ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

DEPARTMENT OF ANESTHESIA

MAGNITUDE AND ASSOCIATED FACTORS OF EARLY POSTOPERATIVE HYPOXEMIA IN PEDIATRIC PATIENTS UNDERGOING ELECTIVE SURGERY UNDER GENERAL ANESTHESIA AT TIKUR ANBESSA SPECIALIZED HOSPITAL ETHIOPIA, 2019/20

INVESTIGATOR

REBKA KETEMA

ADVISORS

WOSENYELEH ADMASSU (MSC IN ACA)

LEMLEM GETACHEW (B.SC. M.SC. LECTURER IN ANESTHESIA**)**

A THESIS SUBMITTED TO DEPARTMENT OF ANESTHESIA, COLLEGE OF HEALTH SCIENCES, ADDIS ABABA UNIVERSITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR M.Sc. IN CLINICAL ANESTHESIA.

ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF MEDICINE

DEPARTMENT OF ANESTHESIA

MAGNITUDE AND ASSOCIATED FACTORS OF EARLY POSTOPERATIVE HYPOXEMIA IN PEDIATRIC PATIENTS UNDERGOING ELECTIVE SURGERY UNDER GENERAL ANESTHESIA AT TIKUR ANBESA SPECIALIZED HOSPITAL ETHIOPIA, 2019/20

BY: REBKA KETEMA

Phone number- +251913392634

Email- Rebkaa.ketemaa@gmail.com

Approved by examining board

1.__________________________

2.__________________ _________

Head department of anesthesia

____

June ,2020

Annex 1: Declaration

I, the undersigned, senior clinical Anesthesia student declare that this thesis is my original work in partial fulfillment of the requirement for the degree of Masters of clinical Anesthesia.

Name: ________________________________

Signature: ______________

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

Date of Submission: ____________________________

This thesis work has been submitted for examination with my/our approval as advisors and tutors on the Master of Science degree in anesthesia.

Advisor

Name	Signature
____	_____________________

ASSURANCE OF 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 pre terms and conditions of the research and publications office of the Addis Ababa University.

Name of the student: ____

Date: ____________________ Signature: _____________________

Approval of the advisor

Advisors

Name	Signature	Date
1. ________________________________	_________________	________________
2. ________________________________	_________________	________________

Acknowledgement

I am deeply indebted to my advisors Wosenyleleh admassu (Msc in ACA) and Lemlem Getachew (BSC,MSC) for their support, comment, and guidance throughout research process I am going through. I extend my deepest gratitude and appreciation to my data collectors and my sincere acknowledgement also goes to Tewoderos Shitemaw and Mitiku desalegn for their valuable comments and inputs.

Acronyms

ASA- American society of anesthesiologists

AOR- Adjusted Odds Ratio

COR- Crude Odds Ratio

ETT- Endotracheal tube

GA- General Anesthesia

ICU- Intensive care unit

LMA – Laryngeal mask airway

OR- Operation room

PACU- post anesthesia care unit

PONV- post operative nausea vomiting

PRC- postoperative respiratory complications

Spo2- oxygen saturation

SPSS- statistical package for social sciences

TASH- Tikur anbessa specialized hospital

V/Q mismatch- ventilation perfusion mismatch

VC- vital capacity

Table of content

List of tables

List of figures

Abstract

Introduction: Hypoxemia is defined as a low amount of oxygen in our blood. Early postoperative hypoxemia leads to cellular ischemia which may delay recovery and complications are associated with significant cost and mortality implications for patients.

Objectives: The objectives of the study was to determine the magnitude and associated factors of hypoxemia in pediatric patients aged 1-14 years who undergone surgery under general anesthesia in Tikur Anbessa specialized hospital from October 26, 2019 to February 26, 2020 G.C.

Method: Institutional based cross sectional study was conducted at Tikur Anbessa specialized Hospital, Addis Ababa, Ethiopia data was collected from October 26/2019 to February 26, 2020 using a pre-tested questionnaire starting from preoperative period to postoperative period in PACU. After sample size was calculated and systematic random sampling technique applied, 229 patients included in the study. The data was entered to Epi Info version 7.2.1 and analyzed by SPSS version 22 software performing descriptive statistics, bivariate and multivariate logistic regression.

Result: The incidence of early postoperative hypoxemia is found to be 44.5%. Muscle relaxant use has a 3.13 times [AOR=3.13; 95% CI: (1.13-8.64)] and not using premedication has 10 times [AOR=10.93; 95% CI: (4.74-25.21) more risk for developing early post-operative hypoxemia. Duration of surgery greater than an hour has 4.6 times [AOR=4.68; 95 % CI: (2.01-10.89)] and duration of anesthesia greater than an hour has 11 times [AOR=11.29; 95% CI: (3.96-32.19)] risk for early post-operative hypoxemia.

Conclusion and recommendation: The magnitude of early postoperative hypoxemia is high. Some of the identified factors were muscle relaxant use, duration of surgery and anesthesia greater than an hour therefore it’s important to give attention for patients undergoing long surgical procedures and for patients who took muscle relaxants.

Chapter one: Introduction

1.1 Background

Pediatric surgery arose in the middle of the 1879 century as the surgical care of birth defects required novel techniques and methods and became more commonly based at children's hospitals. The little available information in sub-Saharan Africa suggests pediatric-surgical diseases are common and poor care results in significant morbidity and mortality (1, 2).

General anesthesia is a drug induced loss of consciousness in which even painful stimulation will not arouse the patient. A relative reduction in Functional residual capacity, increased risk of airway closure during tidal breathing, higher basal metabolic rate and alveolar minute volume which increases oxygen consumption, relatively large tonsils & adenoids leading to airway obstruction, increased heart rate are more possible causes for children to have a more rapid and severe decrease in SpO2 than adults (3, 4).

When our body doesn't have adequate amount of oxygen we could get hypoxemia, which is defined as a low amount of oxygen in our blood. This low amount can further cause hypoxia, a low oxygen content that is unable to meet needs at tissue level resulting in deleterious conditions of having damage in multiple organs inside our body like brain, liver and heart (5).

Many factors may be involved in early postoperative hypoxemia. Anesthetic itself, results in alveolar hypoventilation, ventilation/perfusion mismatch, right to left shunting of blood, depressed cardiac output, low inspired O_2 and laryngospasm. (6, 7).

Arterial hypoxemia can occur anytime during anesthesia with astonishing suddenness. Severe hypoxemia can kill a patient or leave the victim with devastating neurological handicaps. Early detection of hypoxemia with pulse oximeter would lead to early correction of the hypoxemic event (8).

Pulse oximetry displays a beat to beat value of blood saturated with oxygen from peripheral sites as a surrogate marker for tissue oxygenation (10). It is considered as a “fifth vital sign” by having a feature of standard, non-invasive assessment of oxygenation and lifesaving tool for identifying children’s with early hypoxemia which cannot be detected clinically (9,11).

Because of the characteristic shape of the hemoglobin oxygen dissociation curve, a slight reduction in oxygen saturation at the upper end of the curve corresponds to much larger reductions in arterial oxygen tension. Thus an oxygen saturation of 90% has an equivalent tension of no more than 60mm.Hg. In otherwise normal arterial blood, Hypoxemia, defined as an arterial oxygen saturation <90% recorded by pulse oximetry (12,13).

Treatment for hypoxia and/or hypoxemia is to give additional oxygen to the patient as quickly as possible. Techniques vary widely according to the patient's condition, but may include oxygen by face mask or nasal cannula, mechanical ventilation (intubation) or other devices or medicines to open airways (14).

1.2 Statement of the problem

Hypoxemia is a common phenomenon and feared critical events during anesthesia and in the recovery room following major surgery and has been documented even after minor procedure under general anesthesia (15).

Reduction in functional residual capacity leading to increased shunting of blood through the lungs, V/Q imbalance or the development of atelectasis and diffusion hypoxia and hypo-ventilation due to central nervous system depression, or inadequate antagonism of neuromuscular blockade is some causes of early postoperative hypoxemia (16, 17).

The incidence of significant desaturation in the post-anesthesia care unit (PACU) is significantly greater 16.9–43.8% (18). At the cellular level, hypoxia has been shown to lead to acute heart failure, pulmonary hypertension, and acute renal failure. Additionally, studies have demonstrated that even modest fluctuations in oxygen delivery due to hypoxia-induced changes in neural tissue may lead to cognitive dysfunction (6).

Early postoperative hypoxemia leads to cellular ischemia, which may delay recovery or lead to organ dysfunction and increased morbidity and mortality. In addition, post hyperventilation hypoventilation and the persistence of ventilatory depression produced by anesthetics and neuromuscular blocking drugs may aggravate hypoxemia (19).

Before the widespread adoption of pulse oximetry in the 1980s and the establishment of anaesthesia monitoring standards in the 1990s, hypoxemia was the leading cause of anaesthesia-related mortality. Since then, anaesthesia-related mortality has dropped nearly 20-fold in developed settings. Much of this decline is attributable to improvements in the safety of anaesthesia administration and monitoring (6).

The severity of arterial desaturation and the incidences and duration of hypoxemia during the early postoperative period are closely related to the surgical sites and that they are the most pronounced for thoracoabdominal surgery, less for upper abdominal surgery, and least for peripheral surgery suggesting close respiratory monitoring and oxygen therapy during the early post-operative period (20).

The significance of even transient anoxia during anesthesia has been widely recognized for many years but until recently the frequent occurrence of and potential danger of minor degrees of prolonged oxygen desaturation during the immediate postoperative period has not been appreciated. Postoperative hypoxemia has been intensively investigated and though the problem is not solved yet (12).

More rapid and severe arterial desaturation is common in children than adults. Children have greater basal metabolic rate and greater oxygen requirement. They also have lower lung static recoil pressures and hence have more compliant thoracic wall than adults (21). As a result, their awake functional residual capacities are lower than adults.

1.3 Significance of the study

Hypoxemia is a recognized risk factor for death &correlated with disease severity. It is often overlooked in developing countries due to limited availability of pulse oximetry for more accurate detection and oxygen for treatment and low accuracy of clinical predictors

Early postoperative respiratory complications are associated with significant cost and mortality implications for patients. Postoperative episodic hypoxemia is understudied in surgical patients, though have significant value in predicting the risk of early postoperative respiratory complications. However the incidence in developed countries is even higher and in countries like Ethiopia with resource and equipment issues being a major problem, and poor establishment of post anesthesia care units, the problem would be more.

This study aims to answer which factors are more contributing for pediatrics hypoxemia postoperatively. Study also attempts to answer which type of anesthesia techniques more predisposes for pediatrics hypoxemia. To the best of our search published researches which can be used as a reference could not be found in this country, which will make this study to be used as a baseline for further country wide study.

Moreover the risk factors associated with early postoperative hypoxemia after general anesthesia can be identified and the necessary precaution can be used by anesthetists.

Chapter two: Literature review

2.1 Incidence of hypoxemia

General anesthesia has mechanical and functional changes that have an effect on respiratory system from anesthetic induction to postoperative period. GA reduces FRC with immediate development of atelectasis through compression of lung tissue, absorption of alveolar air and surfactant function impairment resulting V/Q mismatch, increased shunt and hypoxemia (22).

Children with active or recent upper respiratory infection are more prone to breath-holding, severe cough, and arterial desaturations below 90% during recovery, especially if they have a history of reactive airway disease or secondhand smoke exposure or have undergone intubation and/or airway surgery (23).

A comparative study done in Beijing peoples republic of china in 1152 postoperative patients from infant to adult with Younger patients showed lower SpO_2 levels and a higher incidence of hypoxemia during the early postoperative period. The incidences of hypoxemia SpO_2 of 86%-90% and severe hypoxemia SpO_2<or=to 85% in the recovery room were 30.6% and 16.7%, respectively, in age less than 1 year, 20.0% and 10.0% in 1-3 year age, 14.1% and 3.3% in 3-14 year of age , and 7.8% and 0.6% in 14-58 year old patients. A significant correlation was found between low SpO_2 levels on admission to the recovery room and children's age (24).

A study done in china has shown an incidence of a 41% (31.4% hypoxemia Spo2 85-%90% and 9.6% severe hypoxemia with Spo2 <85%) early postoperative hypoxemia in patients undergoing elective palatoplastic surgery shortly after arrival in the recovery room (0 minute) (25).

A prospective observational study in Deutschland on 2012 with 959 patients who undergone broad spectrum of elective surgery under general anesthesia the SpO2 was measured at the end of the transfer from the OR to the PACU immediately after the anesthetist who had taken care of the patient during the operation had estimated the SpO2, has showed a 17% incidence of SpO2 < 90% and 6.6% a SpO2 < 85% (26).

A study done in london Royal hospital revealed The highest incidences of hypoxemia (Sao2< 90%) occurred in the immediate postoperative period (28% of patients) and in the post-waking period (42% of patients on air and 14% on supplemental oxygen). The lowest recorded saturations were 72% in the immediate postoperative period and 69%in the post-waking period in children who breathed air (27).

A comparative study done in Brazil in 2005 with 882 patients who underwent elective surgery aged 0-88 years of ASA I ,II and III has shown an incidence of 8.77%, 14.74% and 16.46% in ASA I, II &III patients respectively (28). Another cross sectional study in tikur anbessa hospital in 2007 has shown an incidence of immediate post op hypoxemia of 22.7% in adults patients age greater than 18 years (32).

A non-randomized prospective study in 110 ASA I or II pediatric surgical outpatients undergoing dental, minor opthalmological or urological procedures, tonsillectomies or herniorraphy in Canada, Quebec in 1989 has shown a higher incidence of arterial desaturation ≤ 90% in 35% of the patients (29).

The hospital of sick children in Canada university of Toronto done in 71 ASA I pediatrics patients scheduled for minor surgery aged ranged from 3.5 month to 16.5 years shows an incidence of 28.1% significant arterial desaturation of ≤ 90%, 15 patients 21.1% desaturated to 85-90% and five patients (7%) desaturated to less than 85% at time during transfer to the recovery room withno contributing factors thus recommending Supplemental oxygen administration during transfer to recovery room for every pediatric anesthetic (30).

A two single blinded observer study in Herlev hospital in 1994 done in 736 patients in the OR and PACU shows mild hypoxemia (SpO2 86-90%) in 53% and 55% of the patients, respectively. Severe hypoxemia with SpO2 values < 81% was recorded in 20% and 13% of the patients, respectively (31).

A study in London has measured arterial oxygen saturation of 50 healthy children undergoing dental extraction under general anesthesia and found a decrease in Spo2 of greater than 5 % of the base line value in 70% of the patients and greater than 10% in 26% of patients (32).

Another observational study has showed a decrease in oxygen saturation less than 90% in 29 children(26.8%) & less than 80% in 7 children (6.4%) during induction of general anesthesia from total of 108 children with age less than 14 years (33).

An observational study in South Australia between age of 2 days and 19 years 152 ASAI &II pediatrics patients following general anesthesia for different procedures in 1988 has showed an incidence of hypoxemia in 26% of the patients post operatively (34).

2.2 Associated factors for early post-operative hypoxemia

A cross sectional study in china done on 1998 shows Diazepam use, alveolar hypoventilation, V/Q mismatch, decreased cardiac output, shivering, obstructive apnea and more complex surgical procedures of palatoplasty has been shown to increase the incidence of hypoxemia (25).

An observational study in Deutschland in 2012 shows patient-dependent risk factors had the strongest impact on hypoxemia. The use of opioids and relaxants with short duration of action may have favorable effects on preventing hypoxemia and decreases of SpO_2. Saturation before induction of GA, body mass index, age, ASA physical status, mode of ventilation, the choice of opioid and muscle relaxant as well as the use of nitrous oxide risk factors had the strongest impact on hypoxemia (26).

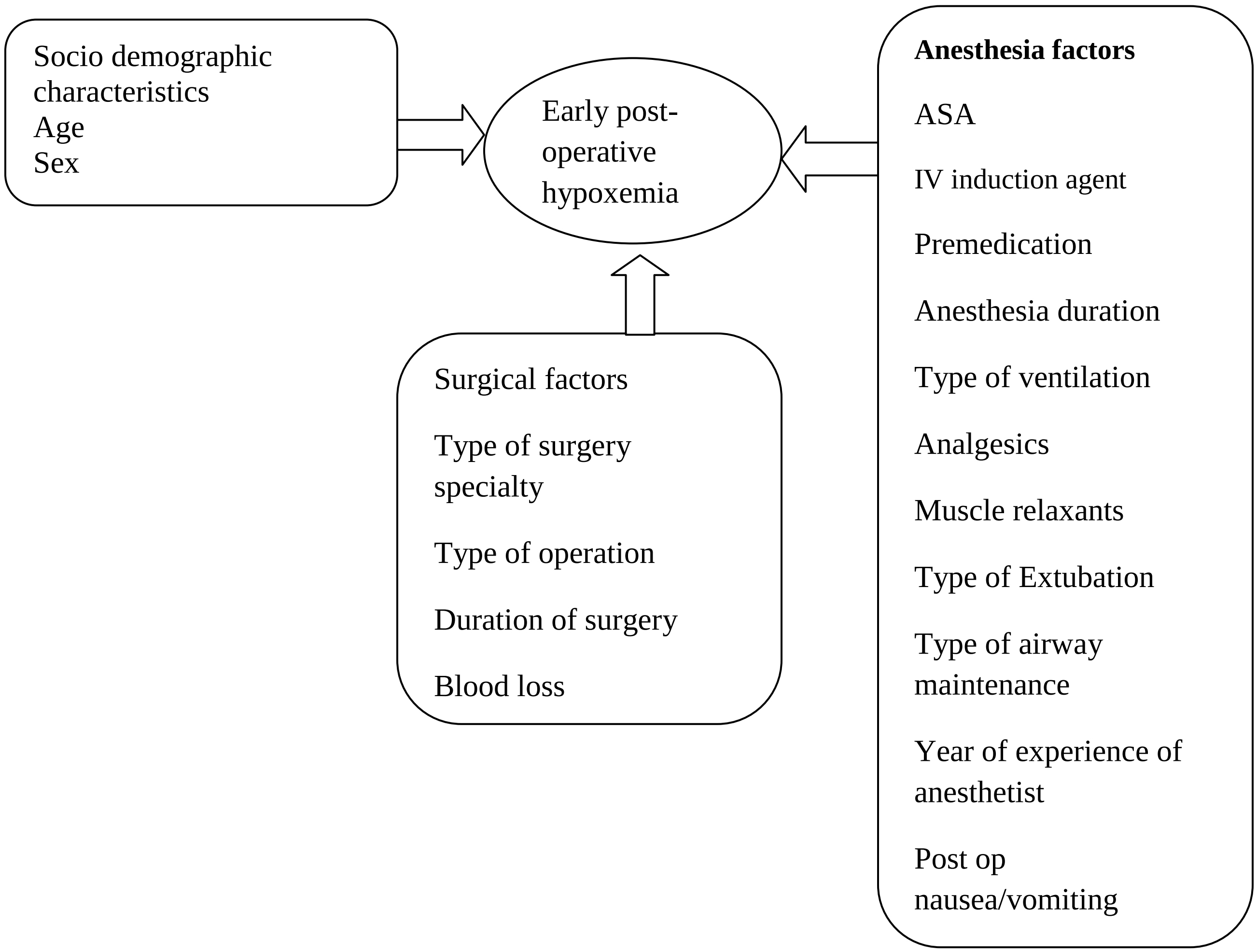
A cross sectional study in brazil concluded that female patients, patients with ASA II and/or III, the presence of general anesthesia and superior abdominal (gastro proctologic)(14.18%), cardiothoracic(28.21%), and head and neck surgeries (18.18%) are important risk factors for postoperative hypoxemia (28).

A prospective non randomized study in Quebec in 1989 has shown Otolaryngeological procedures, lower age groups and upper respiratory tract infections increase risk of hypoxemia (29).

An observational study in South Australia in 1988 showed intubation, use of muscle relaxants, IV induction and duration of surgery greater than one hour were found to be correlated with an increased incidence of postoperative hypoxemia (35).

An observational study in London shows Tracheal extubation followed by breath holding and hypoventilation were anesthetic included risk factors another single blind observer study done in Denmark in 1991in 296 inpatients shows greater incidence of hypoxemia with patient age and anesthetic technique(27,36).

Conceptual framework



Chapter three: objectives

3.1 General objective

- To determine the magnitude and associated factors of early post-operative hypoxemia in elective pediatrics surgical patients at Tikur Anbessa specialized Hospital from October 26, 2019 to February 26, 2020.

3.2 Specific objective

- To determine the magnitude of early post-operative hypoxemia.
- To identify the associated factors of early post-operative hypoxemia.

Chapter Four: Method

4.1 Study Area

The study was conducted in Addis Ababa, the capital city of Ethiopia. With an area of 527 square kilometers and 10 sub cities, it is the largest city in the country. The city has 12 government hospitals.

TASH is chosen for this study because it is the only government hospitals in Addis Ababa in which most major pediatric surgeries are performed. TASH is located in the nation's capital Addis Ababa, is Ethiopia's largest referral hospital. It offers diagnosis and treatment for approximately 370,000- 400,000 patients a year with nearly 2800 pediatrics surgeries are performed annually.

4.2 Study design and Period

Institutional based cross-sectional study was conducted from October 26, 2019 to February26, 2020.

4.3 Source of population

All pediatric surgical patients who underwent surgery at Tikur Anbessa hospital

4.4 Study population

All elective pediatric patients aged 1-14 who underwent surgery at Tikur Anbessa specialized Hospital under the specified time period were included in this study.

4.5: Inclusion and exclusion criteria

4.5.1 Inclusion criteria

All ASAI and ASAII pediatric surgical patients undergoing general anesthesia aged 1-14years

4.5.2 Exclusion criteria

- ✓ preoperative documentation of existing airway (i.e. endotracheal tube or tracheostomy in situ)
- ✓ Age <1 year
- ✓ preoperative ventilator dependence
- ✓ patients with cardiac or lung disease
- ✓ preoperative oxygen saturation <90%

4.6 Sample size and sampling technique:

4.6.1 Sample size determination

The sample size was determined using the single population proportion method by assuming that 50% of the patients have early postoperative hypoxemia (to obtain the maximum representative sample size since no similar study was found in the area) with 95% confidence interval (CI) and 5% margin of error**.** Situational analysis of pediatric surgery was done on the 4 months before the start of the study and averages of 128 procedures are done per month.

Early postoperative hypoxemia (p)=50%

Confidence Level = 95%

Margin of error =5%

After obtaining sample size of n=219 and adding 5%for incomplete data total sample size of **n=229** was obtained and systematic random sampling was used to choose patients by using skip interval of K=N/n 510/229= 2

Therefore, the sampling interval was two and the first study participant (random start) was selected using lottery method from the daily pediatric surgery. Then, every second cases from the daily pediatric surgery was included in the study during the study period

4.7 Study variables

4.7.1 Dependent variable

- Early postoperative hypoxemia

4.7.2 Independent variables

Socio demographic

- Age
- Sex

Anesthesia and surgical

- ASA status
- Type of induction
- Type of maintenance
- Type of anesthetic technique
- Type of ventilation (controlled/spontaneous)
- Premedication
- Analgesics
- Use of muscle relaxants
- Post-operative Pain
- Year of anesthetist experience
- Time taken from OR to recovery
- Type of surgery specialty
- Type of operation
- Duration of anesthesia
- Duration of surgery

4.8 Operational definition

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

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

Elective surgery: is surgery done before onset (appearance) of any complication that might constitute urgent decision

Hypoxia : is defined by reduced level of tissue oxygenation (7).

Post anesthesia care unit: place where patient is admitted after surgery and anesthesia to be followed by professionals

Early post-operative hypoxemia: Is defined as a drop in SpO_2 levels under 90% measured by pulse oximetry for at least 30 seconds any time point at recovery within 20 min post operatively (37).

Awake extubation: Removing ET tube/LMA after eye opening, facial grimace, movement other than coughing, purposeful movement, adequate oxygenation, reversal of neuromuscular blockade (40).

Deep extubation: The ET tube/LMA is removed before wake-up and before the return of upper airway reflexes (41).

Premedication: Drugs given 20 minutes to three hours preoperatively (42).

Pain: yes for pain is >2 for wong baker faces and >3 for visual analogue score and no pain is <2 for wong baker faces and < 3 for visual analogue score (44).

4.9 Data collection procedure: After training the data collectors (2nd year MSc students and Anesthesiology residents) data was collected from all eligible patients after consent was taken from patient parents or caregivers. Medication, Co morbidity and medical history were extracted from patient records and interview. Intra operative anesthesia and surgery related data was obtained from the responsible anesthetist and from anesthesia chart. After the patient transferred to PACU peripheral oxygen saturation was immediately recorded from 0 to 30 minute duration and pain assessment was done after patient got his/her consciousness . Pulse rate, respiratory rate and temperature were recorded. The lowest reading persisting for at least 30 second was noted. If the oxygen saturation was below 90%, the attending PACU nurse was informed. Episodes of hypoxemic changes were recorded including the time they occurred.

4.10 Data quality assurance: Training was given for data collectors on the data collection tool. Collected data were checked once a week for its completeness, clarity, consistency and accuracy by the principal investigator. In case of missed measurement electronic data store of the machines were recalled and back traced data was filled.

4.11 Data analysis: Data was coded, entered, cleaned and edited using Epi Info version 7 and exported to Statistical package for Social Sciences (SPSS) software version 22.0. Using SPSS basic descriptive statistics like frequency was done for socio demographic variables and prevalence of hypoxemic changes. Binary and multivariable logistic regression analysis were done to determine presence of association between dependent and independent variables, and odds ratio with 95% confidence intervals was used to determine the degree of association between dependent and independent variables. Variables with a p-value less than 0.25 in the binary logistic regression analysis were considered as candidates for multivariable analysis. Multivariable analysis was performed to adjust for possible confounders and to come up with significant predictors. Level of statistical significance was declared at p-value less than 0.05. Both crude and adjusted odds ratio with 95% confidence interval were reported.

4.12 Ethical considerations: permission was obtained from Addis Ababa university ethical committee before the start of the research. The hospital administrators received letters containing objective and purpose of the research. Data collectors took informed consent orally from each patient family to collect data. During the data collection process, Norms, values and morals of patients were respected by data collectors.

4.13 result dissemination plan

The copy of the research will be submitted to Addis Ababa University College of health science, Addis Ababa city health bureau and student research office. The result will be presented to department of Anesthesia as a part of MSc in advanced clinical anesthesia thesis, communicated through annual students/staff research conference and annual national conference of Ethiopian Anesthetist association. Moreover, efforts will be done to publish the findings of the study.

5. Results

5.1 Socio-demographic and surgical characteristics of patients

During the study period, data was collected from 229 patients. The mean (±SD) ages of the patients were 4.4(±3.189). Most of patients were ASA I with body weight ranging from 5 to 38 kg with all preoperative peripheral oxygen saturation of above 90%.

Table1. Socio demographic and surgical characteristics of patients who underwent elective pediatric surgery at TASH from October 26, 2019 to February 26, 2020 (n=229)

Variables	Category	Frequency (percent)
Age in years	1-7	180 (78.6)
	8-14	49 (21.4)
Sex	Male	153 (66.8)
	Female	76 (33.2)
Type of surgery specialty	General surgery	92 (40.2)
	Urology	93 (40.6)
	ENT	15 (6.6)
	Orthopedics	29 (12.7)
Type of operation	Laparascopic	27 (11.8)
	Open	202 (88.2)
Duration of surgery	≤ 60 minutes	112 (48.9)
	>60 minutes	117 (51.1)

5.2 Preoperative and intraoperative anesthesia characteristics

All the 229(100%) patients underwent surgeries under General Anesthesia. General anesthesia with endotracheal tube for 196(85.6%) and laryngeal mask airway for 33(14.4%) was used. Intraoperative anesthesia was maintained with volatile anesthetics (>=1minimum alveolar concentration) for both halothane and isoflurane. Caudal analgesia using bupivaciane(1-2 ml/kg) and neostigmine as an adjuvant were used for intraoperative as well as postoperative pain control for 108(47.2%) and 11(4.8%) patients respectively.

Table 2. **Preoperative and intraoperative anesthesia characteristics of patients who underwent elective pediatric surgery at TASH from October 26, 2019 to February 26, 2020 (n=229)**

Variables	Category	Frequency(percent)
ASA	Class I Class II	183(79.9) 46 (20.1)
Hemoglobin	<11 g/dl ≥ 11 g/dl	72 (31.4) 157 (68.6)
Patient condition before induction	Crying Comfortable	129 (56.3) 100 (43.7)
Type of anesthetic technique	GA with ETT GA with LMA	196 (83) 33 (11.4)
Type of ventilation	Controlled Spontaneous	133 (58.1) 96 (41.9)
Premedication	Yes No	111 (51.5) 118 (48.5)
Induction agent	Propofol Ketamine Thiopentone Ketofol	109 (47.6) 55 (24) 43 (18.8) 22 (9.6)
Maintenance	Isoflurane Halothane	153 (66.8) 76 (33.2)
Muscle relaxant	Yes No	167 (72.9) 62 (27.1)

Intra-operative analgesia	Pethidine Morphine Fenatnyl Non opioid	63 (27.5) 48 (21) 8 (3.5) 41 (17.9)
Caudal analgesia	Bupivacaine Bupivacaine+neostigmine	108 (47.2) 11 (4.8)
Duration of anesthesia	> 60 minutes ≤ 60 minutes	145 (63.3) 84 (36.7)
Experience of anesthetist	≥ 5 years <5 years	159 (69.4) 70 (30.6)

Postoperative characteristics

Among 229 pediatric patients, 117 patients undergo surgery greater than an hour and 112 patients less than an hour. PONV was seen in58 patients post operatively.

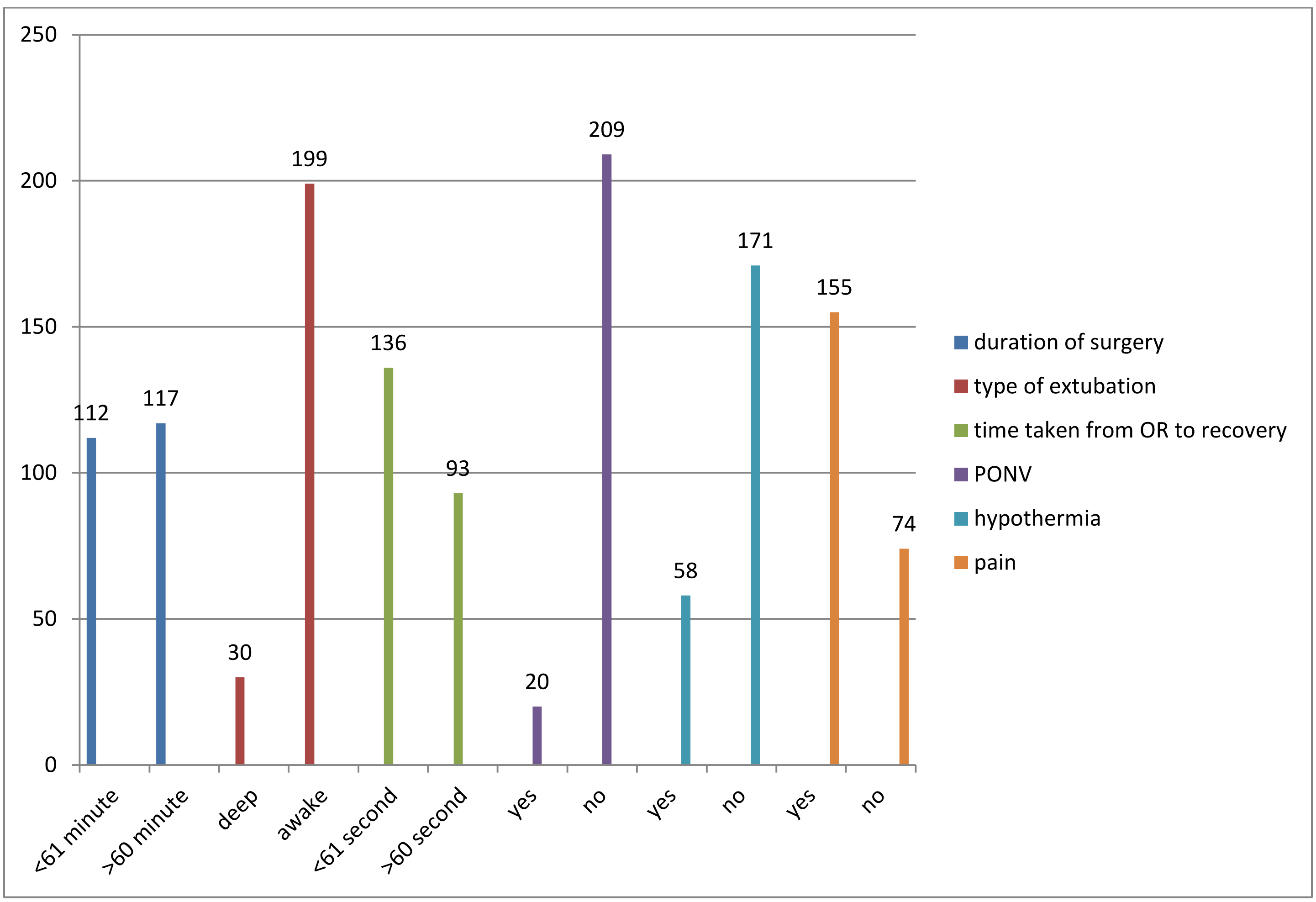


Figure 1. Postoperative characteristics of patients who underwent elective pediatric surgery at TASH from October 26, 2019 to February 26, 2020 (n=229)

5.3 Incidence of hypoxemia

From the total pediatrics patients who undergo elective surgery under general anesthesia, the Magnitude of early postoperative hypoxemia was 44.5%.

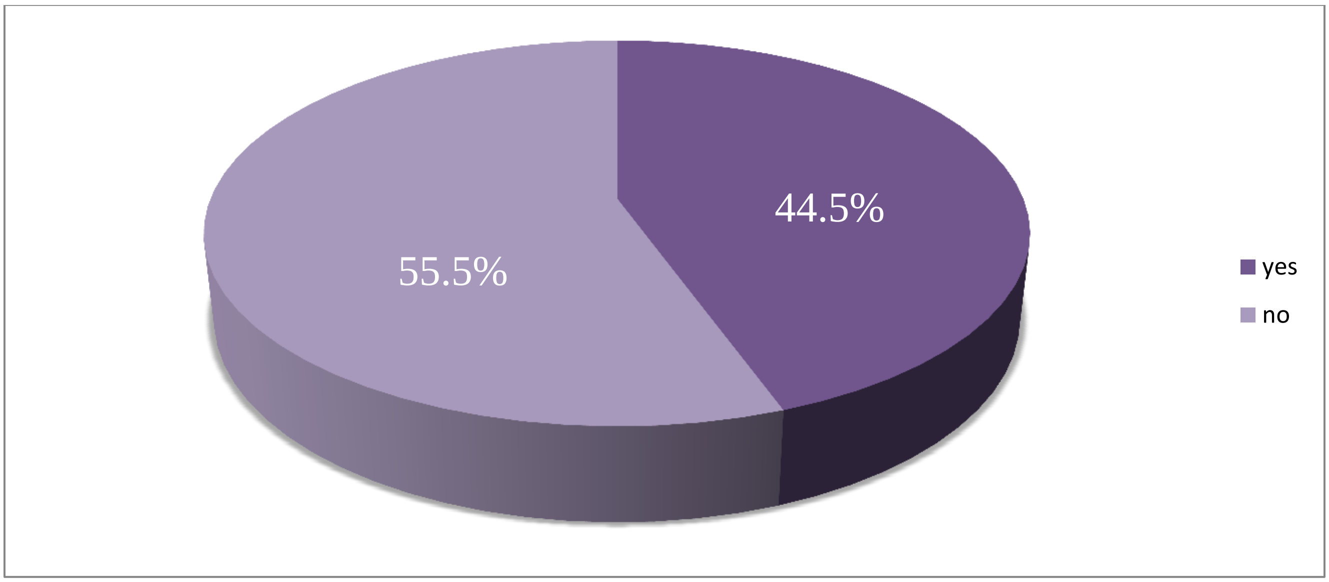


Figure 2. Incidence of early postoperative hypoxemia in pediatric patients who underwent elective surgery under general anesthesia in TASH from October 26, 2019 to February 26, 2020. (n=229)

5.4 Factors associated with early postoperative hypoxemia

5.4.1 Result of bivariate analysis

Binary logistic regression analysis was conducted to see the association between independent variables and early post-operative hypoxemia. General surgery is 4.4[COR=4.4: 95%CI (1.51-12.71) and open surgery is 3.17[(COR= 3.17: 95% CI (1.22-8.18)] times risk of developing hypoxemia in early postoperative period.

Table 3. Socio-demographic and surgical factors associated with early post-operative hypoxemia at Tikur anbessa hospital from October 26, 2019 to February 26, 2020. (n=229)

Variables	Category	Hypoxemia		COR 95%CI	p-value
		Yes n(%)	No n(%)		
Age in year	8-14	15(30.6%)	34(69.4%)	1	
	1-7	87(48.3%)	93(51.7%)	2.12(1.08-4.16)	0.029
Type of surgery specialty	Orthopedics	5(20.8%)	19(79.2%)	1	
	General surgery	51(53.7%)	44(46.3%)	4.40(1.51-12.71)**	**0.006**
	Urology	39(43.3%)	51(56.7%)	2.90(0.99-8.46)	0.051
	ENT	7(35%)	19(65%)	2.04 (0.53-7.87)	0.298
Type of operation	Laparascopic	6(22.2%)	21(77.8%)	1	
	Open	96(47.5%)	106(52.5%)	3.17(1.22-8.18) **	**0.017**

Anesthesia factors associated with early postoperative hypoxemia In pediatrics patients undergoing surgery under general anesthesia at tikur anbessa hospital

Anesthesia related factors such as premedication, muscle relaxant, duration of surgery and duration of anesthesia were observed.

Table 4. **Anesthesia factors associated with early postoperative hypoxemia In pediatrics patients undergoing surgery under general anesthesia at Tikur anbessa hospital from October 26, 2019 to February 26, 2020. (n=229)**

Variables	Category	Hypoxemia Yes n(%)	No n(%)	COR 95%CI	p-value
ASA	I	76(41.5%)	107(58.5%)	1	
	II	26(56.5%)	20(43.5%)	1.83(0.95-3.51)	0.070
Type of anesthetic Technique	GA with LMA	10(30.3%)	23(69.7%)	1	
	GA with ETT	92(46.9%)	104(53.1%)	2.03(0.92-4.49)	0.079
Premedication	Yes	18(16.2%)	93(83.8%)	1	
	No	84(71.2%)	34(28.8%)	12.7(6.7-24.2) **	**0.0001**
Type of induction	ketofol	8(36.4%)	14(63.6%)	1	
	propofol	53(48.6%)	56(51.4%)	1.65(0.64-4.26)	0.296
	ketamine	13(23.6%)	42(76.4%)	0.54(0.18-1.57)	0.261
	thiopentone	28(65.1%)	15(34.9%)	3.26(1.11-9.53)	0.030
Muscle relaxant used	No	14(22.6%)	48(77.4%)	1	
	Yes	88(52.7%)	79(47.3%)	3.81(1.95-7.45) **	**0.0001**
Duration of surgery	≤ 60 minutes	23(20.5%)	89(79.5%)	1	
	>60 minutes	79(67.5%)	38(32.5%)	8(4.4-14.6)**	**0.0001**
Duration of anesthesia	≤ 60 minutes	7(8.3%)	77(91.7%)	1	
	>60 minutes	50(34.5)	95(65.5%)	20(8.9-48.7)**	**0.0001**
Anesthetist experience	≥ 5 years	25(35.7%)	45(64.3%)	1	
	<5 years	77(48.4%)	82(51.6%)	1.69(0.94-3.01)	0.076
Pain	No	28(37.8%)	46(62.2%)	1	
	Yes	74(47.7%)	81(52.3%)	1.50(0.85-2.64)	0.159

**** Statistically significant**

5.4.2 Results of multivariable logistic regression analysis

After excluding variables which doesn't fit for the final model using P-value >0.25 in Likelihood ratio test, multivariable analysis was performed. The result showed patients taking muscle relaxant, taking no premedication and duration of surgery and anesthesia which takes greater than one hour have a high risk of developing early postoperative hypoxemia.

Table 5. Anesthesia factors associated with early post operative hypoxemia in pediatrics patients undergoing surgery under general anesthesia at Tikur anbessa specialized hospital from October 26, 2019 to February 26, 2020. (n=229)

Variables	Hypoxemia		COR 95%CI	AOR 95 %CI	P-value
	Yes n(%)	No n(%)			
Age in year					
8-14	15(30.6%)	34(69.4%)	1	1	
1-7	87(48.3%)	93(51.7%)	2.12(1.08-4.16)	2.25(0.67-7.64)	0.204
Type of operation					
Laparascopic	6(22.2%)	21(77.8%)	1	1	
Open	96(47.5%)	106(52.5%)	3.17(1.22-8.18)	2.26(0.48-10.60)	0.299
Premedication					
Yes	18(16.2%)	93(83.8%)	1	1	
No	84(71.2%)	34(28.8%)	12.7 (6.70-24.2)	10.93(4.74-25.21)**	**0.0001**
Type of maintenance					
Isoflurane	63(41.2%)	90(58.8%)	1	1	
Halothane	39(51.3%)	37(48.7%)	1.5(0.86-2.61)	2.25(0.82-6.20)	0.115
Muscle relaxant used					
No	14(22.6%)	48(77.4%)	1	1	
Yes	88(52.7%)	79(47.3%)	3.81(1.95-7.45)	3.13(1.13-8.64)	**0.002**
Anesthetist experience					
≥ 5 years	25(35.7%)	45(64.3%)	1	1	

<5 years	77(48.4%)	82(51.6%)	1.69(0.94-3.01)	1.98(0.71-5.55)	0.191
Duration of surgery					
≤ 60 minutes	23(20.5%)	89(79.5%)	1	1	
>60 minutes	79(67.5%)	38(32.5%)	8(4.40-14.6)	4.68(2.01-10.89)	**0.0001**
Duration of anesthesia					
≤ 60 minutes	7(8.3%)	77(91.7%)	1	1	
>60 minutes	50(34.5)	95(65.5%)	20(8.90-48.7)	11.29(3.96-32.19)	**0.0001**
Pain					
No	28(37.8%)	46(62.2%)	1	1	
Yes	74(47.7%)	81(52.3%)	1.50(0.85-2.64)	2.33(0.95-5.68)	0.062

**** Statistically significant**

Patient who took muscle relaxant and develops hypoxemia postoperatively has shown to be 52.7%.

In patients with Surgery lasting greater than an hour and developing post-operative hypoxemia has shown to be 67.5% .

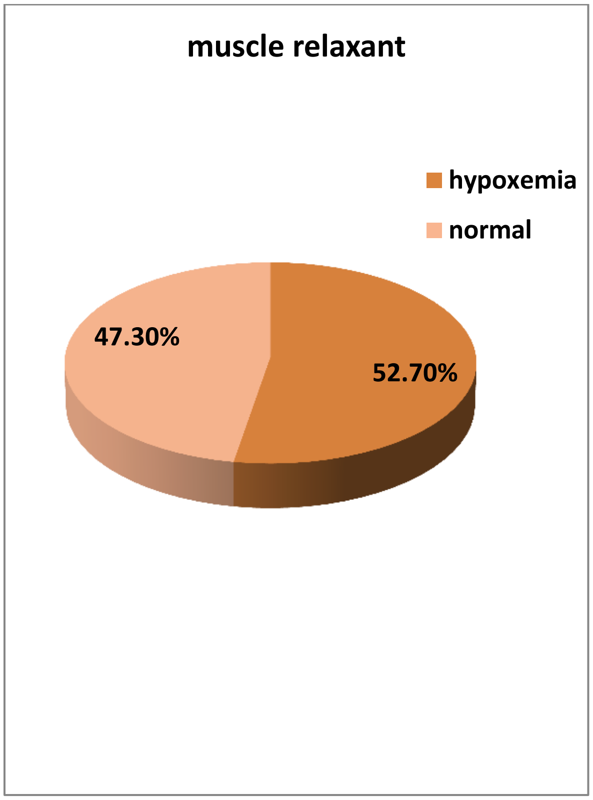


Figure 3. Muscle relaxant use for pediatrics surgery and early post-operative hypoxemia in TASH from October 26, 2019 to February 26, 2020. (n=229)

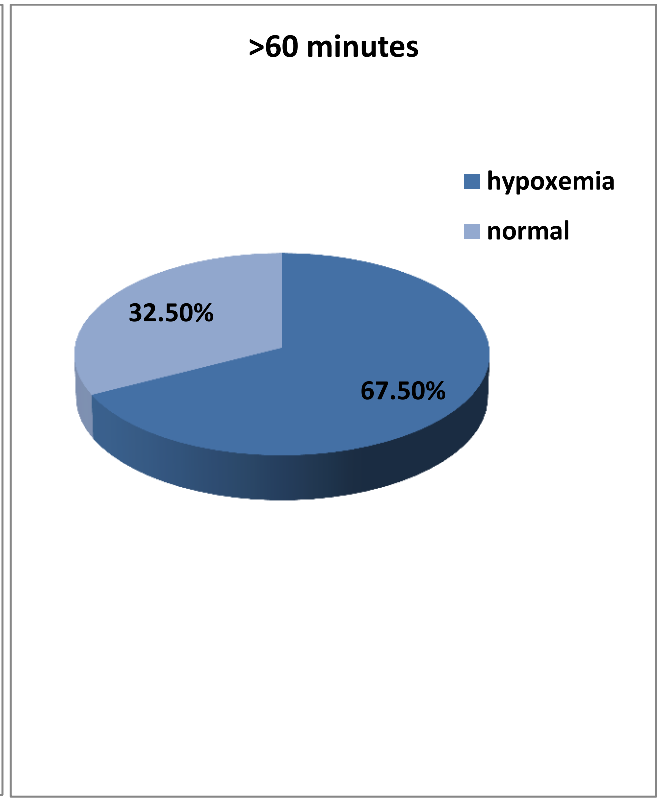


Figure 4. Duration of surgery >60 minutes and early post-operative hypoxemia in pediatrics surgery in TASH from October 26, 2019 to February 26, 2020 (n=229)

6. Discussion

Overall, No attempt was made to influence the type of premedication or anesthetic technique but as long as was felt necessary by the anesthetist. Oxygen saturation was recorded on arrival in the PACU. The lowest reading persisting 30 second was noted. If the oxygen saturation was below 90%, the attending PACU nurse was informed.

The magnitude of early postoperative hypoxemia In pediatrics patients was found to be 44.5%. This magnitude is close to the result of a research conducted by giancario marcondes et al who studies early post-operative hypoxemia in ASA I & II age ranging from 0-88 years in which incidence of moderate to severe hypoxemia is 39.2% (28). And almost the same result with Xue Fs et al who did a comparative study in china between age groups of <1 year, 1-14 year and 14-58 years and early post-operative hypoxemia incidence is 44.1% in children aged 1-14 years (24,16).

A study in tikur anbessa hospital done on post op hypoxemia in adult patients found an incidence of 22.7%. The gap of incidence may be attributed to the difference in age groups and technique of anesthesia used. (32). The higher incidence of postoperative hypoxemia can be associated with reduced functional residual capacity, hypoventilation and ventilation perfusion mismatch and more over pediatrics having immature respiratory centers and smaller airways relative to a large tongue volume are at increased risk of developing hypoxemia(33).

There is significant risk of early post-operative hypoxemia in patients who took muscle relaxant. There was about 3 times risk [(AOR=3.13 CI(1.13-8.64)] to develop early post-operative hypoxemia in reference to patients taking no muscle relaxant. This result is supported by D.P.Tomkins who shows significance in patients taking muscle relaxant in his observational study in south Australia in 152 children aged between 2 days and 19 years (34). The reason for this result can be residual neuromuscular blockage, impaired gas exchange as muscle of chest walls got reduced tone and alteration of bronchomotor and vascular tone changes persist in the post-operative period (38).

Early post-operative hypoxemia was significantly high in surgeries more than an hour and anesthesia time greater than one hour with [(AOR 1.75-11.55)] and[(3.37-30.8)] respectively with 4 and 11 times risk for both surgery and anesthesia. This result is in line with Richard w morris et al and D.P.Tomkins who reported higher risk of hypoxemia in longer duration of anesthesia and surgery(34). The reason for this might be as surgery and anesthesia time increases, there will be substantial atelectasis in combination with hypoventilation and ventilation perfusion mismatch in post anesthesia care unit which causes pulmonary shunt and, therefore, undoubtedly contributes to the impairment of gas exchange (39).

Significant association is also found in patients who take premedicant drugs. Patient who did not take premedication are observed to have 10 fold risk [AOR 10.93; 95%CI; (4.74-25.21)] of developing early post-operative hypoxemia. This result is supported by a study made by G.J.A laycock et al who did an observational study in London on 108 children aged 10 days to 14 years. The children who had no premedication were significantly more likely to be anxious or screaming in the anesthetic room and to have larger decreases in saturation. Much debate continues about the most suitable premedication for children. Sedative premedication resulted in the best pre-induction conditions and the lowest incidence of hypoxemia (27).

7: Conclusion and Recommendations

7.1Conclusion

The findings of this study have shown that overall magnitude of early postoperative hypoxemia was 44.5% in pediatrics patients who underwent elective surgery at Tikur anbessa specialized hospital.

It was also found that use of muscle relaxant, not to use premedication, surgery and anesthesia duration greater than one hour are associated with early postoperative hypoxemia.

7.2 Recommendations

Based on the findings of the present study, the following recommendations are forwarded:-

- Anesthetists should use necessary precaution for patients with long duration of surgery and anesthesia.
- Attention should be given for patients who took muscle relaxant.
- Considering this as a baseline we recommend a further long term multicenter study with large sample size.

8. Strengths and limitations of the study

8.1 Strengths

- It addresses pediatrics Peri-operative factors which can be a baseline data for researchers

8.2 Limitations

- Patient oxygen saturation during transportation from OR to PACU is not included
- It is a single center study; therefore, this result cannot be generalized to other centers

9 Reference

1. Carolder sarkissan Evidence to support oxygen guidelines for children with emergency signs in developing countries;a systematic review and physiological &mechanistic analysis. journal of tropical pediatrics, February,2017
2. S.W.Bicker, Pediatric surgery in sub-Saharan Africa, 15 May 2000.
3. American society of Anesthesiologists, continuum of depth of sedation; definition of general anesthesia and level of sedation/analgesia , October 15/ 2014
4. G.J.A Laycock, Hypoxemia during induction of anesthesia- an audit of children who underwent GA for routine elective surgery. 1988 volume 43 p.981-984
5. Carol dersarkissan Evidence to support oxygen guidelines for children with emergency signs in developing countries;a systematic review and physiological &mechanistic analysis.journal of tropical pediatrics, February,2017
6. Incidence of hypoxemia during surgery: evidence from two institution. Canadian journal of anesthesia, October 2010 volume 57 p.888-897
7. Malay Sarkar ,Mechanism of hypoxemia : Jan-Feb 2017
8. Ana Fernandez-Bustamante, MD, PhD; Gyorgy Frendl, MD, PhD; Postoperative Pulmonary Complications, Early Mortality, and Hospital Stay Following Noncardiothoracic Surgery November 9,2016
9. William R. Mower, MD Pulse Oximetry as a Fifth Pediatric Vital Sign ,Apr 15, 1996
10. Abhijanmaity, Detection of hypoxia in the early postoperative period. 2012 jan-jun;6(1):34-37
11. Adoption of paediatric and neonatal pulse oximetry by 12 hospitals in Nigeria: a mixed-methods realist evaluation
12. J.P.Payne, Hypoxemia after surgery and anesthesia 1966
13. Usen S ,Clinical predictors of hypoxemia in Gambian children with acute lower respiratory tract infection; prospective cohort study, Jun 2018
14. Charles PatricMD,PhD. Hypoxia and hypoxemia; 1996-2018
15. J.Rosenberg. Late post operative episodic and constant hypoxemia and associated ECG abnormalities, British journal of anesthesia 1990 65:684-691

16. Giancarlo Marcondes. Transportation of patients to the post-anesthetic recovery room without supplemental oxygen: repercutions on oxygen saturation and risk factors associated with hypoxemia, , August 2000
17. C Craw ford MD. Pulse oximetry anesthesia & analgesia, October 1996-volume 83 issue p709-7115
18. Satyakrishma. Retrospective observational evaluation of postoperative oxygen saturation levels and associated postoperative respiratory complications and hospital resource utilization;
19. Stephen E. Swanagin. Effect of inspired oxygen concentration and transportation time on arterial hemoglobin oxygen saturation during transport from the operating room to post anesthesia care unit, 1996
20. William R. Mower, MD, Pulse Oximetry as a Fifth Pediatric Vital Sign. Apr 15, 1996
21. Myotoma marshal BE. Hypoxemia during and after anesthesia, anesthesiology 1972;
22. J.canet Post-operative pulmonary complication, May 2014
23. Tait AR. Risk factors for perioperative adverse respiratory events in children with upper respiratory tract infection.,2001 95:295-300
24. Xue.Fu.s MD. Comparative study of early post-operative hypoxemia in infants,children and adults undergoing elective plastic surgery, October 2006.
25. F.S XuE. Influence of surgical technique on early post operative hypoxemia in children undergoing elective palatoplasty. British journal of anesthesia 1998,80 447-451
26. Aust H. Hypoxemia after general anesthesia, April 2012
27. G.J.A. Laycock. Hypoxemia during recovery from anesthesia- an audit of children after general anesthesia for routine elective surgery1988, volume 43
28. Transportation of patients to the post-anesthetic recovery room without supplemental oxygen: repercutions on oxygen saturation and risk factors associated with hypoxemia Aug. 2006
29. Drjoan.C.Bevan. Decreases in arterial oxygen saturation in pediatric outpatients during transfer to the post anesthetic recovery room. department of anesthesia the montreal childrens hospital, 1989
30. Dr.John Pulleritis. Department of anesthesia and research institute,the hospital of sick children , Toronto, Ontario. 1987.

31. Anesthesia related hypoxemia The effect of pulse oximetry monitoring on perioperative events and postoperative complications1994 Nov;41(5):489-500
32. Getahun dendir, Meron Abrar. Magnitude and associated factors of immediate postoperative hypoxemia among elective surgical procedures at tikur anbessa specialized hospital, Addis Ababa, Ethiopia, january 2017
33. Lippincott wiliam. Children at increased risk of hypoxia,1844
34. D.P.Tomkin. Hypoxia in children following general anesthesia. 1988 south Australia.
35. Nicholasm dalesio. Are nocturnal hypoxemia and hypercapnia associated with desaturation immediately after adeno-tonsillectomy, 22 FEB 2015.
36. J.T.Moller. Hypoxaemia during anaesthesia—an observer study, 1991;66 437-444
37. Maity A, Saha D, Swaika S, Maulik SG, Choudhury B, Sutradhar M. Detection of hypoxia in the early postoperative period. Anesth Essays Res 2012 Jun;6(1):34.
38. J. G. Jones. Postoperative hypoxaemia: mechanisms and time course Anaesthesia, 1990, Volume 45, pages 566-573
39. Marcin karcz. Respiratory complications in the postanesthesia care unit: A review of pathophysiological mechanisms , 2013
40. Patel rl. A comparison of tracheal extubation in awake and deeply anesthesized patient. 1991
41. DAS (difficult airway society 2013)
42. Dr.mary harding. Premedication, August 2019.
43. Post operative predictors of moderate to intense acute post-operative pain in patients undergoing abdominal surgery. 2002

Annexes

Annex 2: Information Sheet (English version)

<u>Addis Ababa University College of Health Sciences</u>

<u>School of medicine</u>

<u>Department of Anesthesia</u>

<u>Consent form</u>

Hello, my name is __________________ and I am a data collector for research aimed at assessing the incidence of early post-operative hypoxemia and factors associated with early post-operative hypoxemia. Since the study is not linked with any financial aid there is no direct incentives paid as a result of you taking part in the study. However, your legitimate participation in filling the questionnaire with real information is very important and highly appreciated.

I would like to assure you, that your children name will not be written on this form and all the information gathered will be kept strictly confidential.

You can decide whether you want to take part in the questionnaire or not. I would like to assure you that there are no negative impacts you face because of not taking part in the study. Please feel free to ask any questions data collector nearby.

You can also contact principal investigator with address below:

1. rebkaa.ketemaa@gmail.com +251913392634

We appreciate your response to us and thank you for giving us your time.

Annex 3: Information Sheet (Amharic version)

የአዲስአበባ ዮኒቨርስቲ

የህክምና እና ጤና ሳይንስ ኮሌጅ

የአንስቴዥያ ት/ክፍል

ጤና ይስጥልን እኔ___________________________እባላለሁ፡፡ ከኦፕራሲሆን በሁዋላ በደም ቅዳ ቡዋንባ ዉስጥ የሚኖረውን የኦክስጅን መጠን ለውጦች ላይ የሚሰራ ጥናት መረጃ ሰብሳቢ ነኝ:: ጥናቱ ለእርሶ ምንም አይነት የገንዘብ ጥቅም አያስገኝም ነገርግን የጥናቱ ውጤት በህክምና ዘርፍ ላይ ያሉትን ችግሮች ለመቅረፍ እና የታካሚዎችን ደህንነት የሚያረጋግጡ ህጎች እንዲስተካከሉ እና ሥራ ላይ እንዲውሉ የበኩሉን አስተዋፅዖ ያበረክታሉ፡፡ ስምዎ በዚህ ጥናት ላይ አይፃፍም፡፡ ስለዚህም የእርሶ ምላሽ ሚስጥራዊነቱ የተጠበቀ ነው::በዚህ መጠይቅ ላይ ለመሳተፍ መስማማትም ሆነ አለመስማማት ይችላሉ፡፡ ባለመስማማቶ ምንም የሚጎዱት ነገር የለም፡፡

ምንም አይነት ጥያቄ ካለዎት ቀጥሎ በተፃፈው አድራሻ ተመራማሪውን ማግኘት ይችላሉ፡፡

1. ርብቃ ከተማ (ዋና ተመራማሪ)

   ኢሜይል -rebkaa.ketemaa@gmail.com ስልክ +251913392634

በመጠይቁ በመስማማቶ ከልብ አመሰግናለሁ::

የመረጃ ሰብሳቢ ስምና ፊርማ

ስም______________________ ፊርማ_______________ ቀን________________

Annex 4: Questionnaire

Addis Ababa University College of Public Health and Medical Science

School of Medicine Department of Anesthesia

INFORMATION SHEETCode _____________

Hello

My name is Rebka Ketema. I am a researcher and I have been attending postgraduate program in the field of Anesthesia at Addis ababa university. I am going to conduct research to assess the magnitude and associated factors of early post-operative hypoxemia in pediatrics surgical procedures at Tikur Anbessa specialized Hospital from October 26, 2019 to January 24, 2020 G.C. The information going to obtained will help the government and other responsible bodies to reduce early post-operative hypoxemia complication which helps to reduce mortality and morbidity . 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 cannot 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

Rebka ketema Email rebkaa.ketemaa@gmail.com Cell phone +251-913-39-26-34

Part 1. Identification:

1.1. Ward_______ 1.2. Bed no.______1.3Patient MRN__________

1.4 Age (in year) _________ 1.5. Sex: A. Male B. Female

Part 2. Preoperative Data

2.1. Diagnosis _________________ Planned procedure_________________

2.2Body weight _______Kg 2.3 Height (cm)__________

2.4 Coexisting disease:

A. Upper Respiratory Tract Infection (*yes if at least 2 symptoms are recognized*)

I. Sore throat II. Rhinorrhea III. Congestion IV. Non productive cough

V. Fever (T^o38°C)

B. Congenital disease (Musculoskeletal/Neurologic) ______________

C. OSA(Obstructive sleep apnea)

D. Nasal polyps

E. Bronchial asthma

F. Hepatitis / HIV/AIDS

G. Other (Specify) ______________

2.5 Preoperative Hgb ______g/dL or Hct. _____%

2.6 ASA status: A. I B. II C. III D. IV

2.7 Urgency of surgery A. Elective B. Emergency

2.8Patients condition before inductionA. Crying B. Comfortable

2.9Premedication__________________

i. Route of administration_____

ii. Dose in milligram/ microgram________

Part 3. Operative procedure

3.1Surgery type I. General Surgery(specify)______

II. Orthopedics (specify)_________

III. Urology surgery(specify)______

IV. Neurosurgery(specify)_________

V. ENT (specify)_________

VI.Others (specify)_________

3.2 Type of operation I. Open ____________ II. Laparoscopic________

Part 4. Intraoperative characteristics

4.1. Induction agent A. intravenous______mg

B. inhalational__________agent

4.2 Maintenance A. Intravenous______________

B. inhalational______________

4.5 Muscle relaxant used. Induction________mg.

Maintenance_______mg

4.3 Type of anesthetic technique

A. GA with ETT B. GA with LMA C. GA with Mask

4.4 Type of respiration

A. Controlled B. Spontaneous

4.5 Duration of surgery _________________(Time in minutes)

4.6 Intraoperative blood loss (ml)________________

4.7 Intraoperative IV fluids (ml)______________

4.8.Intraoperative complication (specify)_________

4.9 Intraoperative Analgesia medication______

A. Route_______ B. dose in milligram/microgram

4.10 Type of Extubation A. Deep B. Awake

4.11 Neuraxial/Nerve block__________i. Type of drug __________ ii. dose________

4.12 Anesthetist Level of education

A. BSC B. MSC student

C. MSC holder D. Anesthesiologist

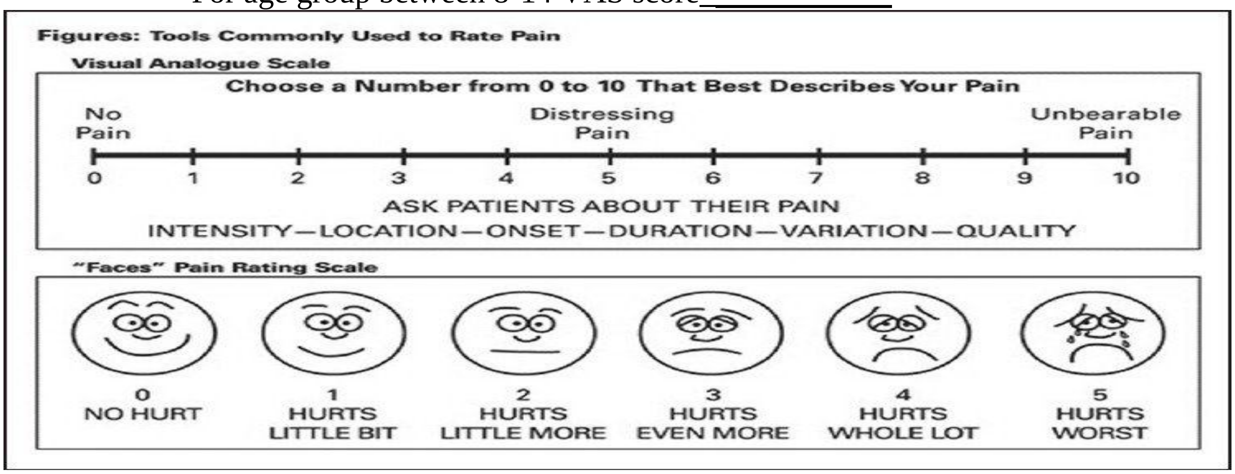
4.13 Anesthetist experience ___________years

4.13 Time taken from OR to recovery

4.14 Postoperative pain assessment

For age group between1-7 FLACCscore_________

For age group between 8-14 VAS score____________



4.15Was there Post-operative nausea vomiting? I. Yes _____II. No _____

4.16 Temperature in ________^{o}C

5. Post anesthesia care unit hypoxia evaluation

Hemodynamic variables	Time in minute										
	0	1	2	3	4	5	10	15	20	25	30
SPo2%											
HR											
BP											
RR											

Key - SPO_2peripheral saturation HR heart rate BP blood pressure RR respiratory rate

5.2 What was done when the patient desaturated

A. Administration of oxygen by mask

B. Administration of oxygen via nasal cannula

C, Re-intubation D. Other (specify)_______