ADDIS ABABA UNIVERSITY-COLLEGE OF HEALTH SCIENCES SCHOOL OF MEDICINE, TIKUR ANBESSA SPECIALIZED HOSPITAL

INCIDENCE OF POSTOPERATIVE COMPLICATIONS IN THE MAJOR OPERATION ROOM POST ANESTHESIA CARE UNIT OF TIKUR ANBESSA SPECIALIZED HOSPITAL

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ADDIS ABABA, ETHIOPIA

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OR PACU POST ANESTHESIA CARE UNIT OF TIKUR ANBESSA SPECIALIZED HOSPITAL

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ACRONYMS

ACT……..Activated Whole Blood Clotting Time

ASA……..American Society of Anesthesiologists

BVM……..Bag Valve Mask

EFMOE……Ethiopian Federal Ministry of Education

ETT……Endotracheal Tube

FMOH……..Federal Ministry of Health

GA ……...General Anesthesia

ICU……Intensive Care Unit

MAC……Monitored Anesthesia Care

OR……Operation Room

OT……...Operation Theatre

PACU……..Post Anesthesia Care Unit

PAR ……..Post Anesthesia Recovery

PCA……Patient Controlled Analgesia

PONV……Post-Operative Nausea and vomitting

RA……Regional Anesthesia

SPSS……Statistical Package for the Social Sciences

TASH……Tikur Anbessa Specialized Hospital

UK……United Kingdom

US……United States

V/Q……Ventilation-Perfusion

Abstract

Background: Emergence from anesthesia is the critical period. This early emergence period is ubiquitous with potential complications. In order to enable early detection and prompt treatment of these potential complications by the practitioner, there needs to be an effective system of detection and reporting of all adverse events occurring during the period of emergence.

A wide spectrum of critical incidents occur in the PACU, many of which are related to the cardiovascular and respiratory systems. Critical incidents have a major impact on healthcare utilization and result in prolonged PACU stays and higher levels of postoperative care than initially anticipated. Events occurring during the PACU period continue to be a source of patient morbidity. The overall incidence of complications occurring during the post anesthesia care unit stay may be higher than previously expected.

Objectives: To investigate the incidence of postoperative complications among patients admitted to the PACU at the major operation room in TASH. And to identify factors that are associated with the complications and to propose an instrument that addresses the complications, risks and individualized interventions.

Methodology: After approval from the university, institutional based prospective cross-sectional study was conducted from June 14- July 29, 2017 to investigate the incidence of complications in all patients admitted to PACU who had surgery (elective and emergency) under general anaesthesia (GA), Monitored Anaesthesia Care (MAC), Regional Anaesthesia (RA). Data was collected using survey data sheet (a standardised data collection form), which is a three page check-box form and was analyzed using Statistical Package for Social Sciences, version 21.

Results: During the study period 312 patients were admitted to the PACU of the major OR. Total number of patients who had complications in the PACU was 65 (20.83%). The type of complications is characteristically of respiratory system in the first place (35.4%); followed by cardiovascular system complications (21.1%), and PONV (13.8%) which comes third on the list. Of all the studied variables only the presence of pre-existing co-morbidity and duration of the surgery had significant association with the incidence of complications. But none of the 65 patients who had complications was found having any significant correlation to: Age (P=0.714), Sex (P=0.717), Urgency of procedure (P=0.472), Type of surgery (P=0.887), Type of anesthesia (P=0.150), Attending anesthesia provider (P=0.378) and Position during surgery (P=0.370)

Conclusion and recommendation: The presence of pre-existing co-morbidity and the longer the duration of the surgery, the higher the incidence of the post-op complication will be.

There was a very small number of patients in the study, I believe that inclusion of more patients and different surgical specialties such as Obstetrics and orthopedic surgeries would have changed the results in terms of kind and percentage of complications. I recommend that a prospective follow-up trial be undertaken in large number of patients, with data on critical incidents being collected by clinicians, to strengthen the findings of this study.

Key words: Anesthesia; postanesthesia care unit; survey on adverse events.

1. Introduction

1.1 Background

The practice of anesthesia is a complex and dynamic system in which there is interaction between human (anaesthesiologist, patient), machine (anesthesia machine and monitors) and the environment (surgeons, nurses, the operating room and hospital). Failures or errors involving any of the components of this system have the potential to compromise patient outcomes, thus giving rise to critical incidents.

Emergence from anesthesia is the critical period of recovery of consciousness, neuromuscular conduction and airway protective reflexes. This early emergence period is rife with potential complications involving all major physiological systems including respiratory, cardiovascular, central nervous and gastrointestinal system.

The severity of the incident may range from transient damage with full recovery to unanticipated mortality. Therefore, critical incident monitoring in anesthesia is an important tool for quality improvement and maintenance of high safety standards in anesthesia services. It is now widely accepted as a useful quality improvement technique for reducing morbidity and mortality in anesthesia and has become part of the quality assurance programs of many general hospitals [42].

In order to enable early detection and prompt treatment of these potential complications by the practitioner, there needs to be an effective system of detection and reporting of all adverse events occurring during the period of emergence. Therefore, critical incident monitoring is a useful means of detecting new problems and analyzing factors or events leading to mishaps.

A critical incident is defined as “any adverse and reversible event in operating theatre, during or immediately after surgery that if it persisted without correction would cause harm to the patient” [38]. Despite low mortality, the practice of anesthesia is associated with significant morbidity [39]. If the frequency of error has to be decreased, a clearer understanding of that process involved is needed with identification of the circumstances that encourage error and the establishment of relative frequencies of different classes of errors. Since its early adoption in the field of aviation [40] and later in the field of anesthesia [41]; the collection of data on critical incidents is widely gaining acceptance.

A post-anesthesia care unit, often abbreviated PACU and sometimes referred to as post-anesthesia recovery or PAR, is a vital part of hospitals, ambulatory care centers, and other medical facilities. It is an area, normally attached to operating room suites, designed to provide care for patients recovering from general anesthesia, regional anesthesia, or local anesthesia.

Recovery rooms were provided so that patients could regain consciousness in relative safety and restore body warmth. They also protected other ward occupants from the distressing sound and sight of postoperative vomiting! But the more crucial need for a recovery room was recognized in an article which appeared in a 1947 issue of the *Journal of the American Medical Association,* peri-operative deaths associated with respiratory obstruction were described and the need for post-anesthesia rooms was strongly emphasized. *(8)*

Even as late as 1982, a survey by Tiret found major complications occurring with anaesthetic management in about 1/700 cases, and of those cases that resulted in death or coma, approximately half of them were associated with post-anaesthetic respiratory depression.(9) When postoperative respiratory depression did occur, it was fatal in 70% of cases when it occurred on the ward versus 29% when it occurred in the operating theatre, recovery room, or intensive care unit. The authors concluded that the prognosis of patients was directly related to the availability of a post-anaesthetic recovery room.

The concept of the recovery room was not always a part of the hospital. The first recorded description of a recovery room was at Newcastle Infirmary in 1801, but it took over 70 years for a recovery ward to be established in the United States at the Massachusetts General Hospital.(6) It was not until after the second world war that recovery rooms were routinely included in plans for new hospitals.(7)

In contrast to the older practice of returning patients directly from the operating table to their ward beds, the PACU allows centralization of care by a group of specially trained nurses who are expert in interpreting and responding to the events of the brief but intense period immediately following a procedure requiring anesthesia. The PACU has highly specialized facilities and essentially functions as an intensive care unit (ICU). This is appropriate since all patients who enter a PACU face some type of threat or danger to their lives. Furthermore, the immediate proximity of the PACU to the OR is critical because it provides instant access to essential resources, including supplies and equipment, but even more importantly, the surgical and anesthesia personnel who recently cared for the patient. This immediate availability allows timely intervention and treatment of any significant problems during the immediate postsurgical period. Finally, the nursing care required by immediate postsurgical patients has become increasingly specialized and is now a recognized subspecialty of nursing. Availability of this specialized nursing expertise is one of the main reasons that PACUs exist.

The basic responsibilities of PACU staff include: airway management and oxygen administration for patients who have undergone general anesthesia, monitoring vital signs (heart rate, blood pressure, temperature, and respiratory rate), managing postoperative pain, treating postoperative nausea and vomiting, treating postanesthetic shivering, monitoring surgical sites for excessive bleeding, mucopurulent discharge, swelling, hematomas, wound healing, and infection.

More intensive care may include: Preparation and education for the use of patient-controlled analgesia (PCA) units, Preparation and administration of intravenous, epidural, or perineural infusions, Invasive monitoring such as arterial lines, central venous lines, and ventriculostomies.

Occasionally, life-threatening complications, such as laryngospasm, respiratory arrest, or

malignant hyperthermia, can arise after anesthesia. Patients may be intubated because of anaphylaxis, pulmonary edema, pneumothorax, or long-term exposure to anesthesia and narcotics. Unless complications occur, most patients will only stay in the PACU for a few hours before returning home or to another department of the hospital.

Recovery room function is always changing. Critical care units with facilities for postoperative mechanical ventilation are often inadequate necessitating the use of the PACU for complex surgical patients who require short-term intensive care. On the other hand, the trend toward outpatient surgery broadens the scope of PACU care to include management of patients who will subsequently be discharged home. PACU case mix continues to be dependent upon individual hospital objectives.

Canadian Anaesthetists Society Guidelines, updated in 1995, have included a section which deals specifically with the postanaesthetic period.(10) These guidelines indicate, "In any hospital providing anaesthetic services, a postanaesthic recovery (PAR) room must be available." The recommendations also state that the Department of Anaesthesia shall have overall medical administrative responsibilities of this area and indicate that "Care should not be delegated to the PAR room nurse until the anaesthetist is assured that the patient may be safely observed and cared for by the nursing staff."

Patients may be discharged from the PACU by an anaesthetist, or this act may be a delegated responsibility in accordance with hospital policy. The guidelines also stipulate the necessary resuscitation and life support equipment, oxygen, suction, monitoring devices, and pulse oximetry for the initial phase of recovery which should be available in the PACU. The guidelines indicate that appropriate records, including complications, be charted for each patient.

Similar guidelines were approved by the American Society of Anesthesiologists in 1994.(47) ASA Standards, Guidelines and Statements. In addition, the American guidelines encourage the use of a PACU scoring system for each patient on admission and at appropriate intervals until the time of discharge.(12) They also stipulate that a physician capable of managing complications

and providing cardiopulmonary resuscitation for patients in PACU must be available.

1.2 Statement of the problem

Attention has been increasingly focused on the PACUs since the 1990s, in part because of the dramatic improvement in patient safety in the OR. In the past, when unrecognized esophageal intubations and ventilator disconnects were more common than they are today, most of the problems that occurred in the PACU seemed small by comparison (with the exception of inadequate ventilation caused by residual muscle relaxant medication). Now that major intraoperative catastrophes directly attributable to anesthesia care are extraordinarily rare, events in the immediate postanesthesia period receive more attention than they have in the past.

Monitoring of patients in the post-anaesthesia care unit (PACU) has become the accepted level of care in the immediate postoperative period. (19,20) Patients are admitted to the PACU following surgery and closely cared for by the nursing and anesthetic staff as they recover from the effects of anesthesia.

The role of the postanesthesia care unit (PACU) has evolved from passive observation to an important determinant of speed of recovery and discharge of patients. It is, therefore, important to identify the types of problems encountered in this area and their mode of presentation and areas for improvement.(19)

Data on critical incidents in the PACU is a valuable source of information that can be used to anticipate and prevent such incidents, and improve processes of care. The incidence of complications in the PACU has been reported to range from 5% to 30%,(13-15) with minor complications (22.1%) occurring often more than major ones (0.2%).(15) Critical incidents occurring in the PACU are often related cardiovascular and respiratory systems.(16,17)

The Post Anaesthesia Care Unit (PACU) of the major operating theatre suite in Tikur Anbessa

Specialized Hospital has 8 beds. The surgical specialties in this hospital are the following: General Surgery, Urology, ENT, Pediatric, Cardiothoracic, Gynacology, and Neuro surgeries.

1.3. Significance of the study

The critical incident monitoring was first used in aviation by Flanagan, a psychologist, in 1954 [3] and was later introduced in anesthesia by Cooper in 1978 [4]. Since the immediate post-operative recovery period is known to be high risk for anesthetic complications to occur [6], it poses a constant threat to millions of people undergoing surgical interventions across the globe. Whether patients are managed in a hospital setting, an ambulatory care facility, or in a free-standing operating suite, the development of postoperative complications can lead to long-term disability and potentially death. It is therefore imperative for healthcare professionals caring for patients during the postoperative period to be alert to the possibility of these complications and requires active inculcation of measures for risk reduction.

The use of critical incident monitoring as a quality assurance measure has several advantages. It is useful in detecting new problems, identifies near misses which can be instructive for trainees, may reveal clusters of incidents or previously undiagnosed sources of errors and is economical [7].

In the argument around what are "true" anaesthetic outcomes, some have suggested that events in the PACU tend to be "intermediate" and not "true" endpoints. Investigators have recently suggested that not only is it necessary to recognize early events (e.g., PACU problems), but it is also imperative to identify those which impact on long-term morbidity and hospital costs. (22,23) Studies of infrequent but severe respiratory problems which occur in the PACU suggest that these problems are associated with increased postoperative morbidity. However, recognition of more frequently occurring events (e.g., hypoxaemia detected by pulse oximetry) failed to reduce major postoperative complications.(24)

On the other hand, when excessive pain was documented in the PACU, patients were more likely to experience increased pain after leaving PACU. (18) As well, nausea and vomiting has been associated with increased length of stay in recovery room and increased rate of unplanned admission to hospital. These outcomes are associated with increasing costs to the hospital sector.

Many researches were done on the incidence of complication in the PACU in different parts of the world. However, there is no data available on PACU incidents from developing countries including Ethiopia. Therefore, this research will assess the incidence of complications and factors that may influence complications in the PACU of the major operating suite of TASH and it would provide information for clinicians to formulate guideline for the management of patients who are admitted to the PACU and for hospital managers to allocate budget properly so as to use the limited resources efficiently and plan for optimum postoperative care of patients.

2. Literature review

The practice of anaesthesia is fundamental to the practice of medicine. However, anaesthesia is not without its problems. Side effects of anesthesia can occur during a surgery or procedure, or afterward when the patient is recovering and the anesthesia is wearing off. The possible side effects vary, depending on the kind of anesthesia given: general, regional or local.

It is common practice for most patients who receive general anesthesia, regional anesthesia, or monitored anesthesia care to be monitored in a post-anesthesia care unit (PACU) prior to

discharge from the hospital or transfer to a ward bed. The exception is critically ill patients and those who are intubated, who may bypass the PACU and be recovered directly in an intensive care unit (ICU). And in most PACUs, medical oversight of patients is the responsibility of the anesthesiology service.

Initial handoff — The initial handoff from the anesthesia care team and other intraoperative personnel to personnel in the PACU is typically standardized. This handoff includes review of pertinent medical history, allergies, the surgical procedure performed; total dose and last timing for opioids, muscle relaxants, and antibiotics; total fluids administered including colloids and blood products; critical intraoperative laboratory values if these were obtained (eg, hemoglobin or hematocrit, glucose and potassium levels, last activated whole blood clotting time [ACT] if heparin was administered), airway management and any difficulties; untoward intraoperative events; prophylactic medications previously administered for postoperative nausea and vomiting (PONV); the plan for postoperative analgesia; and discussion of disposition after PACU discharge (eg, to home, a hospital ward, or an ICU bed).

Phase I and II care — PACU care is typically divided into two phases. Phase I emphasizes ensuring the patient's full recovery from anesthesia and return of vital signs to near baseline. Phase II recovery focuses on preparing patients for hospital discharge, including education regarding the surgeon's postoperative instructions and any prescribed discharge medications.

The original concept for postanesthesia care area is credited to Florence Nightgale , in 1863 wrote on the efficacy of special areas for observation of post surgical patients(1). But, it took approximately more than half a century to adopt this idea and probably the first designated recovery area was established at the Johns Hopkins Hospital in 1923. Traditionally known as the “recovery room”, this area was initially designed as a place for observing postoperative patients (2). As the nature of patient care became increasingly complex, interest in identifying complications that occur during this period has increased (4,5).

Historically, efforts to define and identify factors associated with increased patient morbidity

have focused on intraoperative period. Few studies have examined the relationship between intraoperative factors and events occurring later during the postanesthesia period (13). Studies le Cohen et al. (28) have demonstrated that the overall incidence of complications occurring during postanesthesia care unit (PACU) stay may be higher than previously expected (up to 18%).

In their review of PACU detected complications and how the introduction of pulse oximeter had affected outcome, Cooper et al.(26) had described these incidents as Recovery Room Impact Event and defined it "an unanticipated, undesirable, possibly anaesthesia related effect that required intervention, was pertinent to recovery room care and did or could cause mortality or at least moderate morbidity". They measured many criteria and found that PACU anaesthesia related complications were 18% and in another series by Hines et al.(14) was 23.7%, and then approximately 18 years later Shauna ET had shown that the figures haven't much changed and reported 23.4% rate of complications.(27) The respiratory complications remain the major issue in the postoperative period followed by PONV.

Anaesthesia can cause many complications, but in general we can think of them as centred on the airway, respiratory or circulatory systems. For some, there is debate about where ‘anaesthesia’ complications end and ‘surgical’ complications start. For example, postoperative pneumonia may be caused by the abnormal ventilation that occurs under anaesthesia as well as the positioning for surgery and the surgical incision that makes breathing and coughing painful, shallow and ineffective.

A study done by J.N. Lunn in 1986 in a UK university hospital shows that the post OP complication rate reaches upto 50%.(5) And on another study done at St. Michael’s hospital, Toronto, on 43,914 patients between 1991-1994, 33% of these patients had some kind of problem in the PACU, the most common being nausea and vomitting, oxygen desaturation, excessive pain, confusion/agitation, bradycardia, hypotension, and hypertension.(10) Another study which was done by Roberta Hines & colleagues, at a US university hospital, in 1992, PACU

complication rate reached 23.7%. Nausea & vomitting accounting for 9.8%, respiratory complications requiring upper airway support accounting for 6.9% and hypotension requiring treatment was estimated to be 2.7%.(14)

A study done by Hines R, et al., at University of British on 37,071 patients from April 2001 to March 2004 showed that respiratory complications (all combined, 15.2%), cardiovascular complications (all combined, 12.3%), postoperative nausea and vomiting (PONV, 9.4%), and excessive pain (7.2%) were common complications. (14) And another study done at a University Hospital of Saudi Arabiya in 2005, different types of adverse events were reported in 267 patients represented 9.7%.(41) In conclusion, most studies have identified the overall incidents of adverse events occurring in the PACU as 5%–30%.

Post-operative complications can cause death and suffering, as well as longer hospital stays and increase costs. Patients who have complications are more likely to die, *within 5 Years after surgery*. About 20,000 to 25,000 deaths occur every year in UK Hospitals following surgery, of which about 80% occur in a small group of “high Risk patients”. These Patients account for 10% of surgical inpatients and are at increased risk of mortality and morbidity. True Rates of post-operative complications have been difficult to quantify due to the lack of universally agreed definitions, making comparisons between different hospitals and countries challenging. Complication Rates may differ in the literature for various reasons, not least due to the various methods which can be used to detect a complication.

The frequency of critical incidents was higher in patients receiving general anesthesia which may be attributed to a greater number of high risk surgeries being performed under general anesthesia including neurosurgical procedures. Respiratory problems were the most frequently encountered complications in the recovery room. The overwhelming majority were related to airway obstruction, hypoventilation, or hypoxemia with airway obstruction accounting for 59.6% of the incidents. Critical incidents most commonly occurred during the first hour of recovery room stay which emphasizes the need for meticulous attention during this vulnerable

period to prevent complications leading to adverse patient outcomes. Most of the incidents were identified by the assigned bed side nurse, probably due to more interaction with the patient as compared to the physician.

Early studies were aimed at defining the incidence of overall morbidity and mortality. Cohen et al. (28) described the outcome of a 5 year postanesthetic followup program at a teaching hospital between 1979-1983. Their data showed a PACU complication rate to be 5.19%.(28,13). Another study examined the frequency of PACU complications occuring during 1 month period. This prospective study showed that 30% of patients admitted to the PACU had at least one complication; the most frequently observed were abnormal cardiovascular variables (either hypotension, hypertension and arrhythmia) in 68 of 443 patients (15.3%), nausea and vomiting in 24 of 443 patients (5.4%, and respiratory complications (cyanosis, hypoventilation, reintubation, and laryngeal spasm) in 10 of 443 patients (2.3%).

Respiratory complications in the postanaesthesia period are an important area of concern for anaesthetists. Fortunately, the frequency of serious respiratory problems is low. In Beard's 1981 study, respiratory complications comprised 44 out of 2,293 (1.9%) cases of general anaesthesia.(30).The study carried out ten years later at St. Michaels Hospital, Toronto determined that critical respiratory events occurred in 1.3% of 24,157 consecutive PACU patients receiving general anaesthesia.(18)

Patient and surgical factors and specific anaesthetic management strategies may increase the risk of respiratory problems in the PACU. Respiratory events in order of decreasing frequency which have been noted in the PACU include hypoxemia, hypoventilation, airway obstruction, bronchospasm, laryngospasm, aspiration, and pneumothorax. And among the respiratory complications, hypoxemia is the most common. Hypoxaemic episodes (SpO 2 _<90%) have been recorded in up to 55% of patients admitted to a PACU.(25) Many of these patients were receiving supplemental oxygen, and 95% of the cases went unrecognized by the staff. The aetiology of hypoxaemia in the PACU is most commonly due to V/Q missmatch and is

frequently seen in patients with compromised lung function in the preoperative period (e.g., low preoperative SpO2).

Cardiovascular complications are a major component of PACU adverse events. These complications range from hypotension to cardiac arrest. Hypotension occurrence in PACU is mostly due to hypovolemia, blood loss and medication side effects. Rose DK et al.(18) found that Hypertension and tachycardia in PACU are an infrequent finding; however it is associated with increased risk of unplanned ICU admission and mortality irrelevant to anaesthetic management.

Acute changes in blood pressure, heart rate and rhythm are not uncommon events among patients in the PACU. Ischaemia, pulmonary oedema, and cardiac arrest, on the other hand, are rare events. Preoperative patient problems (coronary artery disease, hypertension, and congestive failure) as well as surgical factors (vascular surgery, lengthy and emergency procedures) are highly correlated with early postoperative cardiac abnormalities.(32)

In addition, it has also been shown that other problems which occur in the PACU (e.g., respiratory distress, excessive pain, agitation, and nausea and vomiting) are related to cardiac events in the PACU. Recognizing the patient at risk, careful intraoperative haemodynamic control with volume replacement and drug therapy, and" prevention of other system problems may help avoid cardiovascular instability in the PACU. Certain events (e.g., bradycardia) may require no treatment.

Despite decades of research, nausea and vomiting remains the most common problem observed in the PACU. This may represent only the tip of the iceberg since the rate of nausea/vomiting is thought to be even higher in the later postoperative period (29). The incidence of nausea varies from 5-60% depending on the type of surgical procedure performed although various pharmacologic regimens have been advocated to reduce postoperative nausea and vomiting, the data shows that nausea and vomiting continues to be a major source

of patient morbidity(29).

Koivuranta M et al., in their findings PONV can be predicted to certain accuracy if the patient is: female, having gynecological procedure, of more 60 min duration, with history of motion sickness, non smoker and have previous postoperative sickness.(35,36) In their extensive study, Christian CA et al. have discussed this problem in details and have suggested many techniques to overcome it(37) however, multiple interventions should be reserved for high-risk patients, yet the issue of PONV remained complex and distressing.

While all patients will have pain after major surgery, the degree to which excessive pain is experienced will vary considerably. This makes the prevention and treatment of pain challenging, but also difficult to study. Postoperative pain in the PACU is currently being assessed by several methods. These include visual analogue pain scores (0 - no pain, maximum - worst pain imaginable) measured at rest and with movement, discomfort scores which rate level of pain (no pain, mild, moderate, severe, or very severe), frequency of demand for and quantity of opioid analgesics, and physical findings related to severe pain (e.g., moaning or writhing).

Due to patient sedation and confusion, pain assessment in the PACU may not be reliable. Many of the recent studies which assess strategies to reduce postoperative pain ignore the patient stay in PACU and instead concentrate on time periods after PACU discharge. However, one study of patients undergoing abdominal surgery did measure analogue pain scores on arrival in PACU.(31). Pain scores (0-10) were high (>6) and dependent on intraoperative management. On a study done in the PACU at St. Michaels Hospital, Toronto also suggested a high frequency of early postoperative pain.(18) This study which assessed over 5,000 high-risk patients in the PACU (elective major surgery following general anaesthesia) found that the rate of excessive pain, defined by moaning or writhing or nursing care dominated by pain control, was 14.8%. The rate of excessive pain in the PACU may vary depending on patient age, preoperative analgesic use, the surgical procedure, and strategies to reduce postoperative pain.

Perioperative care has improved over the last few decades, as a result of developments in anaesthesia practice, mainly in monitoring, equipments, short acting anesthetics with fewer side effects and certainly in perioperative medicine and the availability of anaesthesia clinic usually run by senior anaesthetists with good infrastructure and experience; all in all have a great impact on outcome.(16,34) But perioperative care in developing countries is not yet well developed leading to the precence of undetected complications that needs to be studied further for better perioperative outcome.

3. Objectives

3.1. General objectives

- To assess the incidence of postoperative complications in the major OR PACU of TASH

3.2. Specific objectives

- To identify the types of complications that occur in the PACU.
- To assess factors that may influence the occurrence of complications in the PACU

4. Methodology

4.1. Eligibility criteria and ethical considerations

4.1.1. Inclusion criteria

All patients who had surgery (elective and emergency) under general anaesthesia (GA), Monitored Anaesthesia Care (MAC), and Regional Anaesthesia (RA) in the major OR of TASH were included in the study

4.1.2. Exclusion criteria

- Patients who were transferred directly from the operation theatre (OT) to an intensive care facility, ward or OPD.
- Patients admitted to PACU in the course of transferring them to the Intensive Care Unit

(ICU).

4.2. Ethical considerations

Any specific patient identifiers were not included in the data collection tool and this was assured by using code numbers to each data.

4.3. Study setting

The study was conducted at Addis Ababa University, College of Health Sciences, Tikur Anbessa Specialized Hospital. It is the largest public specialized hospital in Ethiopia located at Addis Ababa under the Ethiopian Federal Ministry of Education (FMOE).

4.4. Study design

After approval from the university, a quantitative institutional based prospective cross-sectional study was conducted from June 14, 2018 to July 29, 2018.

4.5. Source and study population

The source population constituted of all patients who had undergone surgery at the major OR of TASH and the study population included all non-ICU patients who had undergone surgical procedure and who got admitted to the PACU between June14, 2018 to July 29, 2018.

4.6. Sample size determination

The Sample size was determined by the following formula

Part I; n = t2 x p (1 -p)/m2

Part II; n f= n / (l+ n /N)

Where:-

n = required sample size.

t = confidence level at 95% (standard value o f 1.96)

P = estimated incidence o f complications in the PACU is put at 30%

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

Therefore: n = 326

Part II

the population to be studied in a year is less than 10,000 (In our case 7,300 which is the estimated number of surgeries that are done in the major OR of TASH per year), then part II of the formula which uses the required sample size got from part I of the formula was applied,

nf = n/ (1+n/N)

Description:

nf = is the desired sample size when the population studied is less than 10,000.

n: the sample size required if the population would have been less than 10,000(326 in our case to be done in the major OR of TASH is 7,300.

Therefore: nf=312

4.7. Study variables

4.7.1. Dependent variable

- Complications in the PACU

4.7.2. Independent variables

- Age
- Sex
- The ASA physical status

- Urgency of the surgery
- Preexisting co-morbidities
- Type of surgery
- Type of anesthesia
- Position during surgery
- Duration of anesthesia
- Attending anesthesia provider

4.8. Operational Definition

Desaturation: O2 saturation <92%

Stridor: High pitched sound during inspiration.

Hypotension: a decrease of the systolic BP by 20% from baseline

Hypertension: an increase in systolic BP by 20% from baseline

Shock: Hypotension with signs of poor peripheral perfusion

Tachycardia: Heart rate>100 for adults, different in different pediatric age groups

Bradycardia: Heart rate<60 for adults and less than 80 for children

Pain: subjective compliant of the patient

Hypothermia: temperature <36 degree celcius

Persistent sedation: The ease of arausability of the patient

4.9. Data collection and management

Data was collected using survey data sheet (a standardized data collection form), which is a three page check-box form. Three PACU nurses working at the major OR of TASH were trained and were assigned as a data collector. The questionnaires were pre- tested to assess clarity, sequence, consistency, and understandability and the investigator supervised the data collection process. And the data was analyzed using Statistical Package for Social Sciences (SPSS), version 21.

4.10. Dissemination of the result

The study result will be presented to Addis Ababa University, School of Medicine, Department of Anesthesiology and documents will be disseminated to all responsible bodies in the study area, for the hospital where the study is conducted, FMOH and Addis Ababa university school of Medicine.

5. RESULTS

During the study period 312 patients were admitted to the PACU of the major OR (from 07/10/10 EC to 22/11/10 EC). Hundred ninety three patients were males and 119 were females; the percentage is 61.9 and 38.1% respectively.

Age ranges was from 1 day to 95 years with a mean of 29. The majority of the patients with complications were from 25-33 years, followed by age under 2 years, 18.7%, 7.8% respectively.

Table 1 Socio-demographic characteristics of patients admitted to the ICU, 2018

Characterstics	No. (%)	
	PACU complications (n=65)	Total (n=312)
Gender		
Female	22 (18.5%)	119 (38.1%)
Male	43 (22.3%)	193 (61.9%)
Age		
<2	14 (21.5%)	50 (16%)
3-12	10 (15.4%)	42 (13.5%)
13-18	1 (1.5%)	10 (3.3%)
19-34	7 (10.8%)	90 (28.8%)
35-49	14 (21.5%)	59 (18.9%)
50-65	11 (16.9%)	44 (14.1%)
>65	8 (12.3%)	17 (5.4%)

Age Ranges (1 day-95 yrs)

I stratified the patients according to their ASA category and urgency of the procedure (Table 2) and the distribution of complications according to patients' ASA status is also displayed in the same table. The table is uniquely showing that ASA I and II patients have the highest percentage of complications (98.5%) in either elective or emergency surgery 70.7%, 27.8% respectively.

The majority of patients with a critical incident were scheduled for elective procedures (n = 46, 70.7%) leading to the conclusion that, patients undergoing emergency procedures were not more likely to have a critical incident when compared to those scheduled for elective procedures (Table 2). (P=0.472)

Table 2. ASA categories of the patients and urgency of the procedures.

ASA status	Total No of patients	N of with complications	ICU admission
ASA 1 ASA 2 ASA 1E ASA 2E ASA 3E	151 60 56 38 7	27 (41.5%) 19 (29.2%) 11 (17%) 7 (10.8%) 1 (1.5%)	4 2 2 1 1
Total	312	65	10

Total number of patients who had complications in the PACU was 65. The type of complications is characteristically of respiratory system in the first place (35.4%); desaturation was mainly due to hypoventilation (Table 3) other causes such as stridor were documented too. Cardiovascular system complications comes second (21.1%) which exceeds PONV (13.8%) which comes third on the list. The most common cardiovascular incidents were hypotension (n = 9, 13.8%), shock (n =3, 4.6%), and hypertension (n = 2, 3.1%). For critical incidents of neurological origin (n = 52), the most common incident was reduced consciousness (n = 7, 10.8%). The other complications were hypothermia and pain, which occurred in 5 (7.7%) and 7 (10.8%) respectively.

Table 3. Complications in the PACU

Type of complication	N=65 (% of total)
Desaturation	21 (32.3%)
Stridor	2 (3.1%)
Hypotension	9 (13.8%)
Hypertension	2 (3.1%)
Shock	3 (4.6%)
Persistent sedation	7 (10.8%)
PONV	9 (13,8%)
Hypothermia	5 (7.7%)
Pain	7 (10.8%)

The anesthesia record sheet detailed the preoperative status of the patient and highlights co-morbidities and hence it's correlation to PACU complications (Table 4) which shows that there was correlation between the presence of co-morbidities and the incidence of postoperative complications($P<0.01$).

Table 4. Incidence of complications in the PACU in correlation with the presence of co-morbidities.

Pre-existing comorbidities	Complications in the PACU		Total
	YES	NO	
Respiratory	6	0	6
CVS	9	12	21
Renal/Endocrine	1	14	15
None	49	221	270
Total	65	247	312

Pre-existing co-morbidities Vs comp.

Most critical incidents occurred in patients who underwent general surgical procedures (n = 21, 32.3%; Table 5), because of the large volume of general surgical cases done in both pediatric age group and adults. Of all procedures that took place in the major OR during the study period 117, 37.5% were for general surgical patients and 75, 24% were for urologic patients. Majority of patients who had complications fall under general surgery followed by urology (Table 5). There was no correlation between type of surgery and the incidence of complication (P=0.571).

Table 5. Incidence of complications in correlation with type of surgery.

Type of surgery	N of patients	N of patients with complications
General surgery	117(37.5%)	21 (32.3%)
Orthopedic	4(1.3%)	2 (3%)
ENT	37(11.9%)	10 (15.4%)
OBS/GYN	25(8%)	4 (6.2%)
Chest	10(3.2%)	7 (10.8%)
Neurosurgery	44(14.1%)	10 (15.4%)
Urology	75(24%)	11 (16.9%)
Total	312	65

Of the patients studied 249 had GA (79.8%) and 57 patients of the 65 who had complications had GA constituting (87.7%) (Table) six patients (9.2%) of the total number of patients who had RA/Axial anesthesia and two patients (3.1%) of the total patients had MAC. Table 6 shows that there is no major difference in the type of anaesthesia and the immediate postoperative complications. (P=0.237)

Table 6. Incidence of complications in correlation with the type of anesthesia.

Type of anesthesia	N (% of total)	N (% total complication and % to original figures)
GA Regional MAC	249 (79.8%) 53 (17%) 10 (3.2%)	57(22.9%, 87.7%) 6 (11.3%, 9.2%) 2 (20%, 3.1%)

Two patients out of the 65 were anaesthetized by consultants (Table 7). The majority of anesthesia was administered by anesthesiology residents; however the more critical the patients and the procedures the more consultants were involved. There was no correlation between the attending anesthesia provider and the incidence of complication. (P=0.675)

Table 7. Incidence of complications in correlation to the attending anesthesia provider.

Attending anesthesia provider	Complications		Total
	Yes	No	
Consultant Specialist Resident	2 (15.4%, 3%) 22 (18.3%,34%) 41 (22.9, 63%)	11 98 138	13 120 179
Total	65	247	312

Majority of the procedures were done in the supine (254, 81.4%) position, followed by lithotomy (47, 15.1%), prone (6, 1.9%) and lateral (5, 1.6%) (Table 8). There was no correlation between the type of position and the incidence of complications. (P=0.370)

Table 8. The incidence of complications in correlation to position during surgery.

Position	N of patients	Complications
Supine	254 (81.4%)	56 (86.2%)
Lithotomy	47 (15.1%)	6 (9.2%)
Prone	6 (1.9%)	1 (1.5%)
Lateral	5 (1.6%)	2 (3.1%)
Total	312	65

Table 9 shows the incidence of complications in correlation with the lengths of the procedures. The longer the procedure, the higher the incidence of complications (P< 0.01). And table 10 also shows that there is a correlation between the incidence of complication and the length of stay in the PACU. (P<0.01) (i.e. patients with complications tend to stay longer in the PACU than patients without complications.)

Table 9. Incidence of complications in correlation with the length of the procedure.

Duration of anesthesia	Complications Yes	Total
<60 minutes	12 (12.1%)	99
60-120 minutes	26 (20.8%)	125
120-180 minutes	9 (18.8%)	48
>180 minutes	18 (45%)	40
Total	65	312

Table 10. The correlation between the length of stay in the PACU with the presence of complications.

Duration in the PACU	Complications	Total
<30 minutes	1 (25%)	4
30-60 minutes	24 (12.7%)	189
60-90 minutes	16 (22.2%)	72
90-120 minutes	10 (30.3%)	33
>120 minutes	14 (100%)	14
Total	65	312

Ten patients required unplanned admission to the intensive care, all of them had GA. Two of the patients developed persistent hypertension after neurological surgery, five of them developed shock after general and chest surgeries and the other three developed hypoxia because of inadequate ventilation after chest surgeries. Six patients were elective patients of the ASA classes I and II the other four were emergency patients of classes I, II, and III E, their age range 1day–60 years and duration procedures range between 1 to 7 hours.

Table 11. Patient disposition.

Transfer to	N of patients
Ward	299 (95.8%)
ICU	10 (3.2%)
OPD	3 (1%)
Total	312

Table 12. correlation between incidence of complications and different variables.

Variables	Complications		Total	Chi-square test		Pearson corellation	
	Yes	No		Value	P-value sig (2-sided)	Corellation coefficient (R)	Sig 2-tailed
Sex				0.132	0.716	0.021	0.717
Male	43(22.3%)	76(77.7%)	119(38.1%)				
Female	22(18.5%)	171(81.5%)	193 (61.9%)				
Age				62.888	0.976	0.021	0.714
<2	14(21.5%)	36(78.5%)	50 (16%)				
3-12	10(15.4%)	32(84.6%)	42 (13.5%)				
13-18	1 (1.5%)	9(98.5%)	10 (3.3%)				
19-34	7 (10.8%)	83(89.2%)	90 (28.8%)				
35-49	14(21.5%)	45(78.5%)	59 (18.9%)				
50-65	11(16.9%)	33(83.1%)	44 (14.1%)				
>65	8 (12.3%)	9(87.7%)	17 (5.4%)				
ASA_PS				5.444	0.245	0.023	0.680
ASA 1	27 (41.5%)	124(58.5%)	151(48.4%)				
ASA 2	19 (29.2%)	41(70.8%)	60(19.3%)				
ASA 1E	11 (17%)	45(83%)	56(17.9%)				

ASA 2E ASA 3E	7 (10.8%) 1 (1.5%)	31(89.2%) 6(98.5%)	38(12.2%) 7(2.2%)				
Pre-existing co-morbidity Yes No	16(24.6%) 49(75.4%)	16(75.4%) 221(24.6%	42(13.5%) 270(86.5%)	31.761	0.000	0.232	0.000
Type of surg General S Orthopedic ENT OBS/GYN Chest Neuro Urology	21 96(67.7%) (32 22(97%) 2 27(84.6%) (3% 21(93.8% 10) 3(89.2%) (15 34(84.6% 4) 64(83.1% (6.2%) 7 (10.8%) 10 (15.4%) 11 (16.9%)	117(37.5% 4(1.3%) 37(11.9%) 25(8%) 10 (3.2%) 44(14.1%) 75(24%)	18.943	0.004	.008	0.887	
Type of ans GA Regional MAC	57(22.9%) 6 (11.3%) 2 (20%)	192(77.1%) 47(88.7%) 8 (80%)	249(79.8%) 53 (17%) 10 (3.2%)	4.665	0.097	0.082	0.150
Attending Consultant Specialist Resident	2 (15.4%) 22 (18.3%) 41 (22.9%)	11(84.6%) 98(81.7%) 138(77.1%)	13(4.2%) 120(39.4%) 179(57.4%)	1.213	0.545	0.050	0.378
Position Supine Lithotomy Prone Lateral	56 (86.2%) 6 (9.2%) 1 (1.5%) 2 (3.1%)	198(13.8%) 41(90.8%) 5(98.5%) 3(96.9%)	254 (81.4%) 47 (15.1%) 6 (1.9%) 5 (1.6%)	5.797	0.122	0.051	0.370
Dur. of pro. <60 m 60-120 m 120-180 m >180 m	12 (12.1%) 26 (20.8%) 9 (18.8%) 18 (45%)	87(87.9%) 99(79.2%) 39(81.2%) 22(55%)	99(31.7%) 125(40.1%) 48(15.4%) 40(12.8%)	18.475	0.000	0.214	0.000
				59.120	0.000	0.368	0.000

PACU stay <30 m 30-60 m 60-90 m 90-120 m >120 m	 1 (25%) 24 (12.7%) 16 (22.2%) 10 (30.3%) 14 (100%)	3(75%) 165(87.3%) 56(77.8%) 23(69.7%) 0(0%)	 4(1.3%) 189(60.6%) 72(23%) 33(10.6%) 14(4.5%)				
Transfer Ward ICU OPD	 55(84.6%) 10(15.4%) 0(0%)	 244(15.4%) 0(84.6%) 3(100%)	 299(95.8) 10 (3.2%) 3 (1%)	36.403	0.000	0.228	0.000

Result of bivariate analysis showed that, of all the studied variables only the presence of pre-existing co-morbidity and duration of the surgery had significant association with the incidence of complications. None of the 65 patients who had complications was found having any significant correlation to:

1. Age (P=0.714)
2. Sex (P=0.717)
3. Urgency of procedure (P=0.472)
4. Type of surgery (P=0.887)
5. Type of anesthesia (P=0.150)
6. Attending anesthesia provider (P=0.378)
7. Position during surgery (P=0.370)

6. DISCUSSION

There were 65 (20.83%) complications detected in 312 patients over a one and half month period at the major OR PACU, Tikur Anbessa Hospital (The incidences in different part of the world and different time periods **23.7 %** (US 1992), **22.3%** (Germany, 1999), **9.7%** (Saudi Arabia, 2005), **4.25%** (Qatar, 2012), **0.73%** (Singapore, 2016)). Most critical incidents occurred in ASA physical status I and II patients, who also made up the largest proportion of patients in this study. The majority of patients were elective patients and underwent general surgical or urologic procedures.

Cardio-respiratory incidents comprised the majority of incidents reported, with hypoxia and hypotension being the most common. Critical incidents resulted in prolonged stays in the PACU and unexpected admissions to the ICU.

Most patients (70.7%) with critical incidents were of ASA physical status I and II, suggesting that significant critical incidents may occur in patients with relatively few co-morbidities and in whom clinicians might not expect the occurrence of critical incidents. In a study done in Singapore, 2016, **55.8%** of patients with critical incidents were of ASA physical status I and II. Another prospective study by Hines et al involving more than 18,000 patients, which aimed to identify adverse events occurring in the PACU, similarly noted that more than three-quarters of complications involved patients categorized as ASA physical status I or II.(14) The large number of critical incidents involving such patients in this study might also be partly due to the fact that the majority of our surgical patients were of ASA physical status I or II. Furthermore, in our institution, the general practice for patients requiring intensive postoperative care is to transfer them directly from the OT to the ICU, thereby reducing the number of patients with ASA physical status III and IV categories in the PACU.

The majority of critical incidents identified in this study were seen in patients who underwent general surgery. These patients had a higher incidence of PACU complications when compared to those from other disciplines ($p < 0.001$). This is in keeping with other studies, which have reported that patients undergoing major open abdominal procedures had a greater number of complications and longer mean length of stay in the PACU.(14,16)

This might be because of the high proportion of this group of patients in this study. The result might differ if the number of patients were high. Patients from the orthopedics and obstetrics/ gynecology disciplines were less likely to have a critical incident ($p < 0.001$). This may also be explained by the very low number of cases from both disciplines.

Cardio-respiratory incidents (56.5%) comprised the majority of incidents reported, with hypoxia

(32.3%) and hypotension (13.8%) being the most common. In a study done in Singapore, 2016 complications of the cardio-respiratory system comprised of 68.8% of the complications. The most common critical incidents observed in this study were respiratory -related (35.4%) followed by cardiovascular (21.1%), PONV 13.8%, neurological (10.8%), pain (10.8%) and hypothermia (7.7%). Specifically, desaturation, hypotension, and PONV were the most common complications detected. Kluger and Bullock, who extracted 419 incidents from the Australian Incident Monitoring Study, also noted that the majority of their critical incidents were cardio-respiratory related.(16) The most frequently encountered problems in their study were associated with respiratory/airway issues (43%), cardiovascular problems (24%) and drug errors (11%).(16) Of note, Rose et al found that hypertension and tachycardia in PACU patients were associated with increased risk of unanticipated ICU admission and mortality.(18)

Critical incidents resulted in prolonged stays in the PACU and unexpected admissions to the ICU. In this study, 10 (3.2%) of patients required a transfer to a higher level of care (ICU) than initially planned. Kluger and Bullock noted that 29% of all critical incidents that they reviewed resulted in unplanned admissions of patients to the HD or ICU.(16) Another study done in the US in 1992 involving 18,437 consecutive patients recorded a total of 186(1.01%) unexpected ICU admissions.(14) Critical incidents in the PACU influence postoperative resource utilization in hospitals due to unexpected admissions of postoperative patients to higher levels of care.

There was no incidence of reintubations in the PACU in this study. In In the study done in New Zealand in 2002, Kluger and Bullock reported that 17% of patients with a critical incident in the PACU required assistance with ventilation.(16) in a study done in English by Rose et al, it was found that only 0.1% (n = 22) of patients among 21,457 consecutive general anaesthesia patients in the PACU required emergency reintubation.(17) Similarly, in a study done in French by Hines et al it was reported that 21 of 1,275 patients receiving upper airway support required reintubation,(14)

7. Strength and limitations of the study

7.1. Strength of the study

The structured survey questionnaire was adopted and modified from the study done in Qatar to avail the data.

Lack of literature available in Ethiopia and other developing countries makes this study a stepping stone to various small and large scale studies in this area.

7.2 Limitation of the study

The weakness of the study is the type of surgeries included in the study and the number of patients; I believe that inclusion of more patients and different surgical specialties such as Obstetrics and orthopedic surgeries would have changed the results in terms of kind and percentage of complications. The other limitation is with the unavailability of some monitors such as ECG, ETCO2, pediatric sized BP cuffs and thermometer, the calculated incidence of critical events may be an underestimation of the actual number of incidents.

0n top of these, in the context of a busy PACU, all critical incidents may not be uniformly recorded during the study period. The other drawback of the study is that, the complications were detected and documented by the PACU nurses, who may not be able to pick some of the rare complications.

1. Conclusion and recommendation

1.1. Conclusion

The only explanation that most of the complications occurred to ASA 1 and 2 patients who had general anaesthesia for general surgical procedures was due to the large volume of this category of patients. Respiratory complications were the most common adverse events in this study as expected followed by cardiovascular complications and PONV.

Despite the limitations, our study data highlights the role of a PACU in reducing patient morbidity in the immediate postoperative period. Without a PACU, many of these critical incidents would have occurred in the wards, where staff may not be in a position to pick and manage such complications promptly.(16) PACU staff must be highly skilled and receive ongoing training and education to be able to manage both a diverse range of complications and critically ill patients.(16) In cases where critically ill patients are cared for in the PACU due to a shortage of beds elsewhere, the level of care provided must be equivalent with that provided in higher-level care units, such as the HD and ICU.

In conclusion, the current review documents the various critical incidents that were recorded over a one and half month period in the major OR PACU, at Tikur Anbessa specialized hospital and highlights the importance of a PACU in managing patients in the postoperative period. Complications in the PACU can impact healthcare utilisation by prolonging patients' length of stay in the PACU and resulting in the need for higher levels of postoperative care than anticipated.

8.2 Recommendation

Standard ASA monitors should be available in the PACU to detect compliations early.

Regular audits of critical incidents in the PACU are important to maintain the quality of immediate postoperative care, particularly in the context of an ageing population.

We recommend that a prospective follow-up trial be undertaken, with data on critical incidents being collected by clinicians, to strengthen the findings of this study.

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Annexes

Annex 1 Page one of the survey sheet.

○ Sex	○ Male ○ Female
○ Age	○
○ Type of surgery	○ Gs chest ○ Orthopedic neurosurgery ○ ENT urology ○ Obs/Gyn
○ Position of surgery	○ Supine ○ Prone ○ Lateral ○ Lithotomy
○ Type of anesthesia	○ GA ○ Regional (spinal, epidural, nerve block) ○ GA/RA combined ○ MAC (Moderate/Deep sedation/GA)
○ Duration of anesthesia	Hrs: Min:
○ ASA physical status	1 2 3 4 5 E
○ Attending anesthesiologist	○ Consultant ○ Specialist ○ Resident
○ Pre-existing comorbidities	○ Respiratory ○ CVS ○ Neurological ○ Renal/endocrine ○ GIT ○ Trauma ○ Others ○ None
○ Intra operative complications	○ Y ○ If (Y) specify:
REMARKS	

Page two of the survey sheet (complications detected in the PACU)

1	Cardiovascular None	Management
	○ Hypertension (20% change of preop. Value)	
	○ Hypotension (20% change of preop. Value)	
	○ Shock (type) (hypotension with signs of poor or gan perfusion)	
	○ Cardio-respiratory arrest	
	○ Tachycardia (heart rate>/=100 beats/min)	
	○ Bradycardia (heart rate </=50 beats/min)	
2	Airway & Respiratory None	Management
	○ Stridor	○ Airway ○ BVM ○ ETT ○ Medication e.g. Ventolin, Naloxone ○ O2
	○ Wheezing	
	○ Apnea	
	○ Hypoxia (spaO2 <92% on oxygen)	

Page three of the survey sheet (complications detected in the PACU)

3	CNS None	Management
	○ Confusion	
	○ Delirium	
	○ Seizure	
	○ Persistent sedation	
4	GIT None	Management
	○ nausea/vomiting	
5	Drug reaction None	Management
	○ specify (skin rash, anaphylaxis)	
6	Miscellaneous complications None	Management
	○ hypothermia & shivering ○ hyperthermia	
7	Investigations None	Results
	○ ABG	

	○ SE ○ RBS ○ ECG ○ CXR	
8	○ Medical consultation	Y N
9	○ Remarks	
10	○ Duration in PACU	HRs MIN
11	○ Transfer to	○ Ward ○ HDU ○ ICU

PACU Nurse: Anesthesiologist:

Date & time: Date & Time:

Annex 2:- Declaration

I, the undersigned, graduating class of Anesthesiology residency student declared that this thesis is my original work in partial fulfillment of the requirement for degree.

Name:- _____ Signature:- _____

Place of submission: Addis Ababa University, College Health sciences, School Medicine, Department of Anesthesia.

Date of Submission: _____

This thesis work has been submitted for examination with my/ our approval as university advisor(s).

Advisors

Name	Signature
_____	_____