ORIGINAL ARTICLE

Eastern Journal of Medicine

East J Med 30(4): 574-580, 2025
DOI: 10.5505/ejm.2025.93892

Safety in Laparoscopic Gynecologic Surgery: A Comprehensive Evaluation of Complications at a Tertiary Center

Ugurcan Zorlu[1*], Batuhan Turgay[2], Mohammad İbrahim Halilzade[1], Özlem Moraloğlu Tekin[1]

[1]*Department of Obstetrics and Gynecology, Ankara City Hospital, Ankara*
[2]*Department of Obstetrics and Gynecology, Ankara University Faculty of Medicine, Ankara*

ABSTRACT

To evaluate demographic profiles, surgical indications, and complication rates associated with laparoscopic gynecologic procedures for benign conditions, while identifying risk patterns across different surgical types.

This retrospective study included 172 patients who underwent laparoscopic hysterectomy (n = 52), hysterectomy with oophorectomy (n = 48), or cystectomy/oophorectomy (n = 72) at a tertiary center. Data on demographics, indications, complications, and outcomes were analyzed. Postoperative complications were categorized using the Clavien-Dindo classification. Chi-square and t-tests or Mann–Whitney U tests were used for comparisons (SPSS v25.0, $p < 0.05$).

Patients in the hysterectomy with oophorectomy group were older (mean age 53.0 ± 7.0) and had higher comorbidity (70.8%) and medication use (61.5%). Uterine fibroids were the leading indication in hysterectomy groups, while ovarian cysts were predominant in the cystectomy/oophorectomy group. The hysterectomy with oophorectomy group showed significantly higher rates of bladder injury (4.2%, $p = 0.032$), ureter injury (6.2%, $p = 0.043$), and ICU admission (10.4%, $p = 0.022$). Grade IIIb and IV complications were also more frequent. Subgroup analysis of endometrioma cases (n = 32) confirmed elevated complication risk in extensive procedures.

While laparoscopic surgery is effective for benign gynecologic conditions, complication rates vary by procedure type and patient complexity. Thorough preoperative evaluation and surgical expertise are vital, especially in advanced cases. vNOTES and other minimally invasive innovations may offer safer alternatives for select patients.

Keywords: Benign gynecological conditions, Laparoscopic gynecologic surgery, Perioperative outcomes, Surgical complications

Introduction

Minimally invasive techniques—particularly laparoscopic gynecologic surgeries—have profoundly transformed modern gynecologic practice by minimizing postoperative pain, reducing recovery time, and shortening hospital stays (1). These procedures are now standard approaches in the management of benign gynecologic conditions such as hysterectomy, myomectomy, and ovarian cystectomy due to their clear perioperative benefits. However, their increasing complexity and the risk of procedure-related complications highlight the need for continuous assessment of their safety profiles and clinical efficacy (2).

Current literature consistently underscores the reduced intraoperative blood loss, lower postoperative morbidity, and enhanced patient satisfaction associated with laparoscopic approaches (3). Nevertheless, despite their minimally invasive nature, these procedures are not devoid of risks. Common complications—including visceral injuries, vascular trauma, and port-site infections—remain significant, particularly in high-volume tertiary care centers where complex cases are frequently encountered (4).

Surgical outcomes are largely influenced by the surgeon's experience, institutional infrastructure, and technological advancements. For instance, robotic-assisted laparoscopy has emerged as a promising adjunct, offering improved dexterity and ergonomics that may reduce complication rates in selected cases (5). Still, its relevance remains limited in many institutions due to cost and availability. Therefore, the role of surgeon skill and comprehensive preoperative evaluation—

***Corresponding Author:** Uğurcan Zorlu, Beytepe Mah. 5442. Sok No:2c 34 nolu daire Sukent Beytepe Sitesi, Çankaya, Ankara, Turkey
Email: ugurcanzorlu@gmail.com, TEL: +90 553 371 3278
ORCID ID: Ugurcan Zorlu: 0000-0002-8912-0812, **Batuhan Turgay:** 0000-0001-9927-181X, **Mohammad İbrahim Halilzade:** 0000-0002-5946-6302, **Özlem Moraloğlu Tekin:** 0000-0001-8167-3837
Received: 25.01.2025, **Accepted:** 21.08.2025

including case selection—remains fundamental to optimizing patient outcomes (6).

Although numerous studies have investigated individual techniques and complication types, few have provided a broad comparative analysis across various laparoscopic procedures. Additionally, the literature often lacks integration of structured classification systems such as the Clavien-Dindo scale, which enables more objective interpretation of surgical morbidity. To address these gaps, the present study aims to conduct a comprehensive analysis of laparoscopic gynecologic surgeries performed at a tertiary referral center. By evaluating perioperative complications across different surgical subgroups and applying standardized outcome metrics, we seek to contribute evidence-based insights that may enhance patient safety and surgical decision-making in gynecologic practice.

Materials and Methods

This retrospective cohort study evaluated laparoscopic gynecologic procedures performed at a tertiary referral hospital at 2022. The study focused on three distinct surgical categories: laparoscopic hysterectomy (n = 52), laparoscopic hysterectomy with bilateral salpingo-oophorectomy (n = 48), and laparoscopic cystectomy and/or oophorectomy (n = 72). Only patients undergoing surgery for benign gynecological conditions were included. Cases involving malignancy or oncologic surgical indications were excluded to maintain clinical homogeneity.

Inclusion criteria comprised patients who underwent one of the specified laparoscopic procedures, had complete clinical documentation, and were followed for at least six months postoperatively at the same institution. Exclusion criteria encompassed oncologic surgeries, conversions to open procedures, incomplete medical records, follow-up periods of less than six months, additional surgeries during the follow-up period, and patients who declined study inclusion.

Demographic data—including age, body mass index (BMI), parity, and history of prior abdominal surgery—were collected retrospectively from hospital records. Intraoperative findings, complication types, duration of hospital stay, and postoperative outcomes were documented and categorized accordingly.

All procedures were performed under general anesthesia by experienced gynecologic surgeons with over 5 years of advanced laparoscopic training. Standardized surgical protocols were followed. Pneumoperitoneum was established using carbon dioxide insufflation, and trocars were inserted under direct vision. Surgeries were performed using standard laparoscopic instruments. Twenty-one patients in the cystectomy/oophorectomy group underwent emergency procedures, while the remainder were elective.

Complications were classified into specific categories: bladder injury, ureteral injury, bowel injury, vaginal cuff hematoma, ICU admission, blood transfusion, unplanned readmission, and prolonged hospital stay (>72 hours). Postoperative complications were evaluated and reported using the Clavien-Dindo classification system to ensure standardized assessment of surgical morbidity.

A subgroup analysis was performed for patients with endometrioma, assessing complication patterns and surgical outcomes separately. This allowed for a more nuanced interpretation of procedure-specific risks in this population.

Statistical Analysis: All statistical analyses were conducted using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were assessed for normal distribution using the Shapiro-Wilk test. Parametric data were analyzed using the Student's t-test, while nonparametric data were compared using the Mann-Whitney U test. Categorical variables were analyzed using the chi-square test or Fisher's exact test where appropriate. A p-value < 0.05 was considered statistically significant. Effect sizes were calculated for between-group comparisons to support the interpretation of clinical relevance.

Due to the retrospective nature of the study, no formal sample size calculation was performed. This limitation was acknowledged and addressed in the discussion.

Results

A total of 172 patients underwent laparoscopic gynecologic procedures, distributed across three surgical groups: laparoscopic hysterectomy (n = 52), laparoscopic hysterectomy with oophorectomy (n = 48), and laparoscopic cystectomy and/or oophorectomy (n = 72). The demographic characteristics and baseline clinical parameters are summarized in Table 1. The mean age was significantly higher in the hysterectomy with oophorectomy group (53.0 ± 7.0 years), compared to the hysterectomy group (47.2 ± 3.1) and the cystectomy/oophorectomy group (39.0 ± 4.5) ($p < 0.001$). Although body mass index (BMI) was slightly

Table 1: Demographic Data and Complication Rates Tables

Characteristics	Laparoscopic Hysterectomy (Mean ± SD)	Laparoscopic Hysterectomy + Oophorectomy (Mean ± SD)	Laparoscopic Cystectomy/Oophorectomy (Mean ± SD)
Age (years)	47.2±3.1	53.0±7.0	39.0±4.5
Height (m)	1.6±0.1	1.6±0.1	1.6±0.1
Weight (kg)	78.0±10.0	76.5±13.5	72.0±12.0
BMI (kg/m²)	30.5±5.0	29.9±6.0	28.1±5.2
Chronic Disease (n, %)	34 (65.3%)	34 (70.8%)	28 (40.0%)
Medication Use (n, %)	29 (55.7%)	34 (61.5%)	21 (29.1%)
Previous Surgeries (n, %)	7 (13.4%)	8 (16.6%)	5 (6.9%)

Tablo 2: Indications for Surgery for the Patients

Indication	Laparoscopic Hysterectomy (n, %)	Laparoscopic Hysterectomy + Oophorectomy (n, %)	Laparoscopic Cystectomy/Oophorectomy (n, %)
Uterine Fibroids	25 (48.1%)	20 (40.0%)	0 (0.0%)
Endometriosis	7 (13.5%)	11 (22.0%)	14 (18.4%)
Uterine Prolapse	2 (3.8%)	2 (4.0%)	0 (0.0%)
Abnormal Uterine Bleeding	16 (30.8%)	12 (24.0%)	0 (0.0%)
Ovarian Cysts	0 (0.0%)	5 (10.0%)	60 (78.9%)
Pelvic Pain	2 (0.0%)	0 (0.0%)	2 (3.2%)

Table 3: Surgery-Related Complication Rates with Percentages and P-values

Complication	Laparoscopic Hysterectomy	Laparoscopic Hysterectomy + Oophorectomy	Laparoscopic Cystectomy/Oophorectomy	p-value
Bladder Injury	1 (1.9%)	2 (4.2%)	0 (0.0%)	0.032
Ureter Injury	1 (1.9%)	3 (6.2%)	1 (1.4%)	0.043
Vaginal Cuff Hematoma	3 (5.7%)	3 (6.2%)	4 (5.6%)	0.264
Transfusion Need	5 (9.4%)	5 (10.4%)	9 (12.5%)	0.115
Bowel Injury	1 (1.9%)	1 (2.1%)	2 (2.8%)	0.426
Re-admission	2 (3.8%)	1 (2.1%)	2 (2.8%)	0.385
Intensive Care Unit Need	2 (3.8%)	5 (10.4%)	3 (4.2%)	0.022
Prolonged Hospital Stay (>48 hours)	4 (7.5%)	6 (12.5%)	4 (5.6%)	0.011

higher in the hysterectomy group (30.5 ± 5.0 kg/m²), the difference did not reach statistical significance. The prevalence of chronic comorbidities and medication use was highest in the hysterectomy and hysterectomy with oophorectomy groups, while the cystectomy/oophorectomy group had the lowest rates.

Table 4: Clavien-Dindo Classification of Postoperative Complications

Clavien-Dindo Grade	Laparoscopic Hysterectomy (%)	Hysterectomy + Oophorectomy (%)	Cystectomy/Oophorectomy (%)	p-value
Grade I - Minor deviation without treatment (e.g., hematoma)	5.7	6.2	5.6	0.263
Grade II - Requires pharmacologic treatment (e.g., transfusion)	9.4	10.4	12.5	0.112
Grade IIIb - Surgical intervention under general anesthesia (e.g., bladder/ureter/bowel injury)	5.7	12.5	4.2	0.012
Grade IV - Life-threatening, ICU required	3.8	10.4	4.2	0.024
Grade V - Death	0.0	0.0	0.0	-

Table 5: Endometrioma Subgroup Analysis

Group	Bladder Injury	Ureter Injury	Bowel Injury	Transfusion Need	ICU Admission	Prolonged Stay >48h
Laparoscopic Hysterectomy (n=7)	0.0% (0)	0.0% (0)	0.0% (0)	14.3% (1)	0.0% (0)	14.3% (1)
Laparoscopic Hysterectomy + Oophorectomy (n=11)	9.1% (1)	18.2% (2)	9.1% (1)	36.4% (4)	18.2% (2)	27.3% (3)
Laparoscopic Cystectomy/Oophorectomy (n=14)	0.0% (0)	7.1% (1)	7.1% (1)	21.4% (3)	7.1% (1)	14.3% (2)

Surgical indications varied between the groups, as detailed in Table 2. Uterine fibroids were the leading indication in both hysterectomy groups (48.1% and 40.0%), while ovarian cysts predominated in the cystectomy/oophorectomy group (78.9%). Endometriosis was a frequent indication, particularly in the cystectomy/oophorectomy (18.4%) and hysterectomy with oophorectomy (22.0%) groups.

Surgical complications are detailed in Table 3. Bladder injuries occurred most frequently in the hysterectomy with oophorectomy group (4.2%, $p = 0.032$), as did ureter injuries (6.2%, $p = 0.043$). Vaginal cuff hematomas were comparable across groups ($p = 0.264$). Although transfusion needs were highest in the cystectomy/oophorectomy group (12.5%), this difference did not reach statistical significance ($p = 0.115$). ICU admissions and prolonged hospital stays were significantly more common in the hysterectomy with oophorectomy group ($p = 0.022$ and $p = 0.011$, respectively).

All complications were classified according to the Clavien-Dindo system (Table 4). Grade IIIb complications, which include bladder, ureter, and bowel injuries requiring surgical intervention, were significantly more frequent in the hysterectomy with oophorectomy group (12.5%, $p = 0.012$). Grade IV complications, indicating life-threatening conditions requiring ICU care, were also significantly higher in this group (10.4%, $p = 0.024$). No Grade V events (mortality) were observed in any group.

A subgroup analysis was performed for 32 patients diagnosed with endometrioma, with data presented in Table 5. The hysterectomy with oophorectomy subgroup exhibited the highest complication rates,

including ureter injury (18.2%), transfusion need (36.4%), ICU admission (18.2%), and prolonged hospital stay (27.3%). The cystectomy/oophorectomy group showed moderate complication risks, particularly in ureter and bowel injuries (7.1% each) and transfusion (21.4%). The hysterectomy-only group had the lowest complication burden. These findings suggest that endometriosis-related pelvic adhesions and distorted anatomy may increase intraoperative complexity and morbidity, particularly in procedures involving adnexal resection.

Discussion

This study assessed the demographic attributes, surgical indications, and complication rates related to laparoscopic gynecologic procedures conducted at a tertiary care facility. The results indicate considerable differences in patient characteristics, operative purposes, and complication profiles among various laparoscopic techniques, underscoring the necessity of individualized strategies to enhance patient outcomes.

The demographic data revealed that patients undergoing laparoscopic hysterectomy with oophorectomy were significantly older and more likely to present with chronic comorbidities compared to the other groups. This finding is in line with the observations of Wright et al. (7), who emphasized that both age and preexisting conditions significantly affect surgical morbidity and recovery in minimally invasive gynecologic procedures. The high rate of medication use in this subgroup further highlights the need for meticulous preoperative planning and optimization to mitigate surgical risks.

Surgical indications followed expected trends, with uterine fibroids being the most common indication for hysterectomy procedures, and ovarian cysts leading in the cystectomy/oophorectomy group. These results support earlier literature highlighting the role of laparoscopic surgery in managing benign gynecologic conditions such as fibroids and cysts (8). Additionally, the notable presence of endometriosis in patients undergoing oophorectomy and cystectomy reinforces the complexity of these procedures, which often require advanced laparoscopic skills due to adhesions and distorted pelvic anatomy.

Complication rates varied considerably among the groups, with the highest rates of bladder and ureteral injuries observed in the laparoscopic hysterectomy with oophorectomy group. This trend is consistent with the findings of Omatsu et al. (9), who noted that the extent of adnexal dissection and deep pelvic involvement in oophorectomy procedures contribute to higher complication risks. Vaginal cuff hematomas occurred at similar rates across groups, suggesting that factors such as tissue integrity and suture technique may be more influential than procedure type. Zhao et al. (10) have advocated for the use of barbed sutures to enhance cuff integrity and reduce such postoperative issues.

Moreover, the need for intensive care unit (ICU) admission and prolonged hospital stays was significantly higher in the hysterectomy with oophorectomy cohort, reflecting both increased procedural complexity and patient frailty. These findings resonate with the study by Hessami et al. (11), which emphasized that surgical difficulty and comorbidity burden are key predictors of intensive postoperative support needs. While transfusion and readmission rates did not differ significantly, the higher incidence in certain groups underscores the importance of strengthening perioperative hemostatic strategies and post-discharge follow-up systems.

Importantly, all complications in this study were classified according to the Clavien-Dindo system, allowing for an objective and consistent assessment of surgical morbidity across patient groups. This structure revealed that Grade IIIb and IV complications were significantly more frequent in the hysterectomy with oophorectomy group, further highlighting the correlation between surgical extent and complication severity.

The subgroup analysis of patients with endometrioma provided additional insight into procedural risk. Those undergoing hysterectomy with oophorectomy in this subset demonstrated disproportionately higher rates of major complications such as ureter injury and ICU need. This supports the notion that endometriosis demands heightened surgical caution and experience.

Recent studies also offer valuable perspectives for alternative approaches. Fıratligil et al. (12) reported a remarkably low intraoperative complication rate of 0.78% in a five-year series of total laparoscopic hysterectomies performed for benign indications, with bladder injury being the most frequent event. Their findings affirm the safety of TLH when conducted in experienced centers and reinforce the importance of surgeon proficiency and institutional infrastructure in reducing complications.

Furthermore, Tekin et al. (13) introduced the concept of a "vNOTES-first" approach in benign gynecologic surgeries, demonstrating favorable outcomes and high patient satisfaction. This transvaginal access route, by eliminating abdominal trocars, has the potential to reduce visceral injury risk in carefully selected cases. Additionally, İlter et al. (14) evaluated prophylactic and therapeutic use of vNOTES-based high uterosacral ligament suspension (HUSLS) in pelvic organ prolapse, reporting a 96.4% anatomical success rate with minimal complications over two years. These novel techniques represent promising alternatives, particularly for high-risk or recurrent cases, and warrant comparative evaluation against traditional laparoscopy.

A notable strength of this study is its exclusive focus on benign gynecologic disorders, allowing for a more homogeneous sample and clearer interpretation of surgical outcomes. However, its retrospective nature introduces potential limitations such as incomplete data and selection bias. As suggested by Cao et al. (15), future research may benefit from integrating predictive analytics and machine learning models to identify patients at risk of adverse outcomes and personalize perioperative care.

While laparoscopic surgery remains a cornerstone in the management of benign gynecologic disease, procedural complexity, comorbidity profiles, and underlying pathology such as endometriosis significantly influence complication rates. Recent innovations in surgical techniques such as vNOTES and enhanced surgeon training may help reduce these risks and improve long-term outcomes in this patient population.

This study affirms the clinical value of laparoscopic gynecologic surgery in treating benign conditions, while emphasizing the importance of tailoring surgical decisions based on patient characteristics and procedural complexity. Although minimally invasive techniques are generally associated with favorable outcomes, the observed increase in complication rates—particularly in the hysterectomy with oophorectomy group—underscores the critical role of surgical experience and thorough preoperative evaluation in mitigating risk.

Emerging innovations such as improved suturing techniques and alternative access strategies, including transvaginal approaches like vNOTES, offer promising avenues to enhance surgical safety and patient satisfaction. Incorporating these techniques in appropriately selected cases may reduce operative morbidity, especially in patients with endometriosis or other complex pelvic pathologies.

As this study compares different types of laparoscopic procedures rather than contrasting laparoscopy with open surgery, the findings should be interpreted within the scope of laparoscopic technique optimization. Future prospective, multicenter studies are warranted to validate these results and further refine clinical strategies for improving outcomes in minimally invasive gynecologic surgery.

References

1. Ioana JTPM, Voiță-Mekereş F, Motofelea AC, et al. Surgical outcomes in laparoscopic hysterectomy, robotic-assisted, and laparoscopic-assisted vaginal hysterectomy for uterine and cervical cancers. Diagnostics 2024.
2. Sayed AM. Safety and outcomes of laparoscopic management of benign adnexal masses. Aswan University Med J 2024.
3. Sebai A, Elaifia R, Atri S, et al. Intrauterine device migration resulting in acute appendicitis: A case report. Int J Surg Case Rep 2024.
4. Xiao T, Du J, Geng J, et al. Meta-analysis of the comparison of laparoscopic pectopexy and laparoscopic sacrocolpopexy in the treatment of pelvic organ prolapse. Int J Gynecol Obstet 2024.
5. Uwins C, Assalaarachchi H, Bennett K, et al. Feasibility of robotic interval debulking surgery for advanced-stage ovarian cancer following the MIRRORS protocol. Int J Gynecol Cancer 2024.
6. Chen EJ, Otieno L, Ton J. Navigating complexity: Robotic myomectomy for broad ligament and low posterior fibroids. J Minim Invasive Gynecol 2024.
7. Wright JD. Minimally invasive radical hysterectomy: Baby and the bathwater or innovation run amok? Obstet Gynecol 2025.
8. Brzozowski N, Deng L, Laibangyang A. Vaginal cuff complications after closure with an endoscopic device versus conventional suturing. PMC 2025.
9. Omatsu K, Lee CL, Huang KG. Comprehensive analysis of laparoscopic radical hysterectomy outcomes. Int J Obstet Gynecol 2025.
10. Zhao L, Cong R, Pan Z, Xue Y, Li Y. The feasibility and short-term safety of single-site hysterectomy: A retrospective cohort study. Surg Endosc 2025.

11. Hessami K, Liang J, Leaf MC. Racial disparities in minimally invasive benign hysterectomy. PMC 2025.
12. Fıratligil FB, Gündoğan S, Yılmaz A, Kaya B. Analysis of total laparoscopic hysterectomies for benign disease: The experience of a tertiary center. Jinekoloji - Obstetrik ve Neonatoloji Tıp Dergisi. 2025;22(1):62–68. doi:10.38136/jgon.1605802
13. Tekin AB, Şahin Y, Aydın C, Çetinkaya S. Implementing the vNOTES-first strategy in benign gynecologic surgeries. Arch Gynecol Obstet. 2023.
14. İlter PB, Kıran G, Başer E, Uysal G. vNOTES high uterosacral ligament suspension for prophylaxis and treatment of pelvic organ prolapse. J Minim Invasive Gynecol. 2024.
15. Cao X, Wen X, Tang H, Zhou Y. Predictive tool for the risk of hypothermia during laparoscopic gynecologic tumor resection. J Obstet Gynecol Reprod Biol 2025.