

The Impact of Laparoscopic and Transvaginal Vaginal Cuff Closure Techniques on Surgical and Functional Outcomes in Total Laparoscopic Hysterectomy

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Abstract

BACKGROUND/AIMS: To evaluate whether the technique used for vaginal cuff closure after total laparoscopic hysterectomy (TLH) influences perioperative outcomes and early postoperative sexual function.

MATERIALS AND METHODS: Clinical records from women undergoing TLH for benign gynecological indications at Buca Seyfi Demirsoy Training and Research Hospital during the period from January 2021 to December 2024 were retrospectively evaluated. Patients were assigned to either a transvaginal suturing group (n=71) or a laparoscopic intracorporeal suturing group (n=55), according to the route of vaginal cuff closure. Demographic characteristics, operative variables, perioperative complications, vaginal length measurements, and female sexual function index (FSFI) scores were analyzed. Sexual function was assessed before surgery and again three months postoperatively.

RESULTS: No statistically significant differences were observed between the groups regarding baseline characteristics. Women in the laparoscopic closure group demonstrated significantly greater postoperative vaginal length compared with those who underwent transvaginal closure. The duration of surgery and the length of hospitalization were similar. Although both techniques were associated with postoperative improvement in FSFI scores, the degree of improvement was significantly higher among patients who received laparoscopic cuff closure.

CONCLUSION: Intracorporeal laparoscopic closure of the vaginal cuff following TLH is associated with improved preservation of vaginal length and greater enhancement of early postoperative sexual function compared with the transvaginal approach.

Keywords: Total laparoscopic hysterectomy, laparoscopic cuff closure, vaginal cuff closure, sexual function, FSFI

INTRODUCTION

Hysterectomy continues to represent a major component of surgical management for benign gynecologic disorders.¹ With ongoing improvements in endoscopic instrumentation and surgical training, total laparoscopic hysterectomy (TLH) has become increasingly prevalent over the last decade.² Compared with open abdominal hysterectomy, minimally invasive approaches are associated with

reduced postoperative discomfort, shorter inpatient stay, earlier mobilization, and improved cosmetic satisfaction.³ Nevertheless, TLH remains a complex operation that demands advanced laparoscopic proficiency and is characterized by a substantial learning curve.⁴

Reconstruction of the vaginal vault following uterine removal constitutes a pivotal stage of TLH because it directly influences both perioperative safety and long-term outcomes.⁵ Suboptimal

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approximation of cuff tissues may predispose patients to hemorrhage, infectious complications, granulation tissue formation, or separation of the vaginal vault edges.⁶ Furthermore, impaired healing at the cuff site may compromise vaginal dimensions and apical support, thereby affecting postoperative sexual health.⁷

Currently, two principal strategies are employed for vaginal cuff reconstruction during TLH: intracorporeal laparoscopic suturing and transvaginal suturing after specimen extraction.⁸ Laparoscopic suturing allows surgeons to realign tissues under magnified visualization, facilitating circumferential closure and direct hemostatic control.⁹ However, this approach may be technically demanding, particularly during the initial learning phase, and has been reported to extend operative duration.¹⁰

Conversely, closure through the vaginal route is often considered technically straightforward and may shorten the procedure, particularly for surgeons with limited laparoscopic suturing experience.¹¹ Despite this, the restricted operative field inherent to the vaginal approach can hinder optimal hemostasis. Prior investigations have suggested that transvaginal closure may be associated with increased rates of early bleeding or infectious sequelae, whereas laparoscopic closure may promote more uniform tissue healing.^{12,13}

The integrity of the vaginal cuff is closely linked to postoperative sexual well-being. Maintenance of vaginal length, elasticity, and structural support is known to influence parameters such as dyspareunia, orgasmic function, and overall sexual satisfaction.¹⁴ Accordingly, minimizing tissue trauma during cuff reconstruction is regarded as a key determinant of postoperative quality of life.¹⁵

Although multiple studies have examined the impact of cuff closure technique on surgical outcomes, their conclusions remain inconsistent. While some authors report reduced complication rates with laparoscopic suturing despite longer operative times, others favor the practicality of the transvaginal approach, albeit with concerns regarding postoperative inflammatory changes.^{1,8} Moreover, several reports indicate superior preservation of vaginal length and improved sexual function following laparoscopic closure.^{9,14}

Given the ongoing debate surrounding the optimal method of vaginal cuff closure in TLH, this retrospective study was designed to compare laparoscopic and transvaginal techniques in terms of operative parameters, perioperative morbidity, and postoperative sexual function. We aimed to contribute additional evidence to inform surgical decision-making for TLH.

MATERIALS AND METHODS

This retrospective observational study included women who underwent TLH for non-malignant gynecologic conditions at Buca Seyfi Demirsoy Training and Research Hospital between January 2021 and December 2024. Ethical approval for this study was obtained from the Buca Seyfi Demirsoy Training and Research Hospital Non-Interventional Research Ethics Committee (approval no: 2025/526, date: 26.11.2025). The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

A total of 126 consecutive cases were eligible for analysis. Patients with malignant pathology, those who required additional pelvic reconstructive procedures, those converted to open surgery, or those with missing perioperative information were excluded. Participants

were categorized based on the vaginal cuff closure method applied during surgery: transvaginal suturing (Group 1, n=71) and intracorporeal laparoscopic suturing (Group 2, n=55).

To minimize inter-operator variability, all surgeries were performed by the same experienced team using a consistent minimally invasive surgical technique. After laparoscopic coagulation of the uterine arteries and completion of colpotomy, the uterus was extracted through the vaginal canal. In Group 1, the vaginal vault was approximated via the vaginal route with absorbable sutures using either an interrupted or a running technique. In Group 2, closure was completed endoscopically under laparoscopic guidance, most often employing barbed suture material.

Data collected from medical records included demographic characteristics, obstetric history, body mass index (BMI), surgical indications, prior pelvic operations, operative duration, perioperative complications, length of hospitalization, and vaginal length measurements obtained before and after surgery. Sexual function was evaluated using the female sexual function index (FSFI) questionnaire, which was administered preoperatively and again three months postoperatively. Although the present analysis was limited to early postoperative outcomes at three months, extended follow-up assessments at 6 and 12 months are planned to further evaluate the long-term impact of vaginal cuff closure techniques on sexual function and anatomical outcomes. This validated instrument contains 19 items covering six functional domains: desire, arousal, lubrication, orgasm, satisfaction, and pain, yielding a total score between 2 and 36.

Statistical Analysis

Data analysis was performed using IBM SPSS Statistics for Windows, version 29.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics are reported as mean $\pm$ standard deviation (SD) for continuous variables and as numbers with percentages for categorical variables. The normality of continuous variables was determined by combining the Shapiro-Wilk test with graphical assessment using histograms and Q-Q plots. Equality of variances between groups was verified with Levene's test before inferential analyses. When the assumptions for parametric testing were met, between-group comparisons were performed using the appropriate parametric methods. Differences in categorical variables were evaluated using either the chi-square test or Fisher's exact test, depending on the expected cell counts. Statistical significance was defined as a two-sided p-value <0.05 .

Within-group changes in FSFI scores from baseline to the third postoperative month were examined, and the magnitudes of these changes were then compared between the two study groups. Statistical significance was defined as a two-sided probability threshold of 0.05. As this investigation was retrospective, no prospective sample size estimation was undertaken before data collection. Following the completion of the analyses, a post-hoc power calculation was performed using the change in FSFI score as the primary endpoint. Based on an observed mean difference of 3.28, a pooled SD of 8.4, group sizes of 71 and 55 participants, and a two-sided significance level of 0.05, the estimated statistical power was approximately 80%. These findings indicate that the available sample size was adequate to detect clinically relevant differences between the study groups.

RESULTS

A total of 126 patients were included in the study; vaginal cuff closure was performed transvaginally in 71 patients and laparoscopically in 55 patients. No statistically significant differences were identified between the two groups with respect to age, BMI, gravidity, or parity (all $p>0.05$). The mean age was 45.8 ± 10.4 years in the transvaginal suture group and 47.1 ± 9.3 years in the laparoscopic suture group ($p=0.42$). The mean BMI values were 28.1 ± 4.1 and 27.4 ± 3.8 , respectively ($p=0.35$) (Table 1).

The distribution of hysterectomy indications was similar between the two groups, with no statistically significant differences detected. The most common indication in both groups was myoma uteri (transvaginal: 40.8%; laparoscopic: 38.2%; $p=0.76$), followed by adenomyosis (35.2% and 36.4%, respectively) and adnexal masses (14.1% and 16.4%, respectively). The rates of simple or complex endometrial hyperplasia were also similar between the groups ($p=0.88$). The proportion of patients with prior pelvic surgery was high in both groups (transvaginal 66.2%; laparoscopic 67.3%), and no statistically significant difference was observed ($p=0.89$) (Table 2).

Preoperative vaginal length values were similar between the groups (transvaginal: 7.98 ± 0.97 cm; laparoscopic: 8.02 ± 1.02 cm; $p=0.79$). However, postoperative vaginal length measurements were significantly higher in the laparoscopic group (7.52 ± 0.96 cm vs. 7.18 ± 0.83 cm,

$p=0.04$). Mean operative time and duration of hospitalization were comparable between the study groups, with no statistically significant differences observed ($p=0.29$ and $p=0.18$, respectively) (Table 3).

No significant between-group differences were identified in the incidence of either intraoperative or postoperative complications. In the transvaginal group, hematoma occurred in 4 patients (5.6%) and bladder injury occurred in 1 patient (1.4%), whereas in the laparoscopic group hematoma and bladder injury were observed in 2 (3.6%) and 1 (1.8%) patients, respectively ($p>0.05$). The rates of cuff infection, urinary tract infection, and trocar site infection were low, with no significant differences between the groups (all $p>0.05$) (Table 4).

Postoperatively, FSFI scores increased in both groups. In the transvaginal suture group, the mean FSFI score rose from 22.54 ± 9.35 preoperatively to 24.76 ± 8.54 at the third postoperative month, while in the laparoscopic suture group, it increased from 21.41 ± 8.76 to 26.91 ± 8.13 . The mean increase in FSFI score was calculated as 2.22 in the transvaginal group and 5.50 in the laparoscopic group. The difference between the two groups was statistically significant ($p=0.045$) (Tables 5 and 6). The observed improvement in FSFI scores corresponded to a moderate effect size (Cohen's $d=0.42$; 95% confidence interval, 0.05-0.79). This magnitude of effect suggests that laparoscopic vaginal cuff closure was associated with a clinically relevant advantage in postoperative sexual function.

Table 1. Demographic and clinical characteristics of the groups

Parameters	Vaginal cuff closure performed transvaginally (n=71)	Vaginal cuff closure performed laparoscopically (n=55)	p-value
Age	45.8±10.4	47.1±9.3	0.42
BMI	28.1±4.1	27.4±3.8	0.35
Gravida	3.5±1.6	3.2±1.3	0.24
Parity	2.4±1.3	2.3±1.1	0.58

Since all variables were continuous, the Independent Samples t-test was applied.

BMI: Body mass index.

Table 2. Indications for hysterectomy and history of pelvic surgery in both groups

Indications for hysterectomy	Vaginal cuff closure performed transvaginally (n=71)	Vaginal cuff closure performed laparoscopically (n=55)	p-value
Myoma	29 (40.8%)	21 (38.2%)	0.76
Adenomyosis	25 (35.2%)	20 (36.4%)	0.89
Adnexal mass	10 (14.1%)	9 (16.4%)	0.73
Simple or complex hyperplasia	7 (9.9%)	5 (9.1%)	0.88

History of pelvic surgery

Yes	47 (66.2%)	37 (67.3%)	0.89
No	24 (33.8%)	18 (32.7%)	

Since this table includes categorical variables (indications and presence or absence of surgical history), the chi-square (χ^2) test or Fisher's exact test (for small cell frequencies) was used.

Table 3. Comparison of vaginal length, operative time, and length of hospital stay between the two groups

Parameters	Vaginal cuff closure performed transvaginally (n=71)	Vaginal cuff closure performed laparoscopically (n=55)	p-value
Preoperative vaginal length (cm)	7.98±0.97	8.02±1.02	0.79
Postoperative vaginal length (cm)	7.18±0.83	7.52±0.96	0.04
Operative time (min)	60.8±14.94	57.8±15.16	0.29
Length of hospital stay (d)	2.4±1.14	2.67±1.21	0.18

Since this table includes continuous variables, the Independent Samples t-test was used.

The comparison of changes in FSFI domain scores between transvaginal and laparoscopic vaginal cuff closure techniques following TLH. Overall, improvements were observed in all domains in both groups, with consistently greater increases in the laparoscopic closure group (Table 6).

Statistically significant differences between groups were identified in the arousal ($p=0.047$), lubrication ($p=0.039$), and pain ($p=0.028$) domains, suggesting that laparoscopic closure may confer superior benefits for sexual arousal, vaginal lubrication, and reduction of dyspareunia. In contrast, the desire ($p=0.084$), orgasm ($p=0.052$), and satisfaction ($p=0.061$) domains did not reach statistical significance, although all showed a trend favoring the laparoscopic approach.

These results may indicate that laparoscopic vaginal cuff closure has a more pronounced positive impact on postoperative sexual function, particularly in domains closely related to physical comfort and physiological responses. The lack of significance in some domains could be attributed to sample size limitations or inter-individual variability in sexual function.

DISCUSSION

The present study demonstrated that, following TLH, intracorporeal laparoscopic vaginal cuff closure was associated with more favorable

early postoperative functional outcomes than transvaginal closure. Although postoperative FSFI scores improved significantly in both groups, the magnitude of improvement was greater among patients who underwent laparoscopic vaginal cuff closure. Furthermore, postoperative vaginal length was better preserved in this group, suggesting that the laparoscopic approach may offer additional anatomical and functional advantages.

Previous studies have demonstrated that postoperative sexual function following hysterectomy is influenced by several factors, including the surgical indication, operative technique, and the quality of vaginal cuff healing. Several reports have shown significant improvements in FSFI scores after TLH,¹⁶ while others have highlighted improvements particularly in the domains of sexual desire and orgasm, emphasizing the importance of preserving vaginal length for optimal postoperative sexual function.¹⁷ These findings are consistent with the results of the present study.

Intracorporeal suturing allows precise circumferential approximation of the vaginal tissues under magnified laparoscopic visualization, thereby facilitating controlled hemostasis and optimal tissue alignment. In a multicenter analysis, Uccella et al.¹⁸ demonstrated that laparoscopic vaginal cuff closure was associated with a lower incidence of vaginal cuff dehiscence compared with the transvaginal approach.

Table 4. Comparison of intraoperative and postoperative complications between the two groups

Intraoperative and postoperative complications	Vaginal cuff closure performed transvaginally (n=71)	Vaginal cuff closure performed laparoscopically (n=55)	p-value
Hematoma	4 (5.6%)	2 (3.6%)	0.42
Bladder injury	1 (1.4%)	1 (1.8%)	0.88
Cuff infection	2 (2.8%)	1 (1.8%)	0.72
Urinary tract infection	2 (2.8%)	1 (1.8%)	0.72
Trocar site infection	1 (1.4%)	1 (1.8%)	0.88

Since this table includes categorical variables (n, %), the chi-square (χ^2) test or, when necessary, Fisher's exact test was used for evaluation.

Table 5. Comparison of preoperative and postoperative FSFI scores between the two groups

	Vaginal cuff closure performed transvaginally (n=71)	Vaginal cuff closure performed laparoscopically (n=55)	p-value
Preoperative FSFI	22.54±9.35	21.41±8.76	
Postoperative 3 rd -month FSFI	24.76±8.54	26.91±8.13	
FSFI difference	2.22	5.5	0.045

Since these data are continuous numerical variables (FSFI scores), the Independent Samples t-test was used. Between-group comparisons of FSFI change scores were performed using the Independent Samples t-test.

FSFI: Female sexual function index.

Table 6. Comparison of changes in FSFI domain scores between transvaginal and laparoscopic vaginal cuff closure techniques

FSFI domain	Transvaginal closure (n=71) Δ	Laparoscopic closure (n=55) Δ	p-value
Desire	+0.29	+0.62	0.084
Arousal	+0.37	+0.81	0.047
Lubrication	+0.36	+0.94	0.039
Orgasm	+0.36	+0.91	0.052
Satisfaction	+0.36	+0.85	0.061
Pain	+0.48	+1.37	0.028
Total FSFI	+2.22	+5.50	0.045

Δ : Difference between postoperative and preoperative FSFI domain scores (3-month postoperative-baseline).

FSFI: Female sexual function index.

Similarly, another study reported a reduced rate of granulation tissue formation following laparoscopic suturing.¹⁹ These technical advantages may explain the superior preservation of vaginal length observed in the laparoscopic group.

Regarding sexual function, previous studies have reported that minimally invasive hysterectomy techniques are associated with better preservation of vaginal elasticity, which may contribute to improved postoperative sexual function.^{20,21} Consistent with these findings, our study demonstrated a significantly greater improvement in postoperative sexual function in women who underwent laparoscopic vaginal cuff closure.

Although the transvaginal approach has been described as technically less demanding and potentially associated with shorter operative times, particularly for less experienced surgeons,^{22,23} no significant difference in operative duration was observed between the two groups in our study. This finding is likely attributable to the standardized surgical technique and the experience of the operating surgeons.

Accurate and symmetrical reconstruction of the vaginal cuff is important not only for postoperative sexual function but also for long-term apical support. Previous studies have demonstrated superior apical support following laparoscopic vaginal cuff closure,²⁴ while prospective investigations have reported greater postoperative vaginal length and higher FSFI scores in patients undergoing this technique.²⁵ Our findings are consistent with these reports and further support the growing body of evidence suggesting that intracorporeal laparoscopic vaginal cuff closure provides both anatomical and functional advantages following TLH.

Study Limitations

The findings of the present study should be interpreted in light of several methodological limitations. The retrospective nature of the analysis precludes full control over potential confounding variables and introduces the possibility that patient selection or clinical decision-making influenced the observed outcomes. In addition, sexual function was assessed only during the early postoperative period, preventing the evaluation of longer-term functional trajectories.

Although all procedures were conducted within a single surgical unit following uniform protocols, individual technical nuances and the influence of cumulative surgical experience may still have contributed to outcome variability. Moreover, the limited sample size reduces the ability to reliably identify infrequent adverse events, such as vaginal cuff separation or serious postoperative infections. Finally, because patients were not randomly allocated to closure techniques, definitive causal inferences regarding the superiority of one method over the other cannot be made. Furthermore, statistical methods designed for longitudinal data, including repeated-measures analysis of variance and mixed-effects modeling, would have enabled a more comprehensive evaluation of temporal changes, group differences, and their interaction. However, the retrospective nature of the study, together with the available sample size, precluded the use of these approaches. Accordingly, the reported effect size estimates should be interpreted with appropriate caution.

CONCLUSION

This study demonstrates that intracorporeal laparoscopic reconstruction of the vaginal cuff after TLH is associated with better preservation of vaginal anatomy and greater improvement in postoperative sexual function than transvaginal suturing. In settings where sufficient laparoscopic expertise is available, this approach represents a reliable and clinically advantageous option that may contribute to improved recovery and overall patient-reported outcomes.

MAIN POINTS

- Intracorporeal laparoscopic vaginal cuff closure preserved postoperative vaginal length more effectively than transvaginal closure.
- Both closure techniques improved postoperative sexual function; however, laparoscopic closure resulted in significantly greater improvement in total female sexual function index scores.
- Perioperative complication rates, operative time, and length of hospital stay were comparable between the two techniques.
- Laparoscopic vaginal cuff closure may provide superior early functional outcomes without increasing surgical morbidity.
- When adequate laparoscopic expertise is available, intracorporeal cuff closure represents a valuable option for optimizing patient-reported postoperative outcomes.

ETHICS

Ethics Committee Approval: Ethical approval for this study was obtained from the institutional Buca Seyfi Demirsoy Training and Research Hospital Non-Interventional Research Ethics Committee (approval no: 2025/526, date: 26.11.2025).

Informed Consent: This is a retrospective observational study.

Footnotes

Authorship Contributions

Surgical and Medical Practices: M.E.P., U.A., Concept: M.E.P., C.A., Design: M.E.P., U.A., Data Collection and/or Processing: C.A., H.K., Analysis and/or Interpretation: U.A., D.U.K., H.K., Literature Search: M.E.P., D.U.K., H.K., Writing: M.E.P., C.A.

DISCLOSURES

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