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Sahin transvaginal extracorporeal myomectomy as a novel minimally-invasive technique for the management of uterine myomas: a retrospective cohort analysis

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KEY WORDS

extracorporeal myomectomy, minimally-invasive surgery, surgical technique, uterine myomas, vaginal myomectomy

ABSTRACT

INTRODUCTION Vaginal myomectomy (VM) is a minimally-invasive surgery to remove uterine fibroids; however, limited exposure, difficulties in suturing, and challenges in achieving hemostasis restrict its wider adoption. To address these limitations, the Sahin transvaginal extracorporeal (STVEC) technique was developed, allowing for complete uterine exteriorization for extracorporeal reconstruction.

AIM We aimed to evaluate the safety, feasibility, and perioperative outcomes of the STVEC technique in women undergoing surgery for symptomatic uterine myomas.

MATERIALS AND METHODS This retrospective cohort included 200 consecutive patients who underwent VM using the STVEC technique between February 2021 and October 2024. Demographic characteristics, myoma features according to the International Federation of Gynecology and Obstetrics (FIGO) classification, operative variables, postoperative outcomes, and complications were analyzed. The complications were graded using the Clavien–Dindo system. Conversion to laparotomy was performed when safe continuation of the STVEC approach was not feasible.

RESULTS Mean (SD) age of the study cohort was 39.1 (6.5) years and mean (SD) body mass index was 27.5 (5.8) kg/m^2. Mean (SD) myoma count was 1.8 (1.4; range: 1–5) and mean (SD) diameter was 6.7 (2.4; range, 5–10) cm. Intramural myomas (FIGO type 2–5) were the most common (55%). Conversion to laparotomy occurred in 8 patients (4%) due to adenomyotic uteri, adhesions, prior vaginal surgery, or altered cervical anatomy. Median (interquartile range [IQR]) hemoglobin decrease was 1.7 g/dl, median (IQR) estimated blood loss was 180 ml, and mean (SD) operative time was 71.9 (19.5) minutes. Blood transfusion was required in 18 patients (9%). Early complications occurred in 7 participants (3.5%), and all were minor.

CONCLUSIONS The STVEC technique appears safe and feasible, offering good bleeding control, low complication rates, and rapid recovery. Further multicenter studies are needed to confirm our findings.

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INTRODUCTION Uterine myomas (UMs) are common benign tumors of the female reproductive system, which may result in abnormal uterine hemorrhage, pelvic pain, abdominal swelling, bladder and bowel malfunction, infertility, and miscarriage, if untreated. Additionally, some authors demonstrated the association between UMs and depression, frequent hospital admissions, and increased hospital costs.[1] Drug therapies for UMs involve several systemic and hormonal adverse effects, and surgery has become the widely preferred treatment option for UMs.[2] Myomectomy can traditionally be performed using 3 different approaches: hysteroscopic, abdominal, and vaginal. The hysteroscopic method is often not ideal for all myoma locations due to its narrow surgical

field, the need for advanced endoscopic equipment, and potential complications, such as fluid overload, uterine perforation, cervical laceration, and electrosurgical injuries. In the abdominal approach (laparotomy or laparoscopy), the risks of encountering bowel adhesions and causing injury to abdominal organs limit its utility. Additionally, the use of power morcellators in laparoscopy may lead to a widespread dissemination of tissues and undiagnosed malignant cells within the abdominal cavity and port implantation site, as well as complications that may require additional surgical intervention. These potential risks have contributed to the increasing preference for vaginal myomectomy (VM) among gynecologists as a safer and more favorable alternative in many cases.[3]

The advantages of VM have been described in previous studies. Plotti et al[4] analyzed the results of VM, concluding that it was associated with shorter length of hospital stay (LoS) and lower complication rates. In another study, Lagana et al[5] compared laparoscopic abdominal myomectomy and VM, demonstrating that pain scores were significantly lower and recovery times considerably shorter in the patients treated with VM. Although the reliability and efficiency of VM have been verified, it has certain disadvantages, such as the inability to reach and remove UMs in anatomically difficult locations, difficulty in suturing the tissues, and failure to provide adequate bleeding control.

AIM In order to overcome the aforementioned difficulties in VM, we have developed a new technique (Sahin transvaginal extracorporeal [STVEC] myomectomy technique), in which the uterus is completely removed from the body. In this study, we aimed to demonstrate the safety and effectivity of the STVEC VM technique for the management of UMs.

MATERIALS AND METHODS The study included patients who were diagnosed with UMs and underwent VM with the STVEC technique between February 2021 and October 2024 at the Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital. Severe uterine hemorrhage, severe abdominal and/or back pain unresponsive to medical treatment, bowel and/or bladder dysfunction, infertility, and miscarriage were considered indications for VM. All patients were provided with detailed information about UMs and their natural course, indications for surgery, medical treatment options, VM and other surgical techniques for UMs, and the follow-up schedule. All procedures were performed by the same experienced gynecologic surgeon (HŞ), assisted by a standard surgical team.

Exclusion criteria comprised: 1) age below 18 years, 2) a history of pelvic oncological surgery or pelvic radiotherapy, 3) anatomical uterine abnormalities, 4) an active female genital tract infection, 5) uterine size larger than at week 16 of pregnancy, 6) and any pathology contraindicating the use of the vaginal route. No patients were excluded.

No formal power analysis was performed because this study was designed to describe the technique. The sample size (n = 200) reflects the entire consecutive patient population treated with the STVEC technique during the study period.

Age, symptoms of UM, body mass index (BMI), parity status, smoking status, history of myomectomy and cesarean section, and comorbidities—including hypertension, diabetes mellitus, and coronary artery disease—were noted. Moreover, UM characteristics, including the number of UMs, UM diameter, type of UM (intramural, submucosal, or subserosal), and their localization (anterior, posterior, fundus, or cervix/broad ligament) were recorded according to the International Federation of Gynecology and Obstetrics (FIGO) classification. Lastly, parameters related to VM with the STVEC technique, including hemoglobin levels and decrease, amount of bleeding, blood transfusion, operative time, and LoS were recorded in an electronic database system. In the cases where safe continuation of the STVEC VM procedure was not possible, intraoperative conversion to laparotomy was performed.

All VM procedures were performed under general anesthesia. A posterior colpotomy was created between the uterosacral ligaments to access the rectouterine pouch, and the incision was extended laterally to improve exposure (**FIGURE 1A**). A vaginal retractor was then placed to maintain visualization, and the uterus was gently mobilized. Using the Allis clamp for controlled traction, the uterus along with the dominant myoma was delivered through the colpotomy and exteriorized transvaginally in accordance with the STVEC myomectomy technique (**FIGURE 1B** and **1C**).

A lidocaine–adrenaline solution was injected into the serosa to achieve vasoconstriction and minimize intraoperative bleeding. A vertical midline serosal incision was then made directly over the myoma, and the myoma was enucleated from its pseudocapsule and removed (**FIGURE 1D** and **1E**). The myometrial defect was reconstructed in 2 layers using 2–0 polyglycolic acid sutures, followed by serosal closure with 3–0 polydioxanone sutures (**FIGURE 1F**). After reconstruction, the uterus was returned to the pelvic cavity, and the procedure was completed by suturing the peritoneum and the colpotomy incision (**FIGURE 1G**). The procedures are presented in *Videos 1* and *2*.

To evaluate the safety and effectiveness of the STVEC VM technique in the management of UMs, preoperative data, intraoperative parameters, and postoperative outcomes of the first 200 patients treated with this technique were analyzed.

Statistical analysis All statistical analyses were performed using IBM SPSS Statistics software,

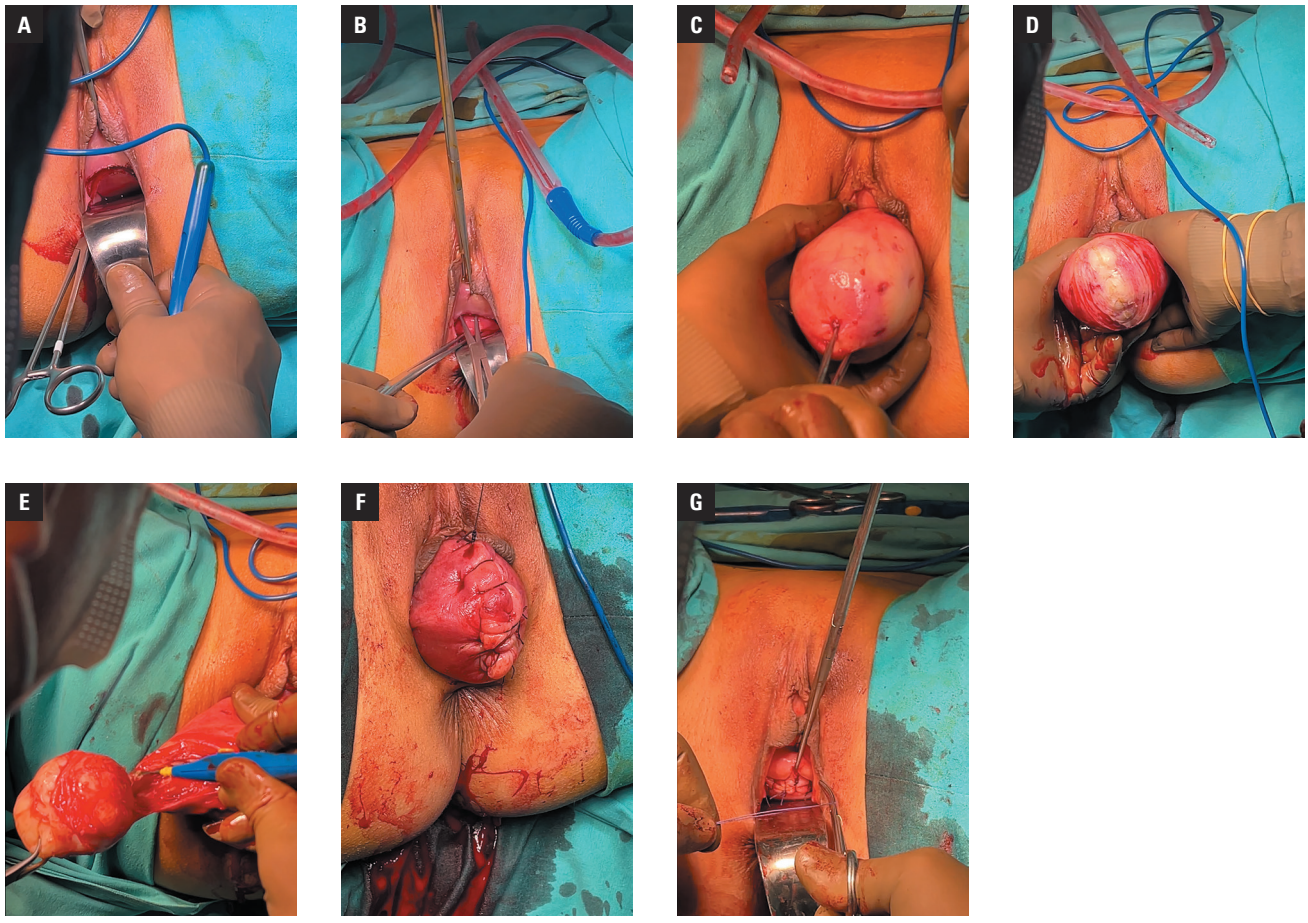

FIGURE 1 Surgical steps of the Sahin transvaginal extracorporeal (STVEC) myomectomy technique; **A** – exposition of the posterior vaginal fornix, and performance of colpotomy between the uterosacral ligaments to gain access to the pelvic cavity; **B** – identification of the uterus through the colpotomy incision and its gentle exteriorization into the vaginal field, allowing for direct visualization of the myoma-bearing uterine wall; **C** – application of controlled traction to deliver the uterine myoma extracorporeally, using grasping instruments to facilitate safe manipulation under direct vision; **D** – extracorporeal enucleation of the uterine myoma through a serosal incision, ensuring precise dissection while preserving the surrounding myometrial tissue and achieving adequate hemostasis; **E** – reconstruction of the uterine defect extracorporeally, using layered suturing to restore the integrity of the myometrium; **F** – confirmation of hemostasis and careful repositioning of the reconstructed uterus back into the pelvic cavity through the colpotomy incision; **G** – final inspection of the surgical field, closing of the posterior colpotomy, and completion of the STVEC procedure

version 2025 (IBM, Armonk, New York, United States). Numerical variables were assessed for distributional normality using the Shapiro–Wilk test. Normally distributed variables are presented as mean (SD), whereas non-normally distributed variables are reported as medians with interquartile ranges (IQRs). Categorical variables are expressed as frequencies and percentages.

Where appropriate, subgroup comparisons were performed. For categorical variables, the χ^2 test was used, and the Fisher exact test was applied when expected cell counts were below 5. For numerical variables, the differences between the groups were analyzed using the independent-samples *t* test for normally distributed data, and the Mann–Whitney test for non-normally distributed data.

For key clinical outcomes, including procedural success rate, conversion-to-laparotomy rate, blood transfusion rate, and overall complication rate, 95% CIs were calculated. Statistical significance was set at a *P* value below 0.05.

Ethics This retrospective cohort study was approved by the Scientific Ethics Committee of the Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital (240). All procedures were conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants prior to surgery.

RESULTS A total of 200 patients at a mean (SD) age of 39.1 (6.5) years were enrolled in the study. Pelvic pain, heavy menstrual bleeding, and infertility were the main complaints in 81 (40.5%), 136 (68%), and 3 patients (1.5%), respectively. Mean (SD) BMI was 27.5 (5.8) kg/m^2, and 17 patients (8.5%) were nulliparous. A total of 41 participants (20.5%) were smokers. Hypertension and diabetes mellitus were diagnosed in 27 (13.5%) and 19 patients (9.5%), respectively, and 7 individuals (3.5%) had coronary artery disease. Nine patients (4.5%) had a history of myomectomy, and 18 (9%) had a history of cesarean

TABLE 1 Demographic and clinical characteristics of the patients (n = 200)

Variable		Value
Age, y		39.1 (6.5)
Symptom	Pelvic pain	81 (40.5)
	Heavy menstrual bleeding	136 (68)
	Infertility	3 (1.5)
Body mass index, kg/m²		27.5 (5.8)
Parity status	Nulliparity	17 (8.5)
	Gravidity, median (IQR)	2 (1–3)
	Parity, median (IQR)	2 (1–3)
Smoking status	Smoker	41 (20.5)
	Nonsmoker	159 (79.5)
Comorbidities	Hypertension	27 (13.5)
	Diabetes mellitus	19 (9.5)
	Coronary artery disease	7 (3.5)
Previous myomectomy		9 (4.5)
Previous cesarean section		18 (9)

Data are presented as mean (SD) or number (percentage) unless indicated otherwise.

Abbreviations: IQR, interquartile range

TABLE 2 Characteristics of the uterine leiomyomas (n = 200)

Variable	Value
Number of leiomyomas	1.8 (1.4)
Leiomyoma diameter	6.7 (2.4)

Data are presented as mean (SD).

TABLE 3 Types of uterine myomas according to the International Federation of Gynecology and Obstetrics classification (n = 200)

Variable	Value
Intramural (FIGO type 2–5)	110 (55)
Subserosal (FIGO type 7)	16 (8)
Intramural and subserosal (FIGO type 5–6)	41 (20)
Intramural, subserosal, and submucosal (FIGO type 1–7)	23 (11.5)
Submucosal (FIGO type 0)	8 (4)
Cervical and intraligamentary myoma (FIGO type 8)	2 (1)

Data are presented as number (percentage).

Abbreviations: FIGO, International Federation of Gynecology and Obstetrics

TABLE 4 Localization of the uterine myomas (n = 200)

Variable	Value
Anterior	41 (20)
Posterior	63 (31)
Anterior and posterior	52 (26)
Fundus	42 (21)
Cervix/broad ligament	2 (1)

Data are presented as number (percentage).

section. Demographic data of the 200 individuals who underwent VM with the STVEC technique are presented in **TABLE 1**.

Mean (SD) UM number was 1.8 (1.4; range, 1–5) and mean (SD) UM size was 6.7 (2.4; range, 5–10) cm (**TABLE 2**). According to the FIGO classification, the most frequently identified myoma type was the intramural myoma (FIGO type 2–5), accounting for 55% of all cases (n = 110). This was followed by intramural and subserosal myomas (FIGO type 5–6) found in 20.5% (n = 41) and subserosal myomas (FIGO type 7) in 8% of the participants (n = 16). Additionally, 11.5% of the patients (n = 23) had combined intramural, subserosal, and submucosal myomas (FIGO type 1–7). Submucosal myomas (FIGO type 0) were detected in 4% (n = 8), while cervical and intraligamentary myomas (FIGO type 8) were identified in 1% of the study population (n = 2; **TABLE 3**).

The most common myoma locations were posterior in 31.5% (n = 63) and combined anterior and posterior localization in 26% of the patients (n = 52). Cervical or broad ligament localization was observed in only 1% of all cases (n = 2; **TABLE 4**).

A total of 8 patients (4%) required intraoperative conversion from the planned STVEC VM procedure to laparotomy. The primary reasons for conversion included: inability to extract the uterus vaginally due to a markedly enlarged adenomyotic uterus in 4 patients; dense pelvic adhesions in the Douglas pouch preventing surgical progression in 2 participants; inability to perform colpotomy due to previous vaginal tightening surgery in 1 patient; and distorted cervical anatomy following recent cervical conization that prevented the identification of a safe dissection plane in 1 individual. For these reasons, continuation of the STVEC VM procedure was deemed unsafe, and laparotomy was performed.

Median (IQR) pre- and postoperative hemoglobin levels were 13 (12–14) g/dl and 11.2 (9.7–11.5) g/dl, respectively with median decrease of 1.7 (1.3–2.7) g/dl. In addition, median (IQR) estimated blood loss was 180 (140–210) ml. Blood transfusion was required in 18 patients (9%). Mean (SD) operative time was 71.9 (19.5) minutes, and mean (SD) LoS was 31.9 (11.8) hours. In total, 7 complications occurred in the early postoperative period. Fever within the first 48 hours was observed in 4 patients (2%), and all cases were treated with intravenous antibiotics. Hematoma was detected in 2 participants (1%). Both hematomas were located at the colpotomy incision site. Following their evacuation, hemostasis was achieved, and oral antibiotic therapy was initiated, resulting in complete resolution. Finally, wound site dehiscence occurred in 1 patient (0.5%), for whom wound care and antibiotic therapy were provided, and the site was resutured after adequate wound healing. Pre- and postoperative data are presented in **TABLE 5**.

Postoperative complications were classified according to the Clavien–Dindo grading system, and all complications were categorized as minor (grade I–IIIa; **TABLE 6**).

Although subgroup comparisons (eg, leiomyoma size categories, number of leiomyomas, FIGO

TABLE 5 Operative outcomes and postoperative results of the study population (n = 200)

Variable		Value
Hemoglobin, g/dl	Preoperative	13 (12–14)
	Postoperative	11.2 (9.7–11.5)
Hemoglobin decrease		1.7 (1.3–2.7)
Bleeding, ml		180 (140–210)
Blood transfusion		18 (9)
Operative time, min, mean (SD)		71.9 (19.5)
Length of hospital stay, h, mean (SD)		31.9 (11.8)
Complications	Fever in the first 48 h postsurgery	4 (2)
	Postoperative hematoma	2 (1)
	Wound site dehiscence	1 (0)

Data are presented as number (percentage) or median (interquartile range) unless indicated otherwise.

SI conversion factor: to convert hemoglobin to g/l, multiply by 10

TABLE 6 Postoperative complications classified according to the Clavien–Dindo grading system (n = 200)

Complication	Patients, n	Rate, %	Management	Clavien–Dindo grade
Fever in the first 48 h postsurgery	4	2	Intravenous antibiotics	II
Postoperative hematoma	2	1	Hematoma evacuation, hemostasis, and oral antibiotics	II
Wound site dehiscence	1	0	Local wound care, antibiotics, and resuturing	IIIa
Total	7	3	–	–

classification groups, or presence of previous pelvic surgery) were planned and performed as described, no significant differences were identified between the evaluated subgroups; therefore, detailed comparative results are not presented.

DISCUSSION UMs are diagnosed in an increasing number of women due to the increase in awareness and development of diagnostic methods.[6] Although there are numerous surgical techniques used in the management of UMs, the VM approach has become increasingly preferred in clinical practice. However, identifying the borders of the myoma, performing adequate suturing, and achieving hemostasis still remain challenging during VM. Therefore, we developed the STVEC VM technique, in which the uterus is completely repositioned extracorporeally, and conducted this study to evaluate the operative and postoperative outcomes of the first 200 women operated using this approach. The findings of the current study suggest that the STVEC VM technique could be a safe and effective treatment modality for the management of UMs, given its high success rate, transfusion rates comparable to other UM surgical techniques, reduced LoS, and low complication rates.

Hemorrhage in surgery is related to the inability to detect anatomical landmarks, deterioration in wound healing, and increases in blood transfusion rate.[7] Also, UMs may cause bleeding before surgery; thus, hemorrhage is a significant issue in surgical manipulations of UMs, and blood transfusion requirements may be higher in these procedures. Kim et al[8] analyzed the risk factors for blood transfusion during UM surgeries, and found that over 10% of the patients needed blood transfusions during myomectomy. Preoperative low hemoglobin levels and open abdominal approach were found to be predictive factors for blood transfusion. In another study, Plotti et al[4] gave blood transfusions to 11% of the patients who underwent VM; however, the study included only 18 patients. In our study, 18 patients who underwent STVEC VM required blood transfusion, and the blood transfusion rate was 9%—a finding comparable to other studies that analyzed transfusion rates during VM.

Prolonged operative time results in anesthesia complications and deteriorates wound healing. LoS is crucial for patients in resuming daily activities, and is an important factor contributing to the incurrence of health care expenses.[9] Wang et al[10] compared VM and laparoscopic myomectomy outcomes, and concluded that VM operative time was considerably shorter than in the case of laparoscopic myomectomy (75.5 vs 101.2 min).[10] Similarly, Liu et al[11] and Birsan et al[12] reported mean operative time for VM of 91.8 minutes and 63.5 minutes, respectively. Moreover, in a study by Rolli et al,[13] which analyzed 46 VM cases, median LoS was 1 day. However, Yu et al[14] reported mean LoS of 4.9 days in their first 43 VM operations. In our study, we recorded mean operative time of 71.9 minutes and LoS of 31.9 hours with the STVEC VM technique, which demonstrates its efficacy and reliability.

The intraoperative conversion rate from the planned STVEC VM procedure to laparotomy was 4%. This rate is comparable to the conversion and complication rates reported in the literature and can be considered acceptable. In their retrospective analysis of 46 cases, Rolli et al[13] demonstrated that VM was a safe and feasible procedure with low complication rates. In our study, the majority of conversions were attributed to anatomical limitations that hindered surgical progression, such as a markedly enlarged adenomyotic uterus or dense pelvic adhesions. These findings highlight the critical importance of appropriate patient selection and thorough preoperative assessment in ensuring the success of VM procedures. Furthermore, performing conversion to laparotomy when necessary, prioritizing patient safety, and the surgical team's expertise in managing intraoperative challenges collectively support the overall reliability of the STVEC VM technique.

Previous reports demonstrated the safety of the VM technique for the treatment of UMs. Agostini et al[15] encountered 5 pelvic abscesses (4.3%) in 89 VM cases, and 2 of them required

surgical intervention. In a review by Faivre et al,[16] the incidence of postoperative hematoma ranged from 0% to 11.4%. However, the authors emphasized that the definition of the presence of hematoma was not based on objective criteria in the studies they analyzed. In another study, Davies et al[17] demonstrated that 1 out of 35 patients required resuturing due to vaginal wound dehiscence. In our analysis, the complication rate following the STVEC VM technique was acceptable and similar to that reported in other studies.

A theoretical concern regarding the STVEC technique is the potential risk of intraperitoneal contamination due to temporary extracorporeal positioning of the uterus during the procedure. However, existing evidence from vaginal hysterectomy and transvaginal endoscopic approaches indicates that transvaginal access does not increase postoperative pelvic infection rates when appropriate antiseptic preparation and antibiotic prophylaxis are applied.[18-20] These procedures also involve exposure of the peritoneal cavity to the vaginal flora, yet pelvic abscess, peritonitis, or infectious morbidity remain rare. Consistent with the literature, no pelvic infection, pelvic abscess, or peritonitis was observed in our cohort. Nevertheless, future multicenter studies with standardized infection surveillance are required to evaluate infection-related outcomes associated with the STVEC VM technique more comprehensively. Recent evidence has also highlighted the importance of preserving ovarian function when selecting minimally-invasive treatment options for UMs. In a recent meta-analysis by Li et al,[21] uterine artery embolization was compared with hysterectomy, and the authors demonstrated that less invasive, uterus-sparing approaches were associated with more favorable postoperative ovarian function outcomes. Although the surgical techniques differed, these findings underscore the clinical relevance of fertility- and hormone-preserving strategies in the management of UMs. In this context, STVEC myomectomy represents a uterus-preserving, minimally-invasive alternative, providing effective symptom control while maintaining ovarian and uterine integrity, which is particularly important in women of reproductive age.

Although this study is the first to describe a new VM technique for the treatment of UMs, it has several limitations. First, the study analyzed the experience of a single center, and institutional practice patterns, surgical skills, and learning curves may differ across centers. Therefore, we believe that the effectiveness and reliability of the STVEC VM technique should be evaluated in multiple centers, and defining the learning curve in different clinical settings may be a subject of future research. Secondly, analyzing only the early outcomes of the STVEC VM technique may be considered a limitation, and medium- and long-term results should be addressed in future studies. Moreover, the aim of this study was to describe the technique, and therefore no comparative arm was included. Future research should investigate comparative outcomes against laparoscopic and abdominal myomectomies in a prospective, controlled setting. Finally, the quality of life of patients following surgery and the cost of the procedure were not evaluated. These 2 aspects should also be addressed in future studies.

CONCLUSIONS The findings of this study indicate that the STVEC VM technique represents a safe and feasible surgical option for the management of UMs in appropriately selected patients. The procedure demonstrated acceptable complication rates and favorable perioperative outcomes, comparable to those reported for other surgical approaches, particularly with respect to hemorrhage, operative time, and of LoS. Nevertheless, the absence of a comparative arm, the single-center design, and the focus on early outcomes limit the generalizability of our results. Further large-scale, prospective, and multicenter comparative studies are warranted to better establish the effectiveness, safety profile, and clinical applicability of the STVEC VM technique.

ARTICLE INFORMATION

VIDEO The video files are available online at https://dx.doi.org/10.20452/wiitm.2025.18000.

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AI STATEMENT Artificial intelligence was not used in the preparation of this manuscript.

CONFLICT OF INTEREST None declared.

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JOURNAL INFORMATION

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