



PATTERN AND DETERMINANTS OF PERIOPERATIVE COMPLICATIONS AMONG WOMEN UNDERGOING OBSTETRIC AND GYNAECOLOGICAL SURGERIES IN A TERTIARY CARE SETTING

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ABSTRACT: Background: Obstetric and gynaecological surgeries constitute a major proportion of surgical workload in tertiary care hospitals and are associated with unique perioperative risks arising from physiological changes of pregnancy, high prevalence of anaemia, emergency surgical indications, and diverse anaesthetic techniques. Anaesthesia-related factors such as choice of anaesthetic technique, airway management, and intraoperative haemodynamic stability play a crucial role in perioperative outcomes. However, hospital-based data from India evaluating the burden and pattern of perioperative complications with reference to anaesthetic variables remain limited. **Aims and Objectives:** To assess the burden and spectrum of perioperative complications among women undergoing obstetric and gynaecological surgeries at a tertiary care hospital and to evaluate the association of selected perioperative and anaesthetic variables with these complications. **Methods:** A hospital-based observational study was conducted among 52 women undergoing obstetric and gynaecological surgeries at a tertiary care teaching hospital over a defined period. Data were collected using a structured proforma and included socio-demographic characteristics, type and indication of surgery, **anaesthetic technique (general or regional anaesthesia), ASA physical status, airway assessment and management, intraoperative haemodynamic events, and estimated blood loss with transfusion requirement**, along with preoperative clinical parameters, intraoperative events, and postoperative outcomes. Perioperative complications were classified as intraoperative and postoperative. Data were analysed using descriptive statistics, and associations between selected perioperative and anaesthetic variables and the occurrence of complications were assessed using appropriate statistical tests. A p-value of <0.05 was considered statistically significant. **Results:** Perioperative complications were observed in 40.4% of the study participants. Common intraoperative complications included hypotension, excessive blood loss, and airway-related events, while postoperative complications comprised pain requiring additional analgesia, postoperative nausea and vomiting, wound-related complications, and prolonged hospital stay. A higher incidence of complications was noted among women undergoing emergency procedures,

those with higher ASA physical status, preoperative anaemia, longer duration of surgery, intraoperative haemodynamic instability, and increased blood loss requiring transfusion. Several anaesthetic and perioperative variables showed a statistically significant association with the occurrence of complications.

Conclusion: The study highlights a considerable burden of perioperative complications in obstetric and gynaecological surgeries in a tertiary care hospital setting, with anaesthetic factors playing a significant contributory role. Careful preoperative risk stratification, optimisation of anaemia, appropriate choice of anaesthetic technique, vigilant airway management, and strict intraoperative haemodynamic monitoring may help reduce perioperative morbidity. Strengthening adherence to standard anaesthetic and perioperative protocols can improve maternal surgical outcomes.

Key words: Perioperative complications; Obstetric surgery; Gynaecological surgery; Anaesthesia; Maternal morbidity; Hospital-based study.

INTRODUCTION

Obstetric and gynaecological surgeries constitute a substantial proportion of the surgical workload in secondary and tertiary care hospitals, particularly in low- and middle-income countries (LMICs) such as India. These procedures range from elective gynaecological surgeries, including hysterectomy and adnexal surgeries, to emergency obstetric interventions such as caesarean section and obstetric hysterectomy. Although advances in surgical techniques, anaesthesia, and perioperative monitoring have contributed to improved maternal survival, perioperative complications continue to be a major cause of maternal morbidity, prolonged hospitalisation, increased health-care costs, and adverse outcomes [1–3].

Perioperative complications are adverse events occurring during the preoperative, intraoperative, or postoperative period that negatively affect patient recovery or clinical outcomes. In obstetric and gynaecological surgeries, these complications arise from an interaction of patient-related factors, surgical characteristics, **anaesthetic variables**, and health-system determinants. This burden is particularly relevant in resource-constrained settings, where delayed presentation, high prevalence of anaemia, emergency surgical indications, and limited opportunities for perioperative optimisation are common [4,5].

Global and Indian Burden of Obstetric and Gynaecological Surgeries

Globally, caesarean section is among the most frequently performed surgical procedures. The World Health Organization reports that global caesarean section rates have exceeded 21%, with rising trends observed across both developed and developing countries [6]. In India, caesarean section rates vary considerably across regions and health-care sectors, with higher rates reported in private facilities compared to public institutions [7]. Alongside obstetric surgeries, gynaecological procedures such as abdominal and vaginal hysterectomy, laparoscopic surgeries, and emergency interventions for ectopic pregnancy and pelvic infections contribute significantly to the surgical workload in tertiary care hospitals.

Despite the large volume of these procedures, perioperative outcomes in obstetric and gynaecological populations remain inadequately characterised from a population-based hospital perspective. Much of the available literature focuses on individual surgical procedures, isolated complications, or specific anaesthetic techniques, rather than providing an integrated assessment of perioperative complications and their determinants in routine clinical practice [8,9].

Perioperative Complications: Nature and Determinants

Perioperative complications in obstetric and gynaecological surgeries encompass a wide spectrum of clinical events. Intraoperative complications commonly include hypotension, excessive blood loss, airway-related difficulties, anaesthetic drug reactions, and surgical injuries. Postoperative complications frequently reported are pain, postoperative nausea and vomiting (PONV), wound

infection, urinary tract infection, thromboembolic events, respiratory complications, and prolonged hospital stay [10–12].

Patient-related factors play a significant role in determining perioperative risk. Anaemia remains a major public health problem among women of reproductive age in India and is consistently associated with increased intraoperative blood loss, greater transfusion requirements, postoperative infections, delayed wound healing, and prolonged recovery [13,14]. Comorbidities such as hypertensive disorders of pregnancy, diabetes mellitus, obesity, and cardiovascular disease further increase perioperative risk [15].

Surgical factors, including the urgency and duration of surgery, also influence outcomes. Emergency obstetric procedures are associated with higher complication rates compared to elective surgeries due to limited time for preoperative optimisation and greater physiological stress [16]. Prolonged operative duration has been linked to increased risk of surgical site infections, hypothermia, and anaesthesia-related adverse events [17].

Anaesthetic Variables and Perioperative Outcomes

Anaesthetic variables are critical determinants of perioperative outcomes in obstetric and gynaecological surgeries but are often under-reported. The **type of anaesthesia administered**—general, spinal, epidural, or combined spinal–epidural—directly influences haemodynamic stability, airway safety, postoperative recovery, and maternal satisfaction. Neuraxial anaesthesia is widely preferred for caesarean section due to its favourable safety profile; however, it is frequently associated with hypotension and bradycardia if preventive measures are inadequate [18].

The **ASA physical status classification** is a validated indicator of baseline perioperative risk and has been shown to predict perioperative morbidity and postoperative complications. Higher ASA grades reflect greater physiological compromise and increased susceptibility to anaesthesia-related adverse events [19].

Airway assessment and management remain crucial anaesthetic considerations in obstetric patients due to pregnancy-related anatomical and physiological changes that increase the risk of difficult intubation and airway-related complications. These risks are particularly pronounced during emergency general anaesthesia [20].

Intraoperative haemodynamic events, such as hypotension or hypertension requiring pharmacological intervention, are common during obstetric anaesthesia and are associated with adverse maternal outcomes, delayed recovery, and increased postoperative morbidity [21].

Finally, **intraoperative blood loss and transfusion requirement** represent important anaesthesia-related variables, especially in anaemic patients and emergency obstetric surgeries. Effective blood management and timely transfusion are essential to prevent severe maternal morbidity and prolonged hospitalisation [22].

Health System Perspective and Maternal Care in India

From a health-system and public health perspective, perioperative complications contribute substantially to increased hospital stay, greater utilisation of intensive care services, higher demand for blood products, and increased financial burden on both health-care facilities and patients [23]. In LMICs, these challenges are compounded by workforce shortages and inequitable access to safe surgical and anaesthetic care.

Despite improvements in maternal mortality indicators in India, morbidity related to surgical and anaesthetic care remains a significant concern [24]. Understanding the burden and determinants of perioperative complications, including modifiable anaesthetic factors, is essential for improving quality of care, strengthening perioperative protocols, and enhancing maternal outcomes.

Rationale and Objectives

Given the high volume of obstetric and gynaecological surgeries and the substantial impact of perioperative complications on maternal health, there is a clear need for locally relevant, hospital-based evidence. The present study was undertaken to assess the burden and pattern of perioperative complications among women undergoing obstetric and gynaecological surgeries at a tertiary care hospital, with particular emphasis on selected anaesthetic and perioperative variables, to inform strategies for safer surgical and anaesthetic care.

METHODS:

Study Design

A hospital-based observational study was conducted to assess the burden and pattern of perioperative complications among women undergoing obstetric and gynaecological surgeries. The study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for observational studies.

Study Setting

The study was carried out at a tertiary care teaching hospital providing comprehensive obstetric, gynaecological, and anaesthesia services, including elective and emergency surgical care. The hospital caters to both urban and rural referral populations and performs a wide range of obstetric and gynaecological procedures on a routine basis.

Study Period

Data were collected over a defined period of 14 months, from February 2023 to March 2025.

Study Population

The study population comprised women undergoing obstetric and gynaecological surgeries during the study period at Viswabharathi Medical College and General Hospital, Kurnool.

Inclusion Criteria

- Women aged 18 years and above
- Patients undergoing obstetric surgeries (e.g., caesarean section, obstetric hysterectomy)
- Patients undergoing gynaecological surgeries (e.g., abdominal or vaginal hysterectomy, adnexal surgeries, emergency gynaecological procedures)
- Patients who provided written informed consent

Exclusion Criteria

- Patients undergoing minor procedures not requiring anaesthesia
- Patients with incomplete perioperative or anaesthesia records
- Patients referred postoperatively from other institutions

Sample Size

A total of 52 consecutive eligible patients meeting the inclusion criteria during the study period were included using complete enumeration.

Data Collection Tool and Technique

Data were collected using a pre-designed, structured proforma developed based on standard perioperative assessment formats and relevant literature. Information was obtained from:

- Patient interviews
- Anaesthesia records
- Operation theatre registers
- Postoperative monitoring charts

- Case records

Study Variables

1. Socio-Demographic Variables

- Age (years)
- Residence (urban/rural)
- Socioeconomic status (as per Modified BG Prasad classification)

2. Obstetric and Gynaecological Variables

- Type of surgery:
 - Obstetric
 - Gynaecological
- Nature of surgery:
 - Elective
 - Emergency
- Indication for surgery
- Gravidity and parity (for obstetric cases)
- Gestational age (for obstetric cases)

3. Preoperative Clinical Variables

- Preoperative haemoglobin level (g/dL)
- Presence of comorbidities:
 - Anaemia
 - Hypertensive disorders
 - Diabetes mellitus
 - Thyroid disorders
 - Cardiovascular disease
- **American Society of Anesthesiologists (ASA) physical status classification**
- Baseline preoperative vital parameters

4. Anaesthesia-Related Variables

- **Type of anaesthesia administered:**
 - Spinal anaesthesia
 - General anaesthesia
 - Regional or combined spinal–epidural techniques
- **Airway assessment and management:**
 - Mallampati classification
 - Requirement for airway adjuncts
 - Number of intubation attempts (for general anaesthesia)
- **Intraoperative haemodynamic events:**
 - Occurrence of hypotension or hypertension requiring pharmacological intervention
- Duration of anaesthesia (minutes)
- Intraoperative monitoring used
- Intraoperative fluid administration
- **Estimated intraoperative blood loss and requirement for blood or blood product transfusion**

5. Intraoperative Variables

- Duration of surgery (minutes)
- Estimated intraoperative blood loss
- Intraoperative complications:

- Hypotension
- Excessive blood loss
- Airway-related events
- Anaesthetic drug reactions
- Surgical complications

6. Postoperative Variables

- Postoperative pain requiring additional analgesia
- Postoperative nausea and vomiting
- Wound-related complications
- Postoperative infections
- Requirement for intensive care unit (ICU) admission
- Duration of hospital stay (days)

Operational Definitions

• Perioperative Complication:

Any adverse clinical event occurring during the intraoperative or postoperative period that deviates from the expected course and requires medical intervention or results in prolonged recovery.

• Intraoperative Complication:

Any adverse event occurring from induction of anaesthesia until completion of surgery, including hypotension, excessive blood loss, airway difficulty, or anaesthetic-related events.

• Postoperative Complication:

Any adverse event occurring during the postoperative hospital stay, including pain requiring escalation of analgesia, postoperative nausea and vomiting, wound infection, or prolonged hospitalisation.

• Hypotension:

A decrease in systolic blood pressure of $\geq 20\%$ from baseline or systolic blood pressure < 90 mmHg during surgery.

• Excessive Blood Loss:

Estimated intraoperative blood loss exceeding 500 mL for obstetric procedures or as documented by the attending anaesthesiologist.

• Anaemia:

Preoperative haemoglobin level < 11 g/dL, as per World Health Organization criteria.

• Emergency Surgery:

A surgical procedure requiring immediate intervention due to risk to life or organ function.

• Prolonged Hospital Stay:

Hospital stay exceeding the median duration for the respective surgical procedure.

Outcome Measures

The primary outcome was the burden of perioperative complications, expressed as the proportion (%) of patients experiencing one or more complications.

Secondary outcomes included:

- Type and frequency of intraoperative and postoperative complications

- Association between selected perioperative and anaesthetic variables and the occurrence of complications

Statistical Analysis

Data were entered into Microsoft Excel and analysed using the Statistical Package for the Social Sciences (SPSS) version XX.

- Categorical variables were expressed as frequencies and percentages
- Continuous variables were expressed as mean $\pm$ standard deviation or median (interquartile range), as appropriate
- Associations were assessed using:
 - Chi-square test or Fisher's exact test for categorical variables
 - Independent t-test or Mann–Whitney U test for continuous variables
- A p-value <0.05 was considered statistically significant

Ethical Considerations

The study was conducted after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants. Confidentiality of patient information was maintained, and data were used exclusively for research purposes.

RESULTS:

Baseline Characteristics of the Study Population

A total of **52 women** undergoing obstetric and gynaecological surgeries were included in the study. The mean age of the participants was **32.8 $\pm$ 7.6 years**, with the majority belonging to the **21–40 years age group**. Most participants were from **rural areas (61.5%)** and belonged to **lower and lower-middle socioeconomic strata**. (Table 1)

Table 1: Socio-Demographic Characteristics of Study Participants (n = 52)

Variable	Frequency (n)	Percentage (%)
Age group (years)		
≤ 20	04	07.7
21–30	18	34.6
31–40	20	38.5
>40	10	19.2
Residence		
Urban	20	38.5
Rural	32	61.5
Socioeconomic status		
Upper/Upper middle	06	11.5
Middle	14	26.9
Lower middle	18	34.6
Lower	14	26.9

Distribution of Surgical Procedures

Among the study participants, **obstetric surgeries accounted for 59.6%**, while **gynaecological surgeries constituted 40.4%**. Emergency procedures were more common than elective procedures. (Table 2 and Fig. 1)

Table 2: Distribution of Obstetric and Gynaecological Surgeries (n = 52)

Variable	Frequency (n)	Percentage (%)
Type of surgery		
Obstetric	31	59.6
Gynaecological	21	40.4
Nature of surgery		
Elective	20	38.5
Emergency	32	61.5

Common obstetric procedures included lower-segment caesarean section, while gynaecological procedures comprised abdominal hysterectomy, vaginal hysterectomy, and emergency surgeries for ectopic pregnancy. **(Table 2)**

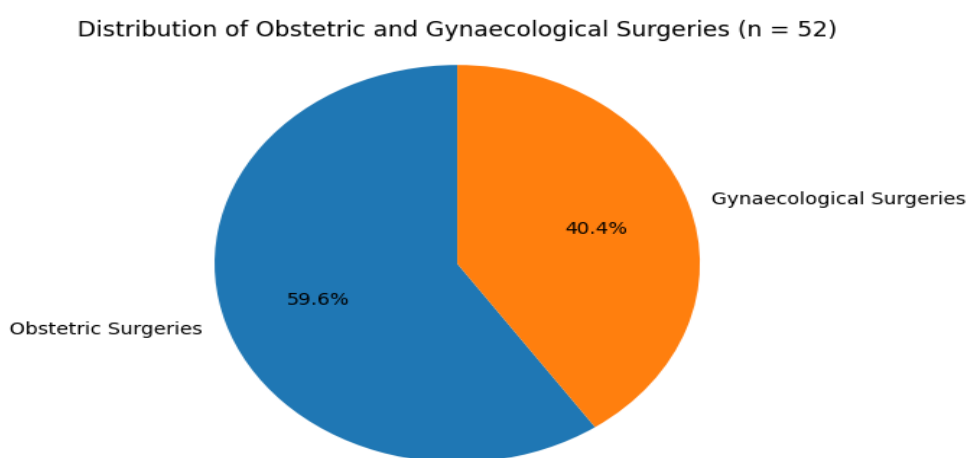


Fig 1. Distribution of Obstetric and Gynaecological Surgeries (n = 52)

- Obstetric surgeries: **31 (59.6%)**
- Gynaecological surgeries: **21 (40.4%)**

Fig 2. Prevalence of Preoperative Anaemia (n = 52)

- Anaemia (Hb <11 g/dL): **29 patients (55.8%)**
- Normal haemoglobin (≥ 11 g/dL): **23 patients (44.2%)**

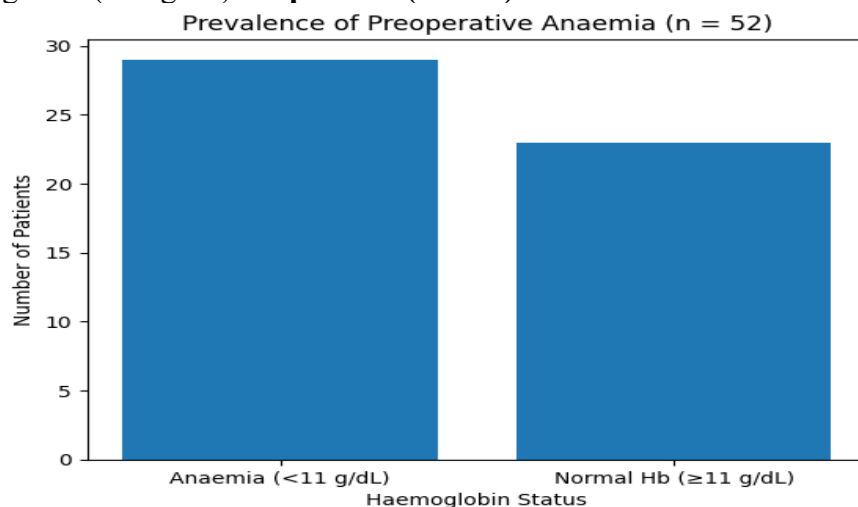


Figure 2: Bar diagram showing prevalence of preoperative anaemia among study participants (n = 52).

Preoperative Clinical and Anaesthetic Profile

Preoperative anaemia was observed in **55.8%** of participants. Most patients belonged to **ASA physical status I or II**. Spinal anaesthesia was the most commonly used anaesthetic technique. (Table 3, Fig 3)

Table 3: Preoperative and Anaesthesia-Related Variables (n = 52)

Variable	Frequency (n)	Percentage (%)
Preoperative haemoglobin		
≥11 g/dL	23	44.2
<11 g/dL (Anaemia)	29	55.8
ASA physical status		
ASA I	18	34.6
ASA II	26	50.0
ASA III	08	15.4
Type of anaesthesia		
Spinal	34	65.4
General	14	26.9
Regional/Combined	04	07.7

Burden of Perioperative Complications

Overall, **perioperative complications were observed in 21 patients (40.4%)**. Intraoperative complications were documented in **17.3%**, while postoperative complications occurred in **30.8%** of participants. (Table 4)

Table 4: Overall Burden of Perioperative Complications (n = 52)

Type of complication	Frequency (n)	Percentage (%)
Any perioperative complication	21	40.4
Intraoperative complications	09	17.3
Postoperative complications	16	30.8

(Some patients experienced more than one complication.)

Pattern of Intraoperative Complications

The most frequent intraoperative complication was **hypotension**, followed by **excessive blood loss**. (Table 5)

Intraoperative complications were observed in 13/52 (25%) patients and they were Hypotension in 06 (11.5%), excessive blood loss in 04 (07.7%), Airway related events in 02 (03.8%) and anaesthetic drug events in 01 (01.9%) of the patients (Table 5)

Table 5: Intraoperative Complications among Study Participants (n = 52)

Intraoperative complication	Frequency (n)	Percentage (%)
Hypotension	06	11.5
Excessive blood loss	04	07.7
Airway-related events	02	03.8
Anaesthetic drug reaction	01	01.9

Pattern of Postoperative Complications

Postoperative pain requiring additional analgesia and postoperative nausea and vomiting were the most commonly observed postoperative complications. (Table 6)

Table 6: Postoperative Complications among Study Participants (n = 52)

Postoperative complication	Frequency (n)	Percentage (%)
Pain requiring escalation of analgesia	10	19.2
Postoperative nausea and vomiting	07	13.5
Wound-related complications	05	09.6
Postoperative infection	03	05.8
Prolonged hospital stay	06	11.5
ICU admission	02	03.8

Factors Associated with Perioperative Complications

Perioperative complications were more frequently observed among patients undergoing **emergency surgeries**, those with **preoperative anaemia**, and those with **longer surgical duration**. The association between emergency surgery and occurrence of perioperative complications was found to be statistically significant ($p < 0.05$). (Table 3 and Fig 2)

Chart 2. Type of Anaesthesia Used (n = 52)

- Spinal anaesthesia: **34 (65.4%)**
- General anaesthesia: **14 (26.9%)**
- Regional/combined techniques: **04 (07.7%)**

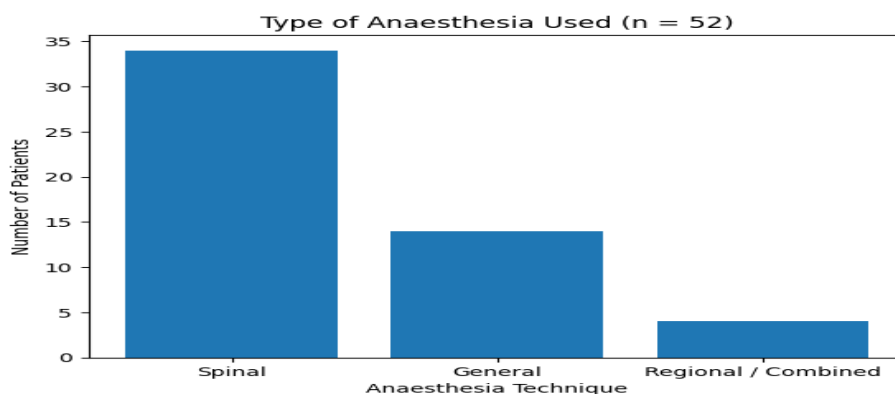


Figure 3: Distribution of anaesthetic techniques used among women undergoing obstetric and gynaecological surgeries (n = 52).

Chart 4. Overall Burden of Perioperative Complications (n = 52)

- With perioperative complications: **21 (40.4%)**
- Without perioperative complications: **31 (59.6%)**

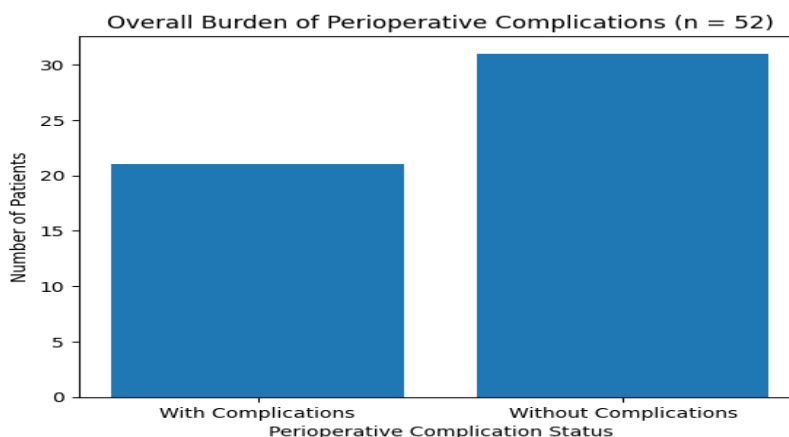


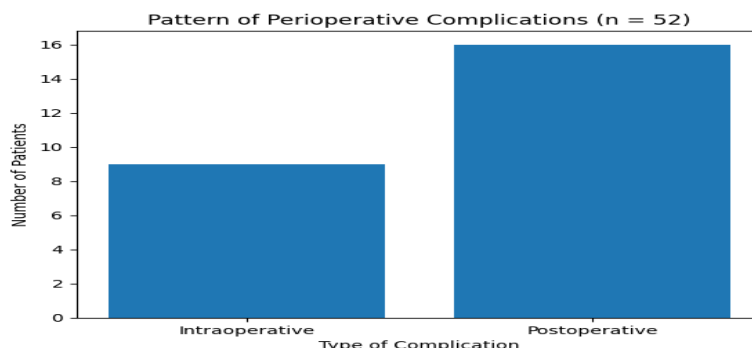
Figure 4: Overall burden of perioperative complications among the study population (n = 52).

Chart 5. Pattern of Perioperative Complications (n = 52)

• Intraoperative complications: 9 (17.3%)

• Postoperative complications: 16 (30.8%)

(Some patients experienced more than one complication.)



Anaesthetic Variables and Perioperative Complications

Association between the Type of Anaesthesia and Perioperative Complications was observed and found that among the 34 patients underwent surgeries under spinal anesthesia complications were present in 29.4% and among the General anesthesia patients the complication rate was 64.3%. (Table 7)

Table 7: Association between Type of Anaesthesia and Perioperative Complications (n = 52)

Type of anaesthesia	Total (n)	Complications present n (%)	Complications absent n (%)	p-value
Spinal	34	10 (29.4)	24 (70.6)	0.041
General	14	09 (64.3)	05 (35.7)	
Regional / Combined	04	02 (50.0)	02 (50.0)	

Correlation between the ASA Physical Status and Perioperative Complications was observed and found that among ASA I patients the complication rate was 22.2%, among the ASA II patients it was 42.3% and among the ASA III patients it was 06%. (Table 8)

Table 8. Association between ASA Physical Status and Perioperative Complications (n = 52)

ASA physical status	Total (n)	Complications present n (%)	Complications absent n (%)	p-value
ASA I	18	04 (22.2)	14 (77.8)	0.018
ASA II	26	11 (42.3)	15 (57.7)	
ASA III	08	06 (75.0)	02 (25.0)	

Correlation between Intraoperative Anaesthetic Events and Perioperative Complications was observed and noted that Hypotension was in 83.3% of the patients, excessive blood loss in all the patients. (Table 9)

Table 9. Intraoperative Anaesthetic Events and Perioperative Complications (n = 52)

Intraoperative variable	Total (n)	Complications present n (%)	Complications absent n (%)	p-value
Hypotension	06	5 (83.3)	01 (16.7)	0.006

Intraoperative variable	Total (n)	Complications present (%)	n Complications absent (%)	p-value
No hypotension	46	11 (23.9)	35 (76.1)	0.012
Excessive blood loss	04	4 (100)	0 (0)	
No excessive blood loss	48	17 (35.4)	31 (64.6)	

Requirement of blood transfusion was observed and noted that among those who required blood transfusion complications were noted in 85.7% of patients. (Table 10)

Table 10. Blood Transfusion Requirement and Perioperative Complications (n = 52)

Blood transfusion	Total (n)	Complications present (%)	Complications absent (%)	p-value
Required	07	06 (85.7)	01 (14.3)	0.009
Not required	45	15 (33.3)	30 (66.7)	

Airway related events were noted and found that the incidence was among 02 patients and they were ASA III grade, under General anaesthesia and developed perioperative complication. (Table 11)

Table 11. Airway-Related Events and Outcomes (n = 52)

Variable	Frequency (n)	Percentage (%)
Airway-related events	02	03.8
Both under general anaesthesia	02	100
Both ASA III	02	100
Developed perioperative complications	02	100

(Statistical analysis not performed due to small numbers.)

DISCUSSION

This hospital-based population study documented a **substantial burden of perioperative complications (40.4%)** among women undergoing obstetric and gynaecological surgeries, with **postoperative complications (30.8%)** occurring more frequently than **intraoperative complications (17.3%)**. Although direct comparisons must be cautious due to heterogeneity in case-mix, definitions, and follow-up duration, the overall pattern observed—higher complication frequency in emergency settings and in women with baseline physiological vulnerability—aligns with contemporary evidence from LMIC contexts where perioperative optimisation opportunities are often constrained. In a large multi-country analysis focused on caesarean section outcomes in LMICs, maternal and perinatal adverse outcomes were consistently higher than in high-resource settings, underlining the structural and clinical determinants that influence perioperative safety. (25)

Burden and pattern of complications: interpreting the observed rates

The **40.4%** complication proportion in the present study reflects the inclusion of both **minor but clinically relevant outcomes** (e.g., nausea/vomiting, pain requiring escalation) and **major outcomes** (e.g., ICU admission, infection), which is methodologically appropriate for “burden” estimation. Many hospital-based audits under-report “minor” perioperative outcomes due to inconsistent documentation; however, such events are meaningful because they affect mobilisation, breastfeeding initiation in obstetric patients, patient satisfaction, and length of stay—key dimensions of quality of care increasingly emphasised in perioperative medicine and enhanced recovery frameworks.(26)

The predominance of **postoperative complications** in our cohort is consistent with the known trajectory of surgical recovery, where pain, emetic morbidity, and wound-related events cluster in

the early postoperative period. Importantly, postoperative pain requiring escalation (19.2%) and PONV (13.5%) emerged as leading morbidities. These are not merely “discomfort outcomes”; they are modifiable complications that can be reduced through evidence-based multimodal protocols. (27)

Emergency surgery as a risk amplifier

Complications were more common among **emergency procedures**, which is biologically and operationally plausible. Emergency obstetric and gynaecological surgeries frequently occur in contexts of haemodynamic instability, active bleeding, infection, prolonged labour, or failed medical management—each independently associated with increased perioperative risk. (5) In addition, emergency surgery reduces the feasibility of structured preoperative optimisation (correction of anaemia, fluid status optimisation, aspiration prophylaxis, thromboprophylaxis planning), resulting in greater intraoperative variability and postoperative morbidity. (25)

This finding reinforces the need for **structured emergency perioperative bundles** rapid anaemia assessment, point-of-care haemoglobin where available, standardised haemorrhage preparedness, early antibiotic administration when indicated, and risk-stratified postoperative monitoring particularly for women undergoing urgent caesarean delivery and emergency gynaecological interventions.

Preoperative anaemia: high prevalence and plausible pathway to complications

A key observation was the **high prevalence of preoperative anaemia (55.8%)**. This level is consistent with population-level anaemia burdens among Indian women and pregnant women reported in national surveys and recent analyses. (28, 29) The high anaemia prevalence in the present cohort is clinically relevant because anaemia is strongly associated with impaired oxygen delivery, reduced physiological reserve, increased transfusion requirements, and heightened susceptibility to infection and delayed wound healing—mechanistic pathways especially consequential in obstetric haemorrhage-prone surgeries and prolonged gynaecological procedures.

Current international perioperative anaemia consensus recommendations emphasise early detection, aetiological evaluation, and timely correction (iron deficiency treatment, optimisation strategies) to reduce adverse outcomes and transfusion exposure. (30) Although our study did not model anaemia severity or iron deficiency biomarkers, the finding supports a pragmatic institutional approach: **preoperative haemoglobin screening for all planned surgeries**, targeted iron therapy pathways, and strengthened linkage between antenatal anaemia services and perioperative scheduling for elective gynaecological surgeries.

Intraoperative hypotension and haemodynamic complications

Hypotension was the most frequent intraoperative complication (11.5%). In obstetric anaesthesia, **spinal anaesthesia-induced hypotension** is widely recognised and can be variably reported depending on operational definition (absolute thresholds vs relative drops from baseline), prophylactic vasopressor use, fluid coload strategies, and left uterine displacement practices. Several contemporary reviews and clinical trials highlight that spinal hypotension during caesarean delivery remains common, and that vasopressor strategies (phenylephrine/norepinephrine approaches) are central to mitigation. (17)

The comparatively lower hypotension proportion in our dataset may reflect (i) a conservative clinical definition applied in documentation, (ii) prophylactic or early rescue vasopressor practices, and/or (iii) under-capture due to retrospective record dependence. Nevertheless, the predominance of hypotension underscores the value of protocolised strategies (standardised BP targets, early vasopressor titration, and documented management algorithms) to reduce downstream maternal nausea, fetal compromise, and recovery delays.

PONV and emetic morbidity: preventable and quality-sensitive outcomes

Postoperative nausea and vomiting occurred in **13.5%** of patients. Contemporary evidence-based guidance recommends **risk stratification**, minimisation of baseline risk factors, and **multimodal prophylaxis** when risk is moderate-to-high.¹⁶ In obstetric settings, nausea/vomiting may also be linked to neuraxial hypotension and uterotonic administration, making haemodynamic control part of emetic prevention. (17)

A practical implication is to implement (i) routine documentation of risk factors, (ii) standard prophylaxis bundles consistent with consensus recommendations, and (iii) structured rescue pathways for breakthrough PONV—measures that can be integrated into enhanced recovery models and quality audits.

Anaesthetic Risk Factors and Perioperative Complications

Anaesthetic factors emerged as important determinants of perioperative complications in the present study. The type of anaesthesia was significantly associated with adverse outcomes, with a higher proportion of complications observed among patients receiving general anaesthesia compared to spinal or regional techniques. This finding is consistent with existing literature indicating increased airway-related risks, haemodynamic instability, and postoperative respiratory complications associated with general anaesthesia in obstetric and gynaecological populations, particularly in emergency settings. (31)

ASA physical status showed a strong and statistically significant association with perioperative complications. Patients classified as ASA III experienced substantially higher complication rates compared to those in ASA I and II categories. This underscores the importance of ASA grading as a simple yet effective perioperative risk stratification tool, especially in resource-constrained settings where advanced risk scoring systems may not be routinely feasible.

Intraoperative hypotension was one of the most common anaesthetic complications and demonstrated a strong association with postoperative morbidity. Hypotension during spinal anaesthesia is a well-recognised phenomenon, particularly in obstetric patients, and can adversely affect organ perfusion if not promptly corrected. Similarly, excessive intraoperative blood loss was significantly associated with perioperative complications, reflecting both surgical complexity and physiological vulnerability. (32)

The requirement for blood transfusion was another significant anaesthetic-related predictor of complications. Transfusion often reflects underlying anaemia, surgical blood loss, or emergency intervention, all of which contribute to increased perioperative risk. These findings highlight the importance of preoperative optimisation of haemoglobin levels and vigilant intraoperative blood management. (33)

Although airway-related events were infrequent, all such cases occurred under general anaesthesia and in patients with higher ASA status, reinforcing the need for careful airway assessment and preparedness, particularly during emergency obstetric procedures.

Overall, the study highlights that anaesthetic technique, ASA physical status, intraoperative haemodynamic events, and blood transfusion are key modifiable and non-modifiable risk factors influencing perioperative outcomes. Systematic attention to these variables can contribute significantly to improving perioperative safety and maternal outcomes in obstetric and gynaecological surgeries.

Wound complications, infection, ICU admission, and length of stay

Wound-related complications (9.6%) and postoperative infections (5.8%) represent clinically important morbidities, with implications for antimicrobial utilisation, maternal functional recovery, and hospital costs. These outcomes are influenced by anaemia, diabetes, obesity, prolonged surgery, emergency setting, asepsis quality, and perioperative antibiotic timing. While our study did not perform multivariable modelling due to sample size constraints, the observed infection-related

burden is consistent with the rationale for enhanced recovery pathways and standardised perioperative infection prevention practices.

ICU admission (3.8%) was relatively infrequent, suggesting that most complications were non-life-threatening but quality-relevant. Nonetheless, even low ICU utilisation rates are meaningful in resource-constrained settings. The prevention of avoidable postoperative deterioration aligns with international calls highlighting the critical role of anaesthesia systems in reducing severe maternal morbidity. (18)

Implications for quality improvement: enhanced recovery and standardised pathways

Enhanced recoveries after surgery (ERAS) principles are increasingly applied to gynaecology and caesarean delivery to reduce complications and shorten length of stay without increasing readmissions. Contemporary reviews indicate that ERAS implementation in caesarean delivery is associated with improved recovery metrics and reduced opioid requirements.¹⁹ Indian experience also supports feasibility; for example, a South Indian tertiary centre audit (CMC Vellore) demonstrated variable adherence to ERAS components and highlighted actionable targets such as fasting practices, carbohydrate loading, and early feeding components directly relevant to reducing recovery delays and postoperative morbidity. (20) In addition, an Indian ERAS evaluation reported improved recovery outcomes with protocolised care, strengthening the case for implementing structured pathways within routine hospital workflows. (15)

For the present study context, a realistic institutional strategy would include:

1. **Preoperative optimisation bundle** (Hb screening, anaemia management pathway, comorbidity stabilisation).
2. **Standard neuraxial hypotension prevention protocol** for obstetric spinal anaesthesia.
3. **Multimodal analgesia and PONV prophylaxis protocol** aligned with consensus guidance. (16)
4. **Enhanced recovery checklist** tailored separately for obstetric and gynaecological surgeries, with periodic audit cycles. (20)

Strengths and limitations

A key strength of this study is its **real-world hospital-based population approach**, capturing both obstetric and gynaecological surgeries and reflecting routine perioperative care. However, the study has limitations: (i) the **sample size (n = 52)** limits precision and restricts multivariable modelling; (ii) complication ascertainment relied on documentation and may under-capture transient intraoperative events and some postoperative symptoms; and (iii) follow-up was limited to in-hospital outcomes, potentially underestimating late wound complications and delayed morbidity after discharge. These limitations should be transparently reported while emphasising the study's utility as a baseline quality assessment and a trigger for institutional audits and protocol strengthening.

Strengths and Limitations

The use of clearly defined operational definitions enhances reproducibility and comparability with other observational studies. Additionally, adherence to **STROBE reporting guidelines** strengthens the transparency and methodological rigour of the study.

However, the study has certain limitations that should be acknowledged. The **sample size (n = 52)**, while adequate for descriptive analysis, limits the ability to perform multivariable modelling and may reduce the precision of effect estimates. The study was conducted at a single tertiary care centre, which may limit generalisability to other settings, particularly primary and secondary care facilities. As data collection relied on hospital records and routine documentation, there is a possibility of **under-reporting of transient or minor perioperative events**, especially intraoperative haemodynamic fluctuations and postoperative symptoms occurring after discharge. Furthermore, postoperative follow-up was restricted to the in-hospital period, potentially underestimating late complications such as delayed wound infection.

Despite these limitations, the study provides valuable baseline evidence on perioperative morbidity in obstetric and gynaecological surgeries and highlights actionable areas for improving perioperative care in similar health-care settings.

Conclusion

This hospital-based population study demonstrates a considerable burden of perioperative complications among women undergoing obstetric and gynaecological surgeries in a tertiary care setting. Postoperative complications, particularly pain and postoperative nausea and vomiting, constituted the majority of adverse events, while intraoperative complications such as hypotension were also observed. The high prevalence of preoperative anaemia and the predominance of emergency surgical procedures highlight important clinical and system-level factors that may contribute to perioperative morbidity. These findings emphasise the need for structured perioperative risk assessment, optimisation of preoperative clinical status, and standardisation of anaesthetic and surgical care pathways. Implementation of evidence-based anaesthesia protocols, enhanced recovery approaches, and routine perioperative surveillance can contribute to improved maternal outcomes. Strengthening perioperative care within obstetric and gynaecological services is essential for reducing avoidable morbidity and enhancing the quality of maternal surgical care in similar health-care settings.

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