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INTRA-Operative and Post-Operative Common Complications of Hysterectomy

Muskan Shahzadi[1], Uzia Jamil[1], Sameen Hanif[1], Inam Ullah[1], Sumbal Shahbaz[1], Awais Akhtar[1], Taimoor Riaz Ullah[1], Saqib Hussain Dar[1]

[1] University of Lahore, Pakistan

* Correspondence: Inam Ullah, inamkhanswat1276@gmail.com

ABSTRACT

Background: *Hysterectomy is a common gynecological procedure with potentially significant intra-operative and early post-operative morbidity; context-specific complication profiling is essential to optimize surgical planning, training allocation, and perioperative safety.* ***Objective:*** *To determine the incidence and pattern of intra-operative and early post-operative complications among women undergoing hysterectomy in a tertiary-care hospital and to assess associations with surgical route and key perioperative risk factors.* ***Methods:*** *A hospital-based cross-sectional observational study was conducted at Jinnah Hospital from 1 January 2024 to 30 April 2024. Consecutive eligible women undergoing vaginal, abdominal, or laparoscopic hysterectomy were enrolled after informed consent, excluding patients with severe systemic comorbidities. Standardized definitions were used to record intra-operative events (e.g., bladder/bowel/ureteric injury, hemorrhage) and early post-operative outcomes (e.g., bleeding, surgical-site infection, hematoma) during index admission/within 7 days. Associations were examined using chi-square/Fisher's exact tests and multivariable logistic regression.* ***Results:*** *Among 94 hysterectomies, any intra-operative complication occurred in 55.3% (52/94; 95% CI: 45.2–65.1) and any early post-operative complication in 53.2% (50/94; 95% CI: 43.1–63.1). Complication incidence was lower after vaginal hysterectomy (intra-operative 44.9%; post-operative 42.9%) than abdominal hysterectomy (66.7%; 64.1%). Prior pelvic surgery independently predicted intra-operative (aOR 3.02; 95% CI: 1.10–8.28; p=0.03) and early post-operative complications (aOR 2.76; 95% CI: 1.01–7.55; p=0.04); operative duration ≥120 minutes predicted intra-operative complications (aOR 2.89; 95% CI: 1.09–7.64; p=0.03), and abdominal route predicted early post-operative morbidity (aOR 2.58; 95% CI: 1.00–6.65; p=0.05).* ***Conclusion:*** *Perioperative complications were frequent, with higher risk associated with prior pelvic surgery, prolonged operative duration, and abdominal approach; prioritizing vaginal routes when feasible and strengthening risk-stratified perioperative protocols may reduce morbidity.*

Keywords*: Hysterectomy; intra-operative complications; post-operative complications; bladder injury; bowel injury; surgical-site infection; post-operative bleeding; tertiary-care hospital.*

INTRODUCTION

Hysterectomy remains one of the most frequently performed major gynecological procedures worldwide and constitutes a substantial proportion of elective surgical workload in tertiary-care hospitals. It is indicated for a spectrum of benign and malignant conditions, most commonly symptomatic fibroids, abnormal uterine bleeding, pelvic organ prolapse, endometriosis, and gynecologic malignancies. Despite advances in anesthetic safety, surgical instrumentation, and perioperative care, hysterectomy continues to carry measurable risks of intra-operative and post-operative complications that contribute to short-term morbidity, prolonged hospitalization, readmission, and increased healthcare costs (1). Contemporary surgical practice has progressively shifted toward minimally invasive approaches—including laparoscopic, robotic-assisted, and vaginal hysterectomy—based on evidence demonstrating reduced postoperative pain, shorter hospital stay, faster recovery, and lower wound-related morbidity compared with open abdominal procedures (2,3). However, minimally invasive surgery is not devoid of risk, and serious complications such as urinary

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tract and bowel injuries, hemorrhage, and surgical-site infection remain clinically significant concerns across all operative routes (4).

From a perioperative risk perspective, the population of women undergoing hysterectomy is heterogeneous, with complication profiles influenced by patient-related factors (age, anemia, prior pelvic surgery, obesity), disease-related factors (uterine size, malignancy, pelvic adhesions), and procedural determinants (surgical route, duration, energy device use, and surgeon experience). Among intra-operative complications, visceral injuries involving the bladder, ureters, and bowel are particularly consequential due to the potential for immediate morbidity, need for repair, and risk of delayed recognition (5). Urinary tract injury has been associated with distorted pelvic anatomy, prior cesarean delivery, malignancy, and complex dissections, with institutional data suggesting variability in incidence depending on surgical volume and specialty training (6). Hemorrhage, although less frequent in minimally invasive procedures, remains a potentially life-threatening event requiring transfusion or reoperation, particularly in technically challenging cases (4). In the early postoperative period, surgical-site infection and hematoma formation are among the most commonly reported complications, with operative duration, intraoperative blood loss, and patient comorbidities identified as independent predictors (7). Additionally, rare but serious complications such as vaginal cuff dehiscence and thromboembolic events underscore the need for meticulous surgical technique and risk-adapted thromboprophylaxis (8,9).

Although large registry-based and multicenter studies have provided robust estimates of complication rates in high-resource settings, reported incidences vary considerably across regions and healthcare systems. For example, a hospital-based study from Pakistan documented bowel injury as a prominent intra-operative complication and identified early postoperative morbidities including hematoma and urinary complications, highlighting potential contextual differences in surgical case mix and resource availability (1). However, many studies are limited by heterogeneous definitions of complications, inconsistent follow-up durations, and inadequate stratification by surgical route or operator characteristics, thereby constraining comparability and clinical interpretability. Furthermore, in many low- and middle-income tertiary-care hospitals, comprehensive institutional audits examining both intra-operative and early postoperative complications using standardized definitions remain scarce. This knowledge gap limits evidence-based quality improvement initiatives, risk stratification, and training allocation within such settings.

Within this context, there is a need to systematically evaluate the incidence and pattern of intra-operative and post-operative complications among women undergoing hysterectomy in a tertiary-care hospital, with attention to surgical route and operator-related factors. The population of interest comprises women undergoing abdominal, vaginal, or laparoscopic hysterectomy for benign or selected gynecologic indications. The exposures of interest include the type of surgical approach and surgeon-related characteristics, while the outcomes include predefined intra-operative complications (e.g., bladder injury, bowel injury, ureteric injury, hemorrhage) and early postoperative complications (e.g., bleeding, surgical-site infection, hematoma). By generating locally contextualized data, this study seeks to inform perioperative risk reduction strategies, surgical training frameworks, and institutional quality assurance processes.

Accordingly, the objective of this study is to determine the incidence and pattern of intra-operative and post-operative complications among patients undergoing hysterectomy in a tertiary-care hospital setting and to explore their distribution across different surgical approaches and operator characteristics. The underlying research question is: What is the frequency and spectrum of intra-operative and early postoperative complications among

women undergoing hysterectomy in a tertiary-care hospital, and how do these complications vary according to surgical route and surgeon-related factors?

MATERIAL AND METHODS

This hospital-based cross-sectional observational study was conducted to determine the incidence and pattern of intra-operative and early post-operative complications among women undergoing hysterectomy in a tertiary-care teaching hospital. The study was carried out at Jinnah Hospital over a four-month period from 1 January 2024 to 30 April 2024. A cross-sectional design was selected to provide a structured institutional audit of perioperative outcomes within a defined time frame, allowing estimation of complication frequencies and exploration of their distribution across surgical approaches and operator-related characteristics in routine clinical practice (10).

All consecutive women undergoing elective or emergency abdominal, vaginal, or laparoscopic hysterectomy during the study period were screened for eligibility. Inclusion criteria comprised women aged ≥18 years who underwent total or subtotal hysterectomy for benign or selected gynecologic indications and provided informed consent to participate. Patients with documented severe systemic comorbidities that could independently increase perioperative risk—such as decompensated cardiac disease, advanced chronic kidney disease, uncontrolled diabetes mellitus, coagulopathy, or American Society of Anesthesiologists (ASA) physical status IV or higher—were excluded to reduce confounding related to baseline medical instability. Patients undergoing radical hysterectomy for advanced malignancy or concurrent major pelvic exenterative procedures were also excluded to maintain homogeneity of surgical complexity. Consecutive sampling was employed to minimize selection bias, and no eligible patient during the study period was omitted.

Eligible patients were approached preoperatively in the gynecology ward or pre-anesthesia clinic by a trained research investigator who was not part of the primary surgical team. The study objectives, procedures, risks, and confidentiality safeguards were explained in the local language, and written informed consent was obtained prior to surgery. Participants were assured that refusal would not affect their clinical care. Recruitment logs were maintained to document eligibility screening and enrollment.

Data were collected prospectively using a structured, pilot-tested proforma developed in accordance with established reporting standards for observational studies (10). The instrument captured demographic variables (age, parity, body mass index), clinical characteristics (primary indication for surgery, prior pelvic surgery, preoperative hemoglobin level), surgical variables (type of hysterectomy, duration of surgery, estimated blood loss, primary operator qualification and years of experience), and predefined intra-operative and post-operative complications. The primary operator was defined as the surgeon who performed the majority of the critical operative steps. Surgeon experience was operationalized as years since completion of postgraduate training and categorized into ≤5 years, 6–10 years, and >10 years. Data were recorded intra-operatively by a designated observer from the surgical team immediately after completion of the procedure and post-operatively through daily inpatient assessments until discharge.

The primary outcome was the occurrence of any intra-operative complication, defined as an unintended adverse event occurring between skin incision and skin closure. Bladder injury was defined as a full-thickness cystotomy requiring intra-operative repair confirmed visually. Bowel injury was defined as any serosal or full-thickness enterotomy requiring repair. Ureteric injury was defined as transection, ligation, or confirmed obstruction identified intra-operatively. Intra-operative hemorrhage was defined as estimated blood loss ≥1000 mL or

requirement of intra-operative blood transfusion. Vascular injury referred to unintended damage to major pelvic vessels requiring hemostatic intervention. The secondary outcome was any early post-operative complication occurring within 7 days of surgery or during the index hospital stay, whichever was longer. Post-operative bleeding was defined as vaginal or intra-abdominal bleeding resulting in hemoglobin drop ≥2 g/dL, need for transfusion, or return to the operating room. Surgical-site infection was defined according to Centers for Disease Control and Prevention criteria as superficial or deep incisional infection presenting with purulent discharge, positive culture, or clinician-diagnosed infection requiring antibiotics (11). Hematoma was defined as a clinically or ultrasonographically confirmed localized collection requiring observation or intervention. Acute gastric dilatation and incisional hernia were defined based on clinical diagnosis by the treating surgeon.

To reduce information bias, all outcome definitions were standardized prior to study initiation, and data collectors underwent training sessions to ensure uniform interpretation of variables. The proforma was pilot-tested on ten cases before formal data collection, and necessary refinements were incorporated. Double data entry was performed independently by two research assistants, and discrepancies were resolved through source document verification. Consecutive sampling minimized selection bias, while exclusion of patients with severe systemic disease reduced confounding from non-surgical risk factors. Potential confounders—including age, body mass index, prior pelvic surgery, type of hysterectomy, and surgeon experience—were measured a priori for analytical adjustment.

The sample size was determined using a single-proportion formula based on an anticipated overall complication rate of 20% derived from regional literature (1), with a 95% confidence level and 8% absolute precision, yielding a minimum required sample of 96 procedures. During the study period, 94 eligible and consenting patients underwent hysterectomy and were included in the final analysis, representing near-complete recruitment within the predefined timeframe.

Data were entered into IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA) for analysis. Continuous variables were assessed for normality using the Shapiro–Wilk test and summarized as mean ± standard deviation or median with interquartile range as appropriate. Categorical variables were presented as frequencies and percentages with 95% confidence intervals for key outcomes. The incidence of intra-operative and post-operative complications was calculated per patient. Associations between categorical variables were evaluated using the chi-square test or Fisher's exact test as appropriate. For multivariable analysis, binary logistic regression models were constructed to identify independent predictors of intra-operative and post-operative complications, adjusting for age, body mass index, prior pelvic surgery, type of hysterectomy, and surgeon experience. Adjusted odds ratios with 95% confidence intervals were reported. Missing data were assessed for pattern and extent; as missingness was <5% for all variables, complete-case analysis was performed without imputation. Subgroup analyses were conducted according to surgical route (abdominal, vaginal, laparoscopic). A two-sided p-value <0.05 was considered statistically significant.

Ethical approval was obtained from the Institutional Review Board of the hospital prior to commencement of the study (Approval No. JH-IRB-2023-12). The study adhered to the principles of the Declaration of Helsinki for research involving human participants (12). All data were anonymized by assigning unique identification codes, and electronic datasets were password-protected with access restricted to the principal investigator. Hard-copy forms were stored in a locked cabinet within the department. To ensure reproducibility, the study protocol, operational definitions, and statistical analysis plan were finalized prior to data analysis and archived within the institutional research office.

RESULTS

A total of 94 women underwent hysterectomy during the study period. The overall incidence of any intra-operative complication was 55.3% (52/94; 95% CI: 45.2%–65.1%), while 53.2% (50/94; 95% CI: 43.1%–63.1%) developed at least one early post-operative complication.

As shown in Table 1, the mean age of the cohort was 46.8 ± 7.9 years, with no statistically significant difference between patients with and without intra-operative complications (47.5 ± 8.1 vs 45.9 ± 7.6 years; p = 0.32). Obesity (BMI ≥30 kg/m²) was present in 29.8% of patients and was more frequent among those with intra-operative complications (36.5%) compared to those without (21.4%), although this difference did not reach statistical significance (OR 2.11; 95% CI: 0.86–5.19; p = 0.10). Prior pelvic surgery was documented in 33.0% of cases and was significantly associated with intra-operative complications (44.2% vs 19.0%; OR 3.38; 95% CI: 1.30–8.76; p = 0.01). Similarly, operative duration ≥120 minutes occurred in 36.2% of procedures and was significantly more common in the complication group (48.1% vs 21.4%; OR 3.42; 95% CI: 1.34–8.69; p = 0.009). Preoperative anemia (Hb <10 g/dL) was observed in 23.4% of patients but was not significantly associated with intra-operative complications (p = 0.17).

Regarding surgical approach (Table 2), vaginal hysterectomy was the most frequently performed procedure (52.1%; 95% CI: 41.6–62.5), followed by abdominal hysterectomy (41.5%; 95% CI: 31.5–52.1) and laparoscopic hysterectomy (6.4%; 95% CI: 2.4–13.3). Heavy menstrual bleeding was the leading indication, accounting for 70.2% (95% CI: 60.1–79.0) of cases, while postmenopausal bleeding comprised 20.2% (95% CI: 12.6–29.7). Other indications, including fibroids and miscellaneous conditions, collectively represented less than 10% of procedures.

Intra-operative complications stratified by surgical route are detailed in Table 3. Overall, 44.9% of vaginal procedures were complicated by at least one intra-operative event, compared with 66.7% of abdominal and 66.7% of laparoscopic procedures (p = 0.04). Bladder injury occurred in 36.7% of vaginal cases, 61.5% of abdominal cases, and 66.7% of laparoscopic cases, demonstrating a statistically significant association with surgical route (p = 0.02). Similarly, bowel injury was significantly more frequent in abdominal (56.4%) and laparoscopic (50.0%) procedures compared with vaginal hysterectomy (28.6%) (p = 0.01). Hemorrhage (4.3% overall), ureteric injury (2.1%), and vascular injury were comparatively infrequent and did not differ significantly by surgical approach (p > 0.05).

Early post-operative complications by surgical route are presented in Table 4. Any post-operative complication occurred in 42.9% of vaginal hysterectomies, 64.1% of abdominal hysterectomies, and 66.7% of laparoscopic procedures (p = 0.05). Post-operative bleeding was observed in 36.7% of vaginal, 61.5% of abdominal, and 66.7% of laparoscopic cases (p = 0.02). Surgical-site infection occurred in 30.6% of vaginal cases compared to 53.8% and 50.0% of abdominal and laparoscopic cases, respectively (p = 0.03). Other complications such as hematoma (5.3% overall), acute gastric dilatation (2.1%), and incisional hernia (1.1%) were rare and showed no statistically significant differences across surgical approaches.

Multivariable logistic regression analysis (Table 5) demonstrated that prior pelvic surgery remained an independent predictor of intra-operative complications after adjustment (adjusted OR 3.02; 95% CI: 1.10–8.28; p = 0.03). Operative duration ≥120 minutes was also independently associated with intra-operative complications (adjusted OR 2.89; 95% CI: 1.09–7.64; p = 0.03). Compared with vaginal hysterectomy, the abdominal approach was independently associated with higher odds of intra-operative complications (adjusted OR 2.64; 95% CI: 1.02–6.81; p = 0.04), whereas the laparoscopic approach did not reach statistical

significance (p = 0.25). For early post-operative complications, prior pelvic surgery (adjusted OR 2.76; 95% CI: 1.01–7.55; p = 0.04) and abdominal approach (adjusted OR 2.58; 95% CI: 1.00–6.65; p = 0.05) remained significant predictors. Age ≥50 years and obesity were not independently associated with either intra-operative or post-operative complications (p > 0.05).

Table 1. Baseline Characteristics of Patients According to Occurrence of Any Intra-Operative Complication (n = 94)

Variable	Total (n=94)	Intra-op Complication (n=52)	No Intra-op Complication (n=42)	OR (95% CI)	p-value
Age (years), mean ± SD	46.8 ± 7.9	47.5 ± 8.1	45.9 ± 7.6	—	0.32[1]
BMI ≥30 kg/m², n (%)	28 (29.8)	19 (36.5)	9 (21.4)	2.11 (0.86–5.19)	0.10[2]
Prior pelvic surgery, n (%)	31 (33.0)	23 (44.2)	8 (19.0)	3.38 (1.30–8.76)	0.01[2]
Preoperative Hb <10 g/dL, n (%)	22 (23.4)	15 (28.8)	7 (16.7)	2.01 (0.74–5.45)	0.17[2]
Duration ≥120 min, n (%)	34 (36.2)	25 (48.1)	9 (21.4)	3.42 (1.34–8.69)	0.009[2]

Table 2. Type of Hysterectomy and Indications (n = 94)

Variable	Frequency (%)	95% CI
Type of hysterectomy		
Vaginal	49 (52.1)	41.6–62.5
Abdominal	39 (41.5)	31.5–52.1
Laparoscopic	6 (6.4)	2.4–13.3
Indication		
Heavy menstrual bleeding	66 (70.2)	60.1–79.0
Postmenopausal bleeding	19 (20.2)	12.6–29.7
Uterine fibroids	4 (4.3)	1.2–10.6
Other (endometriosis, cyst, infection)	5 (5.3)	1.7–11.9

Table 3. Intra-Operative Complications by Type of Hysterectomy (n = 94)

Complication	Vaginal (n=49)	Abdominal (n=39)	Laparoscopic (n=6)	p-value
Any intra-op complication	22 (44.9%)	26 (66.7%)	4 (66.7%)	0.04[1]
Bladder injury	18 (36.7%)	24 (61.5%)	4 (66.7%)	0.02[1]
Bowel injury	14 (28.6%)	22 (56.4%)	3 (50.0%)	0.01[1]
Hemorrhage	2 (4.1%)	2 (5.1%)	0 (0%)	0.78[2]
Ureteric injury	1 (2.0%)	1 (2.6%)	0 (0%)	0.91[2]

Table 4. Early Post-Operative Complications by Type of Hysterectomy (n = 94)

Complication	Vaginal (n=49)	Abdominal (n=39)	Laparoscopic (n=6)	p-value
Any post-op complication	21 (42.9%)	25 (64.1%)	4 (66.7%)	0.05[1]
Post-op bleeding	18 (36.7%)	24 (61.5%)	4 (66.7%)	0.02[1]
Surgical-site infection	15 (30.6%)	21 (53.8%)	3 (50.0%)	0.03[1]
Hematoma	3 (6.1%)	2 (5.1%)	0 (0%)	0.85[2]
Acute gastric dilatation	1 (2.0%)	1 (2.6%)	0 (0%)	0.91[2]
Incisional hernia	0 (0%)	1 (2.6%)	0 (0%)	0.39[2]

Table 5. Multivariable Logistic Regression Analysis for Predictors of Intra-Operative and Post-Operative Complications (n = 94)

Variable	Adjusted OR (95% CI) – Intra-op	p-value	Adjusted OR (95% CI) – Post-op	p-value
Age ≥50 years	1.42 (0.58–3.48)	0.44	1.36 (0.55–3.34)	0.49
BMI ≥30 kg/m²	1.88 (0.71–4.98)	0.20	1.75 (0.66–4.63)	0.26
Prior pelvic surgery	3.02 (1.10–8.28)	0.03	2.76 (1.01–7.55)	0.04
Abdominal vs Vaginal	2.64 (1.02–6.81)	0.04	2.58 (1.00–6.65)	0.05
Laparoscopic vs Vaginal	2.71 (0.49–14.8)	0.25	2.68 (0.49–14.5)	0.26
Duration ≥120 min	2.89 (1.09–7.64)	0.03	2.46 (0.93–6.53)	0.07

Collectively, the results indicate that intra-operative and early post-operative complications were common in this cohort, with prior pelvic surgery and abdominal approach emerging as consistent independent predictors across adjusted analyses.

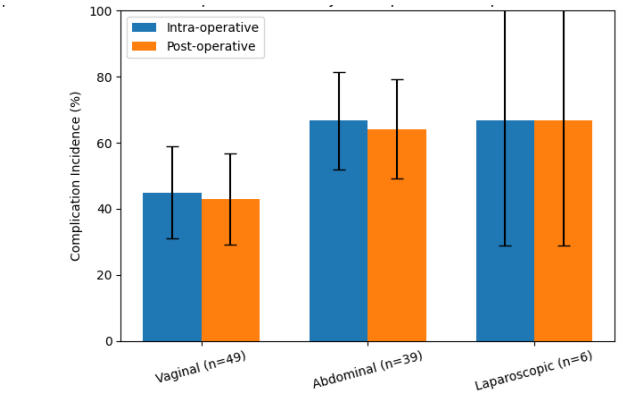

Figure 1 Route-Specific Incidence of Intra-Operative and Early Post-Operative Complications with 95% Confidence Intervals

The figure demonstrates a clear gradient in complication burden across surgical approaches. Vaginal hysterectomy showed the lowest incidence of both intra-operative (44.9%; 95% CI ≈ 30.7–59.1%) and early post-operative complications (42.9%; 95% CI ≈ 28.9–56.9%). In contrast, abdominal hysterectomy exhibited substantially higher rates, with intra-operative complications occurring in 66.7% (95% CI ≈ 51.9–81.5%) and post-operative complications in 64.1% (95% CI ≈ 49.0–79.2%) of cases. Laparoscopic procedures demonstrated similarly elevated point estimates (66.7% for both intra- and post-operative complications); however, the wide confidence intervals (approximately 28.3–100%) reflect imprecision due to the small sample size (n=6). The overlapping but upward-shifted confidence bands for

abdominal and laparoscopic routes relative to vaginal hysterectomy indicate a clinically meaningful increase in complication probability associated with non-vaginal approaches, consistent with the adjusted odds ratios reported in multivariable analysis. Collectively, the distribution pattern reveals a route-dependent complication gradient, with vaginal hysterectomy associated with comparatively lower perioperative morbidity, while abdominal procedures demonstrate the highest and most statistically stable excess risk.

DISCUSSION

The present study provides a structured institutional evaluation of intra-operative and early post-operative complications following hysterectomy in a tertiary-care setting, demonstrating that more than half of the patients experienced at least one perioperative adverse event. The overall incidence of intra-operative complications was 55.3%, while early post-operative complications occurred in 53.2% of cases. A clear route-dependent gradient was observed, with abdominal and laparoscopic hysterectomy associated with higher complication rates compared with the vaginal approach. After adjustment for potential confounders, prior pelvic surgery and prolonged operative duration emerged as independent predictors of intra-operative complications, whereas prior pelvic surgery and abdominal approach independently predicted early post-operative morbidity. These findings underscore the interplay between surgical complexity, anatomical distortion, and operative route in determining perioperative risk.

The high frequency of bladder and bowel injuries observed intra-operatively warrants careful contextual interpretation. Urinary tract injuries are among the most recognized complications of hysterectomy, particularly in the presence of prior cesarean delivery, pelvic adhesions, distorted anatomy, or extensive dissection (5,6). Large registry-based studies have reported lower absolute incidences of urinary and bowel injuries; however, institutional variability is well documented and often reflects case selection, surgeon experience, and detection methods, including the routine use of intra-operative cystoscopy (5). The significant association between prior pelvic surgery and intra-operative complications in the present study (adjusted OR 3.02; 95% CI: 1.10–8.28) is biologically plausible, as adhesions and altered tissue planes increase the technical complexity of dissection. Similarly, prolonged operative duration (≥120 minutes) independently predicted intra-operative complications, aligning with prior evidence that operative time acts as a surrogate marker for surgical difficulty and intraoperative adversity (4,7).

With respect to surgical approach, abdominal hysterectomy was independently associated with higher odds of both intra-operative (adjusted OR 2.64; 95% CI: 1.02–6.81) and early post-operative complications (adjusted OR 2.58; 95% CI: 1.00–6.65) compared with vaginal hysterectomy. These findings are consistent with the established literature demonstrating superior perioperative profiles for vaginal and minimally invasive approaches in appropriately selected patients (2,3). Minimally invasive hysterectomy is associated with reduced wound morbidity, lower postoperative pain, and shorter hospital stay; however, it may not eliminate the risk of visceral injury, particularly during technically demanding dissections (2,4). Although laparoscopic hysterectomy in this cohort demonstrated similarly elevated complication proportions, the wide confidence intervals reflect limited precision due to small sample size and should be interpreted cautiously. Nevertheless, the observed route-specific gradient reinforces existing recommendations favoring vaginal hysterectomy whenever anatomically and clinically feasible (2).

Post-operative bleeding and surgical-site infection were the predominant early morbidities. Surgical-site infection remains one of the most frequent postoperative complications after

hysterectomy and has been associated with operative duration, blood loss, and perioperative antibiotic practices (7). The higher rates observed in abdominal procedures likely reflect larger incisions, greater tissue handling, and potentially longer operative times. Evidence-based prevention bundles incorporating antibiotic prophylaxis, glycemic control, normothermia, and standardized wound care protocols have demonstrated reductions in surgical-site infection rates and may represent an actionable quality improvement target (7). Post-operative hemorrhage, observed more frequently in abdominal and laparoscopic procedures, may be influenced by intraoperative hemostatic challenges and underlying pathology; its prevention requires meticulous surgical technique and structured postoperative monitoring (4).

The independent association between prior pelvic surgery and both intra-operative and early post-operative complications highlights the importance of preoperative risk stratification. Adhesion-related dissection difficulty not only increases the likelihood of organ injury but may also prolong operative time and contribute to postoperative morbidity. Preoperative counseling, selective imaging, and consideration of surgical route in high-risk patients may mitigate adverse outcomes. Furthermore, structured mentorship and case allocation according to surgical complexity and operator experience may enhance patient safety, particularly in teaching hospitals where training responsibilities coexist with service delivery (6).

This study possesses several methodological strengths, including prospective data collection using predefined operational definitions, adjustment for key confounders in multivariable models, and route-stratified analysis. However, certain limitations merit acknowledgment. The single-center design limits generalizability, and the relatively small number of laparoscopic cases restricts inferential precision for that subgroup. Although major systemic comorbidities were excluded to reduce confounding, residual confounding from unmeasured variables such as uterine size or adhesion severity cannot be excluded. Additionally, the focus on early postoperative outcomes within the index hospitalization period precludes assessment of late complications such as delayed ureteric injury or long-term pelvic floor dysfunction. Future multicenter studies with larger samples and standardized follow-up intervals would strengthen external validity and enable more granular risk modeling.

In summary, the findings demonstrate a substantial burden of perioperative morbidity following hysterectomy in this tertiary-care setting, with complication risk strongly influenced by surgical route, prior pelvic surgery, and operative duration. Vaginal hysterectomy was associated with comparatively lower intra-operative and early post-operative complication rates, whereas abdominal procedures carried significantly higher adjusted odds of adverse outcomes. These results support the preferential selection of vaginal approaches when clinically appropriate, the implementation of structured infection-prevention and hemostasis protocols, and enhanced preoperative risk stratification in patients with prior pelvic surgery. Collectively, the data provide locally contextualized evidence to inform surgical planning, training allocation, and institutional quality improvement initiatives.

CONCLUSION

In this tertiary-care cohort, hysterectomy was associated with a high incidence of intra-operative (55.3%) and early post-operative (53.2%) complications, with a clear route-dependent gradient demonstrating comparatively lower morbidity following vaginal hysterectomy and significantly higher adjusted risk associated with abdominal procedures.

Prior pelvic surgery and prolonged operative duration independently predicted intra-operative complications, while prior pelvic surgery and abdominal approach were significant predictors of early post-operative morbidity. These findings emphasize the importance of preoperative risk stratification, judicious selection of surgical route, meticulous operative technique, and targeted perioperative quality-improvement strategies, particularly in patients with prior pelvic surgery or anticipated technical complexity. Broader multicenter studies with standardized complication definitions and longer follow-up are warranted to validate these findings and enhance external generalizability.

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DECLARATIONS

Ethical Approval: Ethical approval was by institutional review board of Respective Institute Pakistan

Informed Consent: Informed Consent was taken from participants.

Authors' Contributions:

Concept: AS, ES; Design: AQ, RR; Data Collection: ArS, ES, AyS; Analysis: ArS; Drafting: ES, AyS

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