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SURGICAL OUTCOMES AND PREDICTORS OF POSTOPERATIVE COMPLICATIONS AMONG WOMEN UNDERGOING MAJOR GYNAECOLOGICAL SURGERY: A PROSPECTIVE CLINICAL STUDY

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Abstract

Major gynaecological surgeries are commonly performed to treat a wide range of benign and malignant conditions affecting women's reproductive health. Evaluating surgical outcomes and identifying factors associated with postoperative complications are essential for improving patient safety, optimizing treatment strategies, and enhancing recovery after surgery. Surgical outcomes and postoperative complications remain important concerns among women undergoing major gynaecological surgery, as these complications can increase morbidity, prolong hospital stay, and affect recovery and quality of life. This prospective clinical study aimed to evaluate surgical outcomes and identify predictors of postoperative complications among women undergoing major gynaecological surgery. The study was conducted in tertiary care hospitals in Pakistan, where data were collected prospectively from women who underwent major gynaecological procedures through clinical assessments, patient interviews, and medical record reviews. A total sample of 391 patients was recruited using a consecutive sampling technique. Information on demographic characteristics, clinical history, surgical procedures, intraoperative factors, and postoperative outcomes was collected using a structured data collection form. Data were analyzed with descriptive statistics (frequencies, percentages, means, and standard deviations), chi-square tests, independent sample t-tests, and logistic regression analysis to identify predictors of postoperative complications. The findings indicated that patient-related and surgical factors influenced postoperative outcomes, with certain clinical and procedural characteristics increasing the likelihood of

complications. The study highlights the importance of early risk assessment, careful surgical planning, and effective postoperative monitoring to improve patient outcomes and reduce complication rates. These findings may assist healthcare professionals in developing evidence-based strategies to enhance the quality and safety of gynaecological surgical care and reduce postoperative morbidity among women.

INTRODUCTION

Various non-cancerous and cancerous conditions affecting the female reproductive system may require major gynecological surgery. These conditions can involve the uterus, ovaries, fallopian tubes, and other reproductive organs. Surgical procedures may be performed through open surgery or laparoscopic (minimally invasive) techniques. Common gynecological surgeries include hysterectomy, which involves the removal of the uterus, and myomectomy, which is performed to remove uterine fibroids (Mowat et al., 2016).

Major gynaecological surgeries can also be required for treatment of gynaecological malignancies. As improvement has been made in the field of anaesthesia, surgical techniques, and advanced monitoring and intensive care, major surgery has become safer. Nonetheless, risk of complications during and after a major gynaecological surgical procedure cannot be completely ruled out (Erekson et al., 2011).

The course after major gynaecological surgery can vary between patients. Some patients can tolerate surgery better than others, and this can be influenced by patients' characteristics and underlying disease, co-morbidities, previous surgery, and type of and the duration of the gynaecological surgical procedure. In gynaecological surgical populations, both patient-related and procedure-related characteristics influence postoperative morbidity and underscore the necessity of thorough and detailed pre-, intra- and post-operative assessment of patients (Iyer et al., 2015; Kaya et al., 2021).

Surgical outcomes are the results of a surgical procedure including the patients' post-operative recovery, any complications, need for further treatment and illnesses, length of stay and readmission, and other adverse events. In major gynaecological surgery, assessment of surgical outcomes is critical to establish the safety and quality of the surgical care provided to the patient. Evaluating postoperative outcomes also helps to define morbidity patterns and determine factors associated with an uncomplicated or complicated postoperative recovery (Elfanagely et al., 2021).

It is also possible to have an uncomplicated recovery after an operative intervention; however, the healthcare requirements remain high due to anemia, infection, thromboembolism, and other complications. Postoperative morbidity is dependent on the type of surgery and the complexity of the clinical condition of the patient. Postoperative assessments and observations remain the cornerstone of care for patients undergoing surgical intervention (Biccard et al., 2011).

Postoperative Complications

Complications that occur after surgery and interrupt the usual postoperative recovery are known as postoperative complications. In major gynaecological surgery, some of these complications include surgical site infection, haemorrhage, wound dehiscence, urinary tract issues, small bowel obstruction, thromboembolism, anaemia, other medical complications, and other surgical complications (Stephenson et al., 2020). The effects of these complications can range from being minor, requiring simple treatment, to being major, requiring intensive intervention or long-term treatment and management. Postoperative complications increase the length of hospital stay, morbidity, and healthcare cost. Postoperative complications can occur in all women who undergo gynaecological surgery, and some risk factors that increase the likelihood of complication includes old age, presence of comorbidity, diabetes, surgical approach, operative duration, and the indication for surgery (Javed et al., 2023).

Predictors of Postoperative Complications

Postoperative complications occur when a patient's condition deteriorates after surgery. Some factors that predispose patients to developing complications include patient-related factors such as advanced age,

obesity, and comorbid conditions, as well as, reduced functional and nutritional status (Shickel et al., 2023). Surgical factors that contribute to complications may include the type and complexity of the surgery, surgery duration, and volume of blood loss (Merath et al., 2020). There are many factors that contribute to postoperative complications. The identification of these factors has clinical implications, as it allows healthcare providers to recognize high-risk patients to ensure proper management. Obesity, poor physical functioning, and performance status, were identified as risk factors for the development of postoperative complications. Closely watching at-risk patients may reduce the severity of postoperative complications.

Clinical and surgical factors must be considered when examining postoperative outcomes. It is often difficult to determine a patient's exact physiologic reserve before surgery. This, along with the severity of a patient's preexisting conditions and the complexity of a surgical procedure, may affect a patient's ability to tolerate surgery and recovery. Obesity and impaired functional status may increase a patient's susceptibility to complications, as may advance age and comorbid conditions. Prolonged and complex procedures increase the burden and affect the recovery from surgery (Wallis et al., 2023).

In a tertiary care setting, identifying these factors is important to prepare women for the expected physical challenges of surgery, recover, and monitor postoperatively. Evidence has shown that demographic characteristics, including advancing age and obesity, increased comorbid conditions, surgical procedure type, and postoperative complications, all increase the risk of negative outcomes. Evidence on risk factors affecting women who undergo major gynaecologic surgery can be used to develop strategies for early risk assessment, plan and time postoperative care to reduce preventable postoperative morbidity (Bayissa et al., 2021).

Research Objectives

1. To assess the surgical outcomes among women undergoing major gynaecological surgery.
2. To determine the frequency and types of postoperative complications among women undergoing major gynaecological surgery.
3. To identify demographic, clinical, surgical, and intraoperative factors associated with postoperative complications.
4. To determine the significant predictors of postoperative complications among women undergoing major gynaecological surgery using logistic regression analysis.

Problem Statement

Major gynaecological surgeries are necessary to treat both malignant and benign conditions. However, these interventions remain as major surgical stresses to the body, and several postoperative complications have been described. Some of these may prolong hospital stay, increase morbidity, and delay the recovery period of patients. Several factors have been identified to be associated with increased postoperative morbidity (Inci et al., 2020). However, evidence from the settings where these surgical interventions are performed may remain scant. Additionally, little systematic evidence is available to demonstrate how combined effect of several demographic, clinical, surgical, and intraoperative conditions may aid the prediction of increased risk of postoperative complications for women undergoing major gynaecological surgeries. Therefore, the aim of this study is to identify and assess risk factors associated with major gynaecological surgical procedures performed at a tertiary care facility in Pakistan, to ultimately inform and facilitate strategies to address the increased risk conditions prior to the surgery (Chambers et al., 2021).

Significance of the Study

This study is clinically significant because it provides prospective evidence on surgical outcomes and factors associated with postoperative complications among women undergoing major gynaecological surgery. Identifying important demographic, clinical, surgical, and intraoperative predictors may help surgeons, gynaecologists, nurses, and other healthcare professionals recognize patients at higher risk of postoperative morbidity and provide appropriate perioperative management. The findings may support improved preoperative risk assessment, individualized surgical planning, timely postoperative monitoring,

and early management of complications, which may contribute to reduced morbidity, shorter hospital stays, and improved recovery. Furthermore, the study may provide useful evidence for tertiary-care hospitals in Pakistan to strengthen patient-safety practices and develop strategies aimed at improving the quality and outcomes of major gynaecological surgical care.

Literature Review

Dumitriu et al. (2021) used the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) dataset to characterize 22,214 major gynecological surgery cases, and assess the influence of age and various medical comorbidities and functional status on post-surgical complications. Schoenfeld et al. (2011) also identified unplanned, or unintentional, weight loss as a significant predictor of post-surgical complications, and, hence, warranted further evaluation in this analysis. While the preceding studies help frame the post-surgical complication risk assessment to include demographic and clinical factors, Luglio et al. (2022) also reinforced the examination of additional risk factors in conjunction with one another. For example, the presence of cancer, coupled with an emergency nature of the surgical procedure, and/or prolonged operative time, were also factors that reflected the poor post-surgical complication risk.

Patient and Surgical Factors in Gynaecological Oncology Surgery

Querleu et al. (2017) conducted the UKGOSOC prospective multicentre study to analyse the predictors of complications in gynaecological oncology surgery. They conducted a prospective recording of the outcomes of 2,948 major surgery cases performed in various gynaecological cancer centres. They assessed postoperative complications using the Clavien-Dindo classification. Regression analyses were performed to determine the factors associated with complications. In the study, the presence of age, comorbidities, diabetes, surgical approach, duration of surgery and final diagnosis predicted the occurrence of postoperative complications. The study demonstrated that the predictors of intraoperative complications and postoperative complications were not similar. This study supported the postoperative morbidity is multifactorial and may be due to an interaction of health status of the patient and the condition, as well as surgical factors (Rivard et al., 2015).

The large multicenter design of Fotopoulou et al. (2021), provides compelling evidence to justify the analysis of surgical and clinical factors concurrently. The findings of their study are pertinent to this study and demonstrate the importance of a prospective assessment in determining the factors responsible for postoperative complications. The study advocated regression analysis in assessing the independent impact of surgical and clinical factors on the risk of postoperative complications.

Wallace et al. (2016) studied postoperative complications of women undergoing hysterectomy for both benign and malignant reasons using a large national surgical database. They included 59,525 women and analyzed the postoperative complications for each group. They assessed complications such as wound complications, venous thromboembolism, urinary tract infections, sepsis, blood transfusion, unplanned readmission, return to the operating room and mortality.

Postoperative complications for malignant conditions were much higher when compared to benign conditions. Thromboembolic events, sepsis and transfusions were higher in the malignant group. The malignant group also had higher readmission and return to operating room rates. The study also showed varying outcomes due to the type of surgical approach used to perform the malignant hysterectomy. They also found that whether the surgery was done robotically or via laparoscopy played a role in postoperative complications.

Study is relevant to Gendreau et al. (2024), because hysterectomies can be performed for either benign or malignant reasons. Our study assesses all major gynecologic surgery and their findings show that there is a need to evaluate the indication and type of surgery when assessing postoperative complications. Therefore, the assessment of surgical characteristics in our study may help elucidate postoperative factors associated with complications.

Clinical Risk Factors for Severe Complications

This study by Steffensen et al. explores predictors for postoperative complications in women with gynaecological cancer undergoing surgery as part of the RISC-Gyn study. It evaluates pre-operative functional, clinical, nutritional and peri-operative factors in relation to post-operative complications. The study highlights the importance of identifying patients prior to major surgery with a reduced physiological reserve (Aoki et al., 2017).

The authors noted that excess body weight and obesity, reduced physical function, and performance status, and low phase angle predicted postoperative complications. Additional intra-operative variables, including the use of norepinephrine and bowel resection, increased risk. They conclude that postoperative morbidity reflects vulnerability of the patient and the complexity of the surgery (Gedebjerg et al., 2020).

The study describes the importance of extensive preoperative and perioperative risk assessment. It describes that predicting postoperative complications for women undergoing major gynaecological surgery may not be possible through assessing clinical status only. In light of the current study, these findings suggest that for predicting postoperative complications for women undergoing gynaecological surgery, other factors including clinical history and surgical and intraoperative variables should be considered.

Kaya et al. (2021) researched the causes and types of complications that happened during and after surgery in women who had a laparoscopic gynaecological surgical procedure. The authors looked over 3000 surgeries and studied patient characteristics, surgery characteristics and what happens before and after a surgery. The authors noted that complications that happen after a surgery contribute significantly to morbidity after gynaecological surgeries.

In the study, several surgical-related factors that include the length of surgery, use of carbon dioxide insufflation, and drop in hemoglobin level and the status of the American Society of Anesthesiologists were linked to post-operative complications. These findings suggest that post-operative outcomes are determined not only by the physiological condition of the patient but also by the characteristics of the surgery. The findings by McCoy et al. (2015), support the need to evaluate other factors occurring during the surgery in addition to the patient-related variables when assessing post-operative outcomes. This also supports the need to evaluate the characteristics of the surgery along with patient-related variables in the present study that examine the causes of post-operative complications.

Surgical Complexity and Severe Postoperative Complications

Tortorella et al. (2019) identified predictors of short-term surgical complications in women undergoing pelvic exenteration for gynaecologic malignancies. As pelvic exenteration is a long, complex procedure, the study added to the knowledge base about surgical complexity and postoperative morbidity. The authors performed logistic regression to find independent predictors of severe adverse events occurring within 30 days of surgery.

Severe postoperative complications occurred in 27% of assessed patients. The researchers reported independent predictors of adverse outcomes as: extent of surgery, preoperative hemoglobins level, and number of comorbid conditions (three or more). Based on the results of this study, the extent of surgery and the health status of the patient prior to surgery influence the post-surgical outcomes.

The study is most relevant to the predictor-focused element of this research as it uses logistic regression to identify independent predictors of postoperative morbidity. The study highlights the importance of using a comprehensive and multidisciplinary approach to identify women who may be at a higher risk of experiencing complications after surgery. Such patients may benefit from additional preoperative assessment, monitoring, and management to improve surgical outcomes (Broggi et al., 2023).

Research Gap

Previous research has identified several patient-related and surgical factors related to postoperative complications for gynaecological surgery; however, the focus has primarily been on specific surgical subspecialties (i.e. gynaecologic oncology) or complex surgical procedures (Sehouli et al., 2021). There is much less evidence on patients undergoing more broadly defined major gynaecological surgery. Large, prospective studies have shown that increased age and the presence of certain comorbidities and diabetes

can increase the risk of postoperative complications, as can increased duration and complexity of surgery. Other studies have highlighted severe postoperative complications in high-risk surgical patients. Most of the literature focused on identifying predictors of postoperative complications in primary care and low- and middle-income countries (LMICs), and very few studies were conducted in tertiary care hospitals in Pakistan. While Pakistan has multicenter studies on postoperative surgical site infections, similar studies focused on other postoperative surgical complications in the region are lacking (Casarin et al., 2024). Hence, this prospective clinical study in Pakistan aims to assess the surgical outcomes of tertiary-care hospitals and determine the factors that may predict postoperative surgical complications among women undergoing major gynecological surgery.

METHODOLOGY

Research Design

The study adopted a prospective clinical research design to understand surgical outcomes and to identify predictors of post-surgical complications for major gynaecological surgical procedures performed at the selected tertiary care hospitals in Pakistan. Prospective research design was warranted, as the study recorded systematic data of patient characteristics and clinical conditions, type of surgical procedure, intra-operative factors and post-operative outcomes from the time of surgery to the post-operative period. This helped to evaluate the occurrence of post-operative complications related to various patient-related and procedure-related factors.

This study included all types of major gynaecological surgeries (both benign and malignant) performed in the study hospitals. The post-operative period for assessment of surgical outcomes was 90 days. The researchers monitored the participants clinically and assessed the patient records to determine if the participants had developed any complication during the predefined and observed period post-surgery. Some of the factors assessed as predictors of post-surgical complications included demographics, pre-existing conditions, co-morbidities, type of clinical procedure, blood loss, transfusion, and other intraoperative factors.

Study Setting

This study was limited to selected tertiary-care hospitals in Pakistan, namely Jinnah Postgraduate Medical Centre, Services Hospital, Mayo Hospital, Lady Reading Hospital and Bolan Medical Complex Hospital. These hospitals were chosen as they have gynaecological and obstetrics specialties and offer surgical services to women requiring advanced operative interventions for a wide range of benign and malignant gynaecological conditions.

Data was collected from the gynecology and obstetrics departments and surgical wards of the selected hospitals, operating rooms, recovery rooms and other relevant inpatient units. Women aged 18 years and above who were scheduled for major gynaecological surgery were assessed from the time of admission to the hospital until the completion of their postoperative observation period. The selected hospitals were the most appropriate to assess surgical outcomes and postoperative complications of women undergoing major gynaecological surgeries in Pakistan.

Sample Distribution

A total of 391 women undergoing major gynaecological surgeries were recruited from the tertiary-care hospitals based on the eligibility criteria.

Table 1: Distribution of Study Participants by Institution (N = 391)

Institution	Frequency (n)	Percentage (%)
Jinnah Postgraduate Medical Centre	80	20.5

Services Hospital	78	19.9
Mayo Hospital	79	20.2
Lady Reading Hospital	77	19.7
Bolan Medical Complex Hospital	77	19.7
Total	**391**	**100.0**

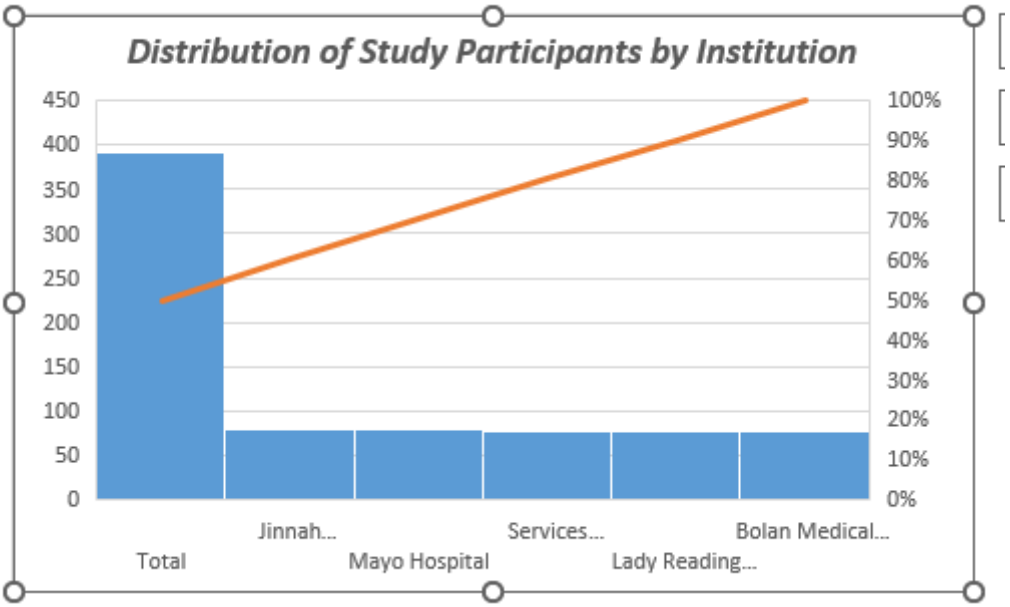


Fig 1: Distribution of Study Participants by Institution (N = 391)

Study Population

The study population was adult women who had a major gynaecologic surgery at the selected tertiary care hospitals during the study period. Participants were included regardless of whether the surgery was for a benign or a malignant condition of the female reproductive organs. The major condition of the surgery was the principal criteria for inclusion in the study.

Sampling

A consecutive sampling technique was used to select participants. Eligible women who underwent a major gynaecologic surgery during the study period were enrolled. To reduce bias, the principal investigator performed consecutive sampling.

Eligibility Criteria

Women aged 18 years and older who underwent a major gynaecologic surgical procedure in the study hospitals were included. Women who underwent major gynaecologic surgery, irrespective of whether the condition was benign or malignant were included. Excluded from the study were; women who underwent minor outpatient gynaecologic surgical procedures, women with incomplete medical records, patients in whom the postoperative outcome could not be assessed, and women who did not meet the criteria for major gynaecologic surgery.

Data Collection Instrument

Data was collected using a structured clinical data collection form. The form was designed to capture demographic data, clinical data, comorbid conditions, and postoperative data. The demographic data captures included patient's age and other pertinent data. The clinical section was sub-divided into medical history, relevant preoperative findings, type of surgery, surgical approach, intraoperative findings, and estimated blood loss. The section was also used to report other intraoperative findings. The postoperative section was used to report complications and other findings related to postoperative recovery.

Data Collection Procedure

It was decided a priori to collect the data from all eligible participants. Data were collected before or at the time of a participant's major gynaecologic surgery. Clinical and demographic data were collected using interviews and review of participants' medical records. Operative and surgical data were collected from the operative notes, anesthesia records, and other pertinent hospital records. Participants were observed during their postoperative stay and postoperative complications were documented by clinical assessment and review of the medical records. Complications were documented by their clinical type and occurred during the postoperative observation period. Potential predictor variables included demographic and clinical data, comorbid conditions, surgical indications, and other pertinent surgical and intraoperative findings. Surgical outcomes and postoperative recovery were assessed by complications and other pertinent findings. Data were coded and analyzed using SPSS.

Descriptive statistics were used to summarize the various patient demographic and clinical characteristics, surgical details, and post-operative information. Categorical variables were reported in frequency and percentage. Continuous variables were reported in mean, standard deviation, or median and interquartile range, based on the data distribution. Associations between categorical patient or surgical characteristics and occurrence of post-operative complications were tested with the chi-square or Fisher's exact test. In case of parametric assumptions for continuous variables, the independent samples t-test was performed to compare women with and without post-operative complication.

Postoperative complication was the dependent variable and other demographic; clinical and surgical variables were the independent variables in the binary logistic regression model to determine the predictors of post-operative complications. The results of the logistic regression were reported as Adjusted Odds Ratio (AOR) with 95% Confidence Intervals (CI) and P values. An ethical review of the study was done by the relevant authority. The research participants were duly informed of the purpose of the study and their right to refuse to participate or withdraw from the study at any time. The identity of the research participants was not disclosed and the data was maintained in a secure and private environment. The research data was not used for any other purpose other than the stipulated research.

Results

The analysis included 391 women who underwent major gynecological surgery at the studied tertiary-care hospitals. Results were presented according to various demographic and clinical characteristics, factors related to surgery and intraoperatively, postoperative complications, and factors related to postoperative complications, as identified by binary logistic regression.

Table 2: Demographic Characteristics of Study Participants (N = 391)

Demographic Characteristic	Category	Frequency (n)	Percentage (%)

Age	≤40 years	172	44.0
	41–50 years	121	30.9
	>50 years	98	25.1
Marital status	Married	360	92.1
	Unmarried	31	7.9
Parity	Nulliparous	54	13.8
	1–3 children	191	48.8
	≥4 children	146	37.3
Residence	Rural	214	54.7
	Urban	177	45.3

About 44% of the participants were less than 40 years of age. About 92.1% of the participants were married. About 48.8% of the participants had 1-3 children and 37.3% of the participants had 4 or more children. About 54.7% of the participants lived in rural areas.

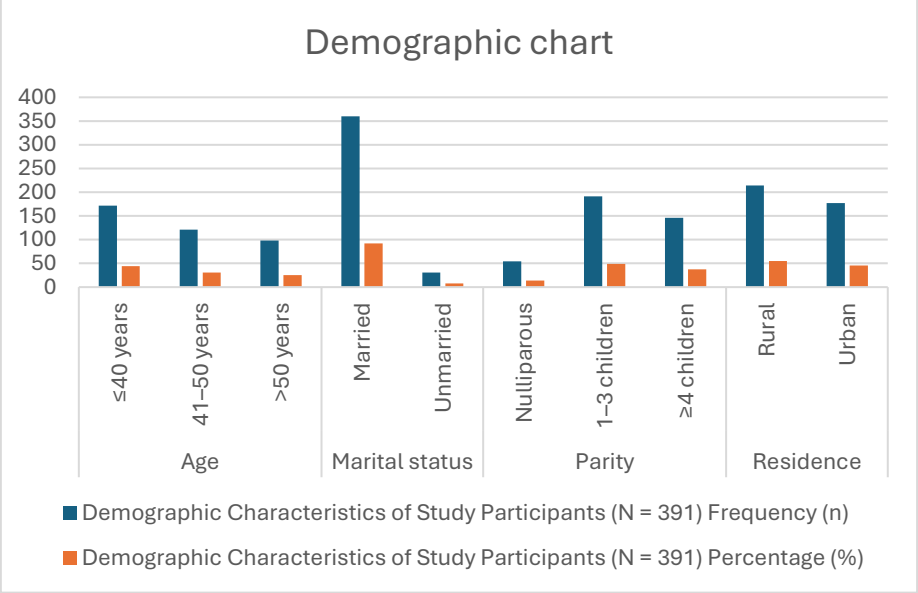


Fig 2: Demographic Characteristics of Study Participants (N = 391)

Table 3: Clinical Characteristics of Study Participants (N = 391)

Clinical Characteristic	Category	Frequency (n)	Percentage (%)
Comorbidity	Present	98	25.1
	Absent	293	74.9
Diabetes mellitus	Present	61	15.6
	Absent	330	84.4
Hypertension	Present	84	21.5
	Absent	307	78.5

Previous abdominal/pelvic surgery	Yes	143	36.6
	No	248	63.4
Preoperative anemia	Present	126	32.2
	Absent	265	67.8
Surgical indication	Benign condition	238	60.9
	Malignant condition	153	39.1

About 25.1% of the participants had some kind of comorbidity. Diabetes and hypertension were seen in 15.6% and 21.5% of the participants, respectively. Previous surgeries of the abdomen and/or pelvis were seen in 36.6% of the participants. Preoperative anemia was seen in 32.2% of the participants. Of the surgeries, about 60.9% were done for benign conditions.

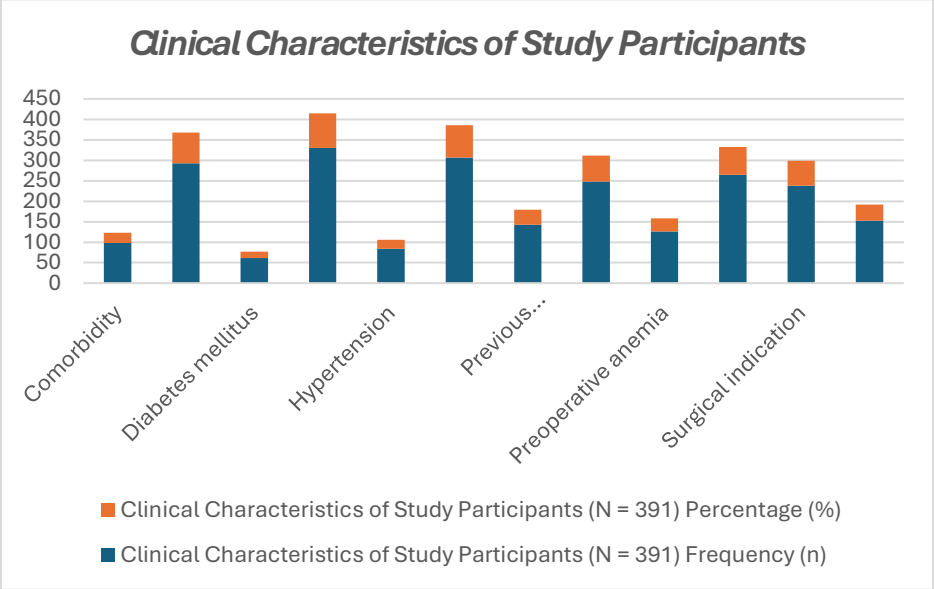


Fig 3: Clinical Characteristics of Study Participants

Table 4: Surgical and Intraoperative Characteristics of Study Participants (N = 391)

Surgical/Intraoperative Characteristic	Category	Frequency (n)	Percentage (%)
Type of surgery	Hysterectomy	184	47.1
	Ovarian/adnexal surgery	82	21.0
	Myomectomy	63	16.1
	Other major gynaecological surgery	62	15.9
Surgical approach	Open surgery	141	36.1
	Minimally invasive/vaginal approach	250	63.9
Operative duration	≤180 minutes	223	57.0

	>180 minutes	168	43.0
Estimated blood loss	≤500 mL	268	68.5
	>500 mL	123	31.5
Intraoperative transfusion	Yes	74	18.9
	No	317	81.1

About 47.1% of the participants underwent hysterectomy. About 21% of the participants underwent ovarian/adnexal surgery. About 63.9% of the surgeries were done by either vaginal route or laparoscopically. Operative time was more than 180 minutes in 43% of the participants. Blood loss was more than 500 mL in 31.5% of the participants. Intraoperative blood transfusion was done in 18.9% of the participants.

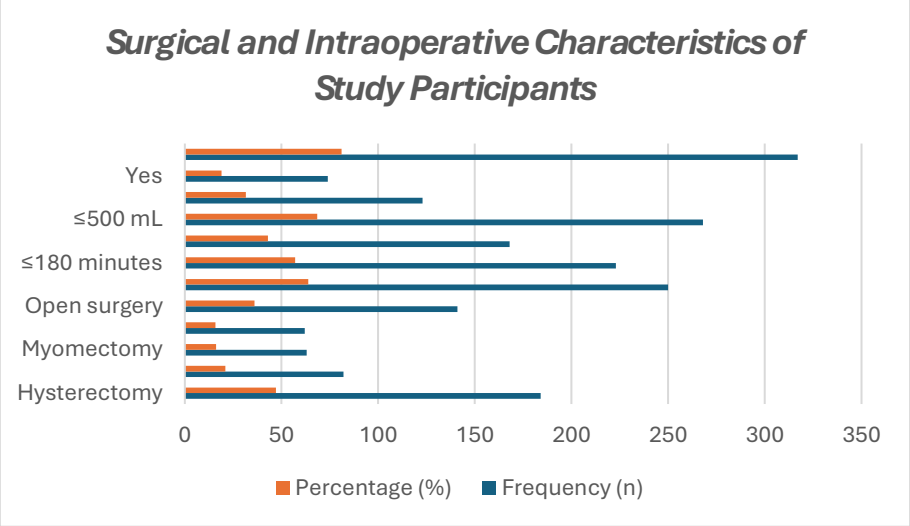


Fig 5: Surgical and Intraoperative Characteristics of Study Participants

Table 5: Frequency and Types of Postoperative Complications Among Women Undergoing Major Gynaecological Surgery (N = 391)

Postoperative Outcome	Frequency (n)	Percentage (%)
No postoperative complication	279	71.4
At least one postoperative complication	112	28.6
Wound infection	27	6.9
Postoperative hemorrhage	21	5.4
Urinary complications	18	4.6
Respiratory complications	12	3.1
Thromboembolic complications	8	2.0
Postoperative sepsis	9	2.3
Other complications	17	4.3

In 28.6% of the participants, postoperative complications developed, and 71.4% did not have any postoperative complication. The most common postoperative complication was infection of the surgical wound (6.9%), followed by postoperative hemorrhage (5.4%), and urinary complications (4.6%).

Table 6: Association of Demographic and Clinical Characteristics with Postoperative Complications (N = 391)

Variable	Category	No Complication n (%)	Complication n (%)	χ^2	p-value
Age	≤40 years	137 (79.7)	35 (20.3)	14.21	<0.001
	41–50 years	85 (70.2)	36 (29.8)		
	>50 years	57 (58.2)	41 (41.8)		
Comorbidity	Absent	231 (78.8)	62 (21.2)	32.04	<0.001
	Present	48 (49.0)	50 (51.0)		
Diabetes mellitus	Absent	247 (74.8)	83 (25.2)	7.21	0.007
	Present	32 (52.5)	29 (47.5)		
Hypertension	Absent	226 (73.6)	81 (26.4)	4.31	0.038
	Present	53 (63.1)	31 (36.9)		
Previous abdominal/pelvic surgery	No	193 (77.8)	55 (22.2)	10.52	0.001
	Yes	86 (60.1)	57 (39.9)		
Preoperative anemia	Absent	203 (76.6)	62 (23.4)	8.64	0.003
	Present	76 (60.3)	50 (39.7)		
Surgical indication	Benign	183 (76.9)	55 (23.1)	9.12	0.003
	Malignant	96 (62.7)	57 (37.3)		

Various demographic and clinical factors were significantly related to the occurrence of post-operative complications. It was observed that women above 50 years, patients with co-morbidities, diabetes, previous abdominal or pelvic surgeries, anemia and malignancy had an increased risk for postoperative complications ($p < 0.05$). Among clinical factors, the strongest association was with co-morbidity ($\chi^2 = 32.04$, $p < 0.001$).

Table 7: Association of Surgical and Intraoperative Characteristics with Postoperative Complications (N = 391)

Variable	Category	No Complication n (%)	Complication n (%)	χ^2	p-value
Surgical approach	Minimally invasive/vaginal	205 (82.0)	45 (18.0)	38.43	<0.001
	Open surgery	74 (52.5)	67 (47.5)		
Operative duration	≤180 minutes	181 (81.2)	42 (18.8)	24.44	<0.001
	>180 minutes	98 (58.3)	70 (41.7)		

Estimated blood loss	≤500 mL	220 (82.1)	48 (17.9)	48.02	<0.001
	>500 mL	59 (48.0)	64 (52.0)		
Intraoperative transfusion	No	243 (76.7)	74 (23.3)	9.46	0.002
	Yes	36 (48.6)	38 (51.4)		
Type of surgery	Hysterectomy	143 (77.7)	41 (22.3)	10.38	0.016
	Ovarian/adnexal surgery	59 (72.0)	23 (28.0)		
	Myomectomy	51 (81.0)	12 (19.0)		
	Other major surgery	26 (41.9)	36 (58.1)		

Postoperative complications were related to surgical approach, the duration of the procedure, estimated blood loss, intraoperative blood transfusion and type of surgery ($p < 0.05$). Complications were more among women with open surgical procedures and longer surgeries (procedure duration > 180 minutes). Women who had blood loss of more than 500 mL and women who had intraoperative blood transfusion also had more postoperative complications.

Table 8: Binary Logistic Regression Analysis of Predictors of Postoperative Complications Among Women Undergoing Major Gynaecological Surgery (N = 391)

Predictor	Category	AOR	95% CI	p-value
Age	>50 years vs. ≤40 years	2.31	1.31–4.08	0.004
Comorbidity	Present vs. absent	2.74	1.63–4.61	<0.001
Previous abdominal/pelvic surgery	Yes vs. no	1.82	1.11–2.99	0.018
Preoperative anemia	Present vs. absent	1.89	1.16–3.08	0.011
Malignant surgical indication	Malignant vs. benign	1.76	1.08–2.87	0.024
Open surgical approach	Open vs. minimally invasive/vaginal	2.68	1.63–4.42	<0.001
Operative duration	>180 minutes vs. ≤180 minutes	2.17	1.34–3.51	0.002
Estimated blood loss	>500 mL vs. ≤500 mL	3.12	1.89–5.16	<0.001
Intraoperative transfusion	Yes vs. no	1.94	1.10–3.43	0.023

Results of binary logistic regression showed that older age (≥ 50 years), presence of co-morbidity, previous abdominal or pelvic surgery, anemia, malignancy, open surgical approach (> 180 minutes) and blood loss > 500 mL and intraoperative blood transfusion were the independent predictors of postoperative complications ($p < 0.05$). The strongest independent predictor of postoperative complications was blood loss > 500 mL (AOR = 3.12, 95% CI: 1.89-5.16, $p < 0.001$), followed by open surgical approach and the presence of co-morbidities.

Discussion

This study analyzed postoperative complications and their potential determinants among 391 women who underwent major gynecological surgery. The overall occurrence of postoperative complications was 28.6%. The most common postoperative complications included wound infection, postoperative hemorrhage and urinary complications. It was concluded that the presence of postoperative complications was influenced by both patient-related and surgical factors (Kengsakul et al., 2023).

The presence of older age, comorbidity, previous abdominal or pelvic surgeries, anemia and a malignant surgical indication were predictors of postoperative complications. Older age and the presence of comorbidities increased a patient's risk of postoperative complications. Prior abdominal or pelvic surgeries and anemia, also increased a patient's risk of postoperative complications. Optimal management of anemia prior to surgery is essential (Gaba et al., 2024). Surgical and intraoperative factors were the most predictive of postoperative complications. The presence of malignancy, and a prolonged, blood-loss surgery were the most predictive of postoperative complications (Levine et al., 2023).

There is a need to appropriately identify high-risk surgical patients, and optimize their preoperative condition to reduce complications. These efforts, along with the use of careful surgical and anesthetic planning and management to optimize blood loss and loss replacement, as well as close postoperative observation may help reduce postoperative complications for women undergoing major gynecological surgery (Ringel et al., 2022).

General Conclusion

The study finds that post-operative complications remain a significant concern for women undergoing major gynaecological surgery. Complications were found in 28.6% of the participants, and included wound infections and postoperative hemorrhages and urinary tract complications. The study shows that there are contributions both from the patient and the surgical side which influence postoperative outcomes.

Higher age, the presence of comorbidities, previous abdominal and pelvic surgeries, preoperative anemia, and a malignant surgical indication were found to increase the risk for postoperative complications. Other risk factors included, open surgery, longer duration of surgery, increased blood loss and transfusion during the operation. Identifying high risk patients, and appropriate preoperative optimization and surgical planning may reduce the need for more invasive and risky surgical strategies.

Future Implications

Future studies should examine the prevalence of postoperative complications in larger and more varied populations. Research should assess the lasting impact of risk factors in order to develop, evaluate, and test strategies to lessen complications through the optimization of patients undergoing surgery, blood-loss management, surgical planning, postoperative care, and monitoring. This could help develop and validate risk assessment strategies. These enhancements may lead to the improvement of the existing evidence base for risk assessment in the context of major gynecological surgical care.

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