



MAGNITUDE AND ASSOCIATED FACTORS OF IMMEDIATE POSTOPERATIVE HYPOXEMIA AMONG ELECTIVE SURGICAL PROCEDURES AT TIKUR ANBESSA SPECIALIZED HOSPITAL, ADDIS ABABA, ETHIOPIA, JANUARY 30, 2017 to MARCH 31, 2017 G.

BY:

GETAHUN DENDIR

RESEARCH PAPER PREPARED FOR THE PARTIAL FULFILLMENT OF THE REQUIREMENTS IN MSC DEGREE IN CLINICAL ANESTHESIA.

JUNE, 2017

ADDIS ABABA, ETHIOPIA

ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCE

SCHOOL OF MEDICINE, DEPARTMENT OF ANESTHESIA

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SPECIALIZED HOSPITAL, ADDIS ABABA, ETHIOPIA**

INVESTIGATOR: GETAHUN DENDIR (MSC. STUDENT)

ADVISOR: MERON ABRAR (MSC. LECTURER)

JUNE, 2017

ADDISABABA, ETHIOPIA

ABSTRACT

Background: definition Hypoxemia is insufficient amount of oxygen in the blood. There are different contributing risk factors for occurrence of post-operative hypoxemia which may lead to myocardial ischemia, organ dysfunction, wound infection, hospital stay and increase cost for the hospital and patient.

Objectives: To assess the magnitude and associated factors of immediate post-operative hypoxemia in elective surgical procedures at Tikur Anbessa specialized Hospital from JANUARY 30,2017 to MARCH 31, 2017 G.C.

Methods: Institutional based Observational study design was conducted. Using Systemic random sampling technique and structured questioners data was collected from sampled elective surgical patients' age $\geq$ 18 that came during the 2 months period. Data was entered into Epi info version 7 computer software by investigators and transported to SPSS version 20 computer program for analysis. Frequency and cross tabulation was conducted to describe relevant variables in relation to the outcome variables. Variables that demonstrated a significant relationship on biviarite analysis (p-value <0.2) were included Multivariate regression analysis was applied to evaluate independent variable relationships with a dependent variable that was continuous. A p-value <0.05 was considered to represent a statistically significant relationship

Results: Among sampled 238 elective surgical patients magnitude of hypoxemia was 54(22.7%).Frequency of hypoxemia was high in first 10 minute after admission to post anesthesia care unit.. The independent predictors of hypoxemia were who had Respiratory co morbidity [(AOR=8.8; CI 2.264, 34.117)] (p =0.002) and cardiothoracic surgery [AOR=4.904; CI1.385, 17.368] (p =0.014).

Conclusion and Recommendation: Magnitude of hypoxemia was high and so specials consideration should given co morbid diseases patients by pre operative optimization of patient that have other factors additional to the surgical procedure.

ACKNOWLEDGMENT

First of all, I would like to thank the Almighty God, for everything. Next, I would like to express my heart-full gratitude and thanks to my advisor Meron Abrar for her continuous suggestions, comments and valuable advice to develop this research.

There are no words to express my feeling towards my family and friends enlightened my way throughout the period of conducting my research.

I would like to thank, Tikur Anbessa specialized hospital Nurses and Anesthetist support during data collection period

Then, I would like to express my great gratefulness towards those authors and researchers of articles, and on-line information for the valuable works I have read and cited in my paper.

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LISTS OF ACRONYMS and ABBREVIATIONS

ASA: American Society of Anesthesiologists

BMI: Body mass index

FMOH: Federal Ministry of Health

HCT: Hematocrite

Hgb: Hemoglobin

ICU: Intensive Care Unit

LOS: Length-Of-Stay

PACU: Post anesthesia care unit

Spo2: Arterial oxygen saturation

TASH: Tikur Anbessa specialized hospital

WHO: World health organization

CHAPTER ONE

1.1 Introduction

Hypoxemia refers to insufficient oxygen in the blood. Any cause that influences the rate, volume of air entering the lungs (ventilation) or any cause that influences the transfer of air from the lungs to the blood may cause hypoxemia. As well as these respiratory causes, cardiovascular causes such as shunts may also result in hypoxemia. The most common causes of hypoxemia are ventilation-perfusion mismatch, hypoventilation, and shunts(1, 2)

Pulse-oximetry commonly used in hospitals and by critical-care professionals to define blood oxygen levels and diagnose hypoxemia. On an average, the normal oxygen levels in our blood stream between 80 and 100 mm Hg). In people suffering from hypoxemia, this falls down to as low as 60 mmHg. Normal pulse_oximeter readings can range from 95 to 100 percent (2-4)

During anesthesia and recovery from anesthesia the oxygen saturation should always be 95 - 100%. If the oxygen saturation is 94% or lower, the patient is hypoxic and needs to be treated quickly. A saturation of less than 90% is a clinical emergency in postoperative patients; the acceptable lower limit for P_{aO_2} varies with individual patient characteristics. A P_{aO_2} below 65 to 70 mm Hg causes significant hemoglobin desaturation, although tissue oxygen delivery might be maintained at lower levels. Maintaining P_{aO_2} between 80 and 100 mm Hg (saturation 93 to 97%) ensures adequate oxygen availability (3, 5)

They are different contributing risk factors occurrence of post-operative hypoxemia includes, anesthesia drug, shock, prolonged surgery, preexisting cardiovascular and respiratory disease, positioning, acute trauma, ASA level, age and obesity which may lead to myocardial ischemia, organ dysfunction, wound infection, hospital stay and increase cost for the hospital and patient. Factors cause hypoxemia (6, 7).

Management of post-operative hypoxemia depend on causes of hypoxemia among this positioning, endotracheal intubation, administration of drug like naloxone, giving oxygen by mask and maintaining adequate perfusion ((1, 3-5).

1.2 Statement of the problem

Postoperative hypoxemia is caused by inadequate ventilation control or by airway patency as a consequence of residual effects of anesthetics and/or neuromuscular blockers and inadequate ventilation/perfusion ratio caused mainly by atelectasis zones in lung-dependent regions)((8-10).

Hypoxemia has been recognized as a risk to patients in the operating room and post anesthesia care unit. It has been suggested that a hypoxemic episode may contribute to myocardial ischemia, infarction, wound infection, mental confusion, heterotrophic ossification and idiopathic arthrofibrosis following the surgical procedure .Myocardial ischemia is more likely to occur if an episode of hypoxemia is prolonged (>5 min) and severe [perioperative peripheral oxygen saturation (SpO₂) <81(11-16).

There is growing evidence, suggesting postoperative hypoxemia may play a role in organ dysfunction leading to morbidity and mortality. Economic pressures to move patients earlier from expensive postanesthesia recovery and intensive care areas to the general care floor (8, 16)

There is large variation in the incidence of critical respiratory events in the PACU, with several prospective observational studies reporting an incidence of between (22-30%)(7, 10, 17-20). Randomized evaluation of subgroup of patients showed that PACU mild hypoxemia (SpO₂ 86-90%) was recorded in 53% and 55% of the patients, respectively. Severe hypoxemia with SpO₂ values < 81% was recorded in 20% and 13% of the patients, respectively (21).

Multiple factors, including surgical, anesthetic and patient variables, contribute to the etiology of postoperative respiratory complications. Surgical risk factors include emergency surgery, long duration of surgery and type of surgery. Anesthetic causes include the use of opioid, neuromuscular blocking drugs and general anesthesia. Patient risk factors include chronic obstructive pulmonary disease (COPD), diabetes, obesity and no modifiable risk factors such as advanced age and male sex (17-20, 22).

Even though no published literature found in Ethiopia studying magnitude, associated factors of postoperative hypoxemia this research may have impact to solve this gape and uses in order to avoid adverse outcomes of postoperative hypoxemia

1.3 Significant of study

Postoperative hypoxemia is one of the most postoperative complications. This study aims to answer which presumptive cause (Anesthesia, patient, Surgical) factors may predispose to post-operative hypoxemia. The study also attempts to answer which type of general anesthesia drugs predisposes to more post-operative hypoxemia. It can reduce mortality and morbidity due to post-operative hypoxemia. In addition, it can reduce economic pressure of hospital and patient by reducing hospital stay .There is no any study conducted on this topic in our country so that it can be used as a base line data for further researchers.

CHAPTER TWO

2.1 Literature review

Study in Brazil showed that the incidence of hypoxemia was (24.01%). Hypoxemia predictors were more than 55 years old, preanesthetic SpO₂ lower than 95%, general anesthesia with enflurane and clinically detectable hypoventilation. Systolic blood pressure and heart rate were significantly higher in hypoxemic patients (10).

Study in Brigham and Women's Hospital, Boston stated that; the prevalence of hypoxemia preoperatively, 5 minutes after arrival in recovery, 30 minutes later, and at discharge was 2%, 4%, 6%, and 9%, respectively. Patient factors associated with a significantly higher prevalence of hypoxemia were obesity, body cavity surgical procedures, age over 40 years, American Society of Anesthesiologists physical status, duration of anesthesia longer than 90 minutes, and intraoperative administration of greater than 1,500 ml of fluid (23).

Study in china Qingdao Municipal Hospital showed that, the incidence of postoperative hypoxemia after surgery for acute aortic dissection was 28.6%. Perioperative death occurred in (6.8%) patients. Factors associated with post operative hypoxemia were body mass, deep hypothermic circulatory arrest, preoperative PaO₂/FiO₂ ≤300 mm Hg and blood transfusion >6U in 24 hours postoperatively as independent predictors of postoperative hypoxemia for patients undergoing Stanford A aortic dissection surgery (24).

Study done in Copenhagen revealed that high incidence of mild (55%) and severe (13%) hypoxemic episodes in 200 patient. among these hypoxemic episodes, 55% occurred despite oxygen supplementation. Duration of anesthesia, anesthetic technique, age, smoking, airway obstruction, obesity and hemodynamic instability identified as risk factors (25).

Research done in herlev hospital Denmark showed a randomized evaluation of subgroup of 736 patients in the OR and PACU mild hypoxemia (SpO₂ 86-90%) was recorded in 53% and 55% of the patients, respectively. Severe hypoxemia with SpO₂ values < 81% was recorded in 20% and 13% of the patients, respectively (21).

According to study conducted in Canada show that PACU critical respiratory event (CRE), general anesthesia the risk of a CRE was 1.3% (hypoxemia 0.9%, hypoventilation 0.2%, airway obstruction 0.2%). Preoperative factors that increase risk were age > 60 yr, male gender, diabetes, and obesity. Patients who underwent operative procedures on an emergency basis and whose operation was longer than 4 h were also at increased risk, but those undergoing perineal procedures were at lower risk. Anesthetic risk factors included opioid premedication(17).

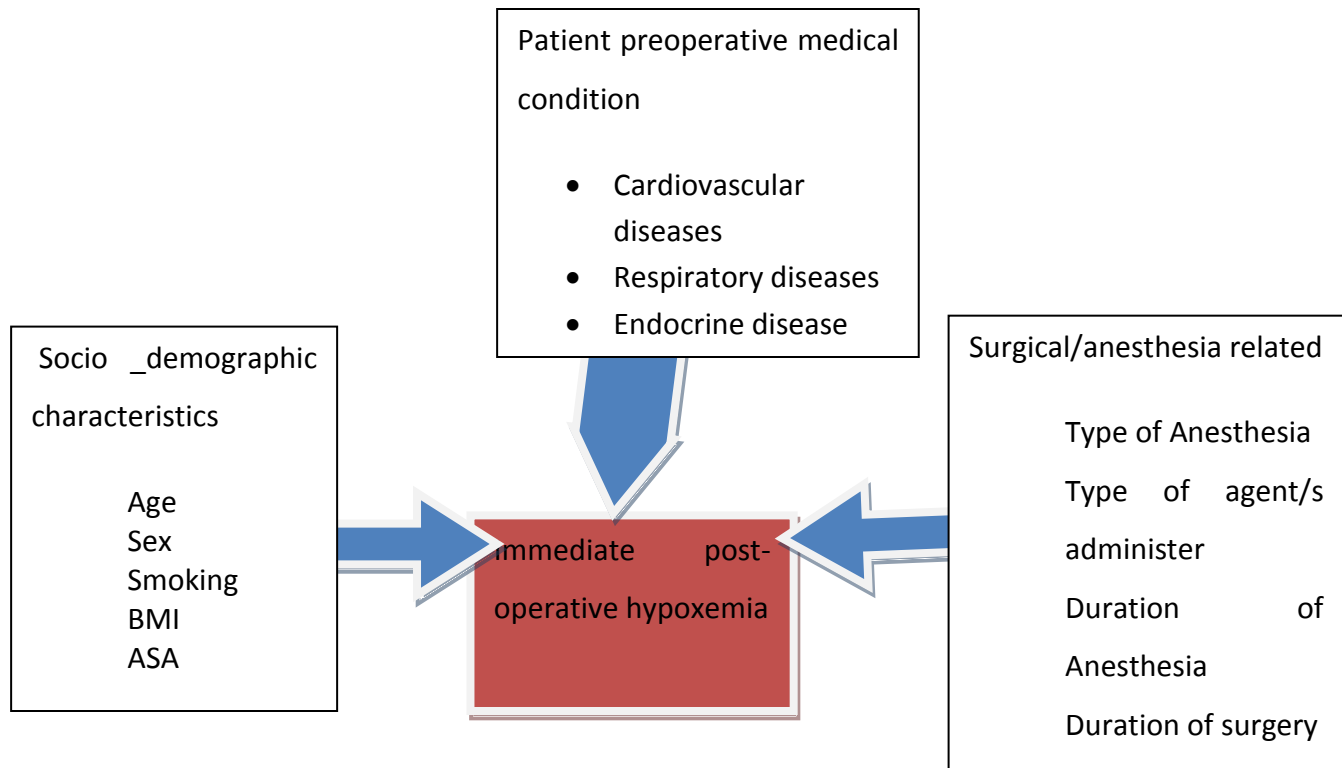
According to study done German in 970 patients underwent a broad spectrum of elective surgery under general anesthesia who were eligible for analysis 17% had a $S(p)O_2 < 90\%$ and 6.6% $S(p)O_2 < 85\%$. Variables with an independent influence on hypoxemia were as follows: saturation before induction of GA, body mass index, age, (ASA) physical status, difference between maximum and minimum inspiratory pressure, mode of ventilation, the use of opioid and muscle relaxant as well as the use of nitrous oxide(7).

According to Japan study revealed that hospital mortality was 6.1% being 5.2% in the hypoxemia group and 6.9% in the non-hypoxemia group. The ventilation time and intensive care unit stay were significantly longer in the hypoxemia group than in the non-hypoxemia group (26).

Study done in Feinberg School of Medicine described those morbidly obese subjects, with or without OSA, experience frequent oxygen desaturation episodes postoperatively, despite supplemental oxygen therapy. It suggested that perioperatively management strategies in morbidly obese patients undergoing laparoscopic bariatric surgery should include measures to prevent postoperative hypoxemia (27).

A retrospective study in USA show that Post operative hypoxemia found in (30%) patients. Hypoxemic patient longer stay than non-hypoxemic. Conditions independently associated with POH ($p < 0.05$) were acute trauma, BMI, ASA level, glycopyrrolate administration, and duration of surgery

2.2 conceptual frame work



CHAPTER THREE

Objectives

3.1 General objective

To assess the magnitude and associated factors of immediate post-operative hypoxemia in elective surgical procedures at Tikur Anbessa specialized Hospital from JANUARY 30, 2017 to MARCH 31, 2017 G.

3.2 Specific objective:

- To assess the magnitude of immediate post-operative hypoxemia.
- To identify the associated factors of immediate post-operative hypoxemia.

CHAPTER FOUR

4. METHOD AND MATERIALS

4.1. Study Area and period

This study will be conducted at Tikur Anbessa specialized Hospital which is located in the capital city Addis Ababa, Ethiopia from JANUARY 30, 2017 to MARCH 31, 2017. Tikur Anbessa specialized hospital is multi-specialist tertiary care teaching hospital in Ethiopia, opened since 1972 and, in 1998 transferred to school by FMOH since then it became a university teaching hospital. TASH is now the main teaching hospital for clinical and preclinical trainings of most disciplines. It is also an institution where specialized clinical services that are not available in other public or private institutions are rendered to the whole nation.

It has 800 beds, 12 operation theatres, annually 6000-8000 operation done and more than 900 health professionals in the different specialties dedicated to providing health care services, and the various departments' residents under specialty training in the school of medicine also provide patient care in the hospital.

4.2 Study design: cross sectional study was employed.

4.3 Population:

4.3.1 Source of population: all surgical patients who undergo surgery at Tikur Anbessa specialized Hospital.

4.3.2 Study population: selected patients who undergo elective surgery in Tikur Anbessa specialized Hospital in the specified time period.

4.3.3 Sample population: sampled patient who undergo elective surgery transferred to post anesthesia care unit in Tikur Anbessa specialized Hospital

4.4 Exclusion criteria

Patients who already intubated and transferred to post anesthesia care unit or intensive care unit, and those whose ages was less than 18 years

4.5 Sample size and sampling technique:

4.5.1 Sample size determination: the sample size was calculated using the single population proportion formula; since, no related study was found in Ethiopia and Africa

$$n = \frac{(Z_{\alpha/2})^2 \times p \times q}{d^2}$$
$$= \frac{(1.96)^2 \times (0.5)(0.5)}{(0.05)^2} = 384$$

Where: n= number of sample size. Z= desired 95% confidence, Z=1.96.

p = 0.5 maximum population proportion, since no previous studies found.

q = 1-p = 1-0.5=0.5 d = is the margin of sampling error tolerated (5%)

By using correction formula for finite population since source population were less than 10,000.

$n_f = \frac{n}{1 + \frac{n}{N}}$ where n= the sample size = 384

N = Total No of pts who undergo elective operation = 600

N

= $\frac{384}{1 + \frac{384}{600}}$ Final sample study

1+ $\frac{384}{600}$

600 = 234

Mean of midyear population was used to get total number of elective patients who undergo operation in 2 months duration and age 18 or above. The midyear population in six month from situational analysis was 1800. So, the size of population in 2 months is 1800 divided by 3 gives

600. From this the final sample size was **234**. Adding 5% contingency it was 246. after data collection 8 questioners not completely filled. 238 questioners was used for analysis

4.5.2 Sampling Technique: Systemic random sampling technique was used to select study participants by using skip interval of $K = N/n = 600/246 = 3$

n = total sample size K = skip interval N = Total study population

The first study participant was selected by lottery method first cases that undergo surgery in each department

4.6 Study variables

4.6.1 Independent variable

Socio demographic

- Age
- sex
- Smoking
- body mass index

Patient clinical characteristics

- type of procedure
- patient medical condition
- types of anesthesia,
- ASA physical status
- opoid drug used,
- duration of anesthesia
- intraoperative fluid used,
- type of muscle relaxant used
- Blood losses.

4.6.2 Dependent variable: immediate postoperative hypoxemia

4.7 Data collection tools and procedure

Data was collected using pretested structured questionnaires with observing saturation level and patient cared. After patient come to post anesthesia care unite saturation level measured immediately with pulse oximetry then every 5minute. A positive post-operative hypoxemia screen will defined episodes of $SpO_2 \leq 94\%$, on room air or nasal cannula supplemental oxygen .Intraoperative data was collected by two trained anesthetist . Postoperative data was collected by two trained post anesthesia care unit nurse and the principal investigator was supervised the completeness of the data daily.

4.8 Data Quality Assurance

Pretest was done on 5% of the sample size at Zewditu memorial hospital, in the area different from the study area before actual data collection. Data collectors trained on each items included in the study tools, objective, relevant of study, right of respondents, confidentiality of information obtained, about pretest.

During data collection, regular supervision and follow up was made. Investigators cross check for completeness and consistency of data on daily basis. Once the data had collected and checked for completeness, consistency and accuracy, it was sorted, categorized and summarized. Then, the data was entered in to the computer using developed data entry, format, coded for each category of variables and again cross check for errors.

4.9 Data Analyzing and processing

Data were checked manually for completeness, coded and entered in to Epi Info version 7 and exported to SPSS version 20 computer program for cleaning, transformation and analysis. Statistical analysis was performed using the SPSS version 20. The mean calculated for continuous and discrete variables respectively as required. Frequency and cross tabulation was conducted to describe relevant variables in relation to the outcome variables. Variables that demonstrated a significant relationship on biviarite analysis ($p < 0.2$) were included Multivariable regression analysis was applied to evaluate independent variable relationships with a dependent variable that was continuous. A $p < 0.05$ was considered to represent a statistically significant relationship.

4.10 Dissemination plan

The copy of research paper will prepared in copies and disseminated to college of health science, school of medicine/department of anesthesia, Tikur Anbessa specialized Hospital and Addis Ababa University student research office.

4.11 Ethical Consideration

Ethical clearance and approval was obtained from ethical review committee, Anesthesia department, Addis Ababa University. Permission to conduct was obtained from Tikur Anbessa Hospital. Informed Verbal consent was secured from every study participants. The obtained data was used for study purpose. Confidentiality and anonymity was ensured.

4.12 Operational definition:

Anesthetist: is a licensed professional to administer general as well as regional anesthesia to the Patient undergoing surgery.

Duration of surgery: the time starting from incision to end of surgery (skin suturing).

Duration of anesthesia: the time starting from administration of anesthesia to end of administering anesthesia

Elective surgery: is surgery done before on set (appearance) of any complication that might constitute urgent indication.

General anesthesia: is type of anesthesia administered with loss of consciousness

Hypotension: a fall in systolic blood pressure greater than 20-30% of the preoperative baseline.

Pulse oximetry: an instrument used to measure oxygen saturation

Post anesthesia care unit: place where patient admitted after surgery and anesthesia in order to give care

Regional anesthesia: is type of anesthesia administered at site or near to the site of procedure without loss of consciousness.

Severe hypoxemia: A positive post-operative severe hypoxemia will defined as episodes of SpO₂ <90%, on room air or supplemental oxygen.

Spinal anesthesia: administering of local anesthetics agents in subarachnoid space.

Hypoxemia: SpO₂ ≤94% and Hypoxemia Both mild and severe combined

Mild hypoxemia: A positive post-operative mild hypoxemia will defined as episodes of SpO₂ ≤94%, on room air or supplemental oxygen

CHAPTER FIVE

5. RESULTS

Socio-demographic and clinical characteristics

A total of 238 sampled patients were included in two month period with 131 males and 107 females (Male: Female ratio of 1.2:1. Hypoxemia distribution of Male and female were 26% and 18.7% respectively. The mean age distributions of patients were 41.4 ± 16.1 year. 195 (82%) patient age was less than 60 while forty three (18%) greater than or equal to 60. percentage of hypoxemia in age greater than or equal 60 and less than 60 were 23.6 ,16.3 respectively.

From total sampled patients, magnitude of hypoxemia was 22.7%. Body mass index was less than 18.5(11.8%), 18.5-24.9(76.2%) and 25-29.9(12.6%) and Hypoxemia distribution in each range of body mass index were 21.4%, 21.5% and 30% consequently. Frequency of patient in each ASA class were 145 (60.9%), 82(34.5%) and 11(4.6%) respectively. ASA-I and hypoxemia was increased with increased ASA class of patients. Smoker patient were 4 (1.7%), in which case (75%) smokers were hypoxemic.

Table 1. Socio-demographic and clinical characteristics of elective surgical patients at TASH Hospital, Ethiopia, JANUARY 30, 2017 to MARCH 31, 2017 (N=238).

Characteristics	Frequency	Percentage %	Hypoxemia (%)	
			Normal	Hypoxemia
Sex male	131	55	74	26
Female	107	45	81.3	18.7
Age <60	195	82	83.7	16.3
≥60	43	18	76.4	23.6
BMI <18.5	28	11.8	78.6	21.4
18.5-24.9	181	76.2	78.5	21.5
24.9-29.9	30	12.6	70	30
ASA I	145	60.9	83.4	16.6
II **	82	34.5	68.3	21.7
III **	11	4.6	54.5	45.5
Smoking **	4	1.7	25	75

** Factors P value<0.05

Socio-demographic and clinical characteristics of elective surgical patients

Patient induced with general anesthesia in countered hypoxemia was 26.4% and regional anesthesia 4.9%.The mean duration of anesthesia was 136.9 ± 77 . Mean Duration of anesthesia was (131 ± 76 mint in normal and 156 ± 78 mint in hypoxemic patients. The mean fluid given was 2303 and mean intraoperative fluid given was (2610 ± 866 ml in normal and 2750 ± 918 ml in hypoxemic patients. One hundred eighty six (78.2%) patients lost below 500ml of blood .The mean blood lose was 339.84ml and Mean intraoperative blood loss was (295 ± 80 ml in normal, and 459.3 ± 120 ml in hypoxemic patients. Hypoxemia was correlated with ASA class of patients, smoking, type of anesthesia and duration of anesthesia (Tabel2).

Table 2: Descriptive of Socio-demographic and clinical characteristics of surgical patients at TSH Hospital, JANUARY 30, 2017 to MARCH31, 2017G. (N=238).

Characteristics	Frequency	Percent (%)	Hypoxemia (%)	
			Normal	hypoxemia
Duration of anesthesia**				
<120minute	106	44.6	84.9	15.1
≥ 120minute	132	55.4	72	28
Number of patient	238	100	77.3	22.7
Type of anesthesia**				
GA	197	82.8	73.6	26.4
RA	41	18.2	95.1	4.9
Intraoperative blood lose				
<500ml	180	75.6	67.9	32.1
501-1000ml	38	16	79.2	20.8
1001-1500ml	11	4.6	92.5	7.5
1501-2000ml	4	1.7	96.2	3.8
Variables	mean	Mean - normal	Mean of hypoxemic	
Age1	41.4±16.1 year	42.57±13 year	41.4±17 year	
Duration of anesthesia	136.9±77.24 minute	131±76 minute	156±78 minute	
Intraoperative blood lose	339.84ml	295±80ml	459.3±120ml	
Intraoperative fluid given	2303ml	2610+866ml	2750+918ml	

** Factors P value<0.05

Case and Hypoxemia distribution of different surgical departments

Case distribution of patients were general surgery (25.2%), urology (22.7%) and cardiothoracic (13.4%). Hypoxemic distribution of different surgical departments were 62.5%, 28.35%, 18.25% cardiothoracic, general surgery and orthopedic respectively. Cardiothoracic and urology surgeries were correlated with hypoxemia (Table 3 and fig1).

Table 3: Hypoxemia distribution of different surgical departments in TASH elective surgical patients at TSH Hospital, JANUARY 30, 2017 to MARCH 31, 2017G (N=238).

Department	Frequency	Percent (%)	Hypoxemia (%)	
			Normal	Hypoxemia
ENT	13	5.5	84.6	15.4
Cardiothoracic**	32	13.4	37.5	62.5
GYNECOLOGY	26	10.9	88.5	11.5
GENERAL SURGERY	60	25.2	71.7	28.3
NEUROSURGERY	31	13	87.1	12.9
ORTHOPEDIC	22	9.2	81.8	18.2
UROLOGY**	54	22.7	92.6	7.4
TOTAL	238	100	77.3	22.7

** Factors P value < 0.05

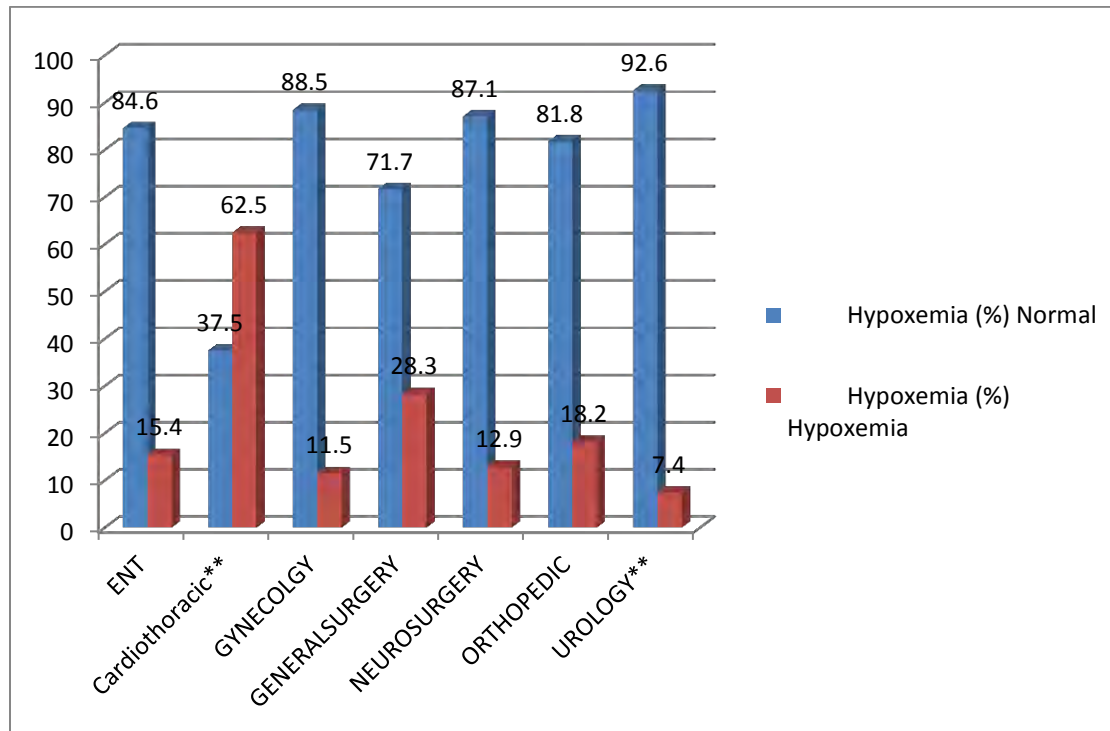


Figure 1 : No of cases and hypoxemia distribution of different surgical departments of TSH elective surgical patient, Ethiopia, JANUARY30, 2017 to MARCH31, 2017G (N=238).

Co- morbidity and hypoxemia

From all patients the magnitude of co- morbidity was sixty eight (28.6%). Respiratory and cardiovascular co-morbidities were (8.4%) and *eight* (8%) respectively. The occurrence of hypoxemia was more common in patients with a retroviral infection (66.7%), followed by patients with respiratory (65%) and renal (60%) co-morbidities. Hypoxemia was correlated with more respiratory co-morbidity and retroviral infection. Two hundred ten (77.6) patient had hemoglobin level greater than or equal to eleven. Patients' hemoglobin greater than equal to eleven were 22.4% hypoxic and less than eleven 25%hypoxic (tabel4).

Table 4: Descriptive of Co-morbidity and Hypoxemia elective surgical patients at TASH Hospital, JANUARY 30, 2017 to MARCH 31,2017G (N=238).

Co-morbidities	Frequency	percentage	Hypoxemia (%)		P-value
			Normal	hypoxemia	
Cardiovascular	19	8	80	20	.400
Endocrine	17	7.1	70.6	29.4	.232
Hepatic	4	1.7	75	24	.448
Renal	5	2.1	40	60	.169
Retroviral	3	1.3	33.3	66.7	0.032
Respiratory	20	8.4	35	65	0.000
Hemoglobin	<11	28	75	25	0.356
	≥11	210	77.6	22.4	

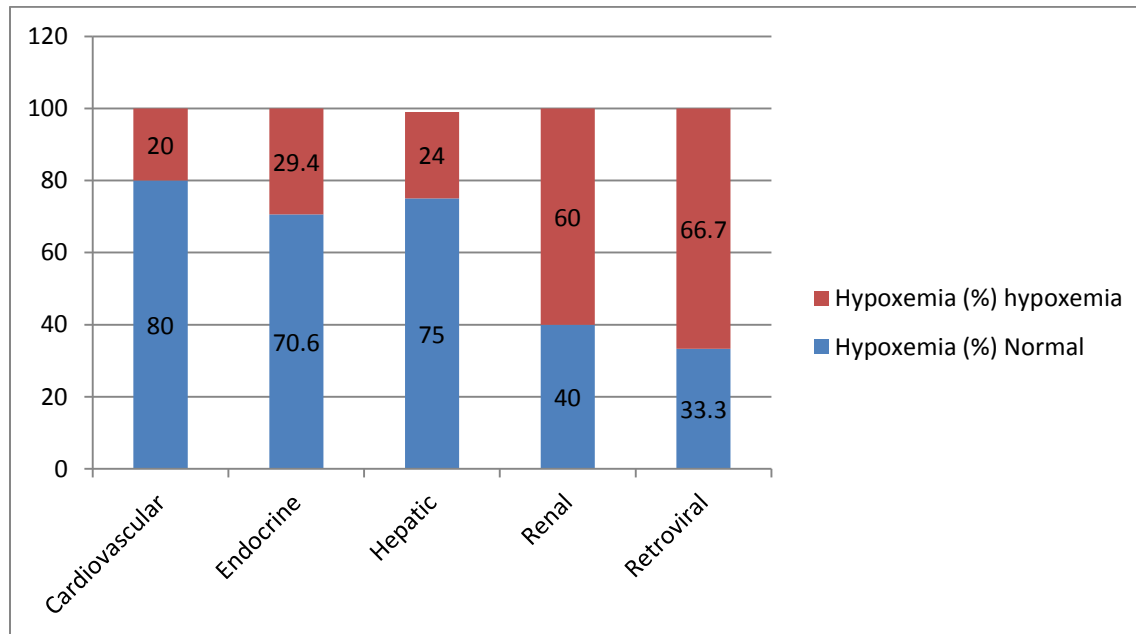


Figure 2: Descriptive of Co-morbidity and hypoxemia distribution of elective surgical patients at TSH hospital, JANUARY30, 2017to MARCH31, 2017G (N=238).

Anesthesia drugs and hypoxemia

Among sampled patient 197 patient induced with general anesthesia. Patients who are induced by Propofol+fentanyl eighty eight (37%) followed by Thiopental+fentanyl (19.7%) and Propofol+pethedine (7.6%). Drugs used for maintenance of general anesthesia used during were, halothane seventy (29.4%), halothane+fentanyl fifty six (23.5%) and isoflurane thirty three (13.9%). Hypoxemia distribution patients maintained with Isoflurane+pethedine (50%), isoflurane (33%) and halothane+fentanyl (25%). For muscle relaxation, one hundred eighteen (49.6%) were given Succinylcholine +Vecuronium, where as the rest was relaxed using Succinylcholine+Pancuronium (13.4%) and Vecuronium (12.6%), respectively. Hypoxemia distribution of patients relaxed with Succinylcholine+pancuronium and Succinylcholine+Vecuronium, 37.5% and 26.3% respectively. Anesthesia drug correlated with were Propofol+fentanyl, isoflurane+ fentanyl, halothane+ pethedine and Succinylcholine +Pancuronium (Table5, 6, 7)

Table 5: Induction drugs and Hypoxemia distribution of elective surgical patients at TASH Hospital, Ethiopia, JANUARY30, 2017 to MRCH31, 2017G (N=238).

Induction drug	frequency	Percent (%)	Hypoxemia (%)		P-value
			normal	hypoxemia	
Propofol	19	8	84.2	15.8	.241
Ketamine	14	5.9	71	29	.107
Propofol+fentanyl	88	37	67.8	32.2	.003
Propofol+pethedine	18	7.6	72.2	27.8	.280
Thiopental+fentanyl	48	19.7	85.4	14.6	.077
Ketamine+fentanyl	10	4.2	70	30	.275
Total	197	82.8			

Table6:Maintenance drug and Hypoxemia distribution of elective surgical patients at TASH Hospital,Ethiopia,JANUARY30,2017 to MARCH 31,2017G(N=238).

Maintenance drug	frequency	Percent (%)	Hypoxemia (%)		p-value
			normal	hypoxemia	
halothane	70	29.4	75.7	24.3	.372
isoflurine	33	13.9	66.7	33.3	.050
Ketamine	4	1.7	75	25	.448
Isoflurine+fentanyl	26	10.9	76.9	23.1	.007
Isoflurine+pethidine	4	1.7	50	50	.090
Halothane+fentanyl	56	23.5	75	25	.264
Halothane+pethidine	1	0.4	0	100	.031
Total	194				

Table 7: muscle relaxant drug and Hypoxemia distribution of elective surgical patients at TASH Hospital, Ethiopia, JANUARY 30, 2017 to MARCH 31,2017G (N=238).

Muscle relaxant drug	frequency	Percent (%)	Hypoxemia (%)		P-value
			Normal	hypoxemia	
Succinylcholine	11	4.6	72.7	27.3	.342
Vecronium	31	13	80	20	.375
Succinylcholine+pancronium	32	13.4	62.5	37.5	.027
Succinylcholine+Vecronium	118	49.6	73.7	26.3	.094
Atracurium	2	0.8	100	0	.225
TOTAL	194				

Hypoxemia vs Time

OF 238 cases, hypoxemia occurred within the first minute 56 (23.8%), within five minutes 58 (24.8%) and within 10 minute 45 (18.9%). Frequency of hypoxemia was highest first 10 minutes and decreased when time increased.

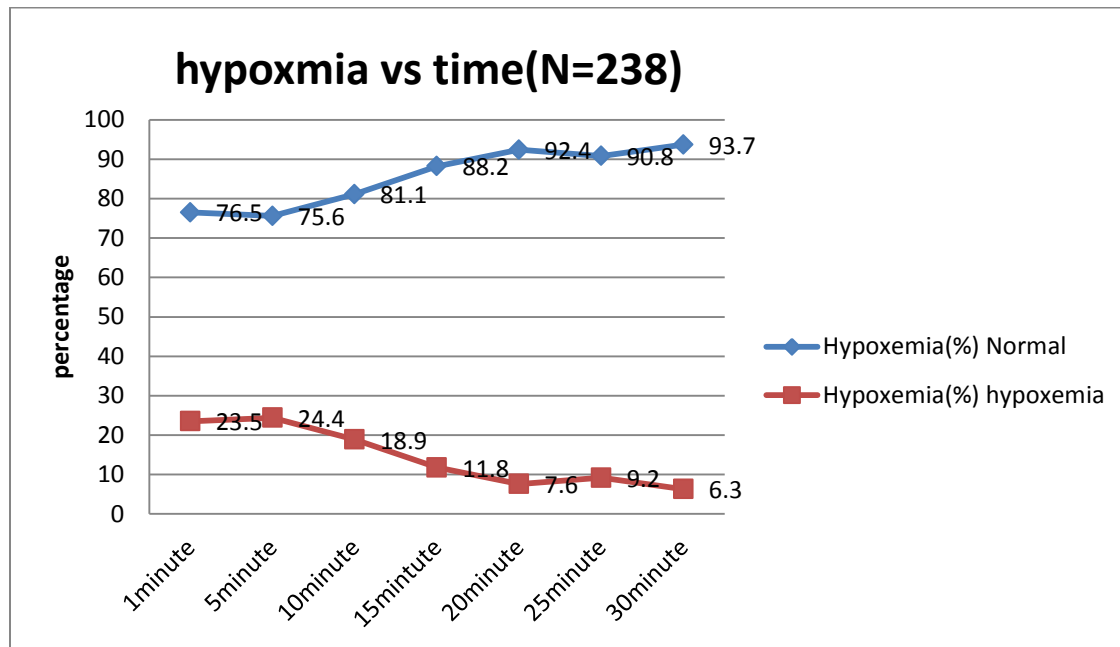


Figure 3: Percentage of Hypoxemia VS time elective surgical patient in post anesthesia care unit TSH, ETHIOPIA JANUARY30, MARCH31, 2017G (N=238).

Factors associated with immediate postoperative hypoxemia

In Multivariate analysis, when 95% CI for the adjusted odds ratios were calculated among these variables, respiratory co morbidity, urology and cardiothoracic surgery statistically significant association with postoperative hypoxemia P-value (0.002, 0.014 and 0.014).

Among study subjects, who had Respiratory co morbidity 8.8, are more likely to have post operative hypoxemia than other co morbidities (AOR=8.8; CI 2.264, 34.117) and patients who had cardiothoracic surgery 4.904 were likely to be hypoxemic than other surgeries (AOR=4.904; 1.385, 17.368). Smokers and patients with Body mass index of (25-29.9) 15, 1.136 developed more post- operative hypoxemia than other patients with (AOR=15; CI 0.478, 469.529) and (AOR: 1.136; CI 0.282, 4.569) respectively.

Table 8: Factors associated with immediate postoperative hypoxemia elective surgical patients at TASH Hospital, Ethiopia, JANUARY 30, 2017 to MARCH 31,2017G (N=238)

Variables		Hypoxemia (%)		Odds Ratio		P-Value
		Normal	Hypoxemia	Crude	Adjusted(95% CI)	
Sex	female	74	26	1.324	0.86(0.396,2.185)	.930
	male	81.3	18.7			
ASA	II	68.3	21.7	2.218,	1.770(0.785,3.989)	0.168
	III	54.5	45.5	2.076	1.834(0.32, 9.919)	0.53
Smoking	Smoker	25	75	15.495	15(0.478,469.5)	0.123
Department	cardiothoracic	37.5	62.5	5.176	4.904(1.385,17.368)	0.014
Typeof anesthesia	GA	73.6	26.4	14.35	4.464(0.467, 42.618)	0.194
	RA	95.1	4.9			
Durationofanesthesia≥120min		72	28	2.19	1.570(0.676,3.648)	0.294
Co-morbidity	Respiratory	35	65	8.529	8.788(2.264,34.117)	0.002
Induction Propofol+fentanyl		67.8	32.2	1.104	0.976(0.4, 2.467)	0.958
Maintenance	Isoflurine	66.7	33.3	1.069	0.872(0. 284,2.75	.81

CHAPETR SIX

6.1 DISCUSSION

Hypoxemia has been recognized as a risk to patients in the operating room and post anesthesia care unit. In this study magnitude of postoperative hypoxemia was 54(22.7%).percentage of hypoxemia more in age greater than or equal to 60. Majority of patient's body mass index was between 18.5-24.9(76.2%). Hypoxemia was found more in patients with body mass index between 25-29.9 kg/m² (30%). 145(60.9%) patients were ASA-I and hypoxemia was increased with increased ASA class of patients. Smoker patient were 4 (1.7%), in which case smokers were more hypoxemic (75%) than non smokers.

While Dunham et al(2014) studied the magnitude of postoperative hypoxemia to be (30%) (6). There is large variation the incidence of critical respiratory events in the PACU, with several prospective observational studies reporting an incidence of post operative hypoxemia between (22-30%) (7, 10, 17-20). So magnitude of postoperative hypoxemia was similar to other studies.

Study done in Brazil, socio demographic data indicated, 204 patients were with mean age of 54.2±17, gender (m/f) 118/86, ASA (I-II-III-V) 83/100/20/1, COPD 5/199. Numbers of patient who took general and regional anesthesia were similar, smoking 61/143 and superficial/abdominal surgery 74/130(10). Socio demographic data of Study in USA indicated 500 patients were with mean age of 54.2±17, M/F 197/303. The mean ASA level was 2.8±0.6 (I-IV), preexisting lung diseases 69(13.8%), and weight (86.2) ±24.3. Operation room stay in minutes was less in non hypoxic group and high among the hypoxic group. The mean ASA level low in non hypoxic group and high in hypoxic group (6).

While in this research socio demographic factors revealed gender(m/f)131/107, smoking 4, ASA(II,III)145/82/11. Respiratory co-morbidity 20(8.4%), Cardiovascular(19)(8%), Renal(5), Endocrine(17), RVI(3), hepatic co-morbidity(40), cardiothoracic surgery (32), general surgery(60) and Urology(54) from total of 238 patients. Mean duration of anesthesia hypoxic group 156 minute non hypoxic group 131 minute. This study showed that patient who had co-morbidity and duration of anesthesia greater or equal to 120 minute had high probability of being

hypoxemic due to comorbidity have its own deleterious effect on cardio respiratory system. Similarly as duration of anesthesia increase administration of anesthesia drug also increases

study done in Feinberg School of Medicine described those morbidly obese subjects, with or without OSA, experience frequent oxygen desaturation episodes postoperatively, despite supplemental oxygen therapy(27). This study show that BMI<18.5(21.4%), 18.5-24(21.5%) 25-29.9(30%) the rate of hypoxemia increase with increasing BMI. Likewise this study did find out that patients with high body mass index had frequently encountered hypoxemia

Patients under general anesthesia and breathing room air in the PACU had more hypoxemia (44.7%) than patients under regional anesthesia (24%) (10). This study revealed that patient who took general anesthesia had more hypoxemia (26.4%) than patient regional anesthesia (4.9%) due to general anesthesia affect more cardio respiratory physiology and uses more drug compared to regional anesthesia.

According to research done in Germany, the choice of opioid and muscle relaxant had an effect on post operative hypoxemia(7). This study revealed that using Succinylcholine+Pancronium and Propofol +fentanyl had high probability to result hypoxemia. This is possibly due to residual effect of the drugs, altered metabolism and redistribution.

In previous studies, variables associated to higher probabilities of immediate postoperative hypoxemia were: males, diabetes mellitus, urgency of surgery, medication with opioid and fentanyl doses above $2 \mu\text{g.kg}^{-1}.\text{h}^{-1}$, association of fentanyl and morphine, thiopental as compared to Propofol, obesity, more than 60 years of age(6, 17, 28).

In this study, variables correlated with postoperative hypoxemia were : physical status ASA (II, III), smoking, history of respiratory co-morbidity, retroviral co-morbidity, cardiothoracic surgery, general anesthesia, perioperative Propofol +fentanyl use, use of Succinylcholine+pancronium, Isoflurane+ fentanyl, Halothane+pethidine and duration of anesthesia greater than or equal to 2hour, had correlated with immediate postoperative hypoxemia.

Research studied by Nakajima T identified the following variables as predictors for postoperative hypoxemia: body mass index ≥ 25 (odds ratio [OR], 5.6; 95% confidence interval [CI], 2.1-15.01; $P < 0.001$)(26). According to Dunham et al ASA level and duration of surgery independently associated with hypoxemia(6). Study studied by Moller JT independent risk factors postoperative hypoxemia was duration of anesthesia, history of smoking and patients who had regional anesthesia had lower hypoxemia(25).

According to this research independent factors associated with postoperative hypoxemia were cardiothoracic-surgery $P=0.014$ (AOR=4.904; CI 1.385, 17.368), respiratory coexisting diseases with P -value of 0.002 (AOR=8.8; CI 2.264, 34.117). Smokers were more (15) likely develop hypoxemia with p -value 0.123 (AOR=15; CI 0.478, 469.5). Cardiothoracic surgery, respiratory coexisting diseases and smoking carried high risk of hypoxemia, because of their significant affect respiratory physiology and airway patency. Even though ASA level, smoking, history of smoking co-related with hypoxemia in this research not independent factors post operative hypoxemia may be due to number of smokers were low in this research compared Moller JT and most of patient in this research were ASA I as morbidity and mortality increase ASA level.

CHAPTER SEVEN

7. STRENGTH AND LIMITATION OF THE STUDY

7.1 Strength of the Study

This study in asses' magnitude and associated factors of immediate post operative hypoxemia it can be used as a baseline data for researchers and policy makers.

7.2. Limitation of the Study

It is a single center study; therefore, this result cannot be generalized to other centers.

CHAPTER EIGHT

8. CONCLUSION AND RECOMMENDATION

8.1. Conclusion

8.1. Conclusion

Magnitude of postoperative hypoxemia was so high. Most patients were given general anesthesia and hypoxemia was more common in general anesthesia as compared to regional anesthesia. It was more frequent in first 10 minute of surgery. Patient who had respiratory co- morbidity were more prone to postoperative hypoxemia when compared to others co-morbidity illness. It was also found that patient with ASA class II and III, smokers, general anesthesia and duration of anesthesia greater than 120 minute were co-related with hypoxemia.

8.2. Recommendation

Based on the finding of the study the following recommendations were drawn.

- Surgeon and anesthetist should do preoperative optimization and special consideration to a patient who had co-morbidity as most of hypoxemia was found among patients who had co morbidity illness.
- Anesthetist should prefer regional anesthesia to general anesthesia as perioperative hypoxemia was common among those who were given general anesthesia. Therefore, general anesthesia should be reserved only for those who are contraindicated for regional anesthesia.
- Porter, surgeon and anesthetists should transport the patients to recovery room soon after discontinuation of oxygen from oxygen source in the operation theatre and provide oxygen supplementation with Ambo bag for those who were prone to be hypoxic.
- Post anesthesia care unit nurse should administer oxygen for a patients who are hypoxic .hypoxemia was common immediately after transporting patients to recovery

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Annexel -Questioners

Hello.

My name is _____. I am a researcher and I have been attending postgraduate program in the field of Anesthesia at Addisababa university. I am going to conduct research on **Magnitude and associated factors of immediate postoperative hypoxemia among elective surgical procedures at Tikur Anbessa specialized hospital, Addis Ababa, Ethiopia**. The information going to be obtained will help the government and other responsible bodies to Improve postoperative out come by reducing postoperative hypoxemia. Your participation is very valuable for the success of this project. Also be mindful that whatever we will get here is for research purposes only and the information will not be used by any other person apart from this research and therefore, confidentiality can be guaranteed. However, your names will not be mentioned or be attached to anything that you say.

Do yo want to continue yes----- No------(Thank you in advance for your help!)

Name and contact address of invesigators

Getahun Dendir Email gechgetahun@gmail.com Cell phone +251-913-72-08-29

Part I: Personal and socio demographic characteristics

			Skip pattern	Remark
01	Ward	-----		
02	Bed no	-----		
03	Patient card no	-----		
04	Department	-----		
05	Age	-----		
06	Sex	-----		

Part II.Preoperative evaluation

Preoperative condition			Skip pattern	Remark
701	Diagnosis	----- -----		
702	Planned procedure	-----		
703	Body weight _____Kg	-----		
704	Height(cm)_____	-----		
705	Coexisting disease:	Hypertension-----1 Rénale disease-----2 Diabetes mellitus-----3 Pulmonary TB-----4 Bronchial Asthma-----5 Hepatitis / HIV/AIDS -----6 Recent Hx of URTI-----7 Obstructive sleep apnea.....8 Other (Specify)-----9		
706	Smoking	Yes-----1 No-----2		
704	Vital sign before anesthetic agent administered	BP-----1 SPO2-----2 HR-----3		
706	Preoperative Hgb _____g/dL	-----		
707	ASA status	ASA I-----1 ASA II-----2 ASA III-----3 ASAIV-----4 ASA V-----5		

Part I: Intraoperative characteristics

			Skip pattern	Remark
801	What type of anesthesia is used?	GA -----1 SA-----2 GA+RA-----3		
802	If GA	GA with ETT-----1 GA with mask-----2 GA with LMA-----3		
803	If GA list drug used for induction	Ketamine(mg).....1 Thiopental(mg).....2 Propofol(mg).....3 Inhalational(specify)%.....4 Opioids (specify)Mg.....5		
804	If GA list drug used for maintainance	Ketamine(mg).....1 Inhalational(specify)%.....2 Opioids(specify)mg.....3 Other(specify).....4		
805	Muscle relaxant	Succinylcholine(mg).....1 Pancronium(mg).....2 Vecronium(mg).....3 Atracurium(mg).....4		

806	If RA	Spinal-----1 Epidural-----2 Peripheral nerve block-----3		
807	Duration of Anesthesia	-----		
808	Duration of surgery	-----		
809	Total Intraoperative IV fluids (ml)	-----		
810	Intraoperative blood loose(ml)			
811	specify intraoperative complication if any	-----		
812	Vital sign at the time of extubation	BP-----1 SPO2-----2 HR-----3		

5. Post anesthesia care unit evaluation

Post OP-vital sign	1min	5min	10min	15min	20mn	25min	30min
SPo2%							
Heart rate							
Blood pressure							
Respiratory rate							

Name of data collector-----signature-----date-----

Name of supervisor-----signature-----date-----

ANNEX II

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 Research Publications Office in effect at the time of
Grant is forwarded as the result of this application.

Name of the student: _____

Date. _____ Signature _____

Approval of the primary Advisor

Name of the primary advisor: _____

Date. _____ Signature _____