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# Incidence And Associated Factors Of Postoperative Complications In The Major Operating Room Post Anesthesia Care Unit Of Tibeb Ghion Specialized Hospital

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# BAHIR DAR UNIVERSITY

## COLLEGE OF MEDICINE AND HEALTH SCIENCE,

## SCHOOL OF MEDICINE

## DEPARTMENT OF ANESTHESIOLOGY CRITICAL CARE AND PAIN MEDICINE

# INCIDENCE AND ASSOCIATED FACTORS OF POSTOPERATIVE COMPLICATIONS IN THE MAJOR OPERATING ROOM POST ANESTHESIA CARE UNIT OF TIBEB GHION SPECIALIZED HOSPITAL

**BY: DR. MULLUSEW YEGEFIE**

A THESIS SUBMITTED TO THE DEPARTMENT OF ANESTHESIOLOGY CRITICAL CARE AND PAIN MEDICINE, COLLEGE OF MEDICINE AND HEALTH SCIENCES, BAHIR DAR UNIVERSITY, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR SPECIALTY CERTIFICATE IN ANESTHESIOLOGY CRITICAL CARE AND PAIN MEDICINE.

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BAHIR DAR, ETHIOPIA

BAHIR DAR UNIVERSITY

COLLEGE OF MEDICINE AND HEALTH SCIENCE,

SCHOOL OF MEDICINE

DEPARTMENT OF ANESTHESIOLOGY CRITICAL CARE AND PAIN MEDICINE

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| TITLE OF THE STUDY | INCIDENCE AND ASIOCIATED FACTOR OF POSTOPERATIVE COMPLICATIONS IN THE MAJOR OPERATION ROOM POST ANESTHESIA CARE UNIT OF TIBEB GHION SPECIALIZED HOSPITAL, 2024 |
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| STUDY PERIOD | NOVEMBER 1- DECEMBER 30 , 2024 |

## DECLARATION

This is to certify that the thesis entitled 'An Assessment of the Incidence and Associated Factors of Postoperative Complications in the Post-Anesthesia Care Unit at Tibebe Ghion Comprehensive Specialized Hospital, Bahir Dar University, Ethiopia, 2024,' submitted in partial fulfillment of the requirements for the Specialty in Anesthesiology, Critical Care, and Pain Medicine in the Department of Anesthesiology, Critical Care, and Pain Medicine at Bahir Dar University, is a record of original work carried out by me and has never been submitted to this or any other institution for the purpose of obtaining any other degree or certificate. The assistance and help I received during the course of this investigation have been fully acknowledged.

Name: Dr. Mullusew Yegefie

## APPROVAL OF RESEARCH PROPOSAL

I certify that I have supervised, read, and evaluated this thesis titled 'The Incidence and Associated Factors of Postoperative Complications in the Post-Anesthesia Care Unit at Tibebe Ghion Comprehensive Specialized Hospital, Bahir Dar University, Ethiopia.

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## ACRONYM

ASA …….. American Society of Anesthesiologists

BMI …….. Body Mass Index

ETT …….. Endotracheal Tube

GA …… General Anesthesia

ICU …… Intensive Care Unit

OR ……. Operating Room

PACU……. Post Anesthesia Care Unit

PONV……. Post-Operative Nausea / Vomiting

SPSS …….. Statistical Package for Social Science

TGSH ……. Tibebe Ghion Specialize Hospital

USA …… United States of America

V/Q…….. Ventilation / Perfusion

# ABSTRACT

**Background:** Emergence from anesthesia is the critical period, and the patient will stay in the post anesthesia care unit until fully awake. Complication occur in this area frequently and range from mild to life threatening conditions. Data are limited on the incidence of complications in the post-anesthesia care unit in Ethiopia and there was significant variation relating from other world.

**Objective**: The objective of this study was to assess the incidence of complications and associated factors among all surgical patients admitted to the Major Operative Room Post-Anesthesia Care Unit at Tibebe Ghion Specialized Hospital, Bahir Dar, Ethiopia, in 2024

**Methods:** A prospective cross-sectional study was conducted on 420 surgical patients admitted to the Post-Anesthesia Care Unit. Participants were selected using systematic random sampling and followed until discharge. Data were collected via self-administered questionnaires, entered into Kobo Tool, and exported to the Statistical Package for the Social Sciences. Bivariate and multivariate logistic regression analyses were performed to assess complications and their associations. A p-value of less than 0.05 at a 95% confidence level was considered statistically significant.

**Result:** A total of 420 patients participated, with a 100% response rate. The incidence of complications in the Post-Anesthesia Care Unit was 50.5% (95% CI). The most common complications were postoperative nausea/vomiting, temperature disturbances, and respiratory issues. Significant predictors of increased postoperative complications included emergency surgery (AOR 0.12; 95% CI 0.07–0.22), younger age (AOR 0.986; 95% CI 0.976–0.997), presence of preexisting comorbidities (AOR 3.619; 95% CI 1.600–8.186), and prolonged anesthesia duration (AOR 1.321; 95% CI 1.016–1.718).

**Conclusion and Recommendation:** The incidence of complications was 50.5%, with common issues including nausea/vomiting, temperature disturbances, and respiratory problems. Emergency surgery, age, preexisting comorbidities, and anesthesia duration were significant predictors. Enhanced monitoring, especially for high-risk patients, and improved staff training are essential. Tailored care for patients with risk factors can help reduce complications.



**Key words**; anesthesia, post anesthesia care unit, postoperative complications

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# 1. INTRODUCTION

## 1.1 Background

Anesthesia involves humans (anesthesiologists, patients), machines (anesthesia machines and monitors), and the environment (surgeons, nurses, the operating room, and the hospital). Emergence from general anesthesia and recovery from surgery are often followed by a number of physiological disturbances that include postoperative nausea and vomiting (PONV), hypoxia, hypothermia and shivering, and cardiovascular instability. Problems involving any of the components of this system have the potential to compromise patient outcomes, thus giving rise to critical incidents. Something that is not intended to happen is termed a complication. Postoperative complications are problems that can occur after surgery but were not intended [1, 2].

Currently, the definition of the post-anesthesia care unit (PACU) is limited. However, it usually refers to the activities undertaken to manage the patient after the completion of a surgical procedure and the concomitant primary anesthetic [3]

General anesthesia is generally safe, and even those with significant health conditions can undergo procedures under general anesthesia. However, it can have both minor and major complications. The occurrence of postoperative complications depends on several factors, some of which are related to the surgical procedures. Risk factors for complications depend on the type of procedure and the patient's general physical health, rather than the type of anesthesia. Complications can occur during induction, maintenance, or after the end of surgery. Respiratory failure is commonly observed during induction, occurring in 25% of cases [4]

Other types of complications may relate to the respiratory system, cardiovascular system, nausea/vomiting, and body temperature, in this descending order. Most of the complications occurred in healthy American Society of Anesthesiology (ASA) I and II patients. Factors that play a major role in determining immediate postoperative complications include the ASA status, the level of anesthesia seniority of the attending physician, the urgency, and the nature of the procedure [5]

Observed postoperative complications occurred in 31.50% of patients, with minor complications (Grade I and II) in 19.75% and major complications (Grade III and IV) in 8.0%. Postoperative

mortality (Grade V) was 3.75%. Significant risk factors included the presence of comorbidities, higher ASA grade, higher BMI, emergency surgery, open surgery, palliative surgery, deeper cavity surgery, higher intraoperative blood loss, prolonged surgical duration, intraoperative complications, and contaminated surgical wounds [6]

There are an estimated 230 million surgical procedures performed per year worldwide. After surgery, nearly 18% of patients will develop major postoperative complications; the three most prevalent in the PACU are airway events, hemodynamic instability, and postoperative nausea/vomiting. Risks can be patient-related, anesthesia-related, or surgery-related. Age, medication history, ASA physical status, and chronic diseases are common patient-related factors. Anesthetics, other drugs, and intraoperative hemodynamic instability are anesthesia-related factors. Intraoperative blood loss, surgeon expertise, type of operation, and urgency may also influence outcomes [7].

Hospital-focused complications and costs are abundant. A study from the Netherlands on complications after abdominal surgery showed that costs doubled for minor complications and doubled again for major complications [8].

To improve the quality of recovery for patients and to prevent complications, PACU nurses must have sufficient knowledge and skills to provide safe, high-quality nursing care. Recommendations include standardized handover tools, documentation, and communication procedures. Measurement tools should be used to assess patient care in the PACU, recognize complications that may develop, and respond quickly [9].

### 1.2 Statement of the problem

Postoperative complications pose a significant challenge in surgical care, affecting patients' outcomes and healthcare costs. Research indicates that approximately 7–15% of patients undergoing major surgery experience postoperative complications, which can range from minor issues to life-threatening conditions [1]

The highest incidence of complications, occurring in 30% of surgical patients, is seen between one and three days postoperatively and usually involves the respiratory system, cardiovascular system, nausea/vomiting, pain, and infection [10].

A study done in 1992 involving 18,473 patients showed that the incidence of complications in the PACU was 23.7%. Results from this study indicate that complications occurring in the PACU remain a significant source of patient morbidity. Nausea and vomiting, as well as upper airway obstruction, continue to represent the most frequently observed PACU events. Several factors were identified, including the site of the surgical procedure, duration of anesthesia, ASA physical status, anesthetic technique, and elective versus emergent procedures [11].

Significant risk factors included the presence of comorbidities, higher ASA grade, higher body mass index (BMI), emergency surgery, open surgery, palliative surgery, deeper cavity surgery, higher intraoperative blood loss, prolonged surgical duration, intraoperative complications, and contaminated surgical wounds. The impact of these postoperative complications extends beyond immediate health risks. They often lead to increased hospital stays, high healthcare costs, and a decline in the quality of life for patients [12].

Studies are limited in developing countries, especially in Sub-Saharan Africa. Limited studies show that the incidence of complications in the PACU was significantly high, reaching up to 68.4%. Nausea/vomiting, pain, and a low Glasgow Coma Scale score were the most frequent complications. ASA status, general anesthesia, and abdominal surgery were found to be statistically significantly associated with postoperative complications [13].

In Ethiopia, the incidence of PACU complications is also significant, and one study shows that as many as 54.6% of patients will develop complications. Female sex, the occurrence of intraoperative complications, and the duration of anesthesia were found to be independent risk factors for developing PACU complications. In this study, the majority of patients developed respiratory and airway-related adverse events, followed by PONV and cardiovascular-related adverse events. [14].

The above research was single-centered, making it difficult to generalize the findings to other parts of the country. Additionally, the incidence of complications is relatively higher than in the previous study. This research will fill this gap.

This study shows that the incidence and associated factors of postoperative complications in the PACU at Tibeb Ghion Specialized Hospital are vital for developing targeted interventions aimed

at reducing these events. By identifying high-risk patients and optimizing perioperative care, healthcare providers can improve surgical outcomes and enhance patient safety.

### 1.3 Significance of the study

Worldwide, the incidence of postoperative complications in the PACU varies and is more prevalent in resource-limited countries. Such studies are limited in these countries as well as in the study area. Therefore, this research is mainly intended to assess the incidence and associated factors of postoperative complications in the major operating room PACU.

Assessing the incidence of complications in the PACU allows hospital administrators to allocate appropriate staff and equipment for monitoring, early detection, and management. It is also important for nursing staff and physicians to develop guidelines.

Knowing the risk factors can lead surgeons to adopt appropriate strategic measures to reduce postoperative complications and improve the quality of patient care. Three key measures emerging from this study are: (1) preoperative patient optimization; (2) diligence during surgery to reduce operative time, blood loss, and intraoperative complications; and (3) implementation of infection control practices.

This research will provide a foundation for further research involving multicenter studies, age specifications, and complications after PACU.

Overall, studying the incidence and associated factors of postoperative complications at Tibebe Ghion Specialized Hospital is crucial for improving surgical practices, enhancing patient safety, and optimizing healthcare resources in the region. By addressing known risk factors and implementing strategic interventions, hospitals can significantly improve postoperative outcomes for patients undergoing major surgery

## 2. LITERATURE REVIEW

Physiologic changes that occur in the immediate postoperative period lead to many complications. These complications vary depending on the type of anesthesia given: general, regional, or local [2]

### 2.1 Incidence of postoperative complication in PACU

Information regarding the overall incidence and nature of recovery room complications is, at best, confusing and incomplete. In the USA, the rate of recovery room complications ranged between 30% and 35%. Most complications were referable to the central nervous system, abnormal cardiovascular parameters, nausea and/or vomiting, and abnormalities related to the respiratory system. Many patients had more than one complication [5, 15].

A study done in the USA involving 1,000 patients showed an overall complication rate of 23.4% (234 patients). Other studies conducted on 18,479 patients between 1986 and 1989 showed that complications occurring in the PACU were 23.7%. The most common complications observed were the need for upper airway support to achieve a patent airway (39.5%), nausea and vomiting (30.5%), tachycardia (13%), hypertension (10.5%), and hypotension (6.5) [16, 17]

Respiratory complications in the post-anesthesia period are an important area of concern for anesthetists. Fortunately, the frequency of serious respiratory problems is low. Respiratory complications ranged between 1.9% and 7.4% in cases of general anesthesia. The incidence of critical respiratory events occurred in 1.3% of 24,157 consecutive PACU patients who received general anesthesia [18-20].

The incidence of hypothermia and shivering varies in different countries, with hypothermia ranging from 32% to 85.7%. In addition, 8.15% of patients develop shivering, which usually occurs at 20 minutes [21, 22].

In European countries, postoperative respiratory adverse events occurred in 67 subjects (19.7%). Other case-control or cohort studies, involving 7,439 patients, showed a median incidence of delirium diagnosed in the PACU to be 16.4% [23, 24].

The incidence of complications in Australia occurred in 19.9% of cases, most frequently due to hypotension, pain, desaturation, oliguria, or hypertension. The mean PACU length of stay was 120 minutes (standard deviation 87.7 minutes), and prolonged stays for medical reasons were common.

Another report in Australia showed that, from 2,000 incidents reported to the Australian Incident Monitoring Study, 120 (6%) occurred in the recovery room after general, regional, or local anesthesia [25, 26].

The incidence and impact of AREs in China, involving 156 patients, showed that hypoxia (n=141, 55.73%) and respiratory depression (n=70, 27.67%) were the most common AREs. The proportion of patients with a prolonged stay in the PACU was significantly higher in the ARE group [27].

Postoperative nausea and vomiting (PONV) is a common phenomenon. A systematic review and meta-analysis involving 23 studies performed on 22,683 people from 11 countries showed that the prevalence of PONV, nausea, and vomiting was 27.7%, 31.4%, and 16.8%, respectively. The prevalence of PONV was higher during the first 24 hours in European countries [28].

A study done in Tanzania involving 430 patients showed that 294 (68.4%) patients developed immediate post-anesthetic complications. Of these, postoperative nausea and vomiting (PONV) was the most common post-anesthetic complication, accounting for 41.6% of cases [13].

An observational study done at St. Paul's indicated that the incidence of complications among surgical patients admitted to the PACU was 54.8%. Of these, respiratory-related complications and postoperative nausea/vomiting were the most common types of PACU complications [14].

Other studies in Ethiopia show the overall prevalence of postoperative nausea and vomiting (PONV) to be 19.85%, with the incidence of nausea, vomiting, and both nausea and vomiting at 4.02%, and 21.86%, respectively [29].

The prevalence of postoperative complications among post-surgical patients at Dessie's Comprehensive Hospital was 35.4%. The overall prevalence of postoperative nausea was 25.4%, with nausea without vomiting occurring in 8.8% of patients. The overall prevalence of postoperative vomiting was 26.7%, and vomiting without nausea occurred in 27.1% of patients[30].

Other studies done in Ethiopia at the University of Gondar show that the overall incidence of postoperative nausea and vomiting was 17.2% [31].

## 2.2 Factors associated with post-operative complication in PACU

One study done in the USA shows that several factors were identified as potential predictors of PACU complications, including the site of the surgical procedure, duration of anesthesia, ASA physical status, anesthetic technique, and elective versus emergent procedures [1, 7, 11].

On the other hand, factors that increase the risk of critical respiratory events include age >60, male gender, obesity, and diabetes. Prolonged surgery (>4 hours), emergency surgery, and anesthesia medications contribute [12, 20].

In Europe, patient factors for reintubation included age >1 year, chronic pulmonary disease, preoperative hypoalbuminemia, and renal insufficiency. Operative factors included emergency cases, head and neck, cardiothoracic, and airway surgeries, and an operative time >3 hours. Anesthetic factors included certain neuromuscular blocking agents and ASA physical status III [13, 19, 32].

A literature review in Brazil indicates that triggering factors for complications in the immediate postoperative period include hypothermia, hypoxemia, pulmonary edema, apnea, tremors, nausea/vomiting, and urinary retention [6, 33, 34].

Age, body mass index (BMI), high-risk surgery, revised cardiac risk index (RCRI), type of anesthesia, use of forced-air warming, amount of intravenous crystalloids administered, duration of anesthesia, duration of surgery, and admission visual analogue scale (VAS) for pain >3 were considered predictors of hypothermia [11, 22, 26]

Patient and surgical factors, along with specific anesthetic management strategies, may increase the risk of respiratory problems in the PACU. Respiratory events, in order of decreasing frequency, that are seen in the PACU include hypoxemia, hypoventilation, airway obstruction, bronchospasm, laryngospasm, aspiration, and pneumothorax. In addition, among the respiratory complications, hypoxemia is the most common, occurring in up to 55% of patients admitted to the PACU [14, 24, 35].

A prospective cohort study done in the eastern part of Ethiopia established that cigarette smoking, patients' morbidity status, ASA status greater than category II, duration of surgery, and intraoperative adverse events were significantly associated with postoperative complications [36].

In an observational study at St. Paul's Hospital involving 396 surgical patients admitted to the PACU, female sex, duration of anesthesia greater than 4 hours, intraoperative complications, and duration of PACU stay were found to be associated with postoperative complications [14].

A cross-sectional study done at Debre-Birhan University shows that the incidence of postoperative nausea/vomiting is significantly associated with female sex, previous history of nausea/vomiting, history of smoking, duration of anesthesia, and intraoperative opioid use [29]. ,

Most studies in the Amhara region indicate that the incidence of postoperative nausea/vomiting is associated with a history of motion sickness, being a non-smoker, type of surgery, duration of surgery, intraoperative opioid use, and intraoperative fluid administration [30, 31].

# 3. CONCEPTUAL FRAMEWORK

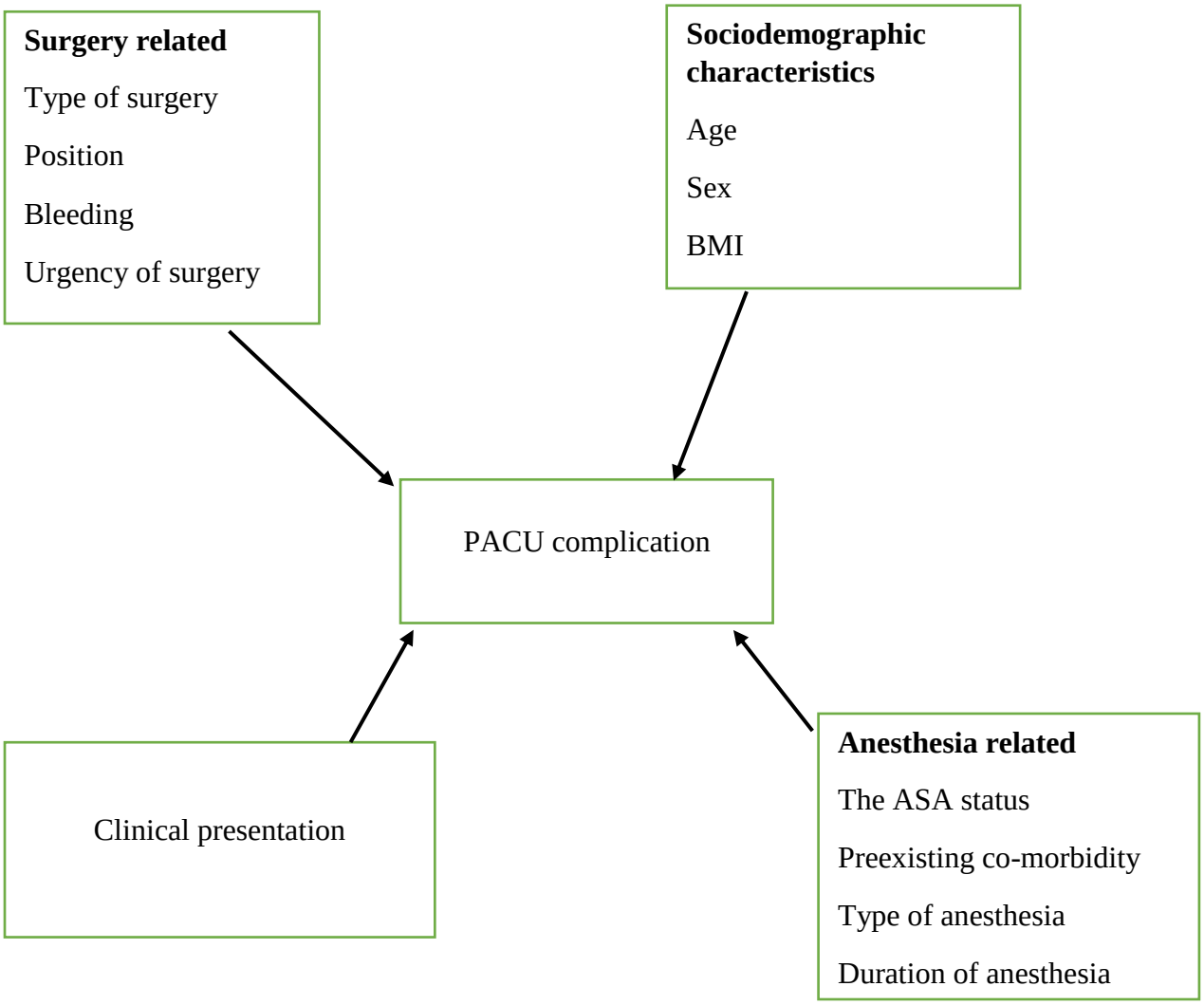


*Figure 1: Conceptual framework of incidence and associated factor of complication in PACU at TGSH, Bahir Dar University, Ethiopia, 2024.*

# 4. OBJECTIVE OF THE STUDY

## 4.1 General objective

- To assess the incidence and associated factors of postoperative complications in the major operating room post-anesthesia care unit of Tibebe Ghion Specialized Hospital, Bahir Dar University, Ethiopia, 2024.

## 4.2 Specific objective

- To determine the incidence of postoperative complications that occur in the major operating room post-anesthesia care unit of Tibebe Ghion Specialized Hospital, Bahir Dar University, Ethiopia, 2024."
- To identify associated factors that may influence the occurrence of complications in the major operating room post-anesthesia care unit of Tibebe Ghion Specialized Hospital, Bahir Dar University, Ethiopia, 2024."

# 5. METHOD

## 5.1 Study setting and period

The study was conducted from December 1 to January 30, 2024, at Tibebe Ghion Specialized Hospital, Bahir Dar University, Ethiopia. The hospital is located in the Amhara Regional State, 560 km northwest of Addis Ababa, the capital city of Ethiopia, and 10 km from Bahir Dar city. It provides services to around 5 million people in various departments for both elective and emergency cases. The Post-Anesthesia Care Unit (PACU) has six beds, and all patients operated on in the major operating room stay there until fully awake, except for neonates and those admitted directly to the intensive care unit.

## 5.2 Study design

An institutional-based prospective cross-sectional study was conducted from December 1, 2024, to January 30, 2024, in the major OR PACU of Tibebe Ghion Specialized Hospital.

## 5.3 Population

### 5.3.1 Target Population:

All patients undergoing surgery at Tibebe Ghion Specialized Hospital during the study period

### 5.3.2 Source population

The source population include all patients who undergone surgery at the major OR of TGSH admitted to the PACU at Tibebe Ghion Specialized Hospital during the research period. These patients will be eligible to be included in the study sample.

### 5.3.3 Study population

All patients who were admitted to the Post-Anesthesia Care Unit and selected to participate in the research.

## 5.4 Inclusion and exclusion criteria

### 5.4.1 Inclusion criteria

All patients who had surgery (elective and emergency) under general anesthesia (GA), Monitored Anesthesia Care (MAC), and Regional Anesthesia (RA) in the major OR and transferred to PACU of TGSH were include in the study

### 5.4.2 Exclusion criteria

Patients who were transferred directly from the operating theatre (OT) to an intensive care facility, ward, or OPD, as well as patients admitted to the PACU during their transfer to the Intensive Care Unit

## 5.5 Sample size determination

In this study, the sample size was calculated using the single population proportion formula, and the sample size was determined using the following formula.

$n = z^2 \times p\ (1 - p)/d^2$

Where:-

n = required sample size.

z = confidence level at 95% (standard value of 1.96)

P = estimated incidence of complications in the PACU is put at 54% [14]

d = margin of error at 5% (standard value 0.05)

Therefore: n = 420 (including 10% non-respondent rate)

For the specific objective, the sample size was calculated considering a 95% confidence interval and 80% power. The factors used for the sample size calculation were ASA greater than category II, duration of anesthesia greater than 4 hours, occurrence of intraoperative complications, and female sex. The calculated sample size for the specific objective was smaller than that for the incidence, so the final sample size of 420 (including a 10% non-response rate) was used for this study.

*Table 1; Sample size calculation for the secondary objective of determining the prevalence and associated factors of post-operative complications in the PACU at TGSH, Bahir Dar, Ethiopia, from December 1 to January 30, 2024.*

| Associated factor | AOR | Sample size | Reference |
|---|---|---|---|
| ASA more than category II | 7.83 | 40 | [36] |
| Duration of anesthesia greater than 4 h | 5.406 | 74 | [14] |
| Intraoperative complications occurrences | 2.238 | 234 | [14] |
| Female sex | 2.570 | 162 | [14] |

### 5.6 Sampling technique and procedure

The selection of participants for this study was done using a systematic random sampling technique. The first participant was selected by lottery method, and for the subsequent intervals, the 'K' value was calculated. Last year, a total of 5,000 patients were admitted to Tibebe Gihon Specialized Hospital's PACU, which is approximately 416 patients per month. We use this value to calculated 'K' value, and was 2; therefore, every second patient was selected.

### 5.7 Study variables

#### 5.7.1 Dependent variables

Presence or absence of complications in the PACU

#### 5.7.2 Independent variables

Age

Sex

BMI

The ASA physical status Urgency of the surgery

Preexisting comorbidities

Type of surgery

Type of anesthesia

Position during surgery

Urgency of surgery

Bleeding

Duration of anesthesia

### 5.8 Operational Definition

**Complications**: We define a complication in the PACU as any new health issue or medical condition that arises after a surgical procedure, which can affect the patient's recovery process and was not present before arrival at the PACU.

**Desaturation**: Defined as SpO2 < 90percentage for longer than 10 seconds [37].

**Stridor:** A high-pitched sound during inspiration due to turbulent airflow through a narrowed airway [38].

**Hypotension:** A decrease in systolic BP by 20% from baseline or MAP < 65 mmHg [39].

**Hypertension:** An increase in systolic BP by 20% from baseline or SBP > 160mmHg for more than 5 min [40].

**Shock:** Hypotension with signs of poor peripheral perfusion resulting in life-threatening organ dysfunction [41]

**Tachycardia:** Heart rate > 100 for adults, varying by pediatric age groups [7].

**Bradycardia**: Heart rate<60 for adults and less than 80 for children[7].

**Pain:** A subjective complaint from the patient, arising as a direct consequence of surgical procedures [42].

**Hypothermia:** Core body temperature <35 degree Celsius[22].

**Significant Blood Loss**: A total blood loss >30% of an estimated blood volume during the intraoperative period [14].

### 5.9 Data collection and management

Patient demographics and preexisting comorbidities were recorded upon arrival in the PACU. Perioperative and intraoperative abnormal findings were recorded from the patient's medical chart and the managing personnel on a pre-structured questionnaire [14, 30, 43]. Patients were followed until discharge from the PACU. During their PACU stay, we recorded the types of complications and any identified factors associated with specific complications, as well as the length of the PACU stay, based on bedside observation and monitoring devices.

### 5.10 Data quality assurance

Data were collected using a questionnaire prepared in both Amharic and English and checked for clarity. Two PACU nurses working in the major OR of TGSH were trained for one day and assigned as data collectors. The questionnaires were pre-tested on a 5% sample size at Felege Hiywet Referral Hospital PACU to assess clarity, sequence, consistency, and understandability, and the investigator supervised the data collection process.

### 5.11 Data analysis and measurement

Data were collected by Kobo Collect tool and subsequently exported to the Statistical Package for Social Sciences (SPSS), version 27, for analysis. All independent variables were analyzed using bivariate analysis, and the variables that had an association with a p-value less than or equal to 0.25 were entered into a multivariate logistic regression model. A p-value $< 0.05$ was considered a risk factor for PACU complications during the postoperative period in this study.

### 5.12 Ethical considerations

Ethical clearance was obtained from the Research Ethics Review Board of the College of Medicine and Health Sciences, Bahir Dar University. Supporting letters were obtained from the Regional Health Bureau. Preoperatively, informed written consent was obtained from the patient or their attendant. Management of any complications proceeded as usual. No harm was imposed on the patients; rather, they received enhanced monitoring to identify all possible complications. No specific patient identifiers were included in the data collection tool, and this was ensured by using code numbers for each data entry.

### 5.13 Dissemination of the result

The study results were presented to Bahir Dar University, School of Medicine, Department of Anesthesia, Critical Care, and Pain Medicine. The findings were disseminated to all responsible bodies in the study area, including the hospital where the study was conducted, FMOH, and Bahir Dar University School of Medicine. The paper was presented at research defense sessions and various workshops, and finally published in journals.

# 6. RESULTS

## 6.1 Socio-demographic characteristics

A total of 420 patients participated in the study, with a 100% response rate. One hundred fifty-nine patients were female, which is 37.9%. The age range was from 3 months to 90 years, with a mean of 33.54 years and a standard deviation of 22.19 years. The average BMI across participants was 20.29, with a range from a minimum BMI of 2 kg/m² to a maximum BMI of 30.2 kg/m².

## 6.2 Anesthesia-related characteristics

Of the study participants, 326 (77.6%) received general anesthesia, and regional anesthesia was used in 76 (18.1%). Less than half of the patients had ASA status I, with 194 (46.2%), followed by ASA status IE, with 83 (19.8%). Eighty-five percent of patients did not have preexisting comorbidities. Intraoperative complications were rare in this study population (6%). The duration of anesthesia ranged from 0.30 hours (18 minutes) to 5.00 hours (300 minutes), with a mean duration of approximately 1.92 hours and a standard deviation of 0.93 hours (Table 2).

## 6.3 Surgery-related characteristics

The majority of surgeries, 277 (66%) were elective, while the remaining 143 (34%) were emergency procedures. Regarding surgical indications by specialty, most were gastrointestinal surgeries (176, 41.9%), followed by urology (73, 17.4%) and ENT (51, 12.1%). The majority of the surgical procedures were performed in the supine position (331, 78.8%). Approximately two-thirds, or 305 (72.6%), of the surgeries had a duration of between 30min and 2 hours (Table 3).

*Table 2. Demographic and anesthesia characteristics of the study participants regarding the prevalence and associated factors of post-operative complications in the PACU at TGSH, Bahir Dar, Ethiopia, from December 1 to January 30, 2024*

| Type of variable | Category | Frequency | Percent |
|---|---|---|---|
| Religion | Orthodox | 330 | 78.5 |
| | Muslim | 69 | 16.4 |
| | Other | 21 | 5.0 |
| Occupation | Farming | 216 | 51.6 |
| | Employer | 27 | 6.4 |
| | Self-employed | 36 | 8.6 |
| | Unemployed | 140 | 33.4 |
| ASA status | I | 191 | 45.5 |
| | IE | 86 | 20.5 |
| | II | 67 | 16.0 |
| | IIE | 20 | 4.8 |
| | III | 19 | 4.5 |
| | IIIE | 23 | 5.5 |
| | VE | 14 | 3.3 |
| Preexisting comorbidity | No | 357 | 85.0 |
| | Yes | 63 | 15.0 |
| Type of anesthesia | General | 326 | 77.6 |
| | Regional | 76 | 18.1 |
| | Sedation | 16 | 3.8 |
| | Combined | 2 | .5 |
| Intraoperative complication | No | 395 | 94.0 |
| | Yes | 25 | 6.0 |

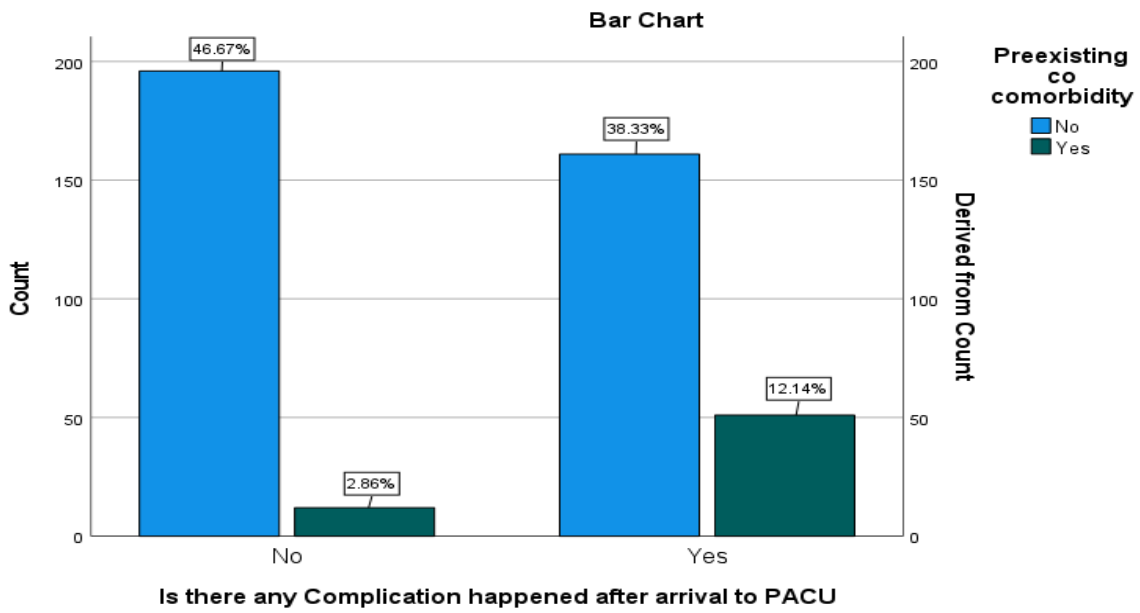


*Figure 2; A bar chart to show the prevalence of post-operative complications and preexisting comorbidities, as well as associated factors of post-operative complications in the PACU at TGSH, Bahir Dar, Ethiopia, from December 1 to January 30, 2024*

*Table 3: Surgery-related characteristics of the study participants regarding the prevalence and associated factors of post-operative complications in the PACU at TGSH, Bahir Dar, Ethiopia, from December 1 to January 30, 2024.*

| Type of variable | Category | Frequency | percent |
|---|---|---|---|
| Type of surgery | Emergency | 144 | 34.2 |
| | Elective | 276 | 65.7 |
| Surgical indication by specialty | GIS | 176 | 41.9 |
| | ENT | 51 | 12.1 |
| | Head and Neck | 17 | 4 |
| | Gynecology | 37 | 8.8 |
| | Neurosurgery | 44 | 10.5 |
| | Urology | 73 | 17.4 |
| | other | 22 | 5.2 |
| Position during surgery | Supine | 309 | 73.6 |
| | Lateral | 18 | 4.3 |
| | Prone | 16 | 3.8 |
| | lithotomy | 77 | 18.3 |

### 6.4 Incidence and type of PACU complications

A total of 420 participants were included in the study. Of these, 208 participants (49.5%, 95% CI) reported no complications after arrival in the PACU, while 212 participants (50.5% ,95% CI) experienced complications. There were no missing values.

The most common complication was post-operative nausea and vomiting, affecting 22.4% of the sample, followed by temperature disturbances (including hypothermia and shivering), which affected 14.5% of participants. Cardiovascular complications were experienced by 10.7% of participants, and 11.9% experienced airway or respiratory system complications.

## 6.5 Factors associated with PACU complications among study participants

Multivariate logistic regression analysis shows that patients with preexisting comorbidities and emergency surgeries had a significantly higher risk of PACU complications. Younger age and longer anesthesia duration also increased the risk. BMI and PACU stay duration were not significantly associated with complications (Table 4).

*Table 4: Bi-variable and multivariable logistic regression analyses showing the prevalence and associated factors of post-operative complications in the PACU at TGSH, Bahir Dar, Ethiopia, from December 1 to January 30, 2024.*

| Type of variable | Category | PACU complication | | COR (95% CI) | AOR (95% CI) | p-value |
|---|---|---|---|---|---|---|
| | | Yes | No | | | |
| Preexisting comorbidity | Yes | 51 | 161 | 5.17(2.66-10.13) | 4.13(1.79-8.88) | <0.001** |
| | No | 12 | 196 | | | |
| Intraoperative complication | Yes | 19 | 193 | 3.31 (1.29-8.47) | 2.66(0.89-7.94) | 0.08 |
| | No | 6 | 202 | | | |
| Type of surgery | Emergency | 119 | 24 | 9.81(5.93-16.24) | 9.70(5.71-16.5) | <0.001** |
| | Elective | 93 | 184 | | | |
| Age | Mean ± SD | 30.5±21.2 | 36.5±22.7 | 0.98 (0.97-0.99) | 0.99(0.98-7.94) | 0.008* |
| BMI | Mean ± SD | 20.9±4.9 | 19.5±3.8 | 1.07 (1.02-1.11) | 1.05(0.99-1.11) | 0.11 |
| Duration of anesthesia in hours | Mean ± SD | 2.1±0.9 | 1.7±0.9 | 1.56 (1.32-2.07) | 1.35(1.04-1.75) | 0.024* |
| Duration of stay in PACU | Mean ± SD | 67.1±15.5 | 63.8±14.6 | 1.02(1.00-1.03) | 1.01(0.99-1,02) | 0.38 |

* Significant p value

Preexisting comorbidities are significantly associated with PACU complications. Individuals with preexisting comorbidities are more than four times as likely to experience a complication in the PACU (4.13 (95% CI: 1.79-8.88: p-value: < 0.001)

Emergency surgeries are significantly associated with PACU complications. Initially, the crude odds ratio indicates a very strong association (COR: 9.81), but after adjusting for other factors, the association becomes much weaker and statistically insignificant (AOR: 0.12). This suggests that

the apparent association between emergency surgery and PACU complications may be confounded by other factors.

Older age is slightly associated with a decreased risk of PACU complications. The crude odds ratio suggests that for every additional year of age, the odds of experiencing a PACU complication decrease by 2% (COR: 0.98). The adjusted odds ratio (AOR) is close to 1, suggesting that the effect of age is minimal once other factors are adjusted for, but it still remains statistically significant ($p = 0.008$).

Longer duration of anesthesia is associated with a higher risk of PACU complications. The crude odds ratio suggests that for every additional hour of anesthesia, the odds of complications increase by about 56%. After adjusting for other factors, the association remains significant (AOR: 1.35, $p = 0.024$).

## 7. DISCUSSION

There were 212 (50.5%) complications detected in 420 patients over a two-month period at the major OR PACU, Tibeb Ghioh Specialized Hospital, which is similar with previous study done in Ethiopia. The incidence of complications varies in different parts of the world. In developed nation the incident is lower (30 -35 %) in the USA [15], (19.9 %) in Australia [25] but much higher in a developing nation, like Tanzania (68.4 %) [13] and Ethiopia (54.8 %)[14].

The most common complication was post-operative nausea and vomiting, affecting 22.4%, which is similar to other studies in Ethiopia, where the prevalence ranges from 17.2% to 26.2%, ([29-31] ,followed by temperature disturbances, including hypothermia and shivering, which affected 14.5% of the sample[22]. Cardiovascular complications were experienced by 10.7% of participants, with a smaller proportion of the sample (11.9%) experiencing airway or respiratory system complications 16% in Colombia [19], 43.32% in Ethiopia[14]. This may be explained by less complex surgery with short duration of time and thoracic surgery is not performed in study area.

The study revealed no significant associations between occupation, sex, and BMI and the occurrence of complications in the Post-Anesthesia Care Unit (PACU). The lack of significant findings for these demographic variables suggests that PACU complications are not heavily influenced by these factors[36].

Age is a statistically significant predictor of the outcome ($p < 0.05$). The odds ratio (Exp (B)) is 0.986**,** suggesting that with each additional year of age, the odds of the event decrease by approximately 1.4% [20, 24]. However, age has a negative effect, which is contrary to the previous study. This may be due to the population in the study area being relatively younger, with children and infants possibly at greater risk of developing complications in the PACU.

Preexisting comorbidity was one of the most significant predictors of PACU complications, with a strikingly higher proportion of patients experiencing complications. These patients had 4.13 times increase risk of complication in PACU. This highlights the importance of considering underlying health conditions when managing in the PACU and adjusting post-operative care plans accordingly[32].

Duration of anesthesia is an important factor in predicting postoperative complications, with an Exp(B) of 1.321 (p = 0.038), suggesting that for each additional hour of anesthesia, the odds of the postoperative complication increase by about 32.1%[29, 30, 44]**.**

Intraoperative complications show borderline significance (p = 0.08) with an odds ratio of 2.66. While it is not statistically significant at the 0.05 level, it still suggests that intraoperative complications increase the odds of the outcome by 2.7–3 times. Intraoperative complications (such as bleeding, organ injury, or anesthesia-related issues) can significantly increase the risk of adverse outcomes. Although not statistically significant in this model, the large odds ratios indicate that intraoperative events may contribute to a higher likelihood of negative outcomes and should be considered in clinical decision-making. The borderline significance suggests that further research with larger sample sizes may help clarify the importance of this factor [14, 36].

Emergency Surgery is a statistically significant predictor of the outcome, with a regression coefficient (B) of 2.054, a p-value of 0.001, and an odds ratio of 9.70. Patients who undergo emergency surgery have approximately 9.7 times higher odds of experiencing the outcome compared to those who do not undergo elective surgery. A previous similar study also showed an association between emergency surgery and an increased incidence of complications [11, 20].

The duration of stay in PACU the is not statistically significant (p > 0.05)[32] which contradicts the previous study. This may be explained by the fact that most of the complications in this study were nausea/vomiting and temperature disturbances, which can be managed in the ward and may require less follow-up.

No significant relationship was found between the type of surgery, surgical position, and the occurrence of PACU complications. This suggests that factors related to the surgical procedure itself, such as the surgical specialty or the patient's position during surgery, do not have a major direct effect on post-operative complications.

# 8. STRENGTH AND LIMITATION

## 8.1 Strength of the study

Prospective design allow real-time data to provide more accurate and reliable information.

Specific Time Frame possible to capture a snapshot of complications during this period.

## 8.2 Limitation of the study

Our study was conducted in the resource-limited setting of a single-center hospital, making it difficult to generalize the findings to the overall features of the country.

The inclusion of more patients from different surgical specialties, such as neurosurgery, thoracic surgery, obstetrics, and orthopedics, would likely have altered the results in terms of the types and percentages of complications.

The unavailability of certain monitors, such as ECG, ETCO2, and pediatric-sized BP cuffs, may have led to an underestimation of the actual incidence of critical events.

Additionally, nurses who followed patients during the study period in the PACU may not have uniformly recorded all critical incidents.

# 9. CONCLUSION AND RECOMMENDATION

## 9.1 Conclusion

The study found that 50.5% of patients experienced post-operative complications in the PACU at Tibeb Ghioh Specialized Hospital, with the most common being post-operative nausea and vomiting (22.4%) and temperature disturbances (14.5%). Factors such as preexisting comorbidities, emergency surgeries, younger age, and longer anesthesia duration were significantly associated with an increased risk of PACU complications. However, variables such as occupation, sex, BMI, and surgical position did not show significant associations with complications. These findings underscore the importance of closely monitoring patients, especially those with comorbidities, undergoing emergency surgeries, or with longer anesthesia durations, to mitigate the risks of PACU complications.

### Recommendation:

Based on our findings, Healthcare providers should conduct thorough preoperative assessments, especially for patients with comorbidities, and tailor post-operative care plans. Special attention should be given to emergency surgery patients and minimizing anesthesia duration to reduce complications. Continuous PACU monitoring and timely interventions are essential, along with provider education on common complications. Further research and improved PACU protocols are recommended to enhance patient outcomes.

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# 11. ANNEXES

## 11.1 Information sheet

**Principal Investigator:** Dr. Mullusew Yegefie (MD)

**Advisors**:

**1.** Dr. Asfaw Nurhusen

**2.** Mr. Gizachew Worku

**Name of organization:** Bahir Dar University

**Title of Research Project**: Incidence and Associated Factors of post-operative complication in PACU at Tibebe Ghion Specialized Hospital, Bahir Dar University, Ethiopia, 2024

**Introduction**

Dear study participant, you are kindly requested to take part in this research project voluntarily. Your personal data and information from your chart will be copied into the research questionnaire. We have two data collectors

**Purpose this study**

The purpose of this study is to assess the incidence of postoperative complications in the PACU among patients at Tibebe Ghion Specialized Hospital. Additionally, it aims to identify the factors associated with the occurrence of these complications. Your data will help improve clinical practices and patient outcomes related to complications in the PACU.

### 11.2 Confidentiality:

The ethical clearance committee of Bahir Dar University, College of Medicine, were approve this study. In addition, personal information were anonymized. Only the researchers were have access to your details. Finally, the results were disseminated to concerned bodies.

**Contact information**: Phone, +251924513195

Gmail, mullusewyegefie@gmail.com

## 11.3 Consent Form

Date---------- Code number_____

**Interviewer signature** ……

**Principal investigator name:** Dr. Mullusew Yegefie

**Phone, +251924513195**

**Study Title:** Incidence and Associated Factors of Post-operative Complications at Tibebe Ghion Specialized Hospital, Bahir Dar University.

I, the undersigned, understand the purpose of the research and agree to take part in this study with a clear understanding of the objectives and conditions of the study. I give informed consent for the proposed research

Signature…….Date…….

Signature for.....Date…….

Signature of the health professional---------- Date: ----------

Signature of Data collector _____ Date_____

## 11.4 Survey sheet

### 11.4.1 Patients socio demographic characteristics

| | |
|---|---|
| Cared number | |
| Sex | 1, Male<br>2, female |
| Age | |
| Religion | 1, Orthodox<br>2, Muslim<br>3, Protestant<br>4, other |
| Occupation | 1, Farming<br>2, Employed<br>3, Self employed<br>4, unemployed |
| Weight in kg | |
| Height in meter | |
| BMI | |

### 11.4.2 Intraoperative anesthesia and surgical condition related questions

| | | |
|---|---|---|
| Time when arrive at PACU | Hrs. | Min, |
| Type of anesthesia | 1, GA,<br>3, Regional | 2, GA/Regional combined<br>4, Sedation |
| ASA status | 1, I<br>2, II<br>3, III<br>4, IV<br>5, V | E |

| | |
|---|---|
| Duration of anesthesia | Hrs: Min: |
| Position of surgery | 1, Supine<br>2, Prone<br>3, Lateral<br>4, Lithotomy |
| Type of surgery | 1, GIS 6, Head and neck<br>2, Neurology 7, Other<br>3, ENT<br>4, Urology<br>5, Gynecology |
| Preexisting co morbidity | 1, yes<br>2, no |
| Intra operative complication | 1, no<br>2, yes, if yes specify type of complication |

### 11.4.3 Complications detected in the PACU

| | | |
|---|---|---|
| 1 | Is any complication happened during PACU stay? | 1, No<br>2, Yes, If yes specify from the following |
| 2 | CVS complication 1, No<br>2, Yes; if yes specify | Management |
| | 1, Hypertension | |
| | 2, Hypotension | |
| | 3, Shock | |
| | 4, Cardio-respiratory arrest | |
| | 5, Tachycardia | |
| | 6, Bradycardia | |
| 3 | Airway & Respiratory complication | Management |

| | | |
|---|---|---|
| | 1, No<br>2, yes; if yes specify | |
| | 1, Stridor | |
| | 2, Wheezing | |
| | 3, Apnea | |
| | 4, Hypoxia | |

| | | |
|---|---|---|
| 4 | CNS 1, No<br>2, Yes; if yes specify | Management |
| | 1, Confusion | |
| | 2, Delirium | |
| | 3, Seizure | |
| | 4, Persistent sedation | |
| 5 | GIT 1, No<br>2, Yes | Management |
| 6 | Nausea/vomiting 1, No<br>2, Yes | Management |
| 7 | Drug reaction 1, No<br>2, Yes, If yes specify | Management |
| | 1, skin rash, itching<br>2, anaphylaxis shock | |
| 8 | Temperature disturbance 1, No<br>2, yes; if yes specify | Management |
| | 1, Hypothermia & shivering<br>2, Hyperthermia | |
| 9 | Miscellaneous complications | |
| 10 | Investigations 1, No<br>2, yes; if yes specify any abnormality | |

| | | |
|---|---|---|
| | 1, SE<br>2, RBS<br>3, ECG<br>4,CXR | |
| 11 | Medical consultation 1, No<br>2, yes | |
| 12 | Duration in PACU | Hrs.… min…… |
| 13 | Patient transfer to 1, ward<br>2, ICU<br>3, OR | |