



**Magnitude and Associated Risk Factors of Perioperative Pediatrics  
Laryngospasm during Elective General Surgery under General Anesthesia in  
Tikur Anbessa University Teaching Hospital, Addis Ababa, Ethiopia**

**A Research Thesis Submitted to Department of anesthesiology and critical care, Addis  
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Anesthesiology and Critical Care**

By: Tsigereda Damene (MD, Final year resident of Anesthesiology and Critical Care )

**ADVISOR: Mesfin Girma ( MD, Assistant professor of anesthesiology and Critical Care)**

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## Abbreviations

ASA	American society of anesthesiologist
AAU	Addis Ababa university
CPAP	Continuous Positive Pressure Ventilation
ETT	Endotracheal tube
LMA	Laryngeal mask airway
$\mu\text{g}/\text{kg}$	Micro gram per kilogram
$\text{Mg}/\text{kg}$	Mille gram per kilogram
PPV	Positive Pressure Ventilation
SPSS	Statistical Package for Social Science
URTI	Upper respiratory tract infection

## Abstract

### Background

Laryngospasm is usually easily detected and managed, but may present atypically and/or be precipitated by factors which are not immediately recognized. If poorly managed, it has the potential to cause morbidity such as severe hypoxemia, bradycardia, pulmonary aspiration, and post-obstructive pulmonary edema and end up with mortality if not treated.

### Objectives

To assess the magnitude and associated risk factors of perioperative pediatric laryngospasm during elective general surgery under general anesthesia.

### Methods

Hospital based cross sectional study was conducted on elective pediatric patients who underwent elective general surgery in Tikur Anbessa University Teaching Hospital from Aug 1, 2017 to Nov1, 2017.

**Result:** From the 68 (21.8%) laryngospasm events identified as cases, during induction 38(12.2%), maintenance 14(4.5%) and emergence 16(5.1%). About 40(12.8) % were precipitated by direct airway stimulations and 19(6.1%) by light plain of anesthesia. Desaturation occurred in 39 (12.4%) of cases, bradycardia in 16 (5.1%), pulmonary aspiration 11(3.5) and negative pressure pulmonary edema 2 (0.6) of case. There is statistical association between status of the providers with the incident of laryngospasm (p-value 0.025). 39 (12.4%) of cases were managed by administration of 100% oxygen with positive pressure or continuous positive airway pressure, deepen anesthesia 17(5.4%), removal of stimuli 11(3.5%) and only 1 (0.3%) case was treated with intravenous succinylcholine with absence of response for other management options. There was no statistical significance with type of airway management devices used with the occurrence of laryngospasm.

**Conclusions:** laryngospasm is mainly associated with airway manipulation and light anesthesia.

**Key words:** - perioperative, Pediatrics, laryngospasm, elective general surgery, general anesthesia

# 1. Introduction

## 1.1. Backgrounds

Laryngospasm is a form of airway obstruction that is so common and distinct that most anesthetists consider it to be a separate entity. It consists of prolonged glottis closure reflex mediated by the superior laryngeal nerve[1].

The incidence doubles in children and triplets in the very young (birth to 3 months of age). The common inciting factors are hyperactive airway like in case of upper respiratory tract infection. Other common triggering factors are painful stimulation, primary vagal hyper tonicity, insufficient depth of anesthesia on endotracheal intubation, light anesthesia on tracheal extubation or combination of either proceeding with or without some irritant such as blood, mucus, laryngoscope blade, suction catheter, surgical debris or other foreign body[2].

Laryngospasm occurs relatively frequently and is nearly always easily recognized and handled, it has the potential to cause morbidity and mortality, especially if managed poorly. Laryngospasm occasionally presents atypically and may be precipitated by factors which are not immediately recognized, increasing the potential for patient harm and further complications such as pulmonary aspiration and post-obstructive pulmonary edema. This latter complication is especially significant as it may cause serious morbidity, and the patient may require intubation, ventilation and management in an intensive care setting[3]. Risk factors include difficult intubation, nasal, oral or pharyngeal surgical site; and obesity with obstructive sleep apnea; however, it may occur unexpectedly in any patient[4].

Extubation laryngospasm occurs more commonly in the pediatric population, with an incidence of 1.7% in the first 9 years of life[5]. There is a close association between laryngospasm and the type of surgery. The overall incidence in a large Scandinavian study of over 130 000 anesthetics was 0.78%, and the risk was greater in certain subgroups such as children with asthma or airway infections or those undergoing esophagoscopy or hypospadias repair, and anal surgery[5].

In country like Ethiopia out of 53 patients (28.3%) laryngospasm events identified as cases, 30 (56.6%) occurred during induction, 4 (7.6%) during maintenance and 19 (35.8%) during

emergence. 41 (77%) and 12 (23%) events were occurred during perioperative period on the hands of BSC and MSC anesthesia providers respectively. About 62.3% were precipitated by direct airway stimulations. Desaturation occurred in 42 (79.2%) of cases, bradycardia in 37 (69.2%), and cardiac arrest in 3 (5.7%) and there was death in 1.9% of case[6].

## **1.2. Statement of the problem**

Laryngospasm is an important clinical scenario which many pediatric anesthesia providers will encounter within their regular practice. In identifying and quantifying potential risk factors for this emergency we can reduce associated morbidity. Ensuring all trainees gain the skills to manage this condition proficiently is important. Overall, rapid, effective management of laryngospasm will improve the safety of pediatric anesthesia.

In our country there is no pediatric anesthesiologist and the numbers of trained physician anesthesia providers are deficient. Anesthesia for most cases including pediatric patient is often administered by non-physician anesthesia providers. They lack medical back ground and have no adequate training in pediatrics anesthesia but they are often administering anesthesia for pediatrics patient alone sometimes managed by anesthesiologist with distant supervision. The aim of the study was to identify the magnitude and risk factors associated with perioperative pediatrics laryngeal spasm.

## 2. Literature review

### 2.1. Laryngospasm in children

Some studies reported 0.43/1000 and 1/1000 incidence of laryngospasm in children respectively[7, 8]. Although a protective reflex, it can persist to cause hypoxia, hypercapnea, cyanosis, desaturations, arrhythmias, pulmonary edema, bronchospasm, cardiac arrest or gastric aspiration. It is often self-limiting as hypoxia and carbon-di-oxide retention abolishes the reflex[9, 10]. Another study found the overall incidence of laryngospasm in the largest 11 year prospective study (of 136929 patients) to be 7.9/1000 anesthetics or 8.7/1000 patients[5].

The incidence in children being higher especially in infants 1-3 months of age. In children younger than one year, laryngospasm is associated with bradycardia in 23% of the cases and one should consider using 0.01 to 0.02 mg.kg<sup>-1</sup> of intravenous atropine to prevent the evolution to cardiac arrest[11]. Intravenous doxapram, 1.5 mg.kg<sup>-1</sup>, works as a potent stimulator of upper respiratory centers and can reverse reflex laryngospasm[12]. Nitroglycerin, 4 µg.kg<sup>-1</sup>.min<sup>-1</sup>, can also reverse this reflex[13]. Some of the precipitating factors were extubation, presence of a nasogastric tube, oral endoscopy, esophagoscopy and majorly in children with respiratory tract infections[14]. Some authors have proposed laryngeal spasm to be a complication of barbiturate induced parasympathetic activity. Amongst the inhalational agents isoflurane showed greater incidence of laryngospasm than halothane, enflurane and sevoflurane[15].

Laryngospasm needs to be differentiated from bronchospasm, supraglottic obstruction, a psychogenic cause in anxious adolescents and young adults (in response to exercise and emotional stress), a paradoxical vocal cord movement (post-extubation vocal cord dysfunction) and episodic laryngeal spasm subsequent to superior laryngeal nerve injury after thyroid surgery. Other causes to be excluded are foreign body, epiglottic impaction, laryngeal edema and tracheal spasm or collapse [16-18].

Incomplete airway obstruction or partial obstruction is generally associated with an audible inspiratory or expiratory sound. The stridulous noise mismatches with bag movement and the patient's respiratory effort. If the obstruction worsens, tracheal tug and paradoxical

respiratory movements of the thorax and the abdomen develop. Audible sounds cease with complete obstruction resulting in no bag movement and no ventilation[19].

## **2.2. Precipitating Risk factors**

An increased risk of laryngospasm may be due to a combination of anesthetic, patient, or surgery-related factors. Without any question, manipulation of the airways is the main anesthetic risk factor for laryngospasm and the situations with greatest risk include, laryngoscopy with tracheal intubation especially when neuromuscular blockers are not used, laryngoscopy in awake patients, difficult tracheal intubation; and, tracheal extubation. Similarly, the use of a laryngeal mask and oropharyngeal cannula also increase the risk[11].Regurgitation and superficial anesthesia can also induce laryngospasm. Some surgical procedures are more apt to trigger laryngospasm. Oral procedures that promote an increase in secretions with blood in the airways, such as tonsillectomy and laryngeal surgery, are associated with a higher risk[5].

Common anesthetic factors include light anaesthesia at the time of stimulus, the use of a potentially more irritant volatile anaesthetic such as isoflurane or desflurane, the presence of blood or secretions in the airway, and instrumentation of the airway at light planes of anesthesia. The use of intravenous anesthetic agents has been associated with a lower incidence of laryngospasm. The use of the laryngeal mask airway (LMA) and the inexperience of the anaesthetist, especially when dealing with children, have been associated with a greater incidence of laryngospasm[20].

Some conditions can increase the incidence of laryngospasm. Children are especially at risk; from 0 to 9 years of age the incidence of laryngospasm is approximately 17 in 1,000 cases. However, in children ages 1 month to 3 months the incidence can be up to three times greater and laryngospasm is even more severe because their airways are narrow and the parasympathetic tonus is increased. In this group, laryngospasm can be fatal because desaturation develops very rapidly and tracheal intubation is more difficult[21].

Manipulation of the airways in patients with upper airways infection or asthma increases the incidence of complication in up to six times due to hyper reactivity of the airways. Several studies have confirmed that children with upper airways infection or who are recovering from it are at a higher risk for the development of laryngospasm, bronchospasm, and desaturation[22-24]. Other conditions include: Down's syndrome, Parkinson's disease, hypocalcemia, hypomagnesaemia, nasogastric tubes and in children whose parents are smokers. Obese patients with sleep apnea are also prone to develop laryngospasm[25, 26].

Young children with hypersensitivity of the airway (from infective, inflammatory, or other irritation such as passive smoking) have a 10-fold increase in the risk of laryngospasm. If possible, an anesthetic should be delayed for at least 4 weeks after an upper respiratory tract infection (URTI) for that reason. Pre-existing airway abnormalities and gastro esophageal reflux are also important risk factors. Tonsillectomy and adenoidectomy have been associated with a >20% incidence of laryngospasm. Appendicectomy, dilatation of the anus or cervix, mediastinoscopy, and hypospadias repair all carry a higher risk[27].

### **2.3. Significance of the study**

The aim of this study will to describe and to evaluate the frequency of perioperative laryngospasm in children undergoing general anesthesia and to identify those perioperative independent risk factors which are commonly associated with a high incidence of laryngospasm. Thus it is believed that this study will provide baseline information on magnitude and associated risk factors of perioperative pediatrics laryngospasm during elective general surgery under general anesthesia. This will ultimately help policy makers to develop evidence-based pediatrics laryngospasm prevention policies and public health interventions to ultimately reduce morbidity, mortality and disability to the health problem.

### **3. Objectives**

#### **3.1. General Objective**

- ✓ To assess the magnitude and associated risk factors of perioperative pediatric laryngospasm during elective general surgery under general anesthesia

#### **3.2. Specific objectives**

- ✓ To determine the magnitude of perioperative pediatric laryngospasm during elective general surgery under general anesthesia
- ✓ To identify risk factors associated with perioperative pediatric laryngospasm during elective general surgery under general anesthesia

## **4. Methodology**

### **4.1 Study area and period**

This study was conducted in Tikur Anbessa Specialized hospitals (TASH) in Addis Ababa the capital city of Ethiopia. Addis Ababa is the largest city in Ethiopia with a population of 3,384,569 according to the 2007 population census in an estimated area of 530.14 square kilometer. In the city there are 11 hospitals have functional operation room and out of this 5 are Federal Hospitals. People from different regions of Ethiopia come to those hospitals to get specialized services. Currently TASH gives surgical services in the following departments Neurosurgery, Cardio-Thoracic surgery, Pediatric surgery, Urological surgery, ENT surgery and orthopedic surgery, Gastro intestinal tract surgery, Obstetrics and Gynecology surgery. This study was conducted from Aug 1, 2017 to Nov1, 2017 G.C at TASH Addis Ababa, Ethiopia.

### **4.2. Study design**

Hospital based cross sectional study was conducted on elective pediatrics patients who underwent general surgery in Tikur Anebessa University Teaching Hospital.

Ahead of the conduct of the study, Standardized checklist were developed, orientation and discussion was given for the anesthesia providers on how to clinically diagnosis/recognize laryngeal spasm during anesthesia, to minimize or rule out some confounding factors. Diagnosis will be made based on the clinical sign symptoms ( inspiratory stridor and decreased or absent air entry with precordial stethoscope, increased inspiratory efforts/tracheal tug, paradoxical chest/abdominal movements, Desaturation with or without bradycardia, central cyanosis and direct visualization of the vocal cords. Anesthesia providers check their machine and circuit as usual before the start and after the end of each procedure. Anesthesia was also free to select drugs, equipments, monitoring and types of anesthesia technique they considered appropriate for each patient as usual. Populations

### 4.3. Populations

#### 4.3.1. Source population

All patients who were admitted to undergo elective pediatric surgery at TASH in Addis Ababa, Ethiopia.

#### 4.3.2. Study population

All patients who were admitted for elective general pediatric surgery at TASH during the study period from March 30-June 11, 2015 G.C in Addis Ababa, Ethiopia.

### 4.4. Sample size determination

Sample size was determined by using single population proportion formula with the following assumption.

The proportion of laryngospasm was 28.3% Confidence interval 95%, margin of error 5%,

Sample size  $n = \frac{[(Z \alpha/2)^2 * p (1-p)]}{d^2}$

$d^2$

Where: - Z= Standard normal distribution value at 95% CI=  $(1.96)^2$

p= proportion of laryngospasm; P= 28.3% (0.283) [28]

d= margin of error (0.05)

n= sample size

Therefore,  $n = \frac{1.96^2 * 0.283(1-0.283)}{(0.05)^2} = 312$

$(0.05)^2$

## **4.5. Sampling Procedure**

The sampling technique all pediatric elective patients in TASH during the study period were used as a sample. Selection of hospital for the study was carried out using purposive sampling. Tikur Anbesa Specialized Hospital was selected, for the service it provides and for the number of case flow.

## **4.6. Data Collection techniques**

### **4.6.1. Data Collection tool**

For data collection structured questionnaires were used. Structured English questionnaire was prepared. The English questionnaire was prepared using literature review used in this study.

### **4.6.2. Method of Data collection**

Data was collected using structured questionnaire a day before the surgery by data collector. Patients were informed they have a right not to participate in the study and the data collected from them was confidential. The data collection process was supervised by the principal investigator (PI) from Aug 1 up to Nov 1, 2017 G.C. Before the actual data collection, 14 data collector was provided with half day training about the aim of the study and the content of the data collection tool.

### **4.6.3. Data quality assurance**

During data collection both principal investigator and data collector were checking for the completeness of the information needed. Furthermore the data was also checked for its completeness during analysis. After each day of data collection principal investigator stored data in a secure place.

#### **4.6.4. Pretest**

One week before the actual data collection 5% of the questionnaires were tested for their validation. That is assessing their ease of comprehension, relevance in their intended topics, effectiveness in providing useful information and the degree to which the questions are understood by different individuals. The pretest was conducted at TASH Addis Ababa.

#### **4.6.5. Data analysis**

Data was cleared, coded and entered into Epi- Data version 3.1 and exported to SPSS (version 20) was used for analysis. The univariate analysis such as percentage and frequency distribution of different characteristics of the questionnaire were analyzed. Bivariate analysis was used to determine the association of independent with the dependent variable. Logistic regression model was employed, odds ratio was used to measure their association and some of the results were computed with results of other study. Statistical associations were considered significant whenever the p -value is less than 0.05.

### **4.7. Ethics and study population**

After approval of hospital ethics committee and informed patient consent data were collected preoperatively by interviewing the parents or guardian and reviewing of their anesthetic records with prepared checklist which include age, sex, ASA physical status, type of surgery planned, type of anesthetic technique and induction agents, status of anesthesia providers and history of co morbidities were addressed. Intraoperative events and postoperative complications, interventions and outcome were recorded for each case.

## **4.8. Eligibility Criteria**

### **4.8.1. Inclusion criteria**

Elective general procedures, ASA physical status class I and II.

### **4.8.2. Exclusion criteria**

Age >14 years, emergency cases, ENT, Neurosurgical and orthopedics procedures and procedures done under regional anesthesia or combined with general anesthesia.

## **4.9. Variables**

### **4.9.1. Dependent Variables**

Laryngospasm

### **4.9.2. Independent variables**

Surgery related factors: - type of surgery

Anesthesia related factors: - airway manipulation, light anesthesia, status anesthesia provider, secretion, Airway device, Anesthetic agents

Patient related factors: - underlying lung pathology, upper tract infections, comorbidity

## **4.10. Operational definitions and definitions of terms**

**Laryngospasm:** - can be defined as exaggerated glottic closure due to reflex constriction of the laryngeal muscles; it can be complete or partial[29].

**Pediatrics age:** - can be defined as age less than or equal to 14 years.

**Perioperative:** - can be defined as the period of time extending from when the patient goes into the hospital, clinic, or doctor's office for surgery until the time the patient is discharged home[30].

**General anesthesia:** - is the induction of a state of unconsciousness with the absence of pain sensation over the entire body, through the administration of anesthetic drugs[31].

#### **4.11. Dissemination of results**

After the study was finalized, the result will be presented by author and will be submitted to department of Anesthesiology and Critical Care. Furthermore the paper can be presented at workshops, seminars, and on other professional gatherings and an effort will be made to publish in peer reviewed journal.

## 5. RESULTS

### 5.1 The characteristics of respondents

A total of three hundred twelve pediatric patients were participated in this study. Among these, 67.3% were males and 32.7% were females. About 84.9% and 15.1% of the cases were ASA physical statuses class I and II respectively.

**Table 1: The characteristics of respondents**

Variables	Category	Frequency	Percent (%)
Age	birth - 12 months	74	23.7
	1 year+ - 5 years	123	39.4
	5 years+ - 10 years	73	23.4
	10 years+ - 14 years	42	13.5
Sex	Male	210	67.3
	Female	102	32.7
Status of the Anesthesia providers	BSC anaesthetist	4	1.3
	MSC anaesthetist	76	24.4
	Anesthesia Resident	232	74.4
ASA physical status	Class 1	265	84.9
	Class 2	47	15.1
Induction agent	Ketamine	111	35.6
	Propofol	101	32.4
	Halothane	15	4.8
	Combined	85	27.2
Maintenance agent	Halothane	29	9.2
	Isoflurene	226	72
	Combined	57	18.2
Premedication	Atropine	310	99.4
	Lidocaine	2	0.6

Type of surgery	Thoracic	27	8.7
	GIT	134	42.9
	GUT	151	48.4

\*BSC: Bachelor of Science \*MSC: Masters of Science \*Combined (Intravenous and Inhalational agents) \*GIT (Gastrointestinal tract) \*GUT (Genitourinary tract)

## 5.2. Triggering factors of laryngospasm

From all of study subjects, 68 laryngospasm events identified as cases. Among them, the onset of laryngospasm was during the time of induction 38(12.2%), maintenance 14(4.5%) and emergence 16(5.1%) respectively.

The majority of the cases are included in age below ten years as mentioned on table 1. From cases, majority of the incidents occurred in children < 10 years of age 60 (88.2%), (0-12 months 23(33.8%), 1-5 years 18(14.6%), 5-10 years 19(27.9%) and 10-14 years 8(11.8%)). There is no correlation between age and the laryngospasm occurrence (table 2).

Table 2: Bivariate and Multivariate Logistic regression analysis of risk factors associated with Laryngospasm among pediatrics age group.

Variable	Category	Crude OR (95 % CI)	Adjusted OR (95 % CI)	p-value
Age	birth - 12 months	1.917(.768, 4.781)	2.297(.835, 6.325)	0.107
	1 year+ - 5 years	.729( .291, 1.825)	.858 (.323, 2.278)	0.758
	5 years+ - 10 years	1.495(.590, 3.793)	1.649 (.599, 4.537)	0.333
	10 years+ - 14 years	1	1	0.338
Status of the Anesthesia providers	BSC anaesthetist	0.40(.054,3.076)	2.419(.210,27.879)	.479
	MSC anaesthetist	0.23(.032,1.707)	1.658(.157,17.508)	.674
	Anesthesia Resident	1	1	
Light Anesthesia	Yes	2.6(1.172,5.766)	17.7(4.020,78.597)	0.0001
	No	1	1	
Airway Manipulation	Yes	8.5(2.556,28.74)	4.50((1.74, 11.63)	.001
	No	1	1	
URTI/Secreti on/Lung underlying pathology	Yes	2.0(.930,4.603)	1.43 (0.72, 2.81)	0.448
	No	1	1	

Majority of the study subjects underwent genitourinary tract 151 (48.4%), gastrointestinal tract 134(42.9), thoracic 27(8.7%) procedures as mentioned on figure 1. In this study, laryngospasm identified in genitourinary tract 39(25.8%), gastro intestinal tract 26(19.4%), thoracic 3(11.0%) procedures respectively. There is no statistical association between type of surgery with occurrence of laryngospasm (p-0.132).

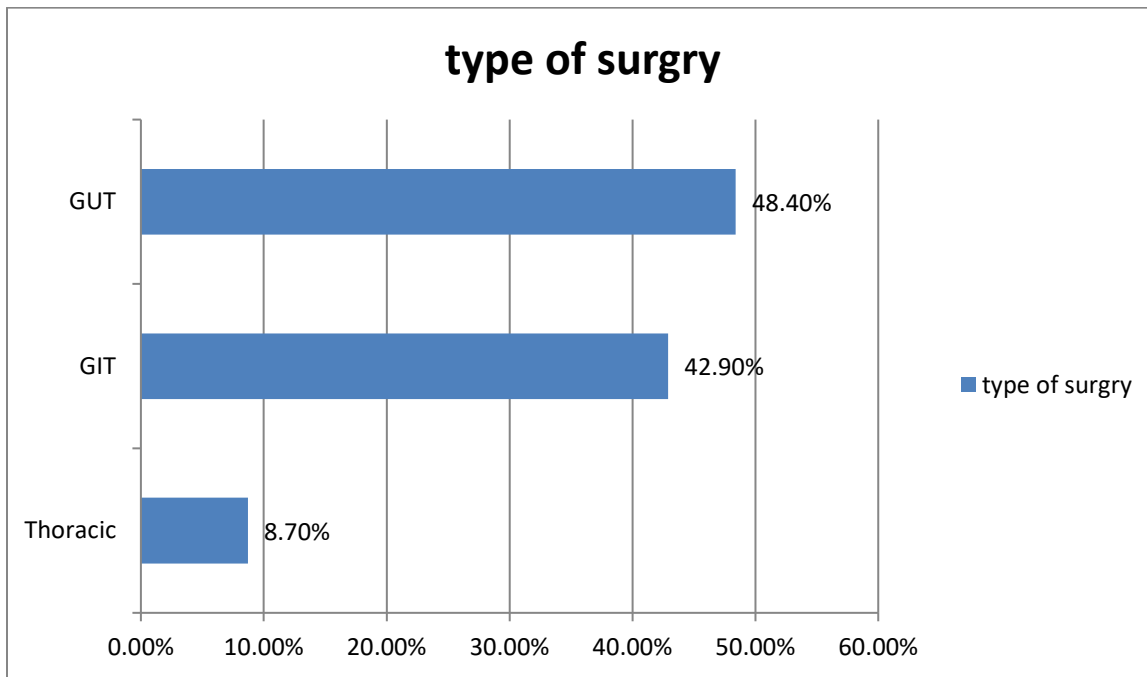


Figure 1: Overall frequency of type of surgical procedures among study subjects

In this study the main triggering factors for laryngospasm were repetitive airway manipulations and light plain of anesthesia which accounting about 40(12.8%) and 19(6.1%) respectively. There should be limitation to the number of attempts for tracheal intubation and adequate depth of anesthesia should be obtained entire intra operative period.

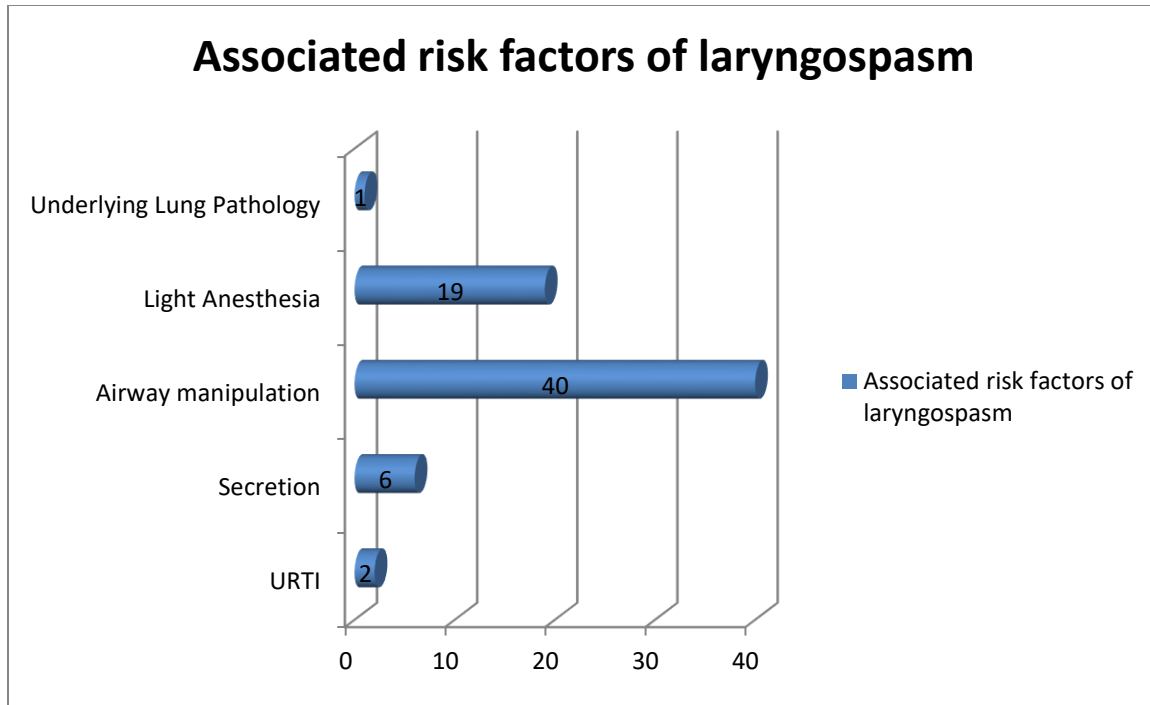


Figure 2: Percentage of identified associated risk factors for perioperative laryngospasm.

### 5.3. Complications of perioperative laryngospasm

The most encountered complications in our study subjects were desaturation 39(12.4%), bradycardia 16(5.1%), pulmonary aspiration 11 (3.5%) and negative pressure pulmonary edema 2(0.6%).

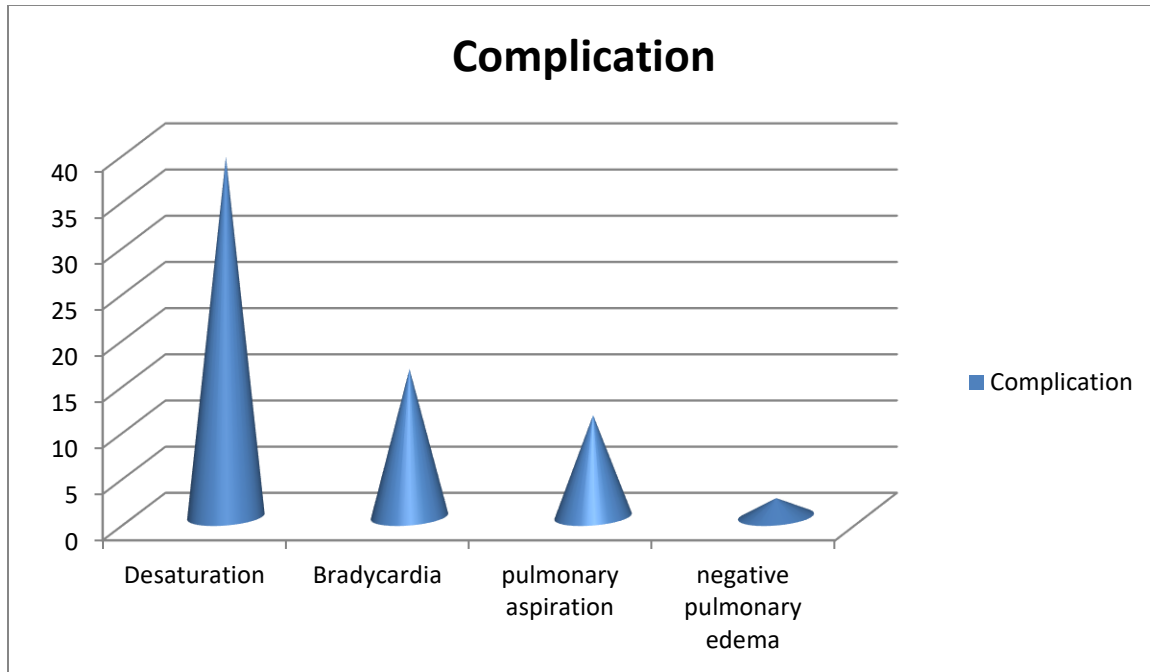


Figure 3: Frequency of complication of perioperative laryngospasm

#### 5.4. Management of laryngospasm

Majority of the cases managed safely with positive pressure ventilation or CPAP with 100% oxygen 39(12.4 %) followed by increased depth of anesthesia 17 (5.4%), removal of the stimuli 11 (3.5%) and use of muscle relaxation with suxamethanum1 (0.3%).

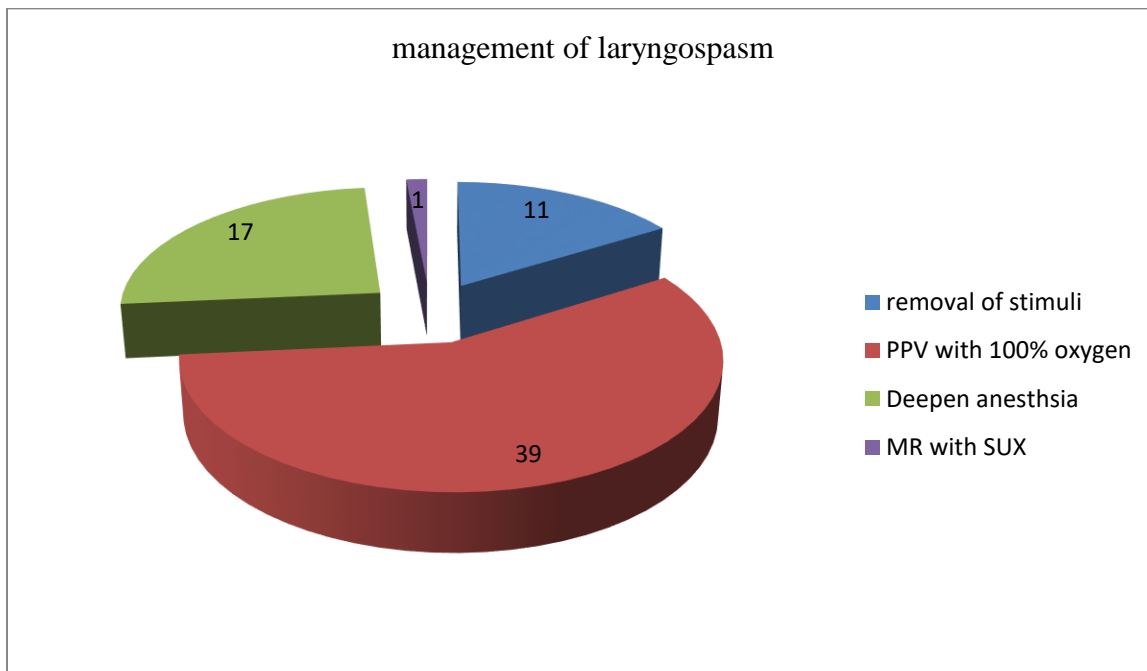


Figure 4: Percentage of perioperative laryngospasm management options.

\*PPV/CPAP-positive pressure ventilation/continuous positive air way pressure\*MR muscle relaxation \*Sux- suxamethanium

### **5.5. Outcome of perioperative laryngospasm**

In this study all cases of perioperative laryngospasm declared resolved 68(100%).

## 6. DISCUSSION

The actual incidence of laryngospasm in pediatric anesthetic practice is difficult to determine. Two of the studies attempt to quantify the incidence of laryngospasm in their hospital population. Each center has a different case mix, which is reflected in their particular experiences. Laryngospasm is probably not an unusual occurrence in most anesthetists practice and it is believed that laryngospasm occurs more commonly in children than adults.

Olsson et al. found the overall incidence of laryngospasm in the largest 11 year prospective study (of 136929 patients) to be 7.9/1000 anesthetics or 8.7/1000 patients. The incidence in children 0-9 years of age was higher 17.4/1000 patients and within this age group infant's 1-3 months of age had the greatest incidence (more than three times the rate in any age group)[5].

In contrast, Burgoyne [7] reports a remarkably low incidence of only 0.1% in their pediatric population. Various factors may explain this, particularly their case mix, in which the majority of children are managed outside the operating room and many have TIVA using Propofol. These major institutions collect their anesthetic data in the same period of time, it is reviewed and analyzed retrospectively and there will be difficulties in interpreting such data[5, 32]. This can include bias because of multiple reporters, potential differences in allocating the diagnosis of laryngospasm and the likelihood of under reporting. The definitions of a clinically reportable laryngospasm may vary between anesthetists and reporting patterns may differ if it is mainly a voluntary process. These factors could result in under-reporting of incidents[33].

In the current study the overall incidence of perioperative pediatrics laryngeal spasm was 21.8%, comparatively higher than that of reported previously. The result is similar with the Haile M et al, Jimma University with the overall incidence of perioperative pediatrics laryngeal spasm was 28.3%[6]. The possible reason is similarity of associated factors.

It is generally considered that the incidence of laryngospasm decreases after vagolytic premedication[34]. Zindler[35] found a twofold increase of the incidence of laryngospasm in patients not premedicated, as compared to those given atropine prior to the anaesthetic. Some authors deliberately avoid the use of atropine or other vagolytic drugs[36], and the benefit of vagolytic premedication is under debate[37]. During this study period, all cases with perioperative laryngospasm premedicated with atropine and there is no statistical significance between premedication and occurrence of laryngospasm.

In the study done by Haile et al Jimma University, the main triggering factors were repetitive airway manipulations (43.3%) and light plain of anesthesia accounting about (22.6%) [38]. In the current study airway manipulations (58.8%) and light plain of anesthesia accounting about (27.9%). This result is comparable with that mentioned previously. In our study there were multiple attempts for tracheal intubation. There should be a limitation to the number of attempts at tracheal intubation and adequate depth of anesthesia should be obtained before attempting intubation and through intra operative period for limiting patient movements and blunting sensation to anxious stimuli.

Mamie et al. reported that children not anesthetized by pediatric anesthesiologist have a 1.7 times greater risk of perioperative RAE (these events included laryngospasm) [39]. Similarly, children who developed laryngospasm were more likely to have their anesthesia supervised by a less experienced anesthesia supervisor. The figure from AIMS database report reveals it is not only lacks of skilled anesthetic assistance contribute to adverse events, but that inadequately trained assistants may actually make an adverse event worse (41). In the present study, there is no association between the status of anesthesia providers and occurrence of laryngospasm. Possible reason is all procedures were supervised by anesthesiologist.

In this study there was no statistical significance between types of air way devices used with the occurrence of laryngospasm. The current study similar with study done by Haile et al jimma

university, (OR=0.6889,95% C.I. 0358-1.3257, P=0.263552) there was no statistical correlation between types of air way devices used with the occurrence of laryngospasm[6].

Desaturation occurred in over 60% of patients and was the most common physiological change reported. Post-obstructive pulmonary edema is occurred in nearly 4% of the incidents[41]. Bradycardia may also complicate laryngospasm and hypoxaemia, especially in young children, and accompanied laryngospasm in one fifth of the cases under 1 year of age[42]. Study done in Jimma university showed overall Perioperative complications, the percentage of desaturation were 42 (79.2%), bradycardia 37 (69.8%),pulmonary aspiration11 (20.8%), negative pressure pulmonary edema 5 (9.4%),cardiac arrest 3 (5.7%) and death 1 (1.9%) [28]. In our current study, the result is comparable with that reported above. Desaturation 39(12.4%), bradycardia 16(5.1%), pulmonary aspiration 11(3.5%), negative pressure pulmonary edema 2(0.6%).

In the current study. perioperative laryngospasm mainly managed by PPV/CPAP with 100% oxygen 39(57.3%), deepen anesthesia 17(25%),removal of stimuli 11(16.17%),muscle relaxation with suxamethanium 1(1.7%) and no child required cardiopulmonary resuscitation and there were no death. Almost all cases resolved without residual effect.

## **7. Limitation of the study**

Some limitations of this study were, first there was no case managed independently with non physician anesthesia providers since every pediatrics procedures during study period supervised by anesthesiologist. So these study could not asses risk of occurrence of laryngospasm with status of anesthesia providers (physician and non physician) independently. Second, Tikur Anebessa hospital is a referral institution and this practice is likely not representative of the general population of pediatrics undergoing surgery. Our study population underwent fewer routine procedures. This factor can potentially bias toward different risk factors compared with a more complex pediatric population. Third, there were no criteria for the diagnosis and recording of laryngospasm in our study therefore we had to rely on assessment accuracy of anesthesia consultant involved with the respective case.

## **8. Conclusion**

In conclusion, perioperative laryngospasm was common under pediatrics age group during general anesthesia, mainly at the time of induction, maintenance and emergence. Major associated risk factors were air way manipulation and light plain of anesthesia. It could be associated with considerable morbidity such as, desaturation and bradycardia and even mortality. Although easily recognized and managed without residual effect.

## **9. Recommendation**

On the basis of the findings of the study the followings are recommended. Earlier recognition and diagnosis of perioperative laryngospasm is recommended. All anesthesia providers (physician and non physician) should know pharyngeal-laryngeal anatomy and physiology and multiple risk factors associated to perioperative laryngospasm for effective management. A structured management approach is recommended to improve the outcome of the patient. Every pediatric procedures should supervised by anesthesiologist especially during induction of anesthesia and emergence period, when laryngeal spasm is more common.

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## 11. Assurance of principal investigation

I the undersigned agree to accept all responsibilities for the scientific and ethical conduct of the research project. I will provide timely progress report to my advisor and seek the necessary advice and approval from my advisor in the course of the research. I will communicate timely to my advisor all stakeholders involved.

Name of the student: Tsigereda Damene(MD,anesthesiology and Critical Care resident)

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Approval of the Advisor

Name of the advisor: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

## 12. Annexes

### 12.1. Annex I: Information sheet and informed consent

Addis Ababa University, school of public health, from Sub specialty program

A questionnaire for assessing magnitude and associated risk factors of perioperative pediatrics laryngospasm under general anesthesia in Addis Ababa University Tikur Anbessa Hospital.

Good morning/good afternoon. My name-----; we come from Addis Ababa University. We are working with an investigator, Tsigereda Damene, doing her thesis for the partial fulfillment of **specialty certificate** of Anesthesiology and Critical Care. We are interviewing associated risk factors of perioperative pediatrics laryngospasm under general anesthesia. We are going to ask you some questions that are not difficult to answer. Your name will not be written in this format and never be used in connection with any of the information you are going to tell me. You are not obliged to answer any question that you do not want to answer and you may end this interview at any time you want to. However, your honest answers to these questions will help us to identify the main risk factors associated with perioperative pediatrics laryngospasm under general anesthesia and helps to solve the identified problems in the future to control and prevent it. We would like to appreciate your help in responding to these questions, and the interview will not take more than 30 minutes.

#### Informed consent

I am the individual asked to be a study participant. Based on the information provided by the principal investigator, understand that it is not necessary to write my name, the information I tell to her/him will not to be used for other purpose and the information obtained from me will help to identify the main risk factors associated with perioperative pediatrics laryngospasm under general anesthesia and helps to solve the identified problems in the future to control and prevent it in the future. So I agree to be a study participant.

1. Yes..... 2. No.....

If yes go to next section.

If no go to next participant

Questioner code -----

Name of data collector----- signature

### 12.3. Annex II: Questionnaire

Magnitude and associated risk factors of perioperative pediatrics laryngospasm during elective general surgery under general anesthesia

1 .Card number-----

2. Age-----

3. Sex-----

4. ASA-----

5. Is there associated Co morbidity in the specific patient?

Yes---- No-----

6. If yes, specify-----

7. Mention a planned surgery-----

8. Status of anesthesia providers

A. Bsc-----

B. Msc---

C. Anesthesia resident---

D. Anesthesiologist----

E. If other,specify---

9.Which one of the following airway device used for provide anesthesia?

A. ETT

B. LMA

C. Face mask

D. If other, specify.....

10. Medications used for induction of anesthesia is /are...

A. Intravenous specify.....,

B. Inhalational, specify.....

C. Combined specify.....,

D. If other, specify

11. Medications used for maintenance of anesthesia is/are

A. Intravenous, specify.....

B. Inhalational, specify.....

C. Combined, specify.....

D. If other, specify-----

12. Which premedication given for the patient?

A. Atropine

B. Lidocaine (IV, spray...)

C. If other, specify

13. Is the laryngospasm diagnosed in this patient?

A. Yes B. No

If yes, please answer the questions below.

14. Onset of laryngospasm during

A. Induction

B.Maintenance

C.Emergence

D.Recovery

D.If other, specify

15. Identified risk factors in specific patient

A.URTI(common cold.....

B. Secretion (blood,vomitus.....

C. Foreign body

D. Airway manipulation

E.Underlying lung pathology

F.Light plain of anesthesia

G. Type of surgery

H. If other,specify-----

16.Managment of laryngospasm via

A.Removal of the stimuli( secretion---

B.Positive pressure ventilation/CPAP with 100% oxygen

C. Deepen the anesthesia

D. Muscle relaxation with suxamethonium

E.Intubation

F. Surgical airway( tracheostomy....

G.If other, specify-----

17. Complications of perioperative laryngospasm

A. Pulmonary (edema, hypoxia/desaturation...), specify

B. CVS (bradycardia, arrest...), specify

C. CNS (hypoxic insults...), specify

D. If other, specify...

18. Outcome

A. Resolved

B. Remain complicated

C. Death

D. If other, specify

