

Impact of Preoperative Uterine Volume on Symptom Recurrence Following Vaginal Hysterectomy for Pelvic Organ Prolapse

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Background: Vaginal hysterectomy (VH) is the preferred minimally invasive technique for benign uterine conditions, such as uterine prolapse, due to its association with faster recovery, shorter hospital stays, and fewer complications compared to abdominal or laparoscopic approaches. Uterine volume is often considered a factor influencing surgical feasibility and potential complications.

Methods: In this retrospective cohort study, we included all women who underwent VH at our institute between January 2010 and December 2016, and validated patient-reported outcome measures to identify the relationship between uterus volume and the recurrence of symptoms.

Results: One hundred thirty-three patients were included, of whom 65 had a uterine volume greater than 22.5 cm³. In a multiple linear regression analysis, uterine volume was independently associated with higher scores on the PFDI-20 ($p = 0.045$) and POPDI-6 ($p = 0.006$) after controlling for the patient's age, parity, and uterine prolapse stage. Complication rates using the DINDO score were comparable between the two groups, which showed a low and similar rate of DINDO 2 and a higher score.

Conclusion: Increased uterine volume is significantly linked to higher postoperative scores on validated patient-reported outcome measures (PFDI-20 and POPDI-6), suggesting a potential impact on quality of life after surgery. These findings contribute to the ongoing discussion surrounding optimal patient selection for VH.

Keywords: vaginal hysterectomy, uterine volume, prolapse

Synopsis

In cases of Vaginal Hysterectomy, the size of the uterus (volume), which can be calculated as part of the pre-operative assessment, is an independent risk factor for recurrence of Genito-urinary symptoms.

Introduction

Pelvic organ prolapse (POP) is a common condition, with an estimated lifetime risk of requiring surgery around 13%.¹ POP can present as the descent of the vaginal apex or the anterior and posterior vaginal walls. Prolapse of the apical compartment is classified into two categories: the descent of the cervix or the vaginal cuff after a hysterectomy.²

Surgical correction of apical prolapse can be performed by reconstructing the vaginal apex or through an obliterative procedure. Techniques for the reconstruction of the vaginal apex include both abdominal and vaginal approaches, with or without a concurrent hysterectomy.^{3,4} The reported success rate is 80 to 92%,⁵ depending on two main factors. First, surgeon-dependent factors, which include the chosen surgical technique, concomitant procedures, and the surgeon's experience; second, patient-dependent factors encompassing preoperative conditions, comorbidities, BMI, smoking

status, and any accompanying urinary incontinence. Vaginal hysterectomy (VH) with apical suspension is one of the main vaginal approaches.^{6,7}

The benefits of VH extend beyond the immediate post-operative outcomes and comprise known elements such as reduced post-operative pain, fewer analgesics, lower healthcare costs, improved cosmetic outcomes due to the absence of abdominal incisions, and the ability to be performed even in cases of enlarged uteri. Additionally, the failure rate requiring surgery for recurrence was recorded at 8.2%, which is comparable to other surgical approaches.^{8,9}

Recurrent POP following VH is known to be influenced by several well-documented risk factors, including obesity, previous pelvic surgeries, genetic predisposition, inadequate surgical technique, suboptimal apical support, and failure to address all prolapsed compartments during the initial surgery.¹⁰ While previous research has indicated that VH may be the preferred method for treating even in cases of enlarged non-prolapsed uteri, the optimal criteria for patient selection remain an ongoing area of investigation.^{11–14} Uterine volume is often considered a potential factor influencing surgical feasibility and complications, including recurrence of symptoms. However, evidence of its relationship to the surgical outcomes following vaginal hysterectomy for prolapse was never thoroughly investigated.¹⁵

The study aimed to investigate this association and impact between preoperative uterine volume and the presence of pelvic floor symptoms in long-term follow-up following vaginal hysterectomy for apical prolapse repair.

Methods

This retrospective cohort study was conducted in a single tertiary university-affiliated medical center. Women who underwent VH for POP between 01/01/2010 and 31/12/2016 were eligible and had their data retrieved from our institute's electronic data collection systems. Women with uterine malignancy or pre-malignancy state were excluded. Also excluded were women who required additional/concurrent procedures due to additional gynecological conditions, women with missing data, or who had not completed the provided follow-up questionnaires.

Preoperative uterine volumes were calculated from transvaginal ultrasound (TVS) measurements using the formula for an ellipsoid ($\pi/6 \times \text{length} \times \text{width} \times \text{depth}$). The cohort was stratified into two groups based on the median uterine volume observed in this study, which was calculated to be 22.5 cm³: “small uterus size” (Uterine volume ≤ 22.5 cm³) and “large uterus size” (Uterine volume > 22.5 cm³). All Transvaginal ultrasound (TVS) measurements were conducted by one certified gynecologist on our team as part of our routine preoperative patient evaluation, therefore limiting inter-rater reliability.

Before surgery, all patients underwent a comprehensive uro-gynecological assessment. Symptoms were evaluated for overactive bladder, stress urinary incontinence, and constipation using validated questionnaires and urodynamic testing when appropriate. The pelvic organ prolapse degree was defined by the Pelvic Organ Prolapse Quantification (POP-Q) system.

Patient demographic data, surgical outcomes, and early and long-term complications were assessed by reviewing the electronic data collection system and assigning severity based on the Clavien-Dindo scoring classification. Medical records included age, Body Mass Index, marital status, parity, menopausal state, prior surgeries, and prior POP surgeries.

Subsequently, postoperative follow-up visits were conducted, commencing one month after the surgical procedure and then semi-annually and annually. During these visits, signs of POP recurrence and long-term complications were assessed. Complications were evaluated and classified using the severity index of the Clavien Dindo classification.^{16–18} To assess for subjective pelvic floor dysfunction, patients completed validated pelvic floor distress inventory questionnaires (based on the short pelvic distress inventory (PFDI-20)).^{19–21} The PFDI-20 questionnaire is a well-validated quality-of-life questionnaire consisting of 20 questions, separated into three scales: pelvic organ prolapse distress inventory (POPDI-6), colorectal-anal distress inventory (CRADI-8), and urinary distress inventory (UDI-6).

Statistical analysis was performed by SPSS version 28.0 (IBM Corp., Armonk, NY). Continuous variables are presented as mean $\pm$ standard deviation (SD) and compared using the Student's *t*-test. Categorical variables are presented as rates and percentages, and comparison was performed using the appropriate chi-squared or Fischer's exact test. All tests were two-tailed, and the threshold for statistical significance was defined as *p*-value < 0.05 . The primary outcome was the difference in PFDI score (or any of its components) between the groups. A multivariable logistic regression

analysis evaluated the association between uterine volume and postoperative scores while controlling for age, parity, and prolapse stage.

The institutional ethical review board approved the study (IRB number WOMC-0004-20). Given this study's use of encrypted data and its retrospective design, informed consent was unnecessary.

Results

One hundred thirty-three patients were included, of whom sixty-five had a uterine volume greater than 22.5 cm³. Patient background characteristics are presented in Table 1. No statistically significant differences were identified between the groups in terms of patients' background characteristics, including parity, menopausal status, rate of HRT usage, urogynecological symptoms, and evaluation. Groups differed slightly in age, with the smaller uterus size group being more common in older women (71.3 ± 8.6 vs 64.4 ± 9.4, $p < 0.001$). No differences were identified in the rate of complication as classified by Clavien-Dindo 2 or greater; two patients were identified in the small volume group (anemia requiring blood transfusion and post-op fever requiring antibiotic treatment), and three in the large uterus group (three patients vaginal cuff hematoma requiring surgical drainage and antibiotic treatment one of them accompanied by anemia requiring blood transfusion) including anemia due to bleeding and the need for blood transfusion or need for an antibiotic for any reason, with no trend for higher rates of DINDO 2 and above events in either of the groups Table 2 presents perioperative details and complications.

The follow-up in both groups was five years on average. Upon comparing the two groups in terms of pelvic floor-related symptoms, PFDI 20 scores were higher (and in all its components) in the patients with a larger uterine volume

Table 1 Basic Characteristics for Entire Cohort

	Uterine Volume ≤22.5 cm ³ (n = 68)	Uterine Volume >22.5 cm ³ (n = 65)	P
Age (years)	71.3 ± 8.6	64.4 ± 9.4	<0.001
Parity	4.1 ± 2.0	4.2 ± 2.3	0.81
Cesarean section	6/67 (9.0%)	5/63 (7.9%)	0.84
Menopause	68/68 (100%)	62/65 (95.4%)	0.073
Years in menopause	23.0 ± 9.3	17.4 ± 10.0	0.001
HRT	4/61 (6.6%)	7/64 (6/6%)	0.39
Previous prolapse surgery	1/65 (1.5%)	2/64 (3.1%)	0.55
Prolapse symptoms	67/68 (98.5%)	63/64 (98.4%)	0.97
SUI symptoms	29/68 (42.6%)	33/65 (50.8%)	0.35

Abbreviations: HRT, Hormone replacement therapy; SUI, Stress Urinary Incontinence.

Table 2 Peri- Operative Details and Complication

	Uterine Volume ≤22.5 cm ³ (n = 68)	Uterine Volume >22.5 cm ³ (n = 65)	P
Uterine weight (gram)	36.9 ± 35.3	101.8 ± 138.0	<0.001
Uterine volume (cm ³)	15.7 ± 4.8	58.9 ± 65.4	<0.001
Uterine prolapse degree	2.9 ± 0.6	3.0 ± 0.8	0.32
Anterior wall prolapse degree	3.0 ± 0.3	2.8 ± 0.6	0.039
Posterior wall prolapse degree	1.4 ± 0.7	1.7 ± 0.8	0.032
Urodynamic SUI	37/68 (54.4%)	37/65 (56.9%)	0.77

(Continued)

Table 2 (Continued).

	Uterine Volume ≤22.5 cm³ (n = 68)	Uterine Volume >22.5 cm³ (n = 65)	P
Concomitant surgery			
Transobturator tape	48/68 (70.6%)	51/65 (78.5%)	0.30
Anterior Colporrhaphy	63/67 (94.0%)	61/65 (93.8%)	0.97
Posterior Colporrhaphy	26/67 (38.8%)	37/65 (56.9%)	0.037
BSO	6/67 (9.0%)	17/65 (26.2%)	0.009
Complication rate	2/67 (2.9%)	3/65 (4.6%)	0.62

Notes: Complication rate – As defined by DINDO classification 2 or greater; including anemia and the need for blood transfusion or need for antibiotic treatment for any reason for example collection and the need for surgical drainage.

Abbreviations: SUI, Stress urinary incontinence; BSO, Bilateral Salpingo-oophorectomy.

group (34.6 ± 39.4 vs 61.0 ± 54.7 , $p = 0.002$). [Table 3](#) summarizes long-term follow-up in terms of pelvic floor-related symptoms.

Following a multiple regression analysis controlling for age, parity, and prolapse stage, we found that a larger preoperative uterine volume measurement was independently associated with higher postoperative PFDI-20 ($p = 0.045$) and POPDI-6 ($p = 0.006$) scores ([Table 4](#)).

Table 3 Long Term Follow-up in Terms of Pelvic Floor Related Symptoms

	Uterine Volume ≤22.5 cm³ (n = 68)	Uterine Volume >22.5 cm³ (n = 65)	P
Follow-up (months)	51.8 ± 25.2	62.6 ± 28.9	<0.001
POPDI-6	8.0 ± 11.2	16.7 ± 20.8	0.031
CRADI-8	10.4 ± 14.9	17.2 ± 18.6	0.023
UDI-6	16.2 ± 21.4	27.2 ± 26.0	0.013
PFDI-20	34.6 ± 39.4	61.0 ± 54.7	0.002

Abbreviations: POPDI-6, Pelvic Organ Prolapse Distress Inventory 6; CRADI-8, Colorectal-Anal Distress Inventory 8; UDI-6, Urinary Distress Inventory 6; PFDI-20, Pelvic Floor Distress Inventory 20.

Table 4 Multi-Variant Regression Analysis According to the Uterine Volume and the Outcome Following Vaginal Hysterectomy

	PFDI-20		POPDI-6		CRADI-8		UDI-6	
	r	p	r	p	r	p	r	p
Age (years)	−0.186	0.031	−0.234	0.006	−0.128	0.140	−0.106	0.222
Parity	0.146	0.095	0.140	0.109	0.283	0.001	0.095	0.279
Uterine prolapse degree	−0.003	0.975	−0.014	0.871	−0.063	0.471	0.088	0.311
Uterine weight (gram)	0.151	0.144	0.128	0.214	0.071	0.493	0.155	0.133
Uterine volume (cm ³)	0.302	0.0004	0.249	0.004	0.215	0.013	0.237	0.006

Abbreviations: POPDI-6, Pelvic Organ Prolapse Distress Inventory 6; CRADI-8, Colorectal-Anal Distress Inventory 8; UDI-6, Urinary Distress Inventory 6; PFDI-20, Pelvic Floor Distress Inventory 20.

Discussion

In this current study, we found a strong association between increased preoperative uterine volume and higher levels of postoperative pelvic floor symptoms and quality of life impact long-term following VH. There was a significant increase in the recurrence rate of POP symptoms in uterine volumes over 22.5 cm³.

These findings highlight uterus volume for the first time as a potential predicting factor for postoperative outcomes and persistent or recurrent symptomatology following vaginal hysterectomy, in contrast with previous studies, which addressed similar but not identical questions. Dancz et al²² surveyed 145 women with uterine size ≥ 12 weeks' gestation and recorded the pelvic floor symptoms resolution rate post-surgery. They found that one year postoperatively, enlarged uterus size did not significantly affect other pelvic floor symptoms. However, there was no sub-stratification regarding the surgical method, and only clinical size estimation of the uterus was performed without sonographic measurements. An additional study by Chill et al²³ surveyed 84 patients who underwent apical prolapse repair up to one year post-operatively. In contrast to our study, the preferred surgical approach for apical support included uterine preservation performed both vaginally and laparoscopically. Their results demonstrated that uterine volume did not significantly affect surgical outcomes following uterine-preserving apical prolapse repair, suggesting that the size of the uterus may not be a critical factor in the success of prolapse repair surgeries. Although sonographic measurements were obtained in their study, no distinction was made regarding the surgical approach, which may have obscured the results. In our study, we used a single vaginal surgical approach over two years of follow-ups, providing more comprehensive surveillance of the symptomology and demonstrating a clear correlation between the uterine volume and symptoms of recurrence. Chill et al used a higher cutoff for uterine volume of 33.5 cm³. Using this higher cut-off, rather than the one observed as the median of the study results, we found that PFDI 20 scores were even higher in the patients with a larger uterine volume group (38.5 ± 45.3 vs 61.8 ± 48.9 , $p < 0.001$).

The pathophysiological mechanisms underlying this relationship remain unclear and are the subject of much debate. Several studies have tried to define this relationship, stating that the type of surgery itself, with its scarring of the autonomic nervous system, might be a contributing factor to the creation of pelvic floor dysfunction following vaginal hysterectomy.^{24,25} It may relate to the technical challenges of achieving adequate vaginal cuff scar healing and support with larger uterine volumes. Larger uterine masses could significantly strain pelvic supportive structures even after hysterectomy.²⁶

Hysterectomy remains one of the most commonly performed gynecologic surgeries, with vaginal and minimally invasive techniques preferred due to their association with reduced morbidity and expedited recovery.²⁷ Long-term research on vaginal native tissue repair for rectocele has consistently reported high success rates, significant improvements in quality of life, and better sexual function, all while presenting minimal complication risks.²⁸ Together, these data underscore the safety and effectiveness of vaginal approaches in prolapse surgery. Our study further contributes by demonstrating that preoperative uterine volume serves not only as a technical consideration influencing surgical feasibility, but also as an independent predictor of long-term pelvic floor symptoms following vaginal hysterectomy. This association between preoperative uterine volume and postoperative pelvic floor symptoms may carry important clinical implications. Preoperative counseling should incorporate uterine volume into patient selection and procedural risk discussions for VH. Our findings raise questions about whether operative techniques should be modified for larger uteri or if alternative treatment approaches, such as hysterectomy via laparotomy, may be preferable in some instances. Ultimately, tailoring management to uterine characteristics could optimize surgical outcomes and patient satisfaction. This study has several limitations. First, it is retrospective in nature, and the sample size is relatively small from a single institution. Secondly, while we controlled for age, parity, and prolapse stage, we did not collect data on other potential confounders, such as BMI, previous pelvic surgeries, patient-reported preoperative symptom severity, and comorbidities, which may have influenced postoperative symptom recurrence. These factors should be incorporated into future studies utilizing multivariable regression analysis to refine risk stratification. Third, we focused solely on patients undergoing vaginal hysterectomy and did not compare them with those who underwent uterine-preserving surgeries. A more informative comparison with other hysterectomy methods would enhance our patient counseling. Therefore, more extensive prospective trials are needed to validate the relationship between uterine volume and symptom recurrence, explore potential effect modifiers, and develop evidence-based surgical recommendations.

Conclusion

We found that larger preoperative uterine volumes in patients undergoing vaginal hysterectomy are independently linked to greater postoperative pelvic symptom discomfort and a more significant impact on quality of life. These findings could aid in patient counseling and surgical planning for those with enlarged uteri before undergoing a hysterectomy.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

The study was approved by the Edith Wolfson Review Board (approval number WOMC-0004-20, approval date 11.2.20). The need for informed consent was waived by IRB of Edith Wolfson Review Board. All methods were carried out in accordance with relevant declaration of Helsinki guidelines and regulations.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors have no conflicts of interest to declare for this work.

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