

**JIMMA UNIVERSITY INSTITUTE OF HEALTH SCHOOL OF MEDICINE, JIMMA
UNIVERSITY MEDICAL CENTER**



DEPARTMENT OF ANESTHESIOLOGY, CRITICAL CARE AND PAIN MEDICINE

**PREVALENCE OF POSTOPERATIVE COMPLICATIONS IN POSTANESTHESIA
CARE UNIT, INSTITUTIONAL BASED CROSS SECTIONAL STUDY AT JIMMA
UNIVERSITY MEDICAL CENTER, JIMMA, ETHIOPIA**

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**A RESEARCH PROPOSAL WILL BE SUBMITTED TO THE DEPARTMENT OF
ANESTHESIOLOGY IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR
THE SPECIALTY CERTIFICATE IN ANESTHESIOLOGY AND CRITICAL CARE**

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APRIL 2020

JIMMA, ETHIOPIA

ASSURANCE OF PRINCIPAL INVESTIGATOR

The undersigned agrees to accept responsibility for the scientific ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the college of public and medical science in effect at the time of grant is forwarded as the result of this application.

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APPROVAL OF THE ADVISORS

This thesis proposal has been submitted with my approval as university advisor

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ABSTRACT

Background: Emergence from anesthesia is a critical period. The early emergence period is a time with many 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 occurs in the postanesthesia care unit (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 are a source of patient morbidity. The overall incidence of complications occurring during the PACU stay may be higher than previously expected.

Objectives: To determine the prevalence of postoperative complications and identify factors associated with those complications among patients admitted to the PACU at the major operation room in Jimma University Medical Center (JUMC).

Methods: After approval from the university, institutional based cross-sectional study was conducted from April to July 2020 to investigate the prevalence of complications in postoperative patients admitted to PACU who had surgery (elective and emergency) under general anesthesia (GA), Monitored Anesthesia Care (MAC), or Regional Anesthesia (RA). Patients admitted to ICU either directly from operation room or from PACU were excluded from the study. During the study period, 265 patients were admitted to PACU; of these 255 patients' data were analyzed. Ten patient's data were excluded from the analysis due to either due to directly admissions to respective ward due to lack of bed in PACU (seven patients) and missed data of the patients (three patients), and patients who stayed in PACU for administrative reasons, such as awaiting discharge from an occupied bed elsewhere (four patients). Data regarding potential risk factors including patients' sociodemographics (e.g. age and sex), American Society of Anesthesiologists (ASA) physical status, types of surgery, types of anesthesia, position during surgery, attending anesthesia provider, preexisting comorbidities, and duration of anesthesia were analyzed. And, possible PACU complications like cardiovascular, respiratory, central nervous system, gastrointestinal, genitourinary, thermal incidents and others was collected using a survey data sheet and was analyzed using SPSS, version 21.

Results: During the study period, from 265 patients admitted to PACU, 255 patient's data were analyzed. Of these, 128 (50.2%) had developed complications. The types of complications were characteristically of the cardiovascular system in the first place (41.7%); followed by postoperative nausea and vomiting (40.2%); hypoxia or desaturation (36.2%); pain (28.3%); hypothermia (27.6%); neurological complications (15.7%); urinary retention (11%); and fall from bed (2.4%).

Of all the studied variables, ASA physical status (AOR 4.99, 95%CI 1.89, 13.16), types of surgery (AOR 0.48, 95%CI 0.16, 1.45), and duration of anaesthesia (AOR 2.84, 95%CI 1.17, 6.94) had significant association with the incidence of complications. These three variables predict the occurrence of postanesthesia care unit complications.

Conclusions and Recommendations:

Results from this study show that complications occurring in the PACU remain a significant source of patient morbidity. Particularly, PONV, hypothermia, pain and urinary retention in Jimma university medical center is significantly high as compared to other institutions, which might need much attention to improve the patient's outcome postoperatively.

Keywords: *Anesthesia; Post anesthesia care unit, Complications: Prevalence, Risk factors*

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ACKNOWLEDGEMENTS

My great gratitude goes to my Advisors Dr. Edosa Kajela, Mr. Desta Hiko and Dr. George Politis for their genuine guidance and advice in all aspects of this research work. Moreover, I would like to express my heartfelt appreciation to JUMC institutive of health, and Department of Anesthesiology and Critical Care for the initiative and opportunity given to me to conduct this thesis work.

ACRONYMS (ABBREVIATIONS)

JUMC	Jimma University medical center
ASA	American Society of Anesthesiologists
BVM	Bag Valve Mask
TASH	Tikur Anbessa Specialized Hospital
ETT	Endotracheal Tube
GA	General Anesthesia
ICU	Intensive Care Unit
HD	High Dependence
MAC	Monitored Anesthesia Care
OR	Operation Room
OT	Operation Theatre
PACU	Post Anesthesia Care Unit
PONV	Post-Operative Nausea and vomiting
RA	Regional Anesthesia
SPSS	Statistical Package for the Social Sciences
UK	United Kingdom
V/Q	Ventilation-Perfusion
US	United States

CHAPTER ONE

1. INTRODUCTION

1.1. Background

Emergence from anesthesia is full of potential complications involving all major physiological systems including respiratory, cardiovascular, central nervous and gastrointestinal system. The post anesthesia care unit (PACU) is designed and staffed to monitor and care for patients who are recovering from the immediate physiologic effects of anesthesia and surgery. It should be located near the operating rooms to provide care for patients recovering from general anesthesia, regional anesthesia, or Monitored Anesthesia Care.(1)

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. It was not until after the Second World War when recovery rooms were routinely included in plans for new hospitals.(2)(3)

In modern practice of perioperative care of the patient, 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. This is appropriate since all patients who enter a PACU face some type of threat or danger to their lives. Its proximity to the OR is also very crucial to access essential resources, including supplies and equipment, but even more importantly, the surgical and anesthesia provider who recently cared for the patient. This immediate availability allows timely intervention and treatment of any significant and urgent problems during the immediate postsurgical period. Basic responsibilities of PACU staff include patients' post anesthetic heart rate, blood pressure, temperature, respiratory rate, oxygen saturation, and airway patency, with airway management and oxygen administration as needed. They must also manage postoperative pain, postoperative nausea and vomiting, post anesthetic shivering, and monitoring surgical sites for excessive bleeding, swelling, and hematoma formation.(4)(5)

Recovery room population is changing, both to accommodate hospital needs and evolving practices. 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 Guidelines prepared by different associations stipulate the responsible personnel who discharge the patient from PACU. AAGBI guidelines stipulate that PACU discharge may be performed by anesthetist or delegated PACU staff.(6) ASA guidelines encourage the physician Anesthesiologist responsible for discharge of the patient. It encourages the use of a PACU scoring system for each patient on admission and at appropriate intervals until the time of discharge.(4)

1.2. Statement of the Problem

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 and surgery. Attention has been increasingly given on the PACU since the 1990s, in part because of the dramatic improvement in patient safety in the OR. In the past, when unrecognized esophageal intubations were the most common cause of mortality related to anesthesia,(7) 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 anesthetic care are extraordinarily rare in developed countries, due to events in the immediate postanesthesia period receive more attention than they have in the past. The role of the post anesthesia 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. Monitoring of patients in the post-anesthesia care unit (PACU) has become the accepted level of care in the immediate postoperative period. (8)(9)(10)

Data on critical incidents in the PACU can be used to anticipate and prevent such incidents, and improve processes of care. A study conducted over four years in the United States, 7.1% of 1175 anesthesia-related malpractice claims were recovery room incidents(11). As one expects serious

adverse outcomes in PACU correlate more closely with airway/respiratory and cardiovascular compromise. In 2002, airway/respiratory problems (183, 43%) and cardiovascular events (99, 24%) accounted for the majority of 419 recovery room incidents reported to the Australian Incident Monitoring Study database. (12) The incidence of complications in the PACU has been reported to range from 5% to 30 %, with minor complications (22.1%) occurring often more than major ones (0.2%).(13)(14)

The Post Anesthesia Care Unit (PACU) of the major operating theatre suite in Jimma University Medical Center has only four beds despite utilizing eight OR tables, which is below the standard (i.e., needs 1.5 PACU beds per OR table). The surgical specialties in this hospital are the following: General Surgery, Pediatric, GI Oncology, Plastic, Neurosurgery, Gynecology, and Orthopedics.

1.3. Significance of the Study

Many researches have been determined prevalence of PACU complications in different parts of the world, including our country, Ethiopia at TASH, AAU. However, none of those studies report on PACU complications and associated risk factors for major operation room (OR) at JUMC. Therefore, this research will assess and determine the prevalence of complications and associated risk factors for these complications in the PACU of the major operating suite of JUMC. Additionally, it would provide information for clinicians to formulate guideline and standard of practice for the management of patients who are admitted to the PACU, and to give attention on how to solve these problems by responsible bodies for optimum postoperative care of patients. It will also help as a stepping-stone for researchers to do different trials on the area of PACU complications to strengthen the findings of this study.

CHAPTER TWO

2. Literature Review

PACU (which stands for Post-Anesthesia Care Unit) is the specialized care unit near the operating theatre where patients are temporarily admitted after any surgical procedures until they recover and wake up from anesthesia.

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). In addition, PACU medical oversight is mostly the responsibility of the anesthesiology service.(5)

The initial handoff from the anesthesia care team and other intraoperative personnel to PACU personnel 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. Moreover, it includes total fluids administered including crystalloids, colloids and blood products and any important intraoperative laboratory values (e.g., hemoglobin or hematocrit, and glucose), and airway management including any difficulties. All untoward intraoperative events are discussed, as well as prophylactic medications administered for postoperative nausea and vomiting (PONV), the plan for postoperative analgesia, and patient disposition after PACU discharge (e.g., to home, a hospital ward, or an ICU bed).(15)

PACU care for ambulatory surgery is typically divided into two phases, Phase I and II care. 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. (16)

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 post anesthesia period. Studies by Cohen et al, have demonstrated that the overall incidence of complications occurring during postanesthesia care unit (PACU) stay may be higher than previously expected (10-18%).(13)(17)

Cooper et al. reviewed PACU complications and how introduction of pulse oximetry affected outcome, They described these incidents as Recovery Room Impact Event and classified those as to whether they were “unanticipated” , “undesirable” , “possibly anesthesia related effect that required intervention” , “pertinent to recovery room care” , and “did or could cause mortality or at least moderate morbidity”. They measured many criteria and found that PACU anesthesia related complications occurred with a frequency of 18%. In another series by Hines et al the frequency was 23.7%, and a study 18 years later Shauna et al, they reported that the PACU complication rate changed little or none, reporting 23.4% rate of complications. A recent study done by Tseganesh et al in 2017 showed the overall complication rates in PACU was 20.8%, with respiratory complications remaining the major issue in the postoperative period, followed by cardiovascular and PONV.(16)(18)(19)

A study done by J.N. Lunn in 1986 in a UK university hospital shows that the PACU complication rate reaches up to 50%. 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 vomiting, oxygen desaturation, excessive pain, confusion/agitation, bradycardia, hypotension, and hypertension. A study done by Hines R, et al. at University of British looked at 37,071 patients from April 2001 to March 2004 and 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 the most common complications. The overall number of patients that had one or more complications in this study was about 23.7%. Moreover, another study which was done by Tseganesh and her colleagues, at BLH, AAU, on 312 patients in 2018, showed respiratory complications (all combined, 35.4%), cardiovascular complications (all combined, 21.1%), PONV (13.8%) were the common complications. In conclusion, most studies have identified the overall incidents of adverse events occurring in the PACU as 5%–30%.(13)(16)(17)(19)(20)

Rates of post-operative complications are difficult to compare between studies, hospitals, and countries due to differing outcome definitions.

The frequency of critical PACU incidents is 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 in order to prevent complications leading to adverse patient outcomes. Most of the incidents were identified by the assigned bedside nurse, probably due to more interaction with the patient as compared to the physician.(21)

Respiratory complications in the post anesthesia period are an important area of concern for anesthetists. In Beard's 1981 study, respiratory complications comprised 44 out of 2,293 (1.9%) cases of general anesthesia. 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 anesthesia.(22)(23)

Respiratory events in order of decreasing frequency, which have been noted in the PACU, include hypoxemia, hypoventilation, airway obstruction, bronchospasm, laryngospasm, aspiration, and pneumothorax. Hypoxemic episodes ($SpO_2 < 90\%$) were recorded in one study at a rate of 55% of PACU, despite many receiving supplemental oxygen, and 95% of those episodes went unrecognized by PACU staff. The etiology of hypoxemia in the PACU is most commonly due to V/Q mismatch and atelectasis and is frequently seen in patients with compromised lung function in the preoperative period (e.g., low preoperative SpO_2). (17)(23)

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 found that hypertension and tachycardia in PACU are an infrequent finding; however it is associated with increased risk of unplanned ICU admission and mortality to anesthetic management.(1)(24)

Acute changes in blood pressure, heart rate and rhythm are not uncommon events among patients in the PACU. Ischemia, pulmonary edema, and cardiac arrest, on the other hand, are rare. Preoperative patient problems (coronary artery disease, hypertension, and congestive failure) as well as surgical factors (thoracic Surgery, vascular surgery, lengthy and emergency procedures) are highly correlated with early postoperative cardiac abnormalities. (24)(25)

Nausea and vomiting are the other most common problem observed in the PACU. 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. (26)

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, non-smoker, and have history of PONV or motion sickness. In their extensive study, Apfel, Christian C et al. have discussed this problem in details and have suggested many techniques to overcome it. However, multiple interventions should be reserved for high-risk patients (i.e., risks greater than 40%).The issue of PONV remains complex and distressing for both patients and staff.(27)(28)(29)

Pain is the other problems patients will experience after major surgery even though the degree to which excessive pain is experienced varies considerably. This makes the prevention and treatment of pain challenging and difficult to study. Postoperative pain in the PACU is currently being assessed by several methods. These include visual analogue pain scores (0-no pain, 10-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).(4)

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 times after PACU discharge. However, one study of patients undergoing abdominal surgery did measure analogue pain scores on arrival in PACU. 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. This study which assessed over 5,000 high-risk patients in the PACU

(elective major surgery following general anesthesia) 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 post-operative pain.(30)(31)

Perioperative care has improved over the last few decades, because of developments in anesthesia practice, mainly in monitoring, equipment, and use of short acting anesthetics with fewer side effects. The availability of anesthesia clinic usually run by senior anesthesiologists with good infrastructure and experience overall have a great impact on outcome too. However, perioperative care guidelines in developing countries is not yet well developed leading to the presence of more complications developing in PACU.(12)(32)

CHAPTER THREE

3. Objectives

3.1. General objectives

1. To determine prevalence of postoperative complications in PACU

3.2. Specific objectives

1. To identify the types of complications among patients admitted to the PACU at the major operation at JUMC.
2. To assess factors that might influence the occurrence of complications the patients develop in the PACU

CHAPTER FOUR

4. METHODS AND MATERIALS

4.1. Study Area and Period

The study will be conducted at PACU of Jimma University Medical Center (JUMC) from April 2020 to August 2020 after the approval from the university. It is one of the oldest public hospitals in the country, which was established in 1930 E.C by Italian invaders for the service of their soldiers. Geographically, it is located in Jimma town, 352 km southwest of Addis Ababa. Currently it is the only teaching and referral hospital in the southwestern part of the country, providing services for approximately 15,000 inpatient, 160,000 outpatient attendants, 11,000 emergency cases and 4500 deliveries in a year coming to the hospital from the catchment population of about 15 million people. Cognizant of the fast-growing service and teaching role of the hospital, the federal government considered construction of a new and level- best hospital with 600 beds.

4.2. Study Design

An institutional based cross-sectional study conducted.

4.3. Source and study population

The source population constituted of all patients who had undergone surgery at the major operation room of Jimma university medical center and the study population included all non-ICU patients who had undergone surgical procedure and admitted to the PACU during the study.

4.4. Eligibility criteria

Inclusion criteria:

All patients who had undergone surgery (elective and emergency) under general anesthesia (GA), Monitored Anesthesia Care (MAC), and Regional Anesthesia (RA) in the major OR of JUMC who was admitted to PACU was included in the study.

Exclusion criteria:

Patients who was transferred directly from the operation theatre (OT) to an intensive care facility, ward or OPD.

4.5. Ethical considerations

Ethical clearance/ permission letter for this study was obtained from Ethics Review Board of the Jimma University research and postgraduate coordinating office of school of medicine, Institute of health before starting data collection. Then after getting the permission letter for collecting data, the study process will immediately start. Specific patient identifiers were not included in the data collection tool and this was assured by using code numbers for each patient. To prevent the transmission of COVID 19, data collectors strictly used appropriate infection prevention and control principles like maintaining his/her social distancing, hand washing or alcohol-based hand rub between each patient's interview, and use appropriate PPE during data collections.

4.6. Sample size determination

The Sample size will be determined by using single population proportion formula

$$n=z^2*pq/d^2$$

Where:

n=required sample size.

z=confidence level, the probability that the value of a parameter falls within a specified range of value, which is at 95 %(standard value of 1.96).

p=estimated prevalence of major complications in the PACU (i.e., 20.8 ≈21% taken from recent literature) (16)

$$q=1-p$$

d=margin of error at 5% (standard value 0.05) - is a small amount that is allowed for in case of miscalculation or change of circumstances. By calculating using this formula, the sample size will be 281 after including 10% probability of missing data.

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% with O₂ or < 90% with room air

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, different in different pediatric age groups

Pain: subjective complaint of the patient

Hypothermia: temperature < 36 degree Celsius

Persistent sedation: The ease of arousability of the patient

Delayed awakening: the failure to regain consciousness 30–60 minutes after general anesthesia

Emergence excitement: non-purposeful movement, restlessness, thrashing, incoherence, inconsolability, and unresponsiveness.

Urinary retention: Bladder volume greater than 600 mL or sensation of full bladder by the patient in conjunction with an inability to void within 30 minutes.

4.9. Data collection, Management and Analysis

Data will be collected using survey data sheet (a standardized data collection form). Two PACU nurses working at the major OR of JUMC was trained and will be assigned as a data collector. The questionnaires was pre- tested using ten percent of the sample size to assess clarity, sequence, consistency, and understandability and the investigator will supervise the data collection process.

All the data generated was arranged, categorized, checked, coded and entered to Excel spreadsheet. Statistical Package for the Social Sciences (SPSS) version 21 software was used for descriptive analysis to describe the proportion of the results. Chi square test was used to determine the presence of association between complications and associated factors of the patient. In addition, the degree to which each associated independent risk factors affecting the outcome or dependent variable was modeled using logistic regression analysis. Finally, the finding was presented using Odds ratio along with their 95% confidence interval.

4.10. Data Quality Assurance

Trained data collectors (two nurses) will collect data. In order to assure data quality, data collectors will be trained about the aim of the study and content of the data abstraction format. Suitability of the data-collecting format will be assessed through discussion with research advisor/s and oncologists. The principal investigator together with the trained data collectors will review and update all patient data for the identification of problems at important period as much as possible. The principal investigator will supervise the work of the data collectors during sample collecting periods from the beginning to end.

4.11. Dissemination of the result

The study result will be presented to Jimma 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 and Jimma University Postgraduate Library.

CHAPTER FIVE

5.1. Socio-demographics and clinical characteristics

The number of patients admitted to the PACU of major operation theatre room were 255 during the study period. The age of the patients ranged from 45 days to 80 (mean age=30.6, SD= \pm 19.5 years). One hundred sixty-eight patients (65.9%) were male. Two hundred fourteen patients are American society of Anesthesiologists (ASA) physical status I, 35 patients are ASA II and the left are ASA III and above. (Table 1)

Table 1. Patient demographics admitted to post anesthesia care unit of major operation room of Jimma university medical center Jimma, Oromia, Ethiopia, June 2020 (N=255)

Variables	Categories	Frequency (N=255)	Percentage (%)	% complications within a group
Gender	Male	168	65.9	47.2
	Female	87	34.1	55.2
Age(years)	\leq 18	69	27.1	40.6
	19-64	169	66.3	50.9
	\geq 65	17	6.7	82.4
ASA status	ASA I	214	83.9	73.4
	ASAI	35	13.7	82.9
	ASA III and above	6	2.4	83.3

Of the total patients, 168 had surgery under general anesthesia GA (65.9%). Of 168 patients, 97 (57.7%) patients developed complications 46 patients (18%) had RA/Axial anesthesia, 30 patients had MAC (11.8%) and 11 patients had undergone surgery under GA/RA combined (4.3%) (Table 2).

One hundred fifty-nine patients (62.4%) were anesthetized by non-physician anesthetists. Of these, 86 patients develop complications, constituting 67.2% of patients developing complications. Ninety-five patients (37.2%) were anesthetized by residents and 0.4% (1) patient was anesthetized by Consultant. (Table 2)

Table 2. Distribution of patients based on the types of anesthesia, types of surgery, anesthesia provider, and types of procedure (N=255)

Variables	Categories	Frequency	Percentage (%)	% of
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		(N=255)		complications within a group
Types of Anesthesia	GA	168	65.9	57.7
	GA/RA combined	46	18	41.3
	Regional/Axial	11	4.3	54.5
	MAC	30	11.8	20
Type of surgery	General surgery	156	61.2	49.6
	Orthopedic surgery	50	19.6	34
	Plastic	29	11.6	65.5
	Gynaecology	20	7.8	75
Anesthesia Provider	Anesthetist (BSc, MSc)	159	62.4	54.1
	Residents	95	37.3	44.2
	Consultant	1	0.4	0
Types of procedure	Elective	140	54.9	55
	Emergency	115	45.1	44.3

Ninety patients among patients who developed complications in PACU stayed under anesthesia for more than two hours. Among patients (n=41) who developed intraoperative complications 73.2 % (n=30) patients developed complications later in PACU. (Table 3)

Table 3: Incidence of complications in correlation with the duration of anesthesia and intraoperative complications (N=255)

Variables	Categories	PACU Complications(N=255)		Total
		YES (%)	NO (%)	
(Duration of Anesthesia)	< 60 minutes	11(4.3)	37(14.5)	48
	60-120 minutes	27(10.6)	35(13.7)	62
	120-180 minutes	45(17.6)	31(12.2)	76
	>180 minutes	45(17.6)	24(9.4)	69

Intra-operation complication	Yes	30(73.2)	11(26.8)	41
	No	98(45.8)	116(54.2)	214

Among one hundred fifty-nine patients (62.4%) who were anesthetized by nurse anesthetists, 54.1% (n=86) developed complications. From patients (n=95) anesthetized by residents, 44.2% (n=42) patients developed complications. (Table 4)

Table 4. The incidence of major complications in correlation to anesthesia provider

Variables		Number of patients (% of n=255)	% of complications within each groups
Anesthesia Providers	Anesthetist (BSc, MSc)	159(62.4)	54.1
	Residents	95(37.3)	44.2
	Consultant	1(0.4)	0

5.2. Types of complications

The overall magnitude of PACU complication among patients admitted to Jimma university medical center was 128 (50.2%, 95% CI 43.1-56.1).

The type of complications is characteristically of cardiovascular in the first place is 20% (n=51). The most common cardiovascular complications were tachycardia, hypotension, and hypertension. Shock and bradycardia are less common problems. PONV comes second. Respiratory complications come third, mainly attributed to hypoxia. Thermoregulatory disturbance, i.e., hypothermia came fourth. Pain came fifth in order. There are also CNS incidents like persistent sedation, emergency excitement, and delayed awakening. The other complications were urinary retention and fall from bed. (Figure 1)

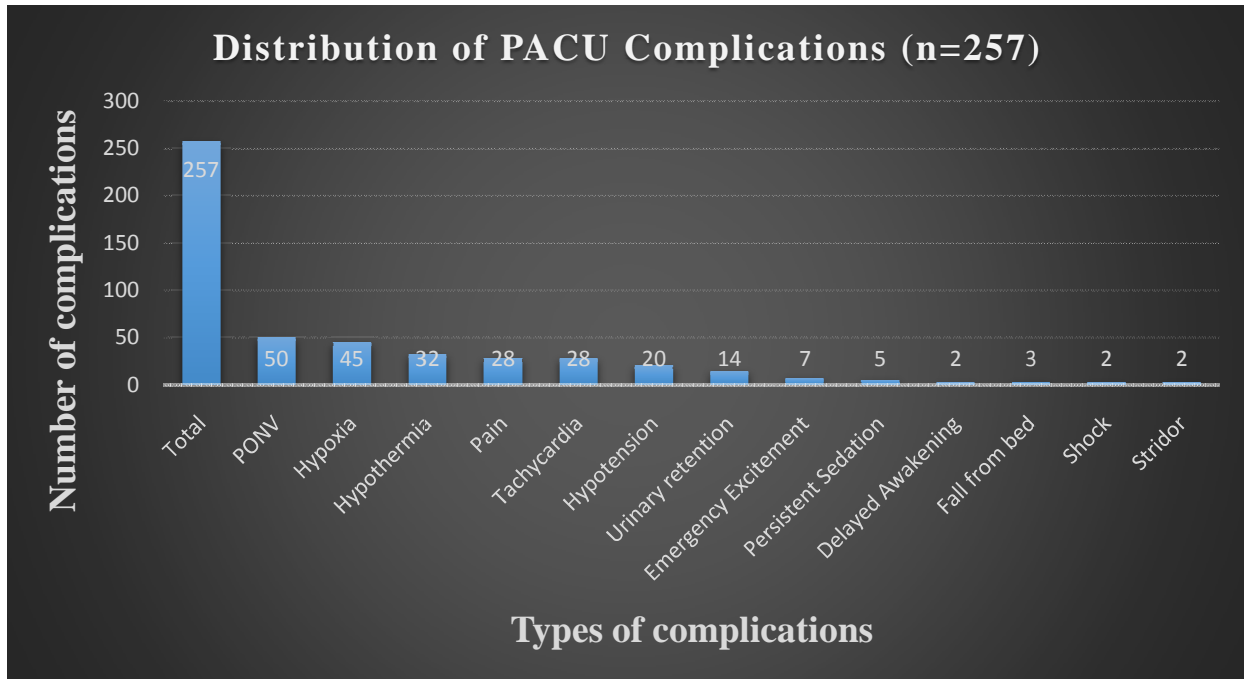


Figure 1: Distribution of PACU complication among patients admitted to Jimma university medical center 2020.

Note: One patient could have more than one complication, which makes the percentage above 100%.

Three patients required unplanned admission to the intensive care unit, all of them had undergone surgery under GA. The first patient, 40 years developed persistent hypoxia and hypotension, who had undergone emergency general surgery for acute abdomen secondary generalized peritonitis due to perforated PUD transferred after six hours and forty-five minutes of stay in PACU. The second patient is two years old child for whom emergency surgery was done for intussusception under general anesthesia, finally developed persistent desaturation, hypothermia and delayed awakening. This child had upper respiratory infection at the time presentation to emergency OR. The third patient is 70 years old who has underlying hypertension on hydrochlorothiazide for whom prostatectomy was done under spinal anesthesia and developed hypotension and persistent desaturation. Two of the patients were of the ASA classes I E and one is II elective, and duration of surgery range between 105 minutes to 180 minutes.

5.3. Factors associated with PACU complication among patients admitted in JUMC, Jimma, South West Ethiopia June 2020.

Candidate variables included in multivariate logistic regression model were age, ASA physical status, types of procedure (elective or emergency), duration of anesthesia, intraoperative complications, types of surgery, and types of anesthesia.

Accordingly, ASA physical status, types of surgery, and duration of anesthesia showed statistically significant association with PACU complications at P-value < 0.05, and 95% CI AOR.

The odds of having PACU complication was fivefold higher among patients who have ASA physical status II compared to patients with ASA PS I (AOR 4.99, 95%CI 1.89, 13.16).

The odds of having PACU complication was nearly threefold higher among patients who stayed under anesthesia from 60 to 120 minutes compared to those who stayed less than 60 minutes (AOR 2.84, 95%CI 1.17). Similarly, the odds of having PACU complication was 5.32 times higher and 6.03 times higher among patients who stayed under anesthesia from 120 to 180 minutes and above 180 minutes compared to those who stayed less than 60 minutes, respectively (AOR 5.32, 95%CI 2.22,12.71).(AOR 6.03, 95%CI 2.46, 14.78).

The odds of having PACU complication was less than 76% for orthopedic surgery as compared to those undergoing gynecological procedures. (AOR 0.24, 95%CI 0.07, 0.79).

The types of procedures, be emergency or elective has no significant association with PACU complications (OR=1.14, 95%CI (0.6, 2.17)

Those patients who developed complications in PACU will stay longer as compared to those not developing complications.

Table 5: Bivariate logistic regression model to identify factors associated with PACU among patients admitted to Jimma Medical Center South West Ethiopia June 2020.

Variables	Categories	Complication status of PACU		COR 95% CI
		Yes (%)	No (%)	
Age	≤18	28(40.6)	41(59.4)	0.15(0.04,0.56)*
	19-64	86(50.9)	83(49.1)	0.22(0.06,0.80)*
	≥65	14(82.4)	3(17.6)	1
ASA categories	ASA I	94(43.9)	120(56.1)	1
	ASAI	29(82.9)	6(17.1)	6.17(2.46, 15.48)*
	ASAI & above	1(16.7)	5(83.3)	6.38 (0.73,55.57)*
Types of procedures	Elective	77(55)	63(45)	1
	Emergency	51(44.3)	64(55.7)	1.5(0.93,2.52)*
Type of surgery	General	77(49.4)	79(50.6)	0.33(0.11,0.94)*
	Plastic	19(65.5)	10(34.5)	0.63(0.18,2.25)
	Orthopedic	17(34.0)	33(66.0)	0.17(0.05,0.55)*
	Oby/Gyne	15(75.0)	5(25.0)	1
Types of Anesthesia	General	97(57.7)	71(42.3)	5.47(2.12,14.07)*
	Regional	19(41.3)	27(58.7)	2.82(0.97,8.21)*
	GA/RA combined	6(54.5)	5(45.5)	4.80(1.09,21.22)*
	MAC	6(20.0)	24(80.0)	1
Intraoperative complications	Yes	30(73.2)	11(26.8)	0.31(0.15,0.65)*
	No	98(45.8)	116(54.2)	1
Duration of Anesthesia(minutes)	<60	11(22.9)	37(77.1)	1
	60-120	27(43.5)	35(56.5)	2.60(1.12,6.01)*
	120-180	45(59.2)	31(40.8)	4.88(2.16,11.02)*
	>180	45(65.2)	24(34.8)	6.31(2.73,14.55)*

*--indicates candidate variables in binary logistic regression @p≤ 0.25

Table 6. Multivariate Logistic Regression model to identify factors associated with PACU among patients admitted to Jimma Medical Center South West Ethiopia June 2020.

Variables	Categories	Complication status of PACU		COR 95% CI	AOR 95% CI
		Yes (%)	No (%)		
Age	≤18	28(40.6)	41(59.4)	0.15(0.04,0.56)*	0.28(0.06,1.37))
	19-64	86(50.9)	83(49.1)	0.22(0.06,0.80)*	0.23(0.05,1.04)
	≥65	14(82.4)	3(17.6)	1	1
ASA categories	ASA I	94(43.9)	120(56.1)	1	1
	ASAI	29(82.9)	6(17.1)	6.17(2.46, 15.48)*	4.99(1.89,13.16)**
	ASAI & above	1(16.7)	5(83.3)	6.38 (0.73,55.57)*	7.21(0.72,72.24)

Types of procedures	Elective	77(55)	63(45.0)	1	1
	Emergency	51(44.3)	64(55.7)	0.65(0.40,1.07)*	1.14(0.60,2.17)
Type of surgery	General	77(49.4)	79(50.6)	0.33(0.11,0.94)*	0.48(0.16,1.45)
	Plastic	19(65.5)	10(34.5)	0.63(0.18,2.25)	0.74(0.20,2.84)
	Orthopedic	17(34.0)	33(66.0)	0.17(0.05,0.55)*	0.24(0.07,0.79)**
	OBY/GYNE	15(75.0)	5(25.0)	1	1
Intraoperative complications	Yes	30(73.2)	11(26.8)	0.31(0.15,0.65)*	0.45(0.20,1.02)
	No	98(45.8)	116(54.2)	1	1
Types of Anesthesia	General	97(57.7)	71(42.3)	5.47(2.12,14.07)*	2.94(0.90,9.47)
	Regional	19(41.3)	27(58.7)	2.82(0.97,8.21)*	1.28(0.34,4.83)
	GA/RA combined	6(54.5)	5(45.5)	4.80(1.09,21.22)*	2.58(0.46,14.42)
	MAC	6(20.0)	24(80.0)	1	1
Duration of Anesthesia(minutes)	<60	11(22.9)	37(77.1)	1	1
	60-120	27(43.5)	35(56.5)	2.60(1.12,6.01)*	2.84(1.17,6.94)**
	120-180	45(59.2)	31(40.8)	4.88(2.16,11.02)*	5.32(2.22,12.71)**
	>180	45(65.2)	24(34.8)	6.31(2.73,14.55)*	6.03(2.46,14.78)**

*--indicates candidate variables in binary logistic regression @ $p \leq 0.25$

**-- indicates statistically significant variables in multivariable logistic regression @ $p < 0.05$

CHAPTER SIX

6.1 Discussion

This study revealed that one hundred twenty-eight (128) (50.2%) patients developed complications among 255 patients in major OR PACU of Jimma University medical center in a month and three weeks period, which is in line with the study done by J.N. Lunn in 1986 in UK university hospital (50%). In another study done by Rose et al at St. Michael's hospital, Toronto, on 43,914 patients from 1991-1994, 33% patients had some kind of problem in the PACU. However, the incidence is higher when compared to the study done in Tikur Anbessa Specialized Hospital, which might be explained by small sample size of the study and poor set up. The incidence of PACU complications in this study also showed higher as compared to different study done in other countries, which might also be explained due to different setup of the PACU and small size of this data (4.25% Qatar, 2012, 23.7% in US 1992, 22.3% in Germany, 1999).

The major complications identified among 257 complications identified in PACU were cardiovascular problems (27.6%), followed by postoperative nausea and vomiting (19.5%), hypoxia or desaturation (17.5%), hypothermia (12.5%) and pain (10.9%). In a prospective study done in US by Hines et al in 1992 in 18,473 patients admitted to the PACU, the complication rate was found to be as high as 24%. Nausea and vomiting (9.8%), the need for upper airway support (6.8%), and hypotension (2.7%) were the most common. ASA classification (II) ($P=0.001$), types of surgery (orthopedic procedures) ($P=0.02$), duration of anesthesia ($P=0.02$) were variables found to affect PACU complications in this study, which had similar finding in a study done by Hines et al. In this study though orthopedic procedures had significant association, it showed protective as compared to other procedures. This might be due to most orthopedic procedures were done under peripheral nerve block during the study period, which had less complications as compared to others. However, unlike the finding in the Hines et al study, the requirement for an emergency operative procedure (vs an elective procedure) ($P=0.7$), age ($P=0.15$), or anesthetic technique ($P=0.07$) or anesthesia provider ($P=0.07$) did not show significant association with PACU complications in this study. Kluger and Bullock, who extracted 419 incidents from the Australian Incident Monitoring Study in 2002, also noted that the majority of their critical incidents were cardiorespiratory related (12). The most frequently encountered problems in their study were associated with respiratory/airway issues (43%),

cardiovascular problems (24%) and drug errors (11%). Faraj, Jafar H. et al in Qatar in 2012 found respiratory system problems (41.66%), cardiovascular system complications (27.06%), and PONV (14.5%) were the most common complications.(33) Similarly, in a study done by Tseganesh et al in Tikur Anbessa Specialized Hospital, 2017, showed that cardiorespiratory incidents (56.5%) comprised the majority of incidents reported, with hypoxia (32.3%) and hypotension (13.8%) being the most common(16), in which preexisting comorbidities and duration of anesthesia/surgery were the factors found having significant associations. In another study done by Bruins et.al in Singapore, 2017, the most critical incidents observed were cardiovascular related (41.8%), followed by respiratory (22.1%), and neurological (7.4%). Pain (10.9%) is the other complications found in this study. In a prospective study of 10,008 ambulatory surgical patients done by Chung et al, found that orthopedic procedures were the most significant surgical factors, which is in line with the finding in this study. Postoperative urinary retention (11%) was also one of the PACU complications found in this study. Keita et al found an incidence of 16% of postoperative urinary retention in the PACU in a study done on 313 adult patients admitted to PACU, which is almost in line with the result found in this study.

Most critical incidents occurred in ASA physical status I and II patients (98.4%) which is in line with the study done by in Tikur Anbessa Specialized Hospital, 2017, and in Singapore, 2017 (70.7%, 55.8%, respectively).(16)(34) 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. The large number of critical incidents involving such patients in this study might be partly because the large volume of our surgical patients was of ASA physical status I or II. The other might be poor ASA physical assessment and classification of the patients despite they have higher ASA class. Furthermore, 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 patients who developed critical incidents were elective patients and who underwent general surgery, which showed similar findings in another study. (12)(19). Patients undergoing orthopedic surgery had less risk of complications unlike other studies found by Hines et al. This is probably due to most orthopedic surgeries were done by peripheral regional block in our set up, which have fewer complications as compared to other types of anesthesia.

In this study, three patients (1.1%) of all patients over the study period) required an unanticipated ICU admission. In a retrospective study done by Bruins et al found that, 0.4% of patients admitted to PACU required a transfer to a higher level of care (ICU or HD)(34). Kluger and Bullock noted that 29% of all critical incidents that they reviewed resulted in unplanned admissions of patients to the HD or ICU(12). Another study involving 18,437 consecutive patients recorded 186 (1%) unexpected ICU admissions.(19)

Three of patients (1.1%) admitted to ICU required reintubation for ventilation support. Bruins et al found 6.9% of patients required reintubation. In another study done by Kluger and Bullock reported about 17% of patients with a critical incident in the PACU required assistance with ventilation. Rose et al found that only 0.1% (n = 22) of patients among 21,457 consecutive general anaesthesia patients in the PACU required emergency reintubation. Similarly, Hines et al reported that 21 of 1,275 patients receiving upper airway support required reintubation.

6.2. Limitation of the study

This study lacks powering of risk assessment for each major events since it only assessed the overall prevalence of the PACU complications and the general risk factors. This led to failure to find an association that may actually exist.

An emergency procedure might have complications from the outset which might affect the outcome of this study.

Lacks of adequate bed in PACU led to fail to follow patients, which might have complications and affect the prevalence of this study.

The sample size may be considered small and being a single center study may not allow generalization to other centers within the country or other countries.

6.3. Conclusions:

Cardiovascular complications were the most common adverse events in this study followed by PONV and respiratory complications.

Despite the limitations, our study data highlights the role of a PACU center in reducing patient morbidity and mortality in the immediate postoperative period.

Complications in the PACU can affect healthcare utilization by prolonging patients' length of stay in the PACU and resulting in the need for higher levels of postoperative care than anticipated.

6.4. Recommendations

The incidence of PACU complication is large in JUMC, so it may need to use the Standard ASA guideline in the PACU to detect and intervene those complications early.

Large clinical trials might be needed to assess risk factors for each complications.

Staffing and infrastructure of the recovery room needs to be supported, with ongoing education and quality assurance programs developed to ensure that such events can be reduced in the future.

Since the sample size is small, doing further clinical trials with large sample size might change the outcome.

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ANNEXES

Annex I: Consent Form

JIMMA UNIVERSITY MEDICAL CENTER

School of Medicine

Department of Anesthesiology and Critical Care Medicine

Assessment of Incidence and Associated Risk Factors of Postoperative Complications in PACU of Jimma University Medical Center, Jimma, Ethiopia

Greeting! Hello, My name is _____ . I am here today to collect data to assess the incidence and associated risk factors of postoperative complications in PACU of JMC, Jimma, Ethiopia. Dr. Tekalegn Lemessa from Jimma University, School of medicine, department of Anesthesiology and Critical Care Medicine, post-graduate program, is conducting the study. The objective of this study will be

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

This is a prospective interventional study so I request all postoperative patients admitted to PACU take part in this study. Your cooperation and willingness is greatly helpful in assessing the incidence and associated risk factors of postoperative complications in PACU of JMC. The study will be conducted through recording medical findings during their stay at PACU. Interventions will be given to correct any complications as fast as possible.

The patient's name will not be written in this form and will never be used in connection with any information we take from the chart. There is no possible risk associated with participating in this study. All information taken will be kept strictly confidential. The patient's participation is voluntary and the patient is not obligated to participate in the study. If you feel discomfort with the study, it is your right to drop yourself from the study. If you have any questions regarding

this study, or would like to be informed of the results after its completion, please feel free to contact the principal investigator.

Address of the principal investigator:

Dr. Tekalegn Lemessa

Cell phone: +251-913-864-137

E-mail: takelemessa123@yahoo.com

Are you willing to participate in this study?

1. Yes -..... Continue
2. No -..... Skip to the next participant

የአስታማሚዎች የፈቃደኝነት መጠይቅ ፎርም

ጅምቶ ኒሽርሲቲ

ጤና ሳይንስ ሌጅ

የህክምና ትምህርት ክፍል

የጅምቶ ኒሽርሲቲ ህክምና ማእከል ውስጥ በማገገሚያ ክፍል ውስጥ መታከም ላይ በሚገኙ ታማሚዎች ላይ የምደርሱ የተለያዩ ጥያቄዎችን ለመለየትና ለጥያቄዎች ላይ ጥያቄዎችን ለመለየትና ውጤታቸውን ለማወቅ የምደረግ ጥናት ነው።

ሰላምታ!

ጤና ይስጥልኝ እኔ

እባላለሁ። አሁን የመጣሁ በትዋናዓላማ በማገገሚያ ክፍል ውስጥ መታከም ላይ በሚገኙ ታማሚዎች ላይ የምደርሱ የተለያዩ ጥያቄዎችን ለመለየትና ለጥያቄዎች ላይ ጥያቄዎችን ለመለየትና ውጤታቸውን ለማወቅ የምደረግ ጥናት ነው።

ጥናቱ የሚካሄደው በዶ/ር ተካል ሻለሜ ሳሲ ሆን በአሁኑ ወቅት የጅምቶ ኒሽርሲቲ፣ በአነስተኛ ስራ ላይ ስለሚገኙ ህመም ማንኛውንም ጨረሻ አመት የድህረ ምረቃ ትምህርት ተማሪ ነው።

የጥናቱ ዓላማም፡ በማገገሚያ ክፍል ውስጥ መታከም ላይ በሚገኙ ታማሚዎች ላይ የምደርሱ የተለያዩ ጥያቄዎችን ለመለየትና ለጥያቄዎች ላይ ጥያቄዎችን ለመለየትና ውጤታቸውን ለማወቅ የምደረግ ጥናት ነው።

ስለዚህ የእርስዎ በጥናቱ እንዲሳተፉ በአክብሮት እጠይቅዎታለሁ። የእርስዎ ትኩረትና ፈቃደኝነት ከካርድ ጋር ላይ እናክእርሳለን።

ድለጥናቱ የሚሰፈሩት መረጃዎችና ለተነሱት ጥያቄዎች የሚሰጡ ቸው መልሶች ሙሉ በሙሉ በምስጢር የሚጠበቁ ሲሆን የእርሰው ስም በማንኛውም መልኩ በጥናቱ ስጥ አይገለጽም፤ እንዲሁም የሚሰጡት ምላሽ ከርስዎ ማንነት ጋር በማንኛውም መልኩ አይያያዝም፡፡ የልጅዎ ፍቃድ ኋላ ብቻ ሳይሆን ሌሎችም ሊሰጡት ይገባል፡፡

በዚህ ጥናት ውስጥ የእርሰው መሳተፍ ምሆን አለመሳተፍ መወሰን ያለበት ስጦታ ለውስጥ በሚያገኙት አገልግሎት ላይ ምንም ዓይነት ተጽእኖ የማይኖረው ሲሆን ተሳትፎውን በማንኛውም ስለት ማቋረጥ ወይም ጥያቄዎችን አለመመለስ ይችላሉ፡፡

ስለ ጥናቱ የበለጠ መረጃ ለማግኘት የአጥኙ አድራሻ፡

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ኢሜል- takelemessa123@yahoo.com

በጥናቱ ለመሳተፍ ፈቃድ ናኝ?

አዎ አይደለም
ፈቃድ ለመስጠት ለራስዎ ስም ለማስገባት ለማንኛውም ሰነድ ማስገባት
ፈቃድ ካልሆኑ ወደ ሚቀጥለው ተገልጋይ ይሸጋገሩ

UNKA WALIIGALTEE

Hospitaala Yuuniversity Jimmaa

Muummee Fayyaa

Damee Fayyaa Aneesteezhiyaa irraa

Nagaa: Animaqaankoo _____ jedhama.
Har' akanandhuf e fodeeffanno oqoranno obal' inarakkoo leekuta adandamanna abaqasani iyaaluho
spitaala Yuuniversity Jimma keessatti uumamani fi
sababarakkoo leekanaaf qorannoogaggeessuufi. Qorannoon kun
kangeggeeffamuu Dr. Takkaalliny Lammeessa ayuuniveersitii Jimmaa, muummeefayyaa Aneesteezh
iyaa irraati.

Kaayyoon qorannookanaa:-

Bal' inarakkoo leekuta adandamanna abaqasani iyaalu qorachuu

Sababoota rakkoo leekanaaf sababata 'an hubachuuta' a.

Qorannoo kana keessattihirmachuunfedhiikeessanirrattikanhundaa'ee fi keessattihirmaachuunkeessanirrattidhiibbaatokkoilleakkahinqabaanneisinbeeksisa.

Odeeffannoonqorannookanarraaargamuicitiinkaneegamuufiqaamaillaallatuqofaafkanibsamuta'a.

Qorannoo kana irrattigaaffiiyooqabaatanyookiinyaadayooqabaattankaraaarmaangadiittifayyadamuunqorataa kana qunnamuunidanda'ama.

Maqaaqorataa: Dr. takkaallinyLammeessaa

Lakk.Bilbilaa: 09-13-86-41-37

E-Meelii: takelemessa123@yahoo.com

Qorannoo kana irrattihirmaachuunifeetuu?

1.Eeyyee_____ Mallattoo_____

2.Miti_____ Gara kanbiroottidarbi

Survey and Management of Complications Detected in PACU

1	Sex	Male	Female
2	Age	_____	
3	ASA Physical status	1	2 3 4 5 E if ≥ 2 , go to Number 7.
4	Types of Surgery	General (Adult/Pediatric) OBY/GYN	Plastic Orthopedic
5	Position of surgery	Supine Lithotomy	Prone Lateral
6	Types of Anesthesia	GA Regional (Spinal, Peripheral Nerve Block, Epidural) GA/RA combined MAC (Moderate/Deep/GA)	
7	Preexisting Comorbidities	Respiratory (B. Asthma, COPD, URTI) CVS (HTN, CHF, IHD) Neurological (Epilepsy, Stroke) Renal/Endocrine (CRF, DM)	

		GIT (e.g. CLD) Trauma Others (pregnancy, Obesity, malignancy, etc.) None
8	Intraoperative Complications	Yes / No If Yes, specify:
9.	Duration of Anesthesia	_____Hrs. _____ min
10.	Duration of Surgery	_____Hrs _____ min
11	Attending Anesthesia Provider	Anesthetist (BSc, MSc) Residents (I, II, III) Senior
12	Remarks	

Survey and Management of Complications Detected in PACU

13	Cardiovascular	Yes	No	If Yes, Interventions	Remarks
	Hypertension (20% change of preop. value)				
	Hypotension (20% change of preop. value)				
	Shock (type) (SBP<90mmHg)				
	Tachycardia (heart rate>/=100 beats/min)				
	Bradycardia (heart rate </=50 beats/min)				
	Cardio-respiratory arrest				
	Arrhythmia requiring treatment (e.g. AF)				
14	Respiratory and Airway				
	Hypoxia (SaO2 <92% on Oxygen, or SaO2 < 90% on room air)			O2 (using intranasal or facemask) Airway Maneuvers	
	Apnea Hypoventilation			BVM ETT	
	Upper Airway Obstruction			Medication e.g. Ventolin, Naloxone	
	Stridor				
	Wheezing				
15	CNS				

	Confusion				
	Seizure				
	Delirium				
	Persistent sedation				
16	GIT				
	Nausea/Vomiting				
17	GUS				
	Urinary retention				
	Low urine output (<0.5ml/kg/hr.)				
18	Thermal Incidents				
19	Hypothermia/Shivering				
	Hyperthermia				
20	Others				
	Drug reactions (skin rashes, anaphylaxis)				
	Pain (wound, chest, shoulder)				
	Emergence Excitement				
	Delayed Awakening				
	Fall from couch or bed				
21	Duration of stay in PACU			_____ Hrs. _____Min	
22	Transfer to			Ward Home	ICU

Annex II: 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: Jimma University Medical Center, School Medicine, Department of Anesthesiology and Critical Care Medicine

Date of Submission: _____

This thesis work will be submitted for examination with my approval as university advisor.

