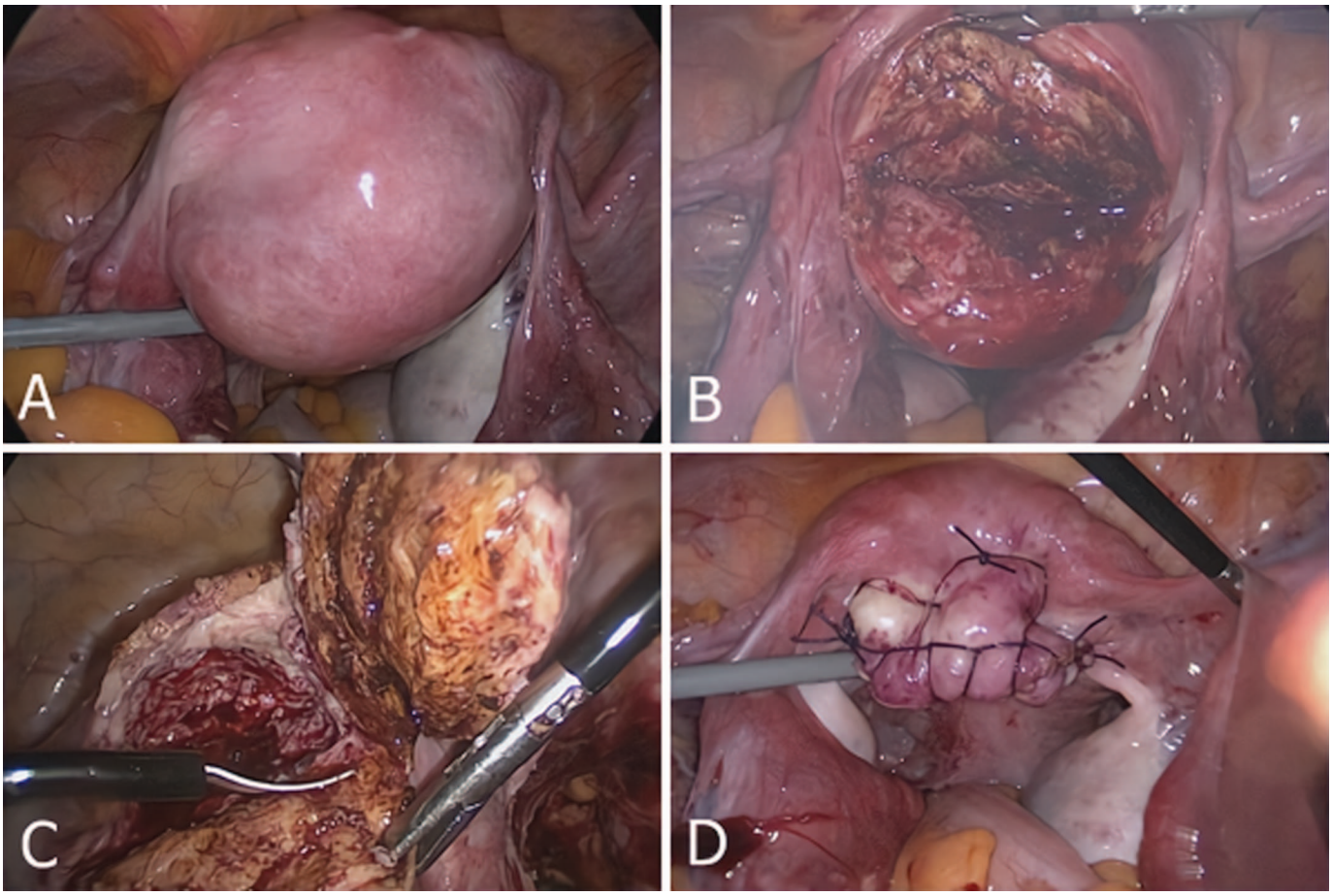

Figure 2. (A) Laparoscopic adenomyomectomy procedure. (B) A 6.0 × 5.5-cm adenomyoma on the posterior body of the uterus. (C) The uterus was deeply incised until the underlying margin was visually exposed inside the margin. (D) Suturing status of laparoscopic adenomyomectomy before removal of endovascular clips.

or readmission occurred during the mean follow-up period of 32.00 ± 17.09 months. At the 7-month follow-up, the main symptoms, including dysmenorrhea and menorrhagia improved (complete remission of dysmenorrhea and menorrhagia occurred in 93.02% and 76.92% of patients, respectively). Seven of the 105 patients showed remnant adenomyotic lesions or recurrent lesions >1.0 cm in maximum diameter on ultrasonography and 5 of the 105 patients developed a relapse of symptoms. Total recurrence rate was 10.48%, which included recurrence during symptom or ultrasonography follow-up (**Table 3**).

DISCUSSION

According to the extent of the adenomyotic lesion, it can be classified into the diffuse type and the focal type. Choice of the laparoendoscopic approach or laparotomic approach is influenced by the type of adenomyosis (diffuse or focal). Diffuse laparotomic approaches are preferred; otherwise, most procedures are focal laparoscopies.

A consistent diagnostic tool and criteria are needed for making a consistent diagnosis. We used ultrasonography as a primary diagnostic tool, and it proved useful in determining types of uterine adenomyosis. It is the most cost-effective and least time-consuming tool among the diagnostic imaging modalities, such as computed tomography and magnetic resonance imaging.

In respect to the safety of the surgical technique used for laparoscopic adenomyomectomy, several factors should be considered, which include operation time, intraoperative complications, and rate of conversion to laparotomy or hysterectomy. Among these factors, conversion rate is very important in determining the safety of the technique

Table 1.
Clinical Characteristics of the Patients

Characteristic	Value
Age (Year)	41.98 ± 4.73
Site of adenomyosis	
Anterior body of uterus	30 (28.6)
Posterior body of uterus	57 (54.3)
Fundal portion of uterus	15 (14.3)
Multifocal adenomyosis	3 (2.9)
Main symptom	
Menorrhagia	13 (12.4)
Dysmenorrhea	34 (32.4)
Combined symptom	52 (49.5)
Others	6 (5.7)

N = 105. Data are expressed as the mean ± SD or the absolute number (%).

used for laparoscopic adenomyomectomy, because it is a very serious problem for patients to accept a change in the original surgical approach or the type of the operation: conservative surgery changed to hysterectomy without preservation of fertility. Conversion to a laparotomic approach or hysterectomy is mostly caused by conditions such as severe pelvic adhesions or intra-operative technical problems that prevent the safe completion of laparoscopic adenomyomectomy.

In the current study, the conversion rate to laparotomy or hysterectomy was zero. On the basis of our experience in 105 laparoscopic adenomyomectomies, to obtain a very low conversion rate, the surgical technique should be safe throughout the operation. To ensure such safety, intraoperative complications should be avoided, which include injury to the vessels that may induce heavy uterine bleeding, injury to the adjacent organs or vessels, and prolonged operative time. To avoid these complications, first, a clean and stable operative field is consistently required throughout the procedure, and second, an established plan for the operation before its initiation and an expert surgical team are required. For our surgical treatment, we planned surgical approaches such as incision site, suturing simulation, and uteroplasty. Also, surgeries were always performed with TOUA to obtain a clean and safe operation field because of good control of the uterine blood flow.[12] After completing the uteroplasty, occlusion of both uterine arteries was released by removal of endovascular clips to restore uterine blood flow.

A clean operative field can facilitate excision of lesions during laparoscopic adenomyomectomy, improving visual and tactile sensations for the excisional procedure and allowing for excision of almost all lesions. Finally, use of the TOUA technique can make laparoscopic adenomyomectomy a safe and easy procedure with a shortened operative time.

Also, in most of the patients with uterine adenomyosis, the lesion invades the uterine serosa from the endometrium. Therefore, during laparoscopic adenomyomectomy, the remaining serosal flaps include hard adenomyotic lesions unlike the elastic normal myometrium. Frequent coagulation for controlling the bleeding foci on these flaps interrupts tensile suturing to obliterate dead spaces created by excisional procedures, because thermal coagulation can change the myometrial architecture and make it fragile, and occasionally, tensile suturing material could act like a knife for the thermally damaged fragile myometrium. Therefore, during tensile suturing procedures used for serosal flaps, less thermal damage and a more successful tensile suturing can be achieved by TOUA because of the need for less thermal bleeding control under TOUA.

Compared with diffuse adenomyomectomy,[2] in patients with focal uterine adenomyosis who underwent laparoscopic adenomyomectomy, the mean age was higher, 41.98 years (37.73 years in patients who received diffuse adenomyomectomy). Unlike patients with diffuse uterine adenomyosis, most of the patients with focal adenomyosis had completed the child-bearing period of life. The most important factors in patients in our study group who desired conservative surgery were personal, emotional, and social attitudes. The trend toward opting for conservative surgery has gradually increased in women. This increase may be induced by Internet communication with women who received diverse treatments, to identify the best treatment and obtain easy access to medical intelligence.

The average length of hospital stay was 3.38 days, a longer stay than when the patient undergoes hysterectomy. Unlike hysterectomy, this surgery does not involve permanent clamping of the vessels. Uterine arterial flow was restored just before the operation was finished. During the surgical procedure of adenomyomectomy, bleeding control is mainly achieved by tight suturing of the remaining myometrium. Therefore, monitoring bleeding in the operative site is important for postoperative management. We inserted a Jackson-Pratt drain in each patient to monitor the amount of bleeding and when the color of body fluids changed from bloody to serous and the drainage

Table 2.
Surgical Outcomes of Laparoscopic Adenomyomectomy With TOUA

Outcome	Mean	SD	Range
Maximal diameter (cm)[a]	4.36	0.99	2.5–7.0
Weight of excised lesion (n = 20)[b]	26.18	8.33	15–40
Operative time (minutes)	75.14	20.56	25–170
Estimated blood loss (mL)	148.19	101.69	50–500
Preoperative Hb (g/dL)	12.26	1.39	8.4–16.1
Postoperative day 1 Hb	10.49	1.38	7.2–13.6
TOUA time (minutes)[c]	4.46	2.68	2.0–25
Hospital stay (days)	3.58	1.05	2–6

N = 105. [a]Maximum diameter of the uterine adenomyoma. [b]Estimation of weights has been lately in study group. [c]From the time of incision of the peritoneum of the right adnexa to the time of occlusion of the left uterine artery.

Table 3.
Clinical Follow-Up at 7 Months After Laparoscopic Adenomyomectomy With TOUA

Clinical Finding or Symptom[a]	Complete Remission	Partial Remission[e]	Persistent
Dysmenorrhea (n = 86)[b]	80 (93.02%)	6 (6.98)	0 (0)
Menorrhagia (n = 65)[c]	50 (76.92)	14 (21.54)	1 (1.54)
Recurrence (n = 11)	11/105 (10.48)		
Symptomatic recurrence	5/105 (4.76)		
Asymptomatic recurrence[d]	7/105 (6.66)		
Combined recurrence	2/105 (1.90)		
Follow-up period (months)	32.0 ±17.09 (range, 5–64)		

N = 105. [a]Data are expressed as absolute number (%), unless otherwise stated. [b]With 0 on a numerical rating scale (range, 0–0) for dysmenorrhea at 7 months after treatment and 2–3 on the Mansfield-Voda-Jorgensen (MVJ) menstrual bleeding scale (range, 1–6) for menorrhagia. [c]Defined as the discrepancy between follow-up period and 7 month after surgery in MVJ score increase. [d]Confirmed by ultrasonography. Recurrence could include a remnant adenomyomatic lesion or recurrent lesion >1 cm in maximum diameter. [e]Defined as symptomatic improvement rate below 50%, before and after treatment or remnant adenomyomatic lesion or recurrent lesion >1 cm in maximum diameter.

amount was less than 100 mL per day, we made a decision about discharge.

In the current study, laparoscopic adenomyomectomy with TOUA had several limitations in the surgical technique, which included limited size or volume of the lesion, location of the lesion, and technique used for uteroplasty. First, in the results of the current study, the maximum diameter of focal adenomyoma was 5 cm. When the maximum diameter of the lesion is more than 5 cm, the remaining normal myometrium is less than half of the total uterine volume, which could cause difficulty in performing uteroplasty and could result in a poor uterine shape and menstrual function after the recovery period. Second, location was not limited to laparoscopic adenomyomectomy in the current study and a well-planned incision line was strongly related to suturing performance. Third, with respect to the technique used for uteroplasty, complete excision to reduce recurrence and a well-designed method of restoring the uterine shape and function as close as possible to that of the original normal uterus are important. In the current study, a learning curve leading to technically sound uteroplasty occurred in the single surgeon during the 105 cases. During the outpatient follow-up period, most of the uteri that underwent laparoscopic adenomyomectomy returned to normal shape. Also, there were no cases of dead space caused by incomplete uteroplasty in any of the 105 cases.

The longest follow-up period during which changes in symptoms were observed was 64 months, and the mean follow-up period was 32 months. The patients were instructed to visit the clinic every 6 months to determine their well-being, the status of pregnancy, and the recurrence of the previous symptoms. We found, however, that many patients did not abide by their follow-up schedule if they did not have any symptoms or discomfort. In the current study, the predetermined follow-up period was 7 months after surgery, at which time we evaluated the effectiveness of the surgical technique, which includes symptom-relief and restoring uterine architecture. To assess recurrence, the patients had to be followed up in a hospital visit at 6-month intervals. Eventually, there were 2 cases of hysterectomy because of recurrence. One patient underwent hysterectomy 34 months after the index surgery, and the other patient had hysterectomy after 49 months because of recurrent dysmenorrhea. In these 2 cases, a laparoscopic vaginal hysterectomy was performed. There was 1 case of natural conception during the follow-up period. A longer follow-up schedule is needed to assess fertility after surgery.

In conclusion, in patients with focal uterine adenomyosis or adenomyoma, who want to preserve their fertility and uterus, laparoscopic adenomyomectomy with TOUA is a safe and effective therapeutic modality. Further, a long-term follow-up analysis of the surgical outcomes of this technique is needed to assess the related recurrence rate and long-term complications and to determine beneficial effects related to low recurrence and patients' satisfaction.

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