Addis Ababa University

College of Health Sciences

School of Medicine

Department of Anesthesia

THE PREVALENCE OF DIFFICULT AIRWAY AND ASSOCIATED FACTORS IN PEDIATRIC PATIENTS UNDERGOING SURGERY UNDER GENERAL ANESTHESIA AT ADDIS ABABA REFERAL HOSPITALS, ADDIS ABABA ETHIOPIA 2019/20.

Investigator

Eleni Amaha (B.Sc.)

Advisors

Lydia Haddis (B.Sc. M.Sc.)

Senait Aweke (B.Sc. M.Sc.)

THESIS SUBMITTED TO DEPARTMENT OF ANESTHESIA, COLLEGE OF MEDICINE & HEALTH SCIENCE, ADDIS ABABA UNIVERSITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR MASTERS IN CLINICAL ANESTHESIA.

Name of Investigator	**Eleni Amaha**
Name of advisors	• **Lydia Haddis (B.Sc. M.Sc.)** • **Senait Aweke (B.Sc. M.Sc.)**
Title of research	**THE PREVALENCE OF DIFFICULT AIRWAY AND ASSOCIATED FACTORS IN PEDIATRIC PATIENTS UNDERGOING SURGERY UNDER GENERAL ANESTHESIA AT ADDIS ABABA REFERAL HOSPITALS. ADDIS ABABA ETHIOPIA 2019/20.**
Duration of project	DECEMBER/2019- MARCH/ 2020
Study area	ADDIS ABABA, ETHIOPIA
Total cost of the project	25,000.00Eth.birr
Address of investigator	**Tel: +251-911-334288** **E-mail: elenimekonenne055@gmail.com**

ADDIS ABABA UNIVERSITY COLLEGE OF MEDICINE AND HEALTH SCIENCE DEPARTMENT OF ANESTHESIA MASTER OF SCIENCE IN CLINICAL ANESTHESIA

Table of Contents

Acknowledgement i

List of Tables ii

List of Figures ii

Acronyms and Abbreviations iii

Abstract iv

1.Introduction 1

1.1. Background 1

1.1. Statement of the problem 2

1.2. Justification 3

2. Literature review 5

3. Objective 8

3.1General Objective 8

3.2 Specific Objective 8

4. Methods and Material 8

4.1 Study Area 8

4.2 Study design and Study period 9

4.3 Source Population 9

4.4 Study Population 9

4.5 Eligibility criteria 9

4.5.1 Inclusion criteria 9

4.5.2Exclusion criteria 10

4.6 Sample size and sampling procedure. 10

4.6.1 Sample size calculation 10

4.7 Sampling technique 10

4.8 Data collection.. 11
4.9 Study variables 12
4.9.1 Dependent Variable 12
4.9.2 Independent variable 12
4.10 Operational Definition... 13
4.11 Data processing and analysis.. 14
4.12 Data quality assurance.. 15
4.13 Ethical consideration 15
5. Result Dissemination plan 15
6. Results... 15
6.1. Demographic characteristics of study participants...................................... 15
6.2. Prevalence of difficult intubation, difficult laryngoscope, difficult mask ventilation and difficult airway. 16
6.3. Anesthesia related factors.. 19
6.3.1 Face mask ventilation related factors 19
6.3.2 Laryngoscopy related variables 20
6.3.3 Endotracheal Intubation related factors 20
6.4 Surgery related variables.. 22
6.5 Associated factors of difficult airway 22
7. Discussion 24
Reference 28
Annexes.. 30
I. Consent form... 30
II. Questionnaire... 32
III. Declaration 35

Acknowledgement

I would like to express my deepest gratitude and appreciation to my advisors Lydia Haddis (B.Sc. M.Sc.) and Senait Aweke (B.Sc. M.Sc.) for their unreserved, continuous support, generous assistance, constructive criticism, guidance, and valuable comments in each & every steps of this thesis. I would also like to extend my appreciation to Addis Ababa University for giving me this opportunity to develop this study and Anesthesia Department for its continuous encouragement and support throughout this work.

My final thanks go to the authors and researchers of the articles I used in this thesis and online information for the valuable works I have read and cited.

List of Tables

Table 1: Intubation difficulty scale score 14

Table 2: Demographic characteristics of patients 16

Table 3: Prevalence of Difficult Intubation, Difficult Laryngoscope, Difficult Ventilation and Difficult Airway. 17

Table 4: Factors related to mask ventilation 19

Table 5: Laryngoscope related factors 20

Table 6: Endotracheal intubation related factors 21

Table 7: Surgery related variables 22

Table 8: Factors associated with difficult airway 22

List of Figures

Figure 1: Result of Intubation Difficult Scale Score 17

Figure 2: Cormack and Lehane Grade of Laryngoscope 18

Figure3: HAN mask ventilation grade before and after giving relaxant 18

Acronyms and Abbreviations

ASA	American Society of Anesthesiologists
CLGL	Cormack and Lehane Grade of Laryngoscopy
DETI	Difficult Endotracheal Intubation
DFMV	Difficult Facemask Ventilation
DL	Difficult Laryngoscopy
ELM	External Laryngeal Manipulation
IDSS	Intubation Difficulty Scale Score
MV	Mask ventilation
SPSS	Statistical package for social sciences
TASH	Tikur Anbessa specialized hospital
ZMH	Zewditu memorial hospital

Abstract

Introduction: one of the major task of anesthetist is securing the airway for surgical procedures or emergency situations**.** 'Airway' in this context is referring to the upper airway which is the part of air passage outside the lung, from nose up to large bronchi. Airway management is an essential skill because it will protect patients from complications of difficult airway like cardiac arrest, brain injury or death. The airway of unconscious or anesthetized patient should be secured with an artificial airway for oxygenation or ventilation because the patient cannot breath by him or herself (1). There is a considerable difference between adult and pediatric airway. Pediatrics are not small adults which means they are different from adult both anatomically and physiologically. Especially these differences are more pronounced when the child is 2 years and under. Additionally congenital anomalies existing on pediatric patients will further add difficulty when securing their airway (2).

Objective: to determine the prevalence of difficult airway and associated factors in pediatric patients who underwent **s**urgical procedures at Addis Ababa Referral Hospitals, from December 30/2019- March 30/2020.

Study design: hospital based prospective cross sectional study design was used.

Results: a total of 290 patients were included in this study and the prevalence of difficult airway was 19.7%, difficult laryngoscope was 7.2%, difficult intubation was 11% and difficult mask ventilation was 5.5%. Small age, underweight, anticipated difficult airway, history of difficult airway and being unexperienced anesthetist were associated with difficult airway.

Recommendations: we recommend that difficult airway in pediatrics age ranging from newborn to 5 years is significant in Addis Ababa Referral Hospitals. Small age, underweight, history of difficult airway, less experienced anesthetist and anticipated difficulty are associated with difficult airway. So anesthetists should always be prepared for difficulty when securing the airway of these patients. And it is better to have experienced anesthetist present when intubating these patients.

1.Introduction

1.1. Background

Airway means the upper airway which is the air passage outside the lung starting from nose up to large bronchi. 'Difficult airway' is when there is a technical difficulty in giving oxygen and removing carbon dioxide from the lungs by face mask ventilation or endotracheal tube intubation (1).

To evaluate the incidence and associated risk factors of difficult tracheal intubations in pediatric intensive care units a large study was conducted in North America from 2010 to 2011. On the study the incidence of difficult tracheal intubation was 9%. Those with difficult tracheal intubation were small age of four years and under, additionally had a previous difficult intubation (3).

Laryngoscopy is a method used to look at the vocal cord using an instrument called laryngoscope to secure the airway. The techniques used are direct and indirect. There are two types of laryngoscope blade used commonly, which are the Macintosh blade and the Miller. Cormack and Lehane grade of laryngoscopy can be used to grade laryngoscopy views (4).

Difficult facemask ventilation is when the anesthetist cannot give enough ventilation due to improper mask or other device seal, large leakage of gas, or huge resistance to movement of gas (5).

Endotracheal intubation can be hard for either anatomic or physiologic causes. An anatomically difficult intubation also known as "difficult airway" consists of problem in looking at the trachea using laryngoscope or intubating the patient using endotracheal tube. A physiologically problem in endotracheal intubation involves problems to the lungs and the heart, resulting in low oxygen in the blood and low blood pressure (6).

The basic difference between pediatric and adult is that pediatrics have large tongue, large head, anterior larynx, small mouth, narrow airway and physiologically they have low functional residual capacity because of this they cannot tolerate hypoxia and they are hard to intubate (7).

Not much information is found about difficult pediatric intubation, laryngoscope or ventilation but there is more difficulty in securing the adult airway than children when comparing the two. There are characteristics that are used to assume difficult airway in pediatrics that have congenital or acquired problems particularly to the airway (8).

For airway mangement evidence based decisions are important because of this there are different societies working on this worldwide (18).

1.1. Statement of the problem

One of the major task of anesthetist is securing the airway of patients with an artificial means. This involves endotracheal intubation and mask ventilation. Since anesthetized patients are unconscious if their airway is not secured immediately, this will lead them to life threatening complications. The second most common complication of the airway is difficult airway. Hypoxia, esophageal intubation and difficult endotracheal intubation are the major reasons of problems of the airway. Difficult tracheal intubation results in 17% of the respiratory associated problems and causes death and suffering. 28% of all anesthesia related mortality are result of difficult intubation or ventilation (1). Because of this the difficult airway should be a great concern of researches in anesthesia practice.

Due to anatomical and physiological differences, the technique of mask ventilation, direct laryngoscopy, and endotracheal intubation is relatively more difficult in children (30).

Particularly pediatric patients are prone to have difficult airway as a result of their anatomy, physiology and congenital or acquired pathology. If difficult airway happens in these groups of patients the outcome is severe. Pediatrics cannot tolerate period of hypoxia like adults. When they are hypoxic or have low oxygen in their system, because of difficult airway, they will be bradycardic immediately. And this will lead to cardiac arrest and death. Even worse they could have brain injury that will result in lifelong suffering to them and their family (9).

Pediatrics have large head compared to the rest of their body, have floppy epiglottis, anterior larynx and narrow airway. These anatomical features will lead to upper airway obstruction and difficult airway. The upper airway will become immediately edematous and will lead to obstruction, when trying to manage difficult airway. Additionally they have acquired and congenital pathology that will affect their airway, because of this they are susceptible to have difficult airway and upper airway obstruction easily and frequently than adults (10).

Different literatures show that problems arising due to not securing the airway in anesthesia are common and they could result in death and disability in children. So whenever securing the airway of pediatrics the clinician should be prepared for difficult airway management because in a matter

of seconds difficult pediatric airway can be a disastrous situation. Because of this the pediatric airway demands special concern and attention (11).

We cannot use the Mallampati, thyromental, hyomental or other predictors of difficult airway in pediatrics and this make the persons that are going to manage difficult pediatric airway un unfortunate (1).

The anatomical differences between the pediatric airway and adult are more visible in children under two years. Major physiological differences also occur in children two years and younger which are summarized as low functional residual capacity, high oxygen consumption, more type 2 respiratory fibers. A significant principle of airway management is oxygenation. Failed oxygenation is, thus the worst result of difficult airway, in which the patient cannot be oxygenated due to failed face mask ventilation and failed endotracheal intubation (12).

When there is difficult airway there will be hypoxia. This low oxygen in the body will lead to several temporary and permanent complications such as cardiac arrest and death. In fact, hypoxia is the most common cause of airway related death. The other complication that could be present when there is difficult airway is a pulmonary aspiration. This remains the leading cause of airway related anesthetic deaths, most cases having identifiable risk factors. Thus avoidance of airway complications needs institutional and individual preparedness, careful assessment, good planning and judgement (14).

Difficult airway is an important factor in morbidity and mortality related to anesthesia. A patent and secure airway is needed to manage anesthetized or critically ill patients (16)

1.2. Justification

Children form a sprecific group of patients, as there are significant differences between children and adults in both anatomy and physiology difficulties encountered during intubation may cause hypoxia, hypoxic brain injury and death (36).

Several types of surgical procedures are done for pediatric patients. Commonly general anesthesia is given for these patients under endotracheal intubation. However, there are no studies done in Ethiopia concerning the difficult airway or endotracheal intubation in pediatrics generally. So our knowledge regarding this, only relied on books and limited researches done abroad.

There is a difference regarding to hospital setup, patients, staff and institution between Africa and developed countries. So what is studied on developed country may not work for us. Or the complications could be worse in our set up as a result of our underdeveloped economy. Additionally, racial difference between Africa and other continents could result in new finding. Generally, for the best of our knowledge no studies were done about the prevalence and associated factors of pediatric airway.

From anatomy and physiology view pediatrics are prone to have difficult airway than adults. They have anterior larynx, floppy epiglottis and small airway and will desaturate rapidly and become bradycardic leading to cardiac arrest and death. Thus pediatric airway needs a special attention because of these life threatening complications.

We can understand that there is a difficult airway in pediatric patients. But the numerical figure is not addressed in studies done at our country. And knowing the actual prevalence could be helpful for a number of reasons. Such as for teaching purposes, for future researches in pediatric airway, for alerting the anesthetists and other clinicians regarding the prevalence and associated factors of difficult airway. Additionally, studying the prevalence of difficult airway and associated factors will help for medico legal and other related issues. As well as the result can be a baseline data for future multicenter study.

Clinicians will be addressed about what factors can be associated with this devastating complication so their knowledge regarding difficult airway can be increased so that they will take appropriate preparation and precautions for solving the difficult airway thus morbidities and mortalities associated with the difficult pediatric airway can be decreased.

Additionally, the pediatric patients can be protected from death or harm, which is a result of difficult airway. And their family will be protected from sorrow and psychosocial trauma. Pediatric patients' life should be our concern because helping one child from death and harm will help the country as well because that individual child is the future hope of the country. As institution, it will be protected from extra financial loss such as needing Intensive Care Unit and ventilator that could take place, if difficult airway happened on one child and no preparation was taken because of not understanding the associated factors that could be identified earlier and take adequate preparation.

There are two studies done about difficult airway in adults in Ethiopia. However, there are no studies done about the prevalence of pediatric airway and associated factors in Ethiopia since there is a considerable difference between adult and pediatric airway we decided to choose this study (19) (20).

2. Literature review

A difficult airway, can be anticipated or unanticipated and it is when there is difficulty in intubation, laryngoscopy or face mask ventilation (2).

Due to anatomical and physiological differences, the technique of mask ventilation, direct laryngoscopy, and endotracheal intubation is relatively more difficult in children (30).

The intubation difficult scale is a blend of subjective and objective criteria that permit a qualitative and quantitative approach to the progressive nature of the difficulty of intubation (31).

Although the incidence of difficult laryngocopy is lower in children than in adults (1.37 vs 9%), the incidence of difficult laryngoscopy in infants is significantly higher than in older children (4.7 vs 0.7%). Additional associated factors for difficult laryngoscopy include children undergoing cardiac and oromaxillofacial surgery and children with a low weight for age (24).

In a study done in India on 2012, among 100 pediatric patients age 1-5 years, the incidence of difficult mask ventilation was 3%, Cormack and Lehane (CL) grading 2 was 32%, CL 3 was 3% CL grade 4 was 0%. Whereas Intubation Difficulty Score (IDS), 0 was 58%, IDS mild (0<IDS>5) was 40% and 2 % showed major difficulty (IDS>5) (17).

A study done at Iran on 2011, CLGL3 had happened in 3% whereas CLGL4 happened in 0 % of cases (33).

Another retrospective data review on management of difficult intubation in infants done at Osaka City General Hospital from May 2012 to May 2014 the incidence of difficult intubation was found in 12 cases among the total number of 497 (2.4%) (16).

In a study done at Children's Hospital of Philadelphia, the difficult direct laryngoscopy rate was 0.25% (16 in 6254 tracheal intubations), and the majority were anticipated. The unanticipated difficult direct laryngoscopy rate was 0.03% (2 in 6254 tracheal intubations) (2).

A prospective cohort study was done at Geetanjali Medical College and Hospital in hundred pediatric patients, laryngoscopy was easy (grade 1 and 2) in 96% and difficult (grade 3 and 4) in 4% cases. Incidence of difficult laryngoscopies was reduced from 4% to 2% from external laryngeal pressure. In that study there was significant association between age and laryngoscopy view. ($p<0.01$). out of 4% difficulty 3% were in age group 1-6 months and 1% in 6-12 months. 2 % cases were observed difficult at laryngoscopy because of large head (hydrocephalous and huge meningomyelocele) and in one case it was laryngeal oedema which made intubation difficult (25).

In a prospective observational study done at Aga Khan University Hospital, Karachi Pakistan Cormack and Lehane (C&L) grades 2 and 3 was observed in 28 patients in younger age group (n=120) as compared to two children above5 years (n=76) ($p<0.001$) from 196 pediatric patients from one month to eight years of age (26).

In a study done at University of Peradeniya, Sri Lanka on 1996 among 800 pediatric patients undergoing repair of cleft lip and palate the incidence of dificult laryngoscopy was 2.95% in patients with unilateral cleft lip, 45.76% in bilateral cleft lip and 34.6% in patients with retrognathia. Tracheal intubation was successful in 99% of patients in whom laryngoscopy was difficult. On the study there was significant association between age and laryngoscopic view ($p<0.01$) (27).

Another similar study done at China on 2006 a total of 985 patients aged 1 month to 3 years undergoing repair of cleft lip and palate were included to study the incidence of difficult laryngoscopy. The total incidence of difficult laryngoscopy was 4.77%. and the incidence of difficult laryngoscopy was closely related to age, sites and degreees of deformities and micrognathia. On the study the incidence of difficult laryngoscopy was 7.06% in 1-6 months group, 2.9% in 6-12 months group and 3.13% in 1-3 years of age. Where as generally the incidences of moderately difficult, difficult and failed intubation were 1.02%, 0.91%, and 0.102% respectively. Difficult intubation occurred mainly in infants with laryngoscopic views of grade 3 and 4 (28).

In a study done at Britain on 1988 the amount of larynx seen at intubation was assessed in 633 adult patients undergoing routine surgery the incidence of difficult laryngoscopy was 9.3%. However, external laryngeal manipulation done by assistance anesthetist made the view better and the incidence of difficulty was reduced to 5.9% (29).

A retrospective study done in Germany about incidence and predictors of difficult laryngoscopy on 2012 showed the incidence of CLGL3 in in 1.1% and CLGL4 in 0.2% (32).

A retrospective review of pediatric difficult airways was done in Toronto, Canada at the Hospital for Sick Children over a two rear period from Janury 1,2010 to December 31,2011; of the 22,766 cases 125 (0.5%) were deemed to have a difficult intubation (21).

In 2004, Han et al. created a scale for mask ventilation. Han's scale included four grades in which Grade 1 patients are those who can be ventilated smoothly and Grade 4 are those who are difficult to ventilate. The reported incidence of DMV varies widely (from .0.5- 15%) (22).

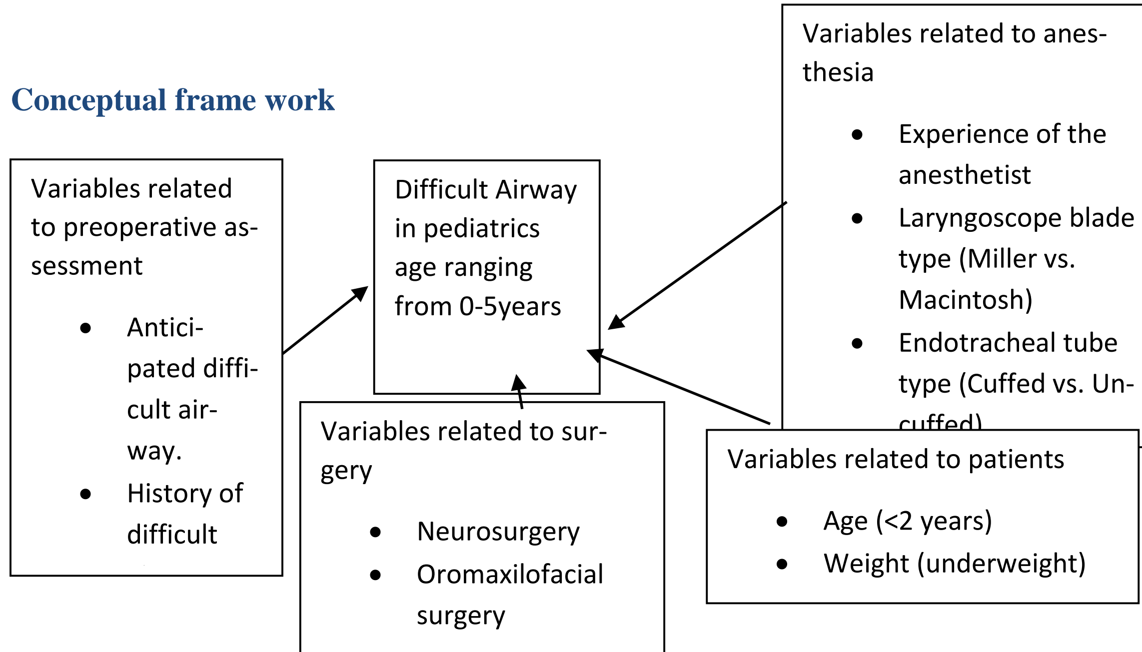
In a prospective observational study, patients between 0 and 8 years, undegoing elective surgery requiring bag-mask ventilation and intubation at the Montreal Childrens Hospital were recruited. Data on incidence of difficult bag mask ventilation and risk factors was collected over a 3 yeasr period for the study. And in a sample of 484 children, the incidence of unexpected difficult bag mask ventilation was 6.6%. the incidence of expected difficult airway among the screened patients was 0.5% (23).

There are two types of endotracheal tubes cuffed and uncuffed. Traditionnaly it was assumed that the narrowest part of pediatric airway is the cricoid cartilage so to prevent tracheal stenosis for children 1-5years uncuffed endotracheal tubes are used (34).

There are studies done to calculate appropraite size of endotracheal tube for pediatrics one such study is done at Osaka to prevent inappropriately large tube selection which was published on 2019 (35).

A study done in Australia had derived equations to determine weight of pediatric patients for age. It was a retrospective observational study of patients age 0-14 years presenting to a tertiary pediatric hospital (37)

Conceptual frame work



3. Objective

3.1General Objective

- To assess the prevalence of difficult airway and associated factors in pediatric patient who underwent surgical procedures under general anesthesia at Addis Ababa referral Hospitals, Ethiopia from December 30/ 2019 up to March 30/2020.

3.2 Specific Objective

- To assess the prevalence of difficult pediatric airway undergoing surgical procedures at Addis Ababa referral hospitals.
- To determine the associated factors for difficult pediatric airway undergoing surgical procedures at Addis Ababa referral hospitals.

4. Methods and Material

4.1 Study Area

This study took place in Addis Ababa which is the capital city of Ethiopia. The average elevation is around 2355 meters. As of the latest 2007 population census conducted by the Ethiopian national statistics authorities, it has a total population of 2,139,551 but currently according to UN report the population is 4,794,000. There are 79 government owned health facilities in the city administration: 13 hospitals, 23 health centers, 9 clinics and 34 health posts.

Pediatric surgical procedures are done for various surgical diagnosis among the 13 hospitals except at Ghandi hospital which is a maternity center. This study was conducted in five government hospitals namely Tikur Anbessa hospital, Zewditu hospital, Yekatit 12 hospital, Meneilk hospital and St. Peter hospital. These hospitals have been chosen because most of pediatric surgical procedures are done in these hospitals and lottery method was done to choose among other hospitals where pediatric surgeries are done.

From these hospitals at ZMH and St. Peter hospital neurosurgical procedures are done for pediatrics mainly for infants and neonates. At TASH general surgeries including orthopedic procedures and urologic procedures and ENT surgeries are done for pediatrics. Similarly, at Meneilk hospital general surgeries, urologic surgeries and ENT surgeries are done and in Yekatit 12 hospital ENT and plastic surgeries for cleft lip and/or palate are done.

4.2 Study design and Study period

A Hospital based cross sectional study design was conducted from December30, 2019 to March 30, 2020.

4.3 Source Population

All pediatric patients who underwent surgical procedures under general anesthesia and endotracheal intubation at Addis Ababa referral Hospitals.

4.4 Study Population

Pediatric patients that undergo elective surgical procedures at the five selected hospitals from Addis Ababa Referral Hospitals during the study period receiving general anesthesia under endotracheal intubation.

4.5 Eligibility criteria

4.5.1 Inclusion criteria

- Pediatric patients falling in classification of ASA class I and II.
- Pediatric patients that are scheduled for elective surgical procedures.
- Pediatrics patients that require endotracheal intubation.
- Age 0-5 years.

4.5.2Exclusion criteria

- Pediatric patients undergoing surgical procedures under endotracheal intubation with students performing the intubation.
- Pediatric surgical undergoing surgical procedures under endotracheal intubation under indirect laryngoscopy technique.

4.6 Sample size and sampling procedure.

4.6.1 Sample size calculation

Sample size was determined using finite population correction formula by assuming the prevalence as 0.5 (since no previous study of the same setup is done) and 5% margin of error at 95% confidence interval using the following formulas:

$$n = \frac{z_{\alpha/2}^2 p(1-p)}{w^2}$$

Where; **n = sample size**, z= **1.96, p= 0.5, w= 0.05, CI= 95% & ά= 5%**

n = (1.96)2 × 0.5 (1− 0.5)/ (0.05)2 = 384

nf = n/ (1+n/N), **N=840**

So, nf =384/ (1+384/840)

=264

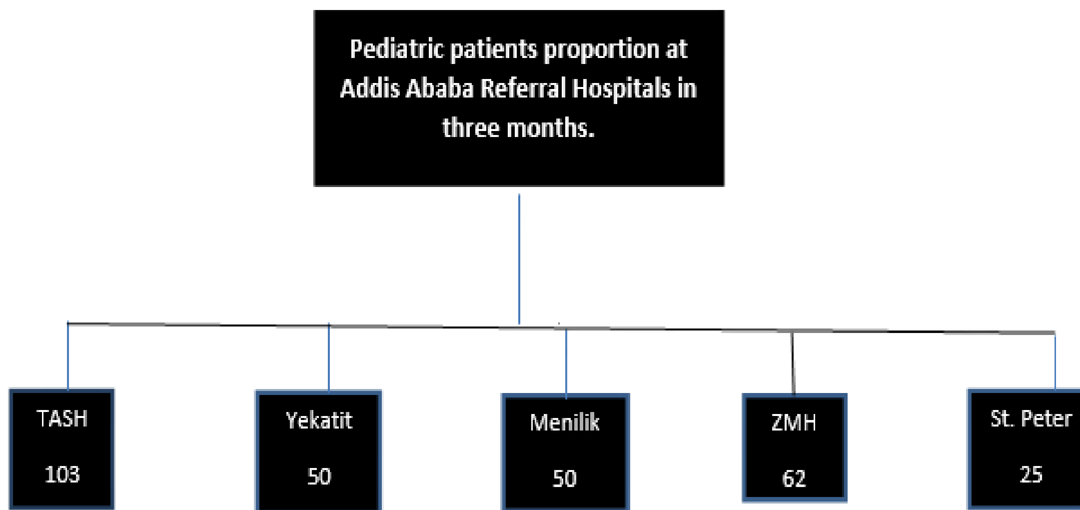
We added **10% of nf** for non-response rate; (i.e.**, 264+26.4 =290**);

Therefore, a total sample size of 290 elective surgical patients were participated in this study.

4.7 Sampling technique

A stratified random sampling technique was used to get the required sample size during the study period. The daily operation schedule list was used as a sampling frame. A situational analysis and log book review showed that during three month period 300 elective pediatric surgeries are done in TASH, 144 in Yekatit 12 hospital, 144 in Meneilk hospital, 180 in ZMH and 72 in St. Peter hospital. So during the study period a total of 840 pediatric patients undergo elective surgery. Since the calculated sample size is 290 (n), to find k when we divide 840 (N) by 290 (n) is 2.9. When we divide the total pediatric elective surgery in three months by 2.9, we will have (300/2.9) =103

elective pediatric patients undergoing surgery at TASH, 144/2.9=50 at Yekatit 12 hospital, similarly 50 at Meneilk, at ZMH 180/2.9=62 and 72/2.9=25 at St. Peter hospital, the first patient was chosen by lottery method then every third patient were chosen for the study. We have used stratified sampling followed by systematic random sampling technique.



Pediatric patients proportion over the study period from the calculated sample size at Addis Ababa referral hospitals.

4.8 Data collection

Data was collected from December 30/2019 to March 30/2020.Half day training was given for data collectors, who were involved in the data collection process. Structured questionnaire was prepared and tested on 5% (15 patients) of the sample size. Informed consent was taken from each patient's parents or guardians before data collection, then elective pediatric patients scheduled for surgery under general anesthesia requiring endotracheal intubation were assessed at the waiting room by the trained data collectors immediately before their entry to the operation room and recorded on the structured questionnaire. Then each patient undergoing endotracheal intubation was observed for difficult intubation, difficult laryngoscopy, and difficult mask ventilation in the operation room. The Cormack and Lehane's laryngoscopy grade of the patient was determined by

the anesthetist who performed the laryngoscopy as well as training was given for the data collectors about the intubation difficulty scale score so grade was given for the score for every patient. Observational data collection technique was used in this study. And the Han's scale for mask ventilation was used for assessing difficult mask ventilation by the data collector.

4.9 Study variables

4.9.1 Dependent Variable

- Difficult airway (Difficult face mask ventilation, laryngoscope and/or intubation)

4.9.2 Independent variable

1. demographic variables
    - Age
    - Sex
    - Weight
2. Anesthesia-related variables
    - Experienceof the anesthetist
    - Type of laryngoscope blade
    - Using inappropraite size endotracheal tube
    - Prevoius history of diificult airway.
    - Anticipated difficulty preoperatively.
    - History of difficult airway
    - Type of endotracheal tube used (cuffed or uncuffef)
    - Stylet initially used or not used
    - Type of induction
3. Type of surgery
    - Oromaxilofacial surgery
    - Neurosurgical Procedures
    - General surgical procedures

4.10 Operational Definition

Difficult airway when an expeienced anesthetist encounters difficulty with any or all of face mask ventilation, laryngoscopy, tracheal intubation during securing the airway with an endotracheal tube for surgical procedures.

Difficult face mask ventilation: when there is difficulty to mask ventilate so there is resistance to the ingress or egress of gas as a result requiring two providers to mask ventilate, using adjuncts such as oral airway and adjusting position with or without muscle relaxant. Or Han Mask Ventilation Grade III or Grade IV.

Han Mask Ventilation Scale:

Grade I- ventilated by mask

GradeII- ventilated by mask with oral airway or other adjuvant with or without muscle relaxant.

GradeIII- difficult ventilation (inadequate, unstable, or requiring two providers) with or without muscle relaxant.

GradeIV- unable to mask ventilate with or without muscle relaxant

Difficult laryngoscopy: the presence of Cormack and Lehane Grade III or IV or when the anesthetist performing the laryngoscopy visulaizes only the epiglottis or just the soft palate.

Cormack and Lehane laryngoscopic grade:

Grade I – Visualization of entire laryngeal aperture.

Grade II – Visualization of only posterior commissure of laryngeal aperture.

Grade III – Visualization of only epiglottis.

Grade IV – Visualization of just the soft palate.

Difficult tracheal intubation: is when more than one attempt, more than one operator and alternative techniques such as inserting stylet, changing endotracheal tubes, adjusting positiong are required to pass an endotracheal tube through the trachea and securing the airway additionally IDDS is >5 (moderate to major difficulty).

Table 1: Intubation difficulty scale score

IDS Score	Degree of Difficulty
0	**Easy**
0<IDS 5	**Slight difficulty**
5<IDS	**Moderate to majordifficulty**

Pediatric age range: defined as ages 0-5 years.

Anesthesiologists (ASA) physical status: is a method of categorizing patients' physical state developed by the ASA taskforce which classify patients according to their physical status (systemic wellbeing). It is classified into six classes.

American Society of Anesthesiologists (ASA) physical status:

ASA 1: Normal healthy patient

ASA 2: Patient with mild systemic disease (nofunctional limitations)

Weight for age: for this study neonates are classified as normal weight when they are 2.5-4kg. Those below 2.5 kg are considered underweight. And we had used the following equation for infants and above years.

<12months= (age in months+9)/2

1-4 years= 2x (age in years+5)

4 years=4xage in years

when the patients are below the calculation we say they are underweight.

4.11 Data processing and analysis

Data with complete information was entered to Epi info version 7. then exported to SPSS version 22 for analysis. All independent variables were analyzed using binary logistic regression with the dependent variable difficult airway and those with a p value of <0.05 form bivariate analysis were fitted to a multivariate logistic regression to check their association with the outcome variable,

Difficult airway. Odds ratio, 95% confidence interval, and p value were computed to identify associated factors and to determine the strength of the association. A p value of <o. o5 was considered as statistically significant. Hosmer-Lemeshow test of goodness of fit was performed to check the appropriateness of the model for analysis.

4.12 Data quality assurance

To assure the quality of data, training on the objectives and relevance of the study and brief orientations on the assessment tools was provided for data collectors. A pretest was done before data collection for its accuracy, clarity and consistency. A structured questionnaire was prepared. During data collection, each questioner was revised by the investigator for being complete and appropriate.

4.13 Ethical consideration

The study was conducted after approval by Addis Ababa University, Ethical review board to conduct the study. A legal letter was submitted to the Hospitals, where the study took place. Verbal informed consent were obtained from all pediatric patient's parents or guardians after full explanations of the goals and procedures of the study. After taking permission from the hospital and study participant the data collection was conducted.

5. Result Dissemination plan

The result of the study will be submitted to the college of medicine and health science of Addis Ababa University, to the study Hospitals, Addis Ababa city and federal health bureau, Ethiopian Anesthetist Association and other responsible bodies. The result will be presented in different seminars, meeting, conferences and workshops. Moreover, efforts will be done to publish the findings of the study and disseminated through national and international journals.

6. Results

6.1. Demographic characteristics of study participants

A sample of 290 pediatric patients who underwent surgical procedures under general anesthesia and endotracheal intubation at Tikur Anbessa Specialized Hospital, Zewditu Memorial Hospital, Meneilk Hospital, Yekatit 12 Hospital and St. Peter Hospital were included in this study. The

mean weight was 8.8 kg. From the total sample188 (64.8%) were male and 102 (35.2%) were female, age less than or equal to 2 were 181 (62.4%). Patients with ASA physical status I were 161 (55.5%) and ASA II were 129 (44.5%). Those having underweight were 178 (61.4%) (Table 2)

Table 2: Demographic characteristics of patients

variables		Frequency (n)	Percentage (%)
Sex	Male	188	64.8%
	Female	102	35.2%
Age	0-2	174	60%
	3-5	116	40%
ASA	ASAI	161	55.5%
	ASAII	129	44.5%
Weight	Normal	112	38.6%
	Under	178	61.4%

6.2. Prevalence of difficult intubation, difficult laryngoscope, difficult mask ventilation and difficult airway.

In this study, we found the prevalence of difficult intubation as 32/290 (11%), difficult laryngoscope as 21/290 (7.2%), difficult mask ventilation as 16/290 (5.5%) and difficult airway as 57/290 (19.7%). (Table3)

Table 3: Prevalence of Difficult Intubation, Difficult Laryngoscope, Difficult Ventilation and Difficult Airway.

Variable	Frequency (n)	Percentage (%)
Difficult intubation	32/290	11
Difficult laryngoscope	21/290	7.2
Difficult ventilation	16/290	5.5
Difficult airway	57/290	19.7

For this study Intubation Difficulty Scale Score was easy on 119/290 (41%), slight difficuly on 139/290 (47.9%) and moderate to major difficulty on 32/290 (11%) (Figure1)

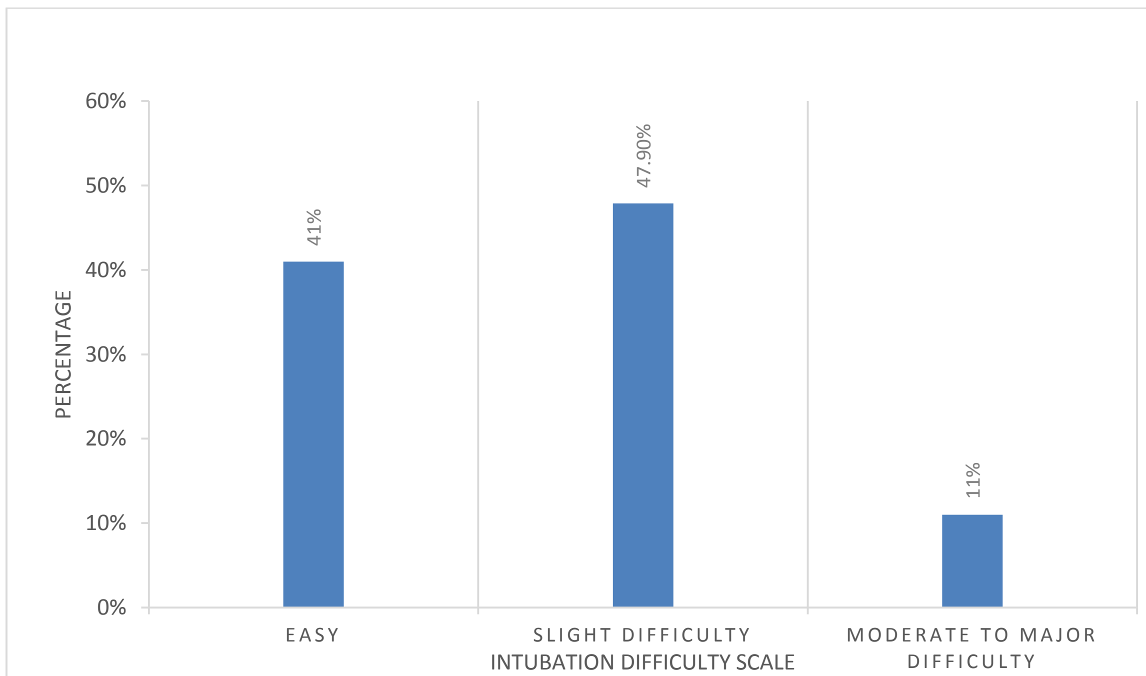


Figure 1: Result of Intubation Difficult Scale Score

Cormack and Lehane grade of Laryngoscopy I-IV for our study was 202/290 (69.7%), 67/290 (23.1%), 21/290 (7.2%) and 0. (Figure2)

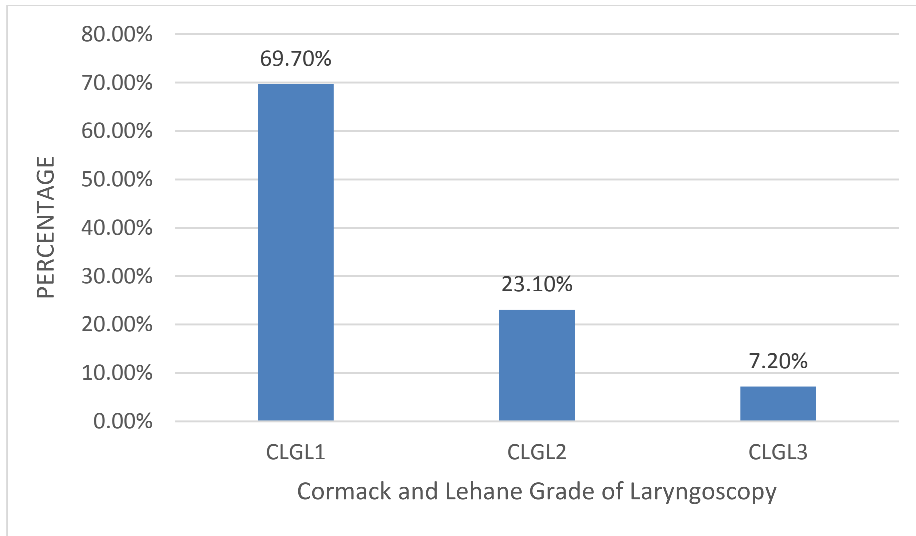


Figure 2: Cormack and Lehane Grade of Laryngoscope

Based on our study the HAN mask ventilation had improved ater muscle relaxant was given. HAN Mask ventilation grade I before and after muscle relaxant was 239/290 (82.4%) and 268/290 (92.4%) respectively and grade II was33/290 (11.4%) and 6/290 (2.1%) and grade III was 18/290 (6.2%) and 16/290 (5.5%). (Figure3)

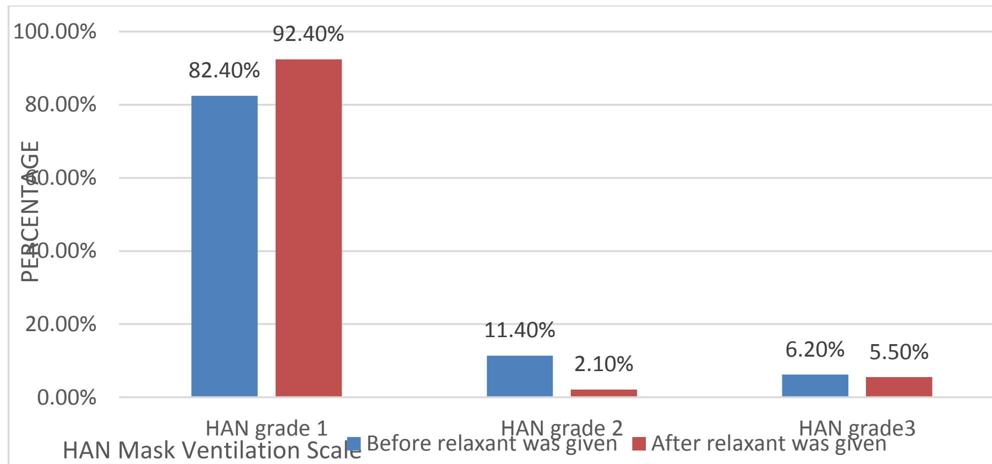


Figure 3: HAN mask ventilation grade before and after giving relaxant

6.3. Anesthesia related factors

6.3.1 Face mask ventilation related factors

Excessive gas leak was in 6.2% of patients, 17.9% required more than two persons to ventilate, jaw thrust was applied in 82.7%, oral airways were used in 11%, 12% had desaturation. (Table4)

Table 4: Factors related to mask ventilation

Variable		**Difficult mask ventilation**		**Frequency (%)**
		Yes	No	
Excessive gas leak	Yes	8	10	18 (6.2%)
	No	8	264	272 (93.7%)
Require more than 1 person to ventilate	Yes	13	39	52(17.9%)
	No	3	235	238(82 %)
Jaw thrust	Yes	12	228	240(82.7%%)
	No	4	46	50(17.24%)
Oral airway	Yes	14	18	32(11%)
	No	2	256	258(88.9%)
Desaturation	Yes	12	0	12 (4.13%)
	No	4	0	4(1.37%)

6.3.2 Laryngoscopy related variables

For this study number of laryngoscope attempt was one in 197 (67.93%), External Laryngeal Pressure was applied in 189(65.1%), and Miller blade was used in 44 (15.17%) whereas Macintosh was used in 246 (84.83%). (Table5)

Table 5: Laryngoscope related factors

Variables		**Difficult laryngo-scope**		**Frequency (%)**
		Yes	No	
Number of laryngoscopy attempts	1	14	183	197 (67.93%)
	>1	7	86	93 (32.0%)
External laryngeal pressure	Applied	21	168	189 (65.17%)
	Not applied	101	0	101 (34.83%)
Type of laryngoscope blade	Miller	4	40	44 (15.17%)
	Macintosh	17	229	246 (84.83%)

6.3.3 Endotracheal Intubation related factors

For this study original endotracheal tube was changed in 85 (29.31%), cuffed endotracheal tube was used in 69 (23.79%), Uncuffed endotracheal tube was used in 221 (76.21%), number of intubation attempt was 1 in 235 (81.03%), 2 in 42 (14.48%), 3 in 13 (4.48%), number of intubators were 1 in 185 (63.79%), 2 in 70 (24.14%), 3 in 35 (12.07%). (Table 6)

Table 6: Endotracheal intubation related factors

Variables		Difficult intubation		Frequency (%)
		Yes	No	
Changing original endotracheal tube	Yes	7	78	85 (29.31%)
	No	25	180	205 (70.67%)
Type of endotracheal tube	Cuffed	1	68	69 (23.79%)
	Uncuffed	31	190	221(76.21%)
	No	32	199	231 (79.66%)
Number of intubation attempts	1	24	211	235 (81.03%)
	2	8	34	42 (14.48%)
	3	0	13	13 (4.48%)
Type of induction	Inhala-tional	41	183	224 (77.24%)
	Intrave-nous	16	50	66 (22.76%)
Number of intubators	1	24	161	185 (63.79%)
	2	8	62	70 (24.14%)
	3	0	35	35 (12.07%)
Stylet	Used	13	133	146 (50.34%)
	Not used	19	125	144 (49.65%)

6.4 Surgery related variables

On this study the types of surgery were 100 (34.48%) general surgery, 103 (35.52%) oromaxilo-facial surgery and 87 (30%) were neurosurgery. (Table7)

Table 7: Surgery related variables

Variables	Difficult airway		Frequency (%)
	Yes	No	
General surgery	0	100	100 (34.48%)
Oromaxilofacial surgery	35	68	103 (35.52%)
Neurosurgery	22	65	87 (30%)

6.5 Associated factors of difficult airway

When adjusted for other variables **Age** AOR=6.768, 95%CI, 2.024,22.636, P=0.002; **Weight for age** AOR=4.661, 95%CI, 1.196,18.154, P=0.027; **Anticipated difficult airway** AOR=18.563, 95%CI, 4.837,71.248, P=0.000; **History of difficult airway** AOR= 8.351, 95%CI, 2.033,34.302, P=0.003; **Experience of the anesthetist** AOR=9.652, 95%CI, 2.910,32.015 P=0.000 were found to be associated factors of difficult airway (Table8)

Table 8: Factors associated with difficult airway

Variables		Difficult airway(n)		COR (95%CI)	AOR(95% CI)	P value
		Yes	No			
Age	0-2 years	46	128	3.430 (1.692,6.954)	6.768 (2.024,22.636)	0.002
	3-5 years	11	105	1	1	
Weight for age	Normal	13	99	1	1	0.027
	Under	44	134	2.501 (1.278,4.892)	4.661 (1.196,18.154)	
Anticipated difficult airway	Yes	41	19	28.862 (13.712,60.751)	18.563 (4.837,71.248)	<0.001
	No	16	214	1	1	
History of difficult airway	Yes	38	8	56.25(22.9911 37.624)	8.35(2.033,34.302)	0.003
	No	19	225	1	1	
Experience of the anesthetist	>2 years	6	157	1	1	<0.001
	<2 years	51	76	17.559(7.217,42.722)	9.652(2.910,32.05)	

7. Discussion

In our study we found the prevalence of difficult airway in pediatric patients age ranging from 0 up to 5 years undergoing surgical procedures at Addis Ababa Referral Hospitals to be 19.7%.

The associated factors for difficult airway in our study were small age, they are prone to have difficult airway seven times than children older. Similarly, underweight children had 5 times of having difficult airway than normal weight children. On the other hand, anticipated difficult airway from history and physical examination had almost 19 times of chance to have difficult airway, and those who had difficult airway history had almost 9 times of having difficult airway. Finally, for our study when comparing experienced and unexperienced anesthetist the unexperienced anesthetist had 10 times chance of having difficult airway than their counterpart.

The prevalence of difficult laryngoscope, difficult intubation and difficult mask ventilation was 7.2%, 11% and 5.5% respectively. Multivariate logistic regression had shown that small age, underweight, having history of difficult airway, having less experience than more experience as anesthetist and anticipated difficult airway by the anesthetist are associated with difficult airway.

When we compare our study with other studies, first there are no studies done about the incidence of difficult airway in pediatrics in Ethiopia. Second it is hard to compare our study with studies done at European countries or United States because of the differences we had regarding institution, patients, staffs performing the intubation where in most setups pediatric anesthesiologists perform majority of intubations in the developed country. Because of this in our study the prevalence of difficult airway had increased from other studies (29).

On our study we had reported greater difficult laryngoscopy and intubation incidences than previous studies. Other than the reasons mentioned earlier the other reason for increased incidence of difficult airway in our study could be due to our operational definition on which case difficult airway can be summarized as the occurrence of any or all of difficult intubation, laryngoscope and mask ventilation.

A study done in pediatric intensive care unit difficult intubation happened in 9% cases. On that study history of difficult airway was associated with the incidence of difficult airway. Similarly, on our study history of difficult airway was associated with the incidence of difficult airway. This is to say if patients had previous history of difficult airway they have great probability of having

difficult airway again. On similar study more experienced providers were likely to be the first laryngoscopist which is similar to our study where less experienced anesthetist were associated with the occurrence of difficult airway (3).

Existing literatures showed that the incidence of difficult airway in healthy children is low. Majority of difficult airway is anticipated similarly on our study difficult airway was associated with anticipated difficult airway from history and physical examination preoperatively (3).

On our study difficult airway had not happened in patients presenting for general surgical procedures on which most patients did not have dysmorphic or abnormal features. But in case of oromaxilofacial procedures like palatoplasty for cleft palate repair the incidence was 35 out of 103 which is 33.9%. Similarly neuro surgical patients are among the group of patients where we anticipate difficult airway from physical feature such as a big head as in Hydrocephalous or mass around the occiput as in encephalocele and on our study in neurosurgical procedures the incidence of diificult airway was 22 out of 87 cases which is 25.3%.

For our study we had used to calculate weight for age as normal weight and underweight using an updated method for pediatric weight estimation which was a study done in Australia. There were more underwight patients 61.4% in our study and there was no over weight patient in our study. Underweight patients were associated with difficult airway for our study (37)

A study found the incidence of unexpected mask ventilation to be 6.6%. On our study we had included both expected and unexpected difficult mask ventilation and we had found the incidence to be 5.5% which is close to the above study. We had used the HAN mask Ventilation scale to gade difficult mask ventilation, where grade 3 and grade 4 were taken as difficult mask ventilation. On our study the use of adjuncts such as oral airway, requesting two persons to ventilate, the presence of excessive gas leak, the presence of desaturation or oxygen saturation below 90 was used to assesse difficult mask ventilation (23)

On our study the mask ventilation was assessed and graded both before and after giving relaxant. We had found that the grade of difficult mask ventilation had improved after relaxant was given. Similarly a study done on India had found the same outcome as ours. Small age, which is 1-2 years was associated with difficult mask ventilation in their study which is similar to our study (17).

On our study the patients were induced with inhalational induction in 77.24%. This type of induction method is commonly used in pediatrics especially in anticipated difficulties. we had not found association between type of induction and difficult airway. And we could not found studies done about the association of type of induction with difficult airway in pediatrics (17).

On our study cuffed endotracheal tube was used in 69 out of 290 (23.79%) cases and uncuffed tube was used in 221 out of 290 (76.21%). The greater percentage which is 60% of the study is age 2 and below for this study. The reason for using uncuffed endotracheal tube could be as a result of the common belief that the narrowest part of airway in pediatrics is at the cricoid cartilage. However we had not found association between type of endotracheal tube and difficult airway incidence in binary logistic regression (34).

On day to day practice we used endotracheal tubes of appropraite size determined by calculation for pediatric patients. These calaculations are studied and derived outside Ethiopia. Most Ethiopian children are underweight and so we usually use tube smaller than the actual calculation. As a result among the independent factors for diificult pediatric intubation for our study was changing original or initial endotracheal tube. However it has no assocation with difficult airway in our study (35).

Miller blade or Maccintosh blade can be used for laryngoscopy. Basically the Miller blade is prefered in pediatric laryngoscoy as it can lift the floppy epiglottis with its straight tip. However depending on the ansthetist experince and availabilty of equipment both type can be used. Majority of anesthetists had used Macintosh blade for our study and it had not association with difficult airway in binary logistic regression.

Limitations: the basic limitation for this study is the lack of other study in similar set up in Africa. Generally there are limited researches done concerning prevalence of difficult airway in developing country. So we could not compare the result of this study with studies done on similar setup. And we suggest futher multicenter study.

Conclusion : we had found the prevalence of difficult airway in prdiatrics to be 19.7%. Which is higher than other studies done at other countries.

Recommendation: we recommend that pediatric patients that are small age groups (less than or equal to 2 years), who are underweight, those who have history of difficult airway and anticipated

difficulties by the anesthetist are associated with difficult airway. So anesthetists should be prepared for difficult airway in these groups and we recommend that experienced anesthetist should be presented when intubating these patient

Reference

1. Sunnada Gupta, et al. Airway Assessment: Predictors of Difficult Airway. Indian J. of Anesthesia. 2005, 49(4):257-262.

2. Huang AS, et al. Difficult aiway management of children in ambulatory anesthesia: Challenges and Solutions. Dovepress, 2016, 37-45.

3. Graciano et al. Incidence and associated factors of difficult tracheal intubations in pediatric ICU: a reportfrom National Emergency Airway Registry for Children. Berlin : Springer-Verlag, 2014.

4. Stephen R Collins. Direct and Indirect Laryngoscopy: Equipment and Techniques. s.l. : Respiratory Care, 2014.

5. Jefrey L Apfelbaum, et al. Practice guideline for management of the difficult airway: an apdated report by the American Society of Anesthesiologists Taskforce on Management of the Difficult Airway. 2013, 251-270.

6. Casey JD, et al. How I manage a difficult intubation. s.l. : Crit Care, 2019.

7. Daniel Rivera-Tocanipa, Elizabeth Diaz Sanchez. Pediatric airway: as difficult as they say? 2018..

8. Diana Raj, et al. Managing the difficult airway in the syndromic child. 2014.

9. L., Adewale. Anatomy and assessement of the pediatric airway. Birmingham : Paediatr Anaesth, 2009.

10. AE, Dickison. The normal and abnormal pediatric upper airway. Recognition and management of obstruction. s.l. : Clin Chest Med, 1987, 583-596.

11. P Mathew, etal. Validation of age and height based formulae to predict paeditric airway distances- a prospective observational study. Chandigarh : s.n., 2019, 164-168.

12. Andrea S Huang, et al. Focused review on management of the difficult pediatric airway. s.l. : Indian Society of Anesthesilogists, 2019. PMID.

13. Ana Paula, et al. Difficult intubation in children: Applicabilty of the Mallampati Index. 2011.

14. T.M. Cook, S.R. MacDougall-Davis. Complications and failure of airway managemnt. 2012.

15. Langeron O, et al. Clinical review: management of difficult airways. 2006, 243.

16. Aida J, et al. The management of difficult intubation in infants: a retrospective review of anesthesia record database. 2015.

17. Anurag Aggarwal, et al. Evaluation of "Difficult Airway Predictors in Pediatric Population As a Clinical Investigation. 2012. ISSN.

18. Popovici, Sonia-Elena. Difficult airway management- a constant chalenge. 2018, 93-94.

19. Workneh SA, et al. Magnitude and Predisposing Factors of Difficult Airway during Induction of General Anaesthesia. 2017.

20. Tadese Tamire, et al. Predictive Values of Preoperative Tests for Difficult Laryngoscopy and Intubation in Adult. 2019.

21. Karsli C, et al. A retrospective review of pediatric difficult aiyways: once easy, not always easy. 2016.

22. EL-Orbany M. et al. Difficult MaskVentilation. 2009.

23. Valois-Gomez T, et al. Incidence of difficult bag-mask ventilation in children: a prospective observational study. 2013.

24. Baker, Paul A. Asssessement and management of the predicted difficult airway inbabies and children. 2019.

25. Seema Patran, et al. Study of various measurements of intubation in infants and their corelation in prediction of difficult airway. 2016.

26. Nosheela Basit Rafique, Fauzia Anis Khan. Comparison of Mallampatti Test, Thyromental Distance and Distance from Tragus to Nares for Predicting Difficult Intubation in Pediatric Patients. s.l. : Scientific Research, 2014.

27. Gunawardana. Difficult laryngoscopy in cleft lip and palate surgery. 1996.

28. Xue FS, et al. The clinical observation of difficult laryngoscopy and difficult intubation in infants with cleft lip and palate. 2006.

29. M.E. Wilson, et al. Predicting difficult intubation. 1988. pp. 211-216.

30. Senthil G. Krisna et al. Management of difficult airway in pediatric patient. 2018

31. Frederic Adnet, et al. The Intubation Difficulty Scale. s.l. : ASA publications.

32. S. Heinrich, et al. Incidence and predictors of difficult laryngoscopy in 11.219 pediatric anesthesia procedures. 2012.

33. Mirghassemi, Asadolah. evaluation of laryngoscopic views and related influencing factors in a pediatric poulation. Tehran, Iran : s.n., 2011.

34. N.A. Chambers, et al. cuffed vs. uncuffed endotracheal tube in children. 2018.

35. Hiroshi Hanamoto, et al. Age-based prediction of uncuffed tracheal tube size in children to prevent inappropraitely large tube selection: a retrospective analysis. 2019 : s.n.

36. Wojciech Walas, et al. The managemnt of unanticipated difficult airways in children of all age groups in anesthetic practice. 2019.

37. Acworth, Katie Tinning and Jason. Make your best guess: An updated method for pediatric weight estimation in emergencies. 2007.

Annexes

I. Consent form

Addis Ababa University

College of Health Sciences

School of Medicine department of anesthesia

Verbal consent form before conducting interview

Greeting

Hello, my name is _________ and I'm a data collector for the study entitled "The prevalence of difficult airway in pediatric patients who underwent surgical procedures and associated factors at Addis Ababa referral hospitals". It is a study aimed to assess the prevalence of difficult airway in pediatric patients who underwent surgical procedures and associated factors in this hospital so that enough attention and concern will be given to pediatric airway management because the complications of failed airway are life threatening. I will ask you few questions that will only take 2-5 minutes of your time regarding this matter.

Being a part of this study will not affect in any way the service you are getting in this hospital. Your child is selected randomly to participate in the study just because he/she undergoes a surgery in this hospital no other special criteria. You are free to withdraw from the study and you can stop answering to any questions that are forwarded to you at any time you want. In the study any answer you gave will be confidential and in addition your name, address or any information that identifies you or your child will not be used.

Do you agree to participate in the study?

Amharic version of verbal consent before conducting interview

<u>ከቃለ መጠይቅ በፊት ፈቃደኝነት መጠየቂያ ቅጽ</u>

ሰላምታ

ጤና ይስጥልኝ እኔ ______________*እባላለሁ፡፡ በአዲስ አበባ ዩንቨርስቲ አንስትዚያ ት/ቤት የጥናት ቡድን አባል ነኝ፡፡ የጥናቱ ዋና አላማ በሆስፒታሉ ውስጥ ቀዶ ጥገና የተደረገላቸው ሰዎችን የህመሙን መጠን መገምገም ነው፡፡ ይህንን በተመለከተ የተወሰኑ ጥያቄዎችን ልጠይቆት እፈልጋለሁ፡፡ መጠይቁ* 2-5 *ደቂቃ ብቻ የሚፈጅ ሲሆን ተሳትፎዎት ሙሉ በሙሉ በዕርሶ ፈቃደኝነት ላይ የተመሰረተ ነው፡፡*

በዚህ ጥናት መሳተፎም ሆነ አለመሳተፎ በሆስፒታሉ ውስጥ በሚያገኙት አገልግሎት ላይ ምንም አይነት ለውጥ አያመጣም፡፡ የተመረጡትም በዚህ ሆስፒታል ቀዶ ጥገና ልጅዎ ስለተደረገለት/ስለተደረገላት ብቻ ነው፡፡ቃለ መጠይቁን በማንኛውም ሰአት ማቋረጥ ወይም ጥያቄዎችን አለመመለስ ይችላሉ፡፡ ለጥያቄዎች የሚሰጧቸዉ መልሶች በሚስጥር የሚጠበቁ ሲሆን የእርሶ ስም ወይንም እርሶን የሚለይ ማንኛውም መረጃ አይገለጽም፡፡ እንዲሁም የሚሰጡት ምላሽ ከርሶ ማንነት ጋር በማንኛውም መልኩ አይያያዝም፡፡

በጥናቱ ለመሳተፍ ፈቃደኛ ነዎት?

II. Questionnaire

Addis Ababa University

College of Health Sciences

School of Medicine Department of Anesthesia

Principal Investigator: Eleni Ameha, B.Sc.
Advisors: Lydia Haddis B.Sc. M.Sc. and Senait Aweke B.Sc. M.Sc.

Study title: Prospective cross sectional study on the incidence of difficult airway and associated factors in pediatric patients who underwent surgical procedures under general anesthesia at Addis Ababa Referral Hospitals.

Part I. Identification

Card number……………. **Age:** **Sex: A.** Male **B.** Female **weight in kg**……

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

Part II. Preoperative information

1. Did the patient have history of difficult intubation?

   A. Yes B. No

2. Did the patient have any congenital problem? If yes specify it

   A. Yes B. No

3. Was there anything that made you anticipated difficult airway?

   A. Yes B. No

Part III. Anesthetic technique

1. Type of induction A. inhalational B. intravenous
2. Muscle relaxant A. used B. not used
3. Baseline oxygen saturation before induction…………………
4. Oxygen saturation immediately after induction………………

Part IV. Face mask ventilation

1. chest excursion during ventilation before relaxant was given

A. Adequate without difficulty

B. Somehow difficult

C. Difficult

2. Chest excursion after muscle relaxant was given

A. Adequate without difficulty B. Somehow difficult C. Difficult

3. If inhalational induction was used chest excursion during ventilation

A. Adequate B. somehow adequate C. Difficult

4. Required more than one provider for ventilation because ventilation was difficult

A. yes B. no

5. Head extension during ventilation A. adequate B. not adequate

6. Excessive gas leak during ventilation A. yes B. no

7. Jaw thrust during ventilation A. used B. not used

8. Oral airways during ventilation A. used B. not used

9. Maximum oxygen saturation during ventilation A. >90 B.<90

Part V. Laryngoscopy

1. External laryngeal pressure: A. applied B. not applied

   a. If external laryngeal pressure was applied the view during laryngoscopy before application of the external laryngeal pressure

   A. the entire laryngeal aperture is visible. B. only posterior part of the glottis is visible.

   C. visualization of only the epiglottis D. visualization of just the soft palate

2. If external laryngeal pressure was applied the view during laryngoscopy after application of external laryngeal pressure

   A. the entire laryngeal aperture is visible. B. only posterior part of the glottis is visible.

   C. visualization of only the epiglottis D. visualization of just the soft palate

3. The view during laryngoscopy if external pressure was not applied

   A. the entire laryngeal aperture is visible. B. only posterior part of the glottis is visible.

   C. visualization of only the epiglottis D. visualization of just the soft palate

4. Number of laryngoscopy attempt

   A. 1 B.2 C. 3 D. more than 3

   4.1.If laryngoscopy attempt was more than one

   A. Different type (Miller/Macintosh) of laryngoscope blade after initial attempt was used.

   B. Different size of laryngoscope blade after initial attempt was used.

   C. If other option was used specify it………

5. Size of laryngoscope blade used initially A. 0 B. 1 C. 2

6. Type of laryngoscope blade used initially A. Macintosh B. Miller

Part VI. Endotracheal intubation

1. Intubating stylets initially: A. used B. not used
2. Number of intubation attempt A. 1 B. 2 C. 3 D. 4
   a. If intubation attempt was more than one
      A. Stylet was used
      B. Bougie was used
      C. Different size of endotracheal tube was used
      D. operator was changed
      E. If other options specify it………..

3. Number of intubators A. 1 B.2 C.3

4. Lifting force required during laryngoscopy A. normal B. increased

4. Number of alternative techniques A. 1 B. 2 C.3
5. Vocal cord mobility A. abduction B. adduction
6. Intubation: A. Failed B. Successful
7. Type of ETT used A. cuffed B. Uncuffed

Part VII. Qualification of the anesthetist:

A. Final year under graduate student

B. M.sc in Anesthesia student

C. B.sc Anesthetist (year of experience………...)

D. M.sc Anesthetist (year of experience……….)

E. Anesthesiology resident (year of residency………)

F. Anesthesiologist (year of experience…………..)

Part VIII. Qualification of Assistant:

A. Final year under graduate student

B. M.sc in Anesthesia student

C. B.sc Anesthetist (year of experience………...)

D. M.sc Anesthetist (year of experience……….)

E. Anesthesiology resident (year of residency………)

F. Anesthesiologist (year of experience…………..)

Part IX. Types of surgical procedure and diagnosis

1. Neurosurgery…………2. Oromaxilofacial ………………3. General…………

III. Declaration

I, the undersigned, declare that this thesis is my original work in partial fulfilment of the requirements for the degree of MSc in Anesthesia. I understand that plagiarism will not be tolerated and all cited materials has been appropriately referenced.

Name: ____________________

Signature: ____________________

Submission to the Dept. of Anesthesia, Addis Ababa University.

Date of Submission: ________________________________

This thesis work has been submitted for examination with my/our approval as Advisor on the MSc in Anesthesia course.

Name Signature