



የቅዱስ ጳውሎስ
ሆስፒታል ሚሊየንዎ ሕክምና ኮሌጅ
St. Paul's Hospital Millennium Medical College

Graduate Study Program

**Magnitude and factors associated with postoperative sore throat
among adults after general anesthesia with endotracheal
intubation at St. Paul's Hospital Millennium Medical College,
Addis Ababa, Ethiopia.**

By Dr. Natnael Eyassu (MD)

A Research Proposal submitted to the Department of Anesthesiology, Critical
Care and Pain Medicine in Partial Fulfillment of the Requirements for the Degree
of Specialty in Anesthesiology, Critical Care and Pain Medicine

March, 2026

Addis Ababa, Ethiopia

St. Paul's Hospital Millennium Medical College

Graduate Study Program

**Magnitude and factors associated with postoperative sore throat
among adults after general anesthesia with endotracheal
intubation at St. Paul's Hospital Millennium Medical College,
Addis Ababa, Ethiopia.**

By Dr. Natnael Eyassu (MD)

A Research Proposal submitted to the Department of Anesthesiology, Critical
Care and Pain Medicine in Partial Fulfillment of the Requirements for the Degree
of Specialty in Anesthesiology, Critical Care and Pain Medicine

Name of advisors:

Dr. Lemi Bayisa (Consultant Anesthesiologist, Assistant Professor)

Dr. Kirubel Abebe (Hepatobiliary Surgeon, Associate Professor)

March, 2026

Addis Ababa, Ethiopia

St. Paul's Hospital Millennium Medical College

Name of investigator	Dr. Natnael Eyassu
Fulltitleoftheresearchproject	Magnitude and factors associated with postoperative sore throat among adults after general anesthesia with endotracheal intubation at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia.
Duration of the project	November 20, 2025, to December 20, 2025 (Gc).
Study Area	St. Paul's Hospital Millennium Medical College
Total Cost of the project	ETB 20,592.00
Source(s) of Funding	Self-sponsor
Address of investigator	Tel:
	Cell phone: +2519135569131
	Fax:
	P.O. Box:
	Email: drnatnaeleyassu@gmail.com
	1) Dr. Lemi Bayisa
Name of Advisor(s)	2) Dr. Kirubel Abebe

Acknowledgement

First and foremost, I would like to thank the study participants, then St. Paul's Hospital Millennium Medical College for providing me with this opportunity to enhance my education. Finally , I sincerely thank my advisors, Dr. Lemi B and Dr. Kirubel A, who have provided me with ceaseless guidance, without whom my work would not be at this stage.

Table of Contents

Acknowledgement	ii
List of tables	v
List of figure	v
Abbreviations and acronyms	vi
Abstract	vii
1. Introduction	1
1.1. Background of study	1
1.2. Statement of the problem	2
1.3. Significance of the study	2
2. Literature review	4
2.1. Prevalence of postoperative sore throat	4
2.2. Factors associated with postoperative sore throat	4
2.2.1. <i>Socio-demographic factors</i>	<i>5</i>
2.2.2. <i>Anesthesia-related factors</i>	<i>5</i>
2.2.3. <i>Patient-related factors</i>	<i>7</i>
2.2.4. <i>Surgical-related factors</i>	<i>8</i>
2.3. Conceptual framework	10
3. Objectives	11
3.1. General objective	11
3.2. Specific objectives	11
4. Method and materials	12
4.1. Study setting and period	12
4.2. Study design	12
4.3. Population	12
4.3.1. <i>Source population</i>	<i>12</i>
4.3.2. <i>Study population</i>	<i>12</i>
4.4. Eligibility criteria	12
4.4.1 <i>Inclusion criteria</i>	<i>12</i>
4.4.2 <i>Exclusion criteria</i>	<i>12</i>
4.5. Sample size and sampling technique	13
4.5.1 <i>Sample size</i>	<i>13</i>
4.5.2 <i>Sampling technique</i>	<i>13</i>

4.6.1. <i>Dependent Variable</i>	13
4.6.2. <i>Independent Variable</i>	13
4.8. Data collection	14
4.7.1. <i>Data Collection Instruments</i>	14
4.9. Data quality control	14
4.10. Data processing and analysis	15
4.11. Ethical consideration	15
4.12. Dissemination of results	15
5. Result	16
5.1. Socio-demographic characteristics	16
5.2. Patient-related clinical characteristics.....	16
5.3. Anesthesia-related characteristics.....	17
5.4. Surgery-related characteristics	18
5.5. Factors Associated with postoperative sore throat among participants.....	19
6. Discussion	22
7. Conclusion and Recommendations	24
7.1. Conclusion.....	24
7.2. Recommendations	24
8. Strengths and Limitations	25
8.1. Strengths	25
8.2. Limitations	25
9. Reference	26
Annex	30
Participant information and voluntary consent form	30
Questionnaire.....	32
Amharic version questioner	35

List of tables

<i>Table 1 Socio-demographic characteristics of adult surgical patients at SPHMMC, 2026 (n = 267)</i>	<i>16</i>
<i>Table 2 Patient-related clinical characteristics of adult surgical patients at SPHMMC, 2026 (n=267)</i>	<i>17</i>
<i>Table 3 Anesthesia-related characteristics of adult surgical patients at SPHMMC, 2026 (n = 267)</i>	<i>17</i>
<i>Table 4 Surgery-related characteristics and POST among adult surgical patients at SPHMMC, 2026 (n = 267)</i>	<i>18</i>
<i>Table 5 Bivariate and multivariable logistic regression analysis of factors associated with postoperative sore throat among adult surgical patients at SPHMMC, 2026 (n = 267)</i>	<i>21</i>

List of figure

<i>Figure 1 A conceptual framework to assess the magnitude and associated factors of post op sore throat following surgery by GA/ETT at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia (10,12,20)</i>	<i>10</i>
<i>Figure 2 Magnitude of POST among adult surgical patients at SPHMMC, 2026 (n = 267)</i>	<i>19</i>

Abbreviations and acronyms

AOR	Adjusted Odd Ratio
CI	Confidence Interval
DLT	Double-Lumen Tube
ETB	Ethiopian Birr
ETT	Endotracheal tube
LMA	Laryngeal Mask Airway
NGT	Nasogastric Tube
NSAID	Nonsteroidal anti-inflammatory drugs
POST	Postoperative Sore Throat
SLT	Single Lumen Tube
SPSS	Statistical Package for the Social Sciences

Abstract

Background: Postoperative sore throat is a common, unpleasant, and upsetting complication of tracheal intubation that increases postoperative morbidity and causes patient dissatisfaction after general anesthesia.

Objective: To determine the magnitude and factors associated with postoperative sore throat among adults after general anesthesia with endotracheal intubation at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia, 2026.

Method: An institution-based cross-sectional study was conducted using a Google sheet. A structured and pre-tested questionnaire was used to collect data from 267 study participants. Statistical Package for Social Sciences (SPSS) version 25.0 software was used for analysis. Data exploration and an overall model fitness test were conducted by the Hosmer-Lemeshow test. Bivariate logistic regression was carried out to see the association of each independent variable with the outcome variable. Then, for those variables having a p-value less than 0.25, the multivariable logistic regression method was used. P-values of < 0.05 and a 95% confidence level were used as a difference of statistical significance.

Result: A total of 267 adult surgical patients were included in this study. The overall prevalence of postoperative sore throat (POST) within 24 hours after surgery was 45.3%. In the multivariable logistic regression analysis, intubation duration greater than two hours (AOR = 3.47; 95% CI: 1.54–7.80), two or more intubation attempts (AOR = 3.43; 95% CI: 1.34–8.80), use of endotracheal tube (ETT) size > 7.0 mm (AOR = 3.31; 95% CI: 1.09–10.07), and presence of visible blood on airway equipment (AOR = 2.36; 95% CI: 1.21–4.61) were independently associated with POST.

Conclusion: Postoperative sore throat affects 45.3% of adult surgical patients at St. Paul's Hospital Millennium Medical College a common but modifiable complication. Key factors include prolonged intubation, multiple attempts, larger ETT sizes, and visible airway damage. Improving airway management practices to reduce mucosal injury and shorten intubation time may help lower the incidence of POST and enhance patient satisfaction after surgery.

Keywords: *Postoperative sore throat, Endotracheal tube, General anesthesia, Ethiopia*

1. Introduction

1.1. Background of study

Tracheal intubation is a common method of securing the airway during general anesthesia, with benefits such as preventing aspiration, making the airway accessible for controlled ventilation and suctioning, and reducing dead space. Since the 1950s, anesthesia professionals have secured the airway in the operating room using an endotracheal tube. Endotracheal intubation has a disadvantage despite its benefits. After tracheal intubation, post-operative sore throat is the most common complaint among patients, followed by pain and nausea (1).

One of the frequent, minor, but unpleasant postoperative side effects that adds to postoperative morbidity after general anesthesia is Postoperative Sore Throat (POST) (2). A sore throat is merely a nonprofessional explanation of pharyngitis, which can include a variety of symptoms such as laryngitis, tracheitis, cough, hoarseness, or dysphagia. POST, on the other hand, is a feeling of pain or discomfort in the larynx or pharynx during the postoperative period (3).

The cause of sore throat after surgery is complicated. POST can be caused by airway instrumentation, including suctioning, intubation, and laryngoscopy, as well as their irritating effects, which can lead to increased mucosal pressure, tracheal perforation, desquamation of the airway mucosa, nerve injury (lingual, hypoglossal, or recurrent laryngeal), and airway edema (3,4). A sore throat can occur as a result of gradually decreased pharyngeal mucosal perfusion and mucosal ischemia brought on by the elevated pharyngeal mucosal pressure brought on by airway instrumentation (5).

1.2. Statement of the problem

POST is one of the most frequent side effects following general anesthesia, ranking second only to other side effects (2). It is brought on by congestion, blood clots, airway securement, vocal cord damage, and other factors like an improperly sized tube, cuff shape, cuff pressure, and airway securement, which all damage the epithelium and mucosal cells (6). After general anesthesia and surgery, the unpleasant and stressful outcome of tracheal intubation affects patient satisfaction and increases mortality and morbidity (7).

POST after surgery with GA/endotracheal intubation is common. The postoperative incidence in Korean patients who underwent elective surgery requiring endotracheal intubation under GA was 57.5% (8). According to a study done at the Ilorin Teaching Hospital in Nigeria, 58% of patients get POST (9). At Debre Tabor General Hospital in Northcentral Ethiopia, 48.8% of patients who had surgery under GA with endotracheal intubation developed POST (10).

The risk of postoperative sore throat is also increased by the type of endotracheal tube used, the extent of oropharyngeal suctioning, and the extent of laryngoscopy-related injury. POST, as opposed to LMA, is more common after ETT and is associated with a number of factors, including younger age, female sex, the use of a double-lumen tube, high ETT cuff pressures, the type of surgery, smoking cigarettes, airway suctioning, dehydration, the length of intubation or anesthesia, the presence of blood on the tip of the ETT or laryngoscope or LMA during extubation, the use of a larger endotracheal tube, and the use of a Nasogastric tube (NGT) (8, 11, 12).

While most POST symptoms resolve on their own, a gargle containing local anesthetics, dexamethasone, and analgesics like benzydamine hydrochloride may be used to treat moderate to severe postoperative sore throat pain and dysphagia (13, 14).

Numerous research studies have been conducted worldwide to examine the prevalence of POST and its risk factors. The majority of these studies have been conducted in developed nations, with relatively few studies on POST predictors conducted in Ethiopia, a country with limited resources and skilled labor. Thus, the purpose of this study is to assess the magnitude of POST and its contributing factors. It will also help reduce risk factor combinations, lower the incidence and

severity of POST, increase postoperative patient satisfaction, and raise awareness of the factors linked to a higher incidence of POST.

1.3. Significance of the study

One of the most frequent complaints from patients who had general anesthesia surgery with endotracheal intubation is POST. Finding the typical risk factors for postoperative sore throat is crucial to enhancing patient satisfaction and lowering postoperative medical expenses, even though it is regarded as a minor complication. This study will help to assess the magnitude and factors associated with POST in local context such as patient demographics, surgical practices, anesthetics techniques and equipment at St. Paul's Hospital Millennium Medical College to design institution-specific data valuable for informing protocols, training, and care improvements, while also enabling future comparisons with other Ethiopian hospitals to uncover broader trends or unique challenges. Additionally, the study is anticipated to help hospital administrators and policymakers enhance the quality of professional education by offering workshops that provide high-quality anesthesia services and a postoperative overview of patient respiratory outcomes, enabling the relevant body to plan and intervene in areas of deficiency. Furthermore, it is anticipated that this study will contribute to the scientific community.

2. Literature review

2.1. Prevalence of postoperative sore throat

The incidence of POST varies depending on the country and study, and it has been extensively studied over the past few decades. A large sample of patients (n=809) in a study conducted at University Hospital in Zurich, Switzerland, showed a 40% incidence of postoperative sore throat (1). In a similar study, conducted on Korean patients at Seoul St. Mary's Hospital, The Catholic University of Korea, and 57.5% (8). According to a non-randomized prospective study conducted at Kuala Lumpur Hospital in Malaysia on 57 consecutive patients who underwent thyroid surgery using ETT, the incidence of POST was 68% (15).

A prospective observational study conducted at Hadassah Hebrew University Medical Center in Israel found that 270 (52%) of the 518 patients who had ETT intubation experienced sore throat. Among 79 patients managed with an LMA, only 20 (25%) patients reported sore throats. A significantly lower incidence of sore throat was reported with LMA (LMA vs. ETT, 20/79 (25%) vs. 270/518 (52%), $P < 0.001$). Among patients who developed a sore throat, the severity measured by VAS was almost similar for those with LMA and ETT (42.7 ± 26.2 vs. 45.9 ± 25.1 , $P = 0.588$). This further demonstrates how intubation with ETT may put patients at risk for POST (16). Similarly, a study conducted at Toronto Western Hospital in Canada found that, when compared to patients with LMA, patients with ETT had the highest incidence of POST (45.4% vs. 17%) (17).

The Örebro University Hospital in Sweden conducted a four-month, non-randomized, prospective, and longitudinal study. According to the results, women had POST at a higher rate than men ($p = 0.07$). POST and PH at the PACU did not significantly differ by gender, regardless of the type of airway device (ETT or LMA) used. More women had POST following hand, orthopedic, gynecological, and general surgery when stratified by surgical department, regardless of airway device. However, POST following urology surgery was more common in men. Men and women did not differ significantly following an ETT (27% vs. 38%, $p = 0.2$). Nonetheless, more women than men experienced POST following an LMA (26% vs. 6%, with $p = 0.004$). POST was reported to be present during swallowing following an LMA by more women ($n = 11$) than men ($n = 1$). There was a higher incidence of POST in the ETT group

compared to the LMA group (32% vs. 19%, $p = 0.012$) as well as a higher incidence of Ph in the ETT group compared to the LMA group (57% vs. 33%, $p < 0.001$) in the PACU (18).

A cross-sectional study conducted at Jimma University Teaching Hospital in Ethiopia found that 56.6% of surgical patients experienced postoperative sore throat (12). According to a hospital-based cross-sectional study conducted on 240 surgical patients at Gondar University Hospital in Ethiopia, the incidence of postoperative sore throat within 48 hours following the procedure was 59% (19). An additional supportive cross-sectional study was conducted at Debre Tabor General Hospital in north-central Ethiopia. Within 24 hours following surgery performed under general anesthesia and endotracheal intubation, the incidence of postoperative sore throat was 48.8% (10). Another study done in Black Lion Hospital, Ethiopia, on 114 patients shows an incidence rate of 45.6% (20).

2.2. Factors associated with postoperative sore throat

2.2.1. Socio-demographic factors

Several studies indicate that having a sore throat is significantly associated with being female. According to a study conducted in Zurich, Switzerland, women experienced sore throats at a significantly higher rate than men (44% vs. 33%; $P = 0.001$) (1). Similar findings were made by Western Hospital in Toronto, Canada, where a 3-year prospective observational study of 5264 patients revealed that female patients experienced more sore throats than male patients (13.4% vs. 9.1%) (17). Related studies in Ethiopia done at the hospital of Gondar University showed that female patients are 3.3 times more likely to develop POST than male patients (AOR = 3.3, 95% CI: 1.07, 10.375) (19).

Age is the other sociodemographic factor linked to a sore throat. A prospective observational study in Jerusalem, Israel, showed that decreasing age (OR 0.976, 95% CI 0.961-0.992, $P = 0.003$) remained a significant predictor of sore throat on multivariate analysis (16).

2.2.2. Anesthesia-related factors

In a randomized double-blind clinical trial, patients who were admitted for urgent abdominal surgery to Iran's Shohada-e-Tajrish hospital had higher POST in the suxamethonium group.

Eighty patients participated in the trial and were randomized to receive cisatracurium or succinylcholine when anesthesia was induced. Significantly more patients in the succinylcholine group (51%) experienced sore throats at the time of recovery room entrance than in the cisatracurium group (25%) ($P = 0.001$) (21).

The NSAID most investigated is benzydamine hydrochloride, a topical preparation that also has antibacterial properties. A meta-analysis of benzydamine identified five randomized controlled trials that included 824 patients. For the studies investigating tracheal tubes, benzocaine was sprayed directly onto the tracheal tube and/or into the oropharynx in three studies, while the remaining study used a benzocaine gargle. The incidence of postoperative sore throat compared with control groups was reduced at all measured time points up to 24 h (RR at 1 h and 24 h were 0.42 and 0.32, respectively). Topical diclofenac reduced the incidence of sore throat following cesarean section (22).

A prospective, randomized controlled trial compared tracheal tube cuff inflation using a manometer (pressure 15–25 mmHg) with manual palpation of the pilot balloon in 509 patients. The cuff pressure, however, was not subsequently monitored during the remainder of the surgery. The manometer group patients had a significant reduction in the incidence of sore throat at 24 h compared with the control (34% vs 44%, respectively) (26).

Prolonged tube intubation was positively linked with POST (27). In a similar way, a study conducted on a cross-sectional investigation at Debre Tabor General Hospital in North Central Ethiopia revealed that there is a 9.7%, 17.9%, and 21.1% incidence of POST when the tube stays in place for <1 hr, 1–2 hr, and >2 hr, respectively (10).

The incidence and severity of POST following GA with ET intubation can be decreased by topical and systemic lidocaine, according to the results of a systematic review study that included 1232 patients from 15 studies (28). Another study conducted in India, which was randomized, double-blind, and placebo-controlled, found that the incidence of POST was higher within the first 24 hours compared to the control/normal saline group (56.3%) and was lower in the dexamethasone group (20%) after surgery (29). In a similar vein, a prospective, randomized, double-blind, placebo-controlled study conducted in Korea on patients undergoing thoracic surgery found that prophylactic administration of 0–2 mg/kg of dexamethasone

significantly reduces the duration and incidence of hoarseness and sore throat following tracheal extubation of a DLT (30).

According to a meta-analysis study, the incidence of POST was statistically significantly lower ($p < 0.015$, $RR < 0.53$) when ketamine gargle (40–50 mg) was administered prior to induction of anesthesia than when a placebo was administered at 0, 2, 4, 8, and 24 hours (31).

The incidence of sore throat is also linked to the use of a nasogastric tube (NGT) during surgery. An increased risk of sore throat was found to be associated with the use of NGT during surgery in a study carried out in Jerusalem, Israel (16). Additionally, the Gondar, Ethiopia, study found a strong correlation between the use of NGT and postoperative sore throat. The prevalence of sore throat was higher when NGT was used than when it wasn't (67.3% vs. 57.2%) (19). A systematic review also concluded that the duration of anesthesia (OR 1.27) was associated with the greatest risk of POST (4). On the other hand, a study conducted at the Gondar Teaching Hospital revealed no correlation between the length of time the tube was in place and a sore throat following surgery (19).

According to a study conducted in Zurich, Switzerland, bloodstain on the ETT following extubation was one of the seven characteristics that was found to be significantly associated with postoperative throat complaints (OR 4.81; $P < 0.001$) (1). The other systematic review at Sheffield Teaching Hospital, UK, stated that the presence of a blood-stained tracheal tube on extubation (OR 4.81) was associated with a higher risk of POST (4).

It has been shown that using a smaller ETT lowers the incidence of POST because the tube's mucosal interface experiences less pressure. Using either ETT size 6.0 or 7.0, 100 healthy adult women who had elective surgery were randomly assigned to oral intubation in a randomized controlled study conducted at Orebro University Hospital in Sweden. After surgery, ETT 7.0 had a higher incidence of POST (51.1 percent) than ETT 6.0 (27.1 percent), $P=0.006$, and ETT 7.0 had a higher degree of sore throat discomfort (38.8%) than ETT 6.0 (18.8%), $P=0.02$. Thus, in the PACU, a smaller ETT helps ease the discomfort and sore throats of women (32).

According to a hospital-based retrospective review conducted at Nara Medical University in Japan, the incidences of POST (32.9% vs. 32.6%, $P=0.84$) and PH (35.8% vs. 35.2%, $P=0.60$) did not differ between tracheal intubation by trainees and tracheal intubation by senior anesthetists (33). In contrast to this research, a facility-based cross-sectional study on 245 elective gynecologic and general surgical patients at JUMC reported that those patients whose intubation was performed by a senior anesthetist (>2 years) had a 0.25 times likelihood of having a postoperative sore throat ($B=0.254$, 95% CI (0.112-0.575)) when compared with those intubated by a junior (12). The number of attempts made during endotracheal intubation is another factor associated with POST. According to a hospital-based cross-sectional study conducted at Gondar Teaching Hospital in Ethiopia, multivariate logistic regression revealed a correlation between POST and repeated attempts to intubate ($AOR = 3.291$, 95% CI: 1.658, 6.531) (19).

2.2.3. Patient-related factors

Smoking is more frequently associated with a sore throat in the prospective study conducted in Switzerland with 809 patients who underwent elective surgery, with $p = 0.03$ (1).

Subsequent logistic regression analysis demonstrated that pre-existing lung disease (OR 3.12) and duration of anesthesia (OR 1.27) were associated with the greatest risk of postoperative sore throat (33).

Patients who are dissatisfied are known to experience more adverse events attributable to medical practice. It is therefore reasonable to suppose that postoperative sore throat and hoarseness could significantly impact the overall patient experience of anesthesia management, during which patients are almost unconscious, if patients consider these minor adverse events as partial outcomes of anesthesia management (33).

2.2.4. Surgical-related factors

A prospective study by Kolawole and Ishaq was conducted for 8 months in the University of Ilorin Teaching Hospital, Ilorin. Overall, it was observed that cesarean section patients were more likely than gynecology patients to report these respiratory complications in the postoperative period (88.4% vs. 58.9%). This difference was statistically significant ($p < 0.05$). There was a statistically significant difference in the incidence of sore throat between the cesarean section patients and

gynecology patients ($p < 0.05$), particularly with endotracheal tube sizes larger than 7.5 mm ID ($p < 0.03$). Duration of intubation, which was slightly longer in gynecology patients (mean = 72.48 ± 30.62), and number of intubation attempts did not have a statistically significant effect on the incidence of respiratory complaints (34).

According to a study done in Korea, the prone position increases the cuff pressure, and there is a significant association between the prone position and sore throat one hour after extubation. The flexed pressure in supine was significantly increased to 38.7 ± 6.7 cmH₂O ($P < 0.001$) compared to the adjusted neutral pressure, and the extended pressure was not statistically changed from the adjusted neutral pressure. After changing position from supine to prone, flexed and extended pressures were increased to 40.5 ± 8.8 ($P < 0.001$) and 29.9 ± 8.7 ($P = 0.002$) cmH₂O more than the adjusted neutral pressure, respectively. The number of patients whose cuff pressure was increased, decreased, or did not change (35).

2.3. Conceptual framework

This conceptual framework was constructed by reviewing different literature that shows the relationship between socio-demographic and economic factors, preoperative factors, anesthesia-related factors, and surgery-related factors with the outcome variable. See Figure 1.

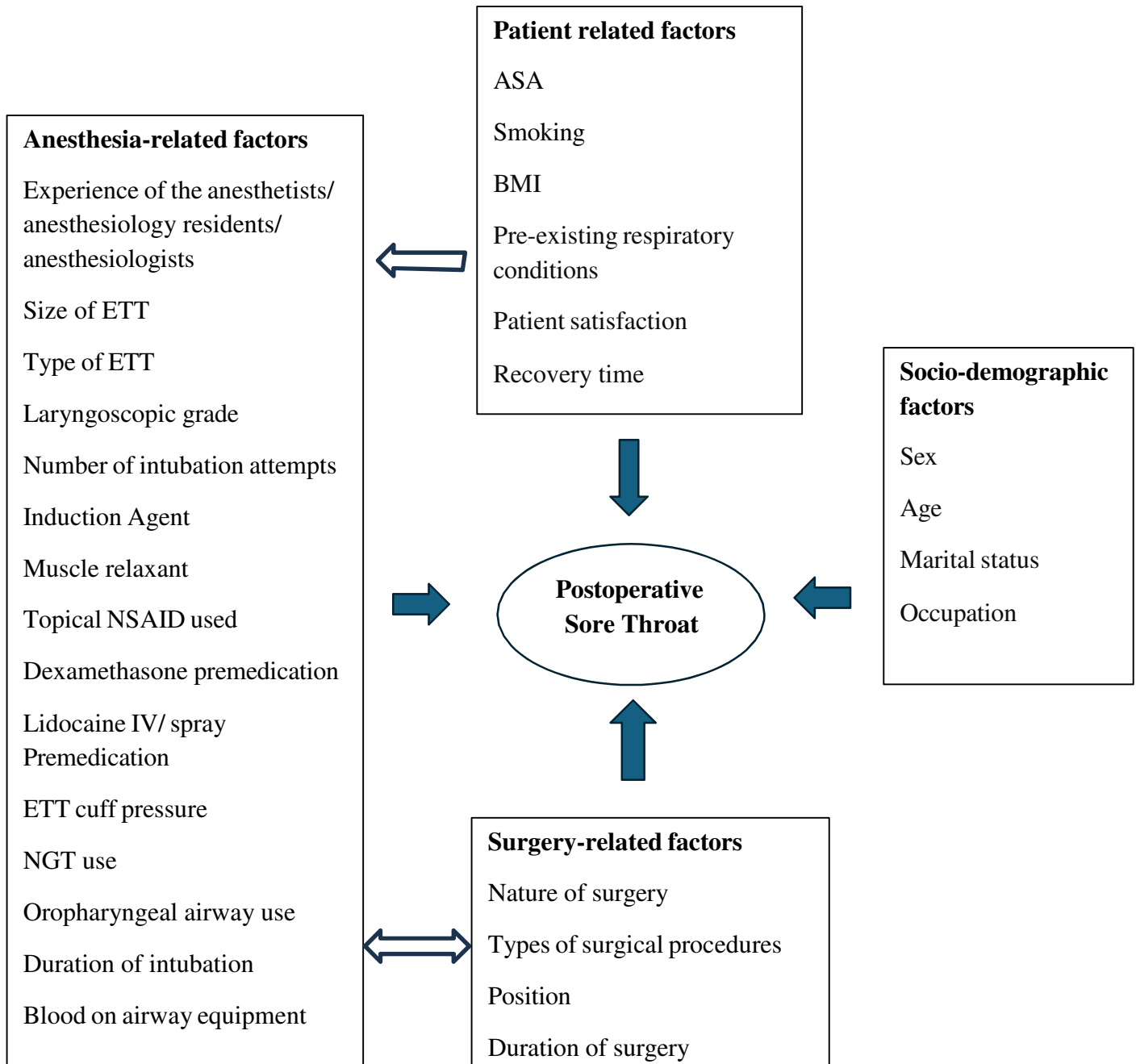


Figure 1 A conceptual framework to assess the magnitude and associated factors of post op sore throat following surgery by GA/ETT at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia (10,12,20).

3. Objectives

3.1. General objective

- ❖ To assess the magnitude and factors associated with postoperative sore throat among adults after general anesthesia with endotracheal intubation at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia, 2026.

3.2. Specific objectives

- ❖ To assess the magnitude of postoperative sore throat among adults after general anesthesia with endotracheal intubation at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia.
- ❖ To identify factors associated with postoperative sore throat among adults after general anesthesia with endotracheal intubation at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia.

4. Method and materials

4.1. Study setting and period

The study was conducted at St Paul Millennium Medical College (SPHMMC), which is one of the tertiary governmental Teaching Hospitals in Addis Ababa, the Capital of Ethiopia, and the seat of the African Union, and the second largest public health Hospital in Ethiopia. It currently has 700+ beds, with an annual average of 200,000 patients and a catchment population of more than 5 million. The Hospital provided surgery for more than 11,000 patients in 2024. The anesthesia work force comprise 20 consultant Anesthesiologist, 63 Anesthesia residents and 37 Anesthetist and Hospital has 21 elective and 5 emergency tables. General anesthesia is administered by anesthesia residents under supervision as part of their training, as well as full- time anesthetists. The study was conducted from November 20, 2025, to December 20, 2025 (Gc) .

4.2. Study design

An institution-based cross-sectional study was conducted

4.3. Population

4.3.1. Source population

All adult patients who have undergone surgery under general anesthesia with endotracheal intubation at SPHMMC.

4.3.2. Study population

Adult patients who underwent surgery under GA with endotracheal intubation during the study period and met the inclusion criteria.

4.4. Eligibility criteria

4.4.1 Inclusion criteria

Patients aged 18 years or older who were operated on under general anesthesia with endotracheal intubation during the study period were included.

4.4.2 Exclusion criteria

Patients who had undergone oropharyngeal surgery, were unable to communicate or had impaired cognitive ability, patients with a pre-existing sore throat, patients not extubated after surgery, or with airway malformation were excluded from the study.

4.5. Sample size and sampling technique

4.5.1 Sample size

The sample size was calculated by using Epi Info 7.2.6.0 using a single population proportion by taking the following assumptions: the proportion of POST is 59% (19), CI of 95%, and margin of error of 5%. The calculated sample size was 372. However, the total population that was admitted within the study period is less than 10,000. Since the source population (N) = Total number of patients who underwent surgery (an average estimate by considering the past 03 months, patients underwent surgery by GA; 690 per month. By taking this into account, the population correction formula was used. A total sample size of 242 was obtained, and with a 10% non-response rate, the final sample size was 267.

4.5.2 Sampling technique

A systematic sampling technique was used to select study participants.

4.6. Variables and Measurements

4.6.1. Dependent Variable

Post-operative sore throat (yes/no)

4.6.2. Independent Variable

Socio-demographic factors: sex, age, marital status, and occupation.

Patient-related factors: ASA status, smoking history, pre-existing respiratory conditions, BMI, patient satisfaction, and recovery time

Surgical-related factors: Nature of surgery, types of surgical procedure, Duration of surgery, and surgical position

Anesthesia-related factors: Type of premedication, experience of the anesthetists/ anesthesiology residents/ anesthesiologists, size of ETT, laryngoscopic grade, number of intubation attempts, induction agent, muscle relaxant, lidocaine spray, Topical NSAID use, ETT cuff pressure, Type of ETT, NGT use, oropharyngeal airway use, duration.

4.7. Operational definitions

Postoperative sore throat- a pain in the pharyngeal area that worsens with swallowing, which occurs after extubation in the first 24 hours following surgeries under GA with ETT (3). Therefore, the data will be recorded as yes if the POST occurred within the 24 h and no if it did not occur within the mentioned time range

4.8. Data collection

4.7.1. Data Collection Instruments

Data was collected by using a structured questionnaire and chart review after verbal informed consent was taken. Data was collected by two trained nurses who were not involved in the management of study participants. First, the English version of the questionnaire was prepared by the investigator. Then, it was translated into Amharic and back to English by language translators to check for consistency. Independent data was taken from the patient chart, anesthesia record sheet, and anesthetists, which was then recorded on the provided questionnaire sheet. The interview that assesses the presence or absence of the outcome variable was done 12-24 hours postoperatively, when the patients have fully recovered from anesthesia and feel comfortable participating in the interview.

4.9. Data quality control

To ensure the quality of the data, the following measures were undertaken: validity and reliability were assessed using a pre-test, which was conducted in St. Paul's Hospital Millennium Medical College (14 clients) of the total sample size. The data collectors and the supervisor were trained a week before the actual date of the data collection period. The principal investigator and the supervisor were actively involved in the supervision of data collection. Data collectors were supervised daily, and the complete questionnaire was checked.

4.10. Data processing and analysis

The data was collected by using a Google Sheet. Then, the data was exported to the Statistical Package for Social Sciences (SPSS) version 25.0 software for analysis. Data exploration and an overall model fitness test were conducted via the Hosmer-Lemeshow test (0.22). Univariate analyses like simple frequency tables, percentages, mean, standard deviation, bar charts, and pie charts were used. Then bivariate logistic regression was carried out to see the association of each independent variable with the outcome variable (Post). Multi-collinearity was checked by the Variance Inflation Factor (less than five). Then, for those variables having a p-value less than 0.25, the multivariable logistic regression method was used. P-values of < 0.05 and a 95% confidence level were used as a difference of statistical significance. Finally, the results were compiled and presented using tables, graphs, and text.

4.11. Ethical consideration

Ethical clearance was obtained from the Institutional Review Board (IRB) of St. Paul's Hospital Millennium Medical College. Verbal consent was obtained from the study participants after a clear explanation of the aim of the study. Confidentiality and privacy were maintained during data collection, analysis, and reporting, in which the information obtained from the respondents. Information obtained from individual charts was kept secure and confidential. Names and other data identifying respondents were made anonymous or eliminated throughout the study process to maintain confidentiality.

4.12. Dissemination of results

The result of the study will be submitted to St. Paul's Hospital Millennium Medical College for the requirement of partial fulfillment of the degree of specialty in Anesthesiology, Critical Care, and Medicine, and will also be submitted and presented to the hospitals and other relevant bodies. Maximum efforts will be made to publish the findings of the research in reputable scientific journals for further utilization.

5. Result

5.1. Socio-demographic characteristics

A total of 267 adult patients who underwent general anesthesia with endotracheal intubation were included in this study, which resulted in a response rate of 100%. Most participants were female, accounting for 154 (57.7%), and the largest age group was 30-39 years old (22.8%). The mean age of study participants was 44.6 ± 15.21 SD. Most participants were married (70.8%), and housewives formed the largest occupational group, representing 106 (39.7%) of the study population. See Table 1 for details.

Table 1 Socio-demographic characteristics of adult surgical patients at SPHMMC, 2026 (n = 267)

Variables	Category	Frequency (n= 267)	Percentage (%)
Sex	Male	113	42.3
	Female	154	57.7
Age group (years)	18-30	42	15.7
	30-39	61	22.8
	40-49	52	19.5
	50-59	54	20.2
	60+	58	21.7
Marital status	Single	34	12.7
	Married	189	70.8
	Divorced/Separated/Widowed	44	16.5
Occupation	Housewife	106	39.7
	Self-employed	61	22.8
	Government/NGO	45	16.9
	Daily laborer	23	8.6
	Student	17	6.4
	Unemployed/Retired	15	5.6

†Other occupations: Priest (n=), Driver (n=), Retired (n=) – recoded into existing categories where applicable.

5.2. Patient-related clinical characteristics

Most patients were classified as ASA II, totaling 163 (61.0%) of the sample, and the majority had a normal body mass index (67.8%). The prevalence of smoking was low, with only 7 patients (2.6%) reporting a positive smoking history. Pre-existing respiratory disease was also rare, found in just 8 patients (3.0%), with asthma being the most common condition. The majority of patients (84.3%) had a recovery time longer than one hour. See Table 2 for details.

Table 2 Patient-related clinical characteristics of adult surgical patients at SPHMMC, 2026 (n=267)

Variables	Category	Frequency (n = 267)	Percentage (%)
ASA classification	I	83	31.1
	II	163	61.0
	III/IV	21	7.9
BMI category (kg/m ²)	Normal (18.5–24.9)	181	67.8
	Underweight (<18.5)	30	11.2
	Overweight (25–29.9)	48	18.0
	Obese (≥30)	8	3.0
Smoking status	Non-smoker	260	97.4
	Smoker	7	2.6
Pre-existing respiratory disease	No	259	97.0
	Yes (specify)‡	8	3.0
Recovery time	≤1 hour	42	15.7
	>1 hour	225	84.3

‡Pre-existing respiratory diseases: Asthma (n=6), Allergic rhinosinusitis (n=1), COPD (n=1).

5.3. Anesthesia-related characteristics

More than half of the patients (58.8%) were intubated for more than two hours. Most intubations (86.5%) were successful on the first attempt, and the majority of patients (92.5%) had an endotracheal tube size of 7.0 mm internal diameter or smaller. Laryngoscopy was often graded as II (46.1%) or I (37.1%). A nasogastric tube was used in 56 patients (21.0%), and blood was found on airway equipment in 62 patients (23.2%). Dexamethasone was given as premedication in most cases (97.4%). Propofol was the main induction agent (95.2%), and the combination of suxamethonium and vecuronium was the most frequently used muscle relaxant regimen (95.9%). See Table 3 for details.

Table 3 Anesthesia-related characteristics of adult surgical patients at SPHMMC, 2026 (n = 267)

Variables	Category	Frequency (n = 267)	Percentage (%)
Duration of intubation	≤2 hours	110	41.2
	>2 hours	156	58.8
Intubation attempts	1 attempt	231	86.5
	≥2 attempts	36	13.5
ETT size (internal diameter)	≤7.0 mm	247	92.5
	>7.0 mm	20	7.5
Laryngoscopy grade	I	99	37.1

	II	123	46.1
	III/IV	45	16.8
NGT use	No	211	79.0
	Yes	56	21.0
Blood on the airway equipment	No	205	76.8
	Yes	62	23.2
Dexamethasone premedication	No	7	2.6
	Yes	260	97.4
Lidocaine (IV)	No	216	80.9
	Yes	51	19.1
Lidocaine (Spray)	No	264	98.9
	Yes	3	1.1
Induction agent	Propofol	254	95.2
	Other§	13	4.8
Muscle relaxant	Suxamethonium + vecuronium	256	95.9
	Suxamethonium alone	11	4.1

Other§ induction agents: Ketamine alone (n=1), Ketofol (n=2), Propofol+Ketamine (n=10).

5.4. Surgery-related characteristics

The majority of procedures were elective (80.5%), and general surgery was the most common specialty, making up 220 (82.4%) of cases. The supine position was the most common surgical position (89.5%). More than half of the surgeries (56.6%) lasted two hours or less. See table 4 for details.

Table 4 Surgery-related characteristics and POST among adult surgical patients at SPHMMC, 2026 (n = 267)

Variables	Category	Frequency (n = 267)	Percentage (%)
Nature of surgery	Elective	215	80.5
	Emergency	52	19.5
Surgical specialty	General	220	82.4
	Gynecology	24	9.0
	Urology	20	7.5
	Other (specify)¶	3	1.1
Surgical position	Supine	239	89.5
	Lateral	17	6.4
	Other††	11	4.1
Duration of surgery	≤2 hours	151	56.6
	>2 hours	116	43.4
	No	146	54.7

¶Other surgical specialties: Plastic (n=1), Thoracic (n=1), Vascular (n=1).

††Other surgical positions left lateral (n=2), Lithotomy (n= 3), Prone (n= 5), Supine with neck extension (n=1)

Postoperative sore throat (POST)

The overall rate of postoperative sore throat in this study was 45.3%, with 121 out of 267 patients reporting the symptom within 24 hours after surgery. See figure 2 for details.

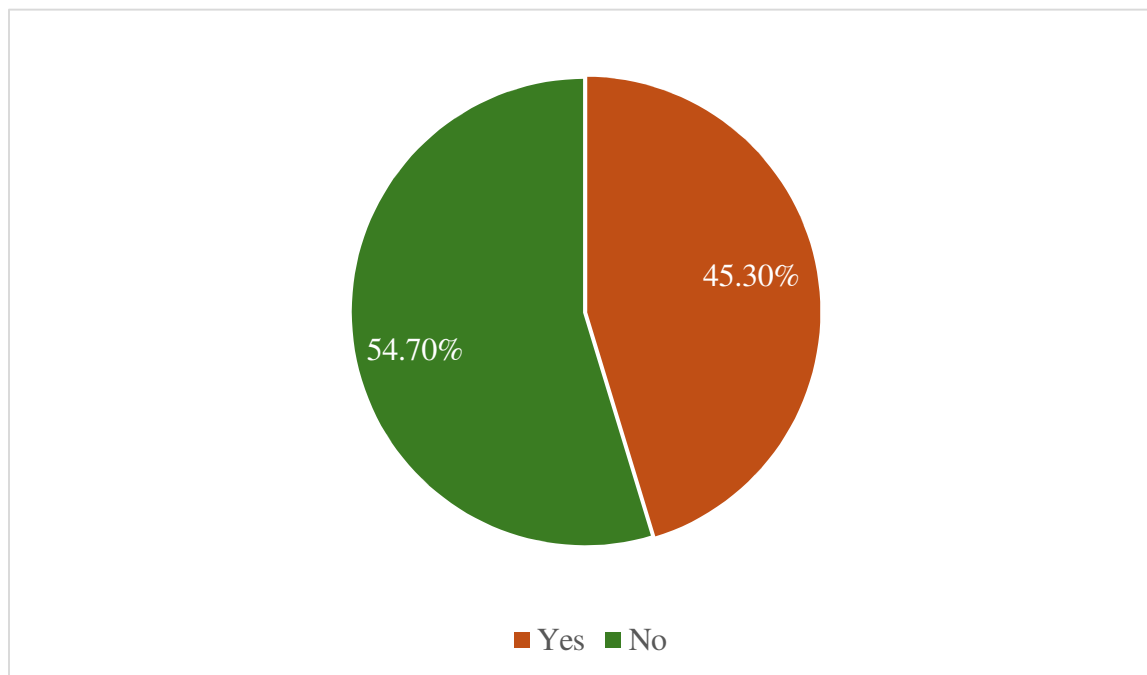


Figure 2 Magnitude of POST among adult surgical patients at SPHMMC, 2026 (n = 267)

5.5. Factors Associated with postoperative sore throat among participants

Bivariate and multivariable logistic regression analyses were used to identify factors independently linked to postoperative sore throat. Variables with a p-value < 0.25 in the bivariate analysis were entered into a multivariable logistic regression model. These variables included **sex, duration of intubation, intubation attempts, ETT size, laryngoscopy grade, NGT use, presence of blood on airway equipment, nature of surgery, and duration of surgery.**

In the multivariable logistic regression analysis, **duration of intubation, number of intubation attempts, ETT size, and presence of blood on airway equipment** were significantly associated with postoperative sore throat.

Surgical patients who were intubated for more than two hours were 3.47 times more likely to develop POST compared to those intubated for two hours or less (AOR = 3.47; 95%CI: 1.54–7.80). Similarly, patients who required two or more intubation attempts had 3.43 times higher odds of having POST compared to those intubated on the first attempt (AOR = 3.43; 95%CI: 1.34–8.80).

Use of a larger ETT size (>7.0 mm) was also significantly associated with POST; patients managed with larger tubes had 3.31 times higher odds of developing POST compared to those with smaller tube sizes (AOR = 3.31; 95%CI: 1.09 – 10.07). Furthermore, the presence of visible blood on airway equipment increased the likelihood of POST by 2.36 times compared to patients without visible blood (AOR = 2.36; 95% CI: 1.21–4.61).

Table 5 Bivariate and multivariable logistic regression analysis of factors associated with postoperative sore throat among adult surgical patients at SPHMMC, 2026 (n = 267)

Variable	Category	Total n(%)	POST n (%)	COR (95% CI)	AOR (95% CI)
Sex	Male	113(42.3)	45(39.8)	1.00 (Ref)	1.00 (Ref)
	Female	154 (57.7)	76 (49.4)	1.47 (0.90 – 2.41)	1.62 (0.9 – 2.86)
Duration of intubation	≤2 hours	110 (41.2)	36 (32.7)	1.00 (Ref)	1.00 (Ref)
	>2 hours	157 (58.8)	85 (54.1)	2.43 (1.461– 4.03)	3.47 (1.54 – 7.80)
Intubation attempts	1 attempt	229(86.5)	94 (41.0)	1.00 (Ref)	1.00 (Ref)
	≥2 attempts	38(13.5)	27 (71.1)	3.53 (1.67– 7.45)	3.43 (1.34– 8.80)
ETT size	≤7.0 mm	247 (92.5)	106 (42.9)	1.00 (Ref)	1.00 (Ref)
	>7.0 mm	20 (7.5)	15 (75.0)	3.99 (1.41–11.32)	3.31 (1.09 –10.07)
Laryngoscopy grade	I	99 (37.1)	40 (40.4)	1.00 (Ref)	
	II	123 (46.1)	56 (45.5)	1.23 (0.72– 2.11)	1.72 (0.66– 4.48)
	III/IV	45 (16.8)	25 (55.5)	1.84 (0.90– 3.76)	1.60 (0.65– 3.96)
NGT use	No	211 (79.0)	90 (42.7)	1.00 (Ref)	1.00 (Ref)
	Yes	56 (21.0)	31 (55.4)	1.67 (0.92 –3.02)	1.50 (0.77–8 2.89)
Blood on the airway equipment	No	205 (76.8)	80 (39.0)	1.00 (Ref)	1.00 (Ref)
	Yes	62 (23.2)	41 (66.1)	3.05 (1.68 –5.54)	2.36 (1.21– 4.61)
Nature of surgery	Elective	215 (80.5)	102 (47.4)	1.00 (Ref)	1.00 (Ref)
	Emergency	52 (19.5)	19(36.5)	1.57 (0.84 –2.93)	1.18 (0.57 –2.40)
Duration of surgery	≤2 hours	151 (56.6)	62 (41.1)	1.00 (Ref)	1.00 (Ref)
	>2 hours	116 (43.4)	59(50.9)	1.49 (0.91– 2.42)	1.70 (0.77– 3.73)

AOR: Adjusted odds ratio; COR: Crude odds ratio; **CI:** Confidence interval; **ETT: Endotracheal diameter; NGT:** Nasogastric tube; **Ref:** Reference category. Bold indicates p < 0.05

6. Discussion

The main goal of this study was to determine the magnitude and associated factors of POST among adult patients undergoing general anesthesia with endotracheal intubation at St. Paul's Hospital Millennium Medical College. According to this study, the magnitude of POST was 45.3%. Duration of intubation, number of intubation attempts, ETT size, and presence of blood on airway equipment were statistically significant associated factors of POST.

The findings of this study revealed that the magnitude of POST was 45.3%. Globally, POST is one of the most common minor but troubling complications after endotracheal intubation. A recent global systematic review and meta-analysis found a pooled prevalence of about 40.5%, which is like current study's finding of 45.3% (7). At the regional level, studies conducted in Nepal report rates of 43% (37) and 50.8% (38). Nationally, the Ethiopian national pooled prevalence of 47.3% (36). The consistency of these estimates indicates that our result reflects common POST occurrence rates across various clinical settings worldwide.

In contrast, evidence from international studies shows much higher incidence rates. Reports document figures of rates up to 62% (40) and 70% (41). Similarly, studies conducted in Ethiopia have reported higher rates, including 59.6% at Gondar University Hospital (19) and 61.8% in another Ethiopian study (39). This discrepancy may be attributed to differences in patient demographics, anesthetic techniques, cuff pressure management practices, and institutional perioperative protocols.

On the other hand, our findings were higher than the prevalence reported in other studies. A systematic review and meta-analysis reported a pooled global POST prevalence of 32.4% at 1 hour and 16.4% at 24 hours postoperatively (40). In addition, a study conducted in Pakistan reported a lower POST of 38.9% (42). This difference may be explained by several factors. The practice settings differ substantially; resource-limited environments may have inconsistent access to essential preventative measures, such as routine cuff pressure monitoring, a wider selection of endotracheal tube sizes to minimize trauma, and pharmacological prophylaxis. These contextual factors likely contribute to the higher burden of POST observed in our study compared to settings with more extensive resources.

Patients who were intubated for more than two hours were 3.47 times more likely to develop POST compared to those intubated for shorter durations. This association is also consistently shown in broader literature, including a systematic review (40), which suggested duration of anesthesia as a major factor for POST. This result is in line with the Ethiopian national meta-analysis and a single study conducted at Ambo University Referral Hospital and Ambo General Hospital, both of which identified prolonged intubation for more than 2 hours as a significant factor affecting POST (36,39). The justification for this might be due to the mechanism that a prolonged contact between the endotracheal tube and the tracheal mucosa leads to cumulative mechanical trauma, resulting in tissue ischemia, inflammation, and subsequent edema formation. The identification of a two-hour threshold as a consistent finding across multiple studies underscores its significance as a critical time point after which the risk of POST substantially escalates, making it a practical and valuable target for clinical awareness and preventive intervention.

Patients who required two or more intubation attempts had 3.43 times higher odds of having POST compared to those intubated on the first attempt. This finding aligns with a study conducted in Japan (45), Eritrean (44), and Ethiopia (10,19,43). The justification for this may be that multiple intubation attempts increase the risk of a sore throat after surgery. This happens because of the repeated injury to the sensitive tissues in the oropharynx and larynx during laryngoscopy and endotracheal tube insertion. Each attempt leads to mucosal erosion, swelling, and inflammation.

Patients who managed with larger tubes (>7.0 mm) had 3.31 times higher odds of developing POST compared to those with smaller tube sizes. This finding is consistent with studies conducted in Pakistan (27), a meta-analysis study (46), and Ethiopia (10,19). This association can be explained by the mechanical interaction between the endotracheal tube and the airway mucosa. A larger diameter causes a tighter fit against delicate laryngeal and tracheal structures. This leads to mucosal erosion from friction, tissue dehydration, and inflammatory responses that appear as a postoperative sore throat.

The presence of visible blood on airway equipment increased the likelihood of POST by 2.36 times compared to patients without visible blood. This finding is in line with studies conducted in Switzerland (1), the UK (40), and Japan (41), which similarly identified visible blood on the intubation tube as a significant factor of postoperative sore throat. The presence of blood is clear evidence of direct mechanical injury to the pharyngeal, laryngeal, or tracheal mucosa during

intubation. This injury breaks the epithelial barrier, triggering an acute inflammatory response. This response includes swelling, increased blood flow, and the release of pro-inflammatory substances. As a result, nociceptive C-fibers become sensitive, leading to postoperative throat pain. These findings highlight the need for gentle intubation techniques to maintain mucosal integrity and lessen postoperative airway issues.

7. Conclusion and Recommendations

7.1. Conclusion

Postoperative sore throat is a common complication among adult patients undergoing general anesthesia with endotracheal intubation at St. Paul's Hospital Millennium Medical College, with a prevalence of 45.3%. Factors such as prolonged intubation duration (> 2 hours), multiple intubation attempts (2 or more), use of larger endotracheal tubes (>7.0 mm), and visible blood on airway equipment were found to be significantly associated factors of POST. These associated factors can often be modified by improving perioperative airway management practices. Therefore, implementing targeted quality improvement strategies that focus on gentle intubation techniques, proper selection of tube sizes, reducing repeated attempts, and cutting down on prolonged intubation is crucial to improving patient comfort and satisfaction after surgery.

7.2. Recommendations

For a clinical practitioner

To reduce airway trauma, the following strategies are suggested:

- Use appropriately sized endotracheal tubes, especially those 7.0 mm or smaller, when it is clinically suitable.
- Focus on achieving first-pass intubation success through adequate preparation, supervision, and airway assessment.
- Limit the duration of intubation, when possible, especially in lengthy surgical procedures.
- Use gentle techniques for laryngoscopy and intubation to minimize mucosal damage and visible airway trauma.

For health institutions

- It is recommended that institutions should ensure the availability and routine use of endotracheal cuff pressure monitoring devices
- It is recommended that institutions create airway management protocols and conduct regular training workshops for anesthesia providers to promote adherence to best practices.
- Carrying out periodic audits and providing feedback on postoperative airway complications could also support quality improvement efforts

For researchers

- Future research should include multicenter studies to make the findings more generalizable across various Ethiopian hospitals.
- Prospective cohort studies or randomized controlled trials that evaluate preventive measures (like cuff pressure monitoring, drug prophylaxis, or tube size protocols) are recommended.

8. Strengths and Limitations

8.1. Strengths

This study was conducted at St. Paul's Hospital Millennium Medical College, a major tertiary teaching hospital known for high surgical activity and a diverse case mix, which adds to the clinical relevance of the findings within the Ethiopian context. The study achieved a high response rate, which minimizes the chance of non-response bias and strengthens internal validity. Using standardized data collection tools, pre-testing the questionnaire, and training data collectors resulted in better data quality and reliability.

8.2. Limitations

The institution-based cross-sectional design limits the ability to establish temporal or causal relationships between associated factors and POST. Conducting the study in a single center may limit generalizability to other hospitals with different patient groups, anesthesia methods, or perioperative protocols. Additionally, the study looked only at whether POST was present or absent, without measuring its severity using a validated pain scale. This limits the ability to fully characterize the outcomes. Manometer Tracheal cuff pressures measurement was not done in this study due to lack of manometer. high cuff pressures were considered to be a contributing factor to

the occurrence of post operative sore throat by causing tracheal mucosa ischemia.

9. Reference

1. Biro P, Seifert B, Pasch T. Complaints of sore throat after tracheal intubation. *Eur J Anaesthesiol*. 2005 Apr;22(4):307–11. doi:10.1017/S0265021505000529
2. Piriyaatsom A, Dej-Arkom S, Chinachoti T, Rakkarnngan J, Srishewachart P. Postoperative sore throat: incidence, risk factors, and outcome. *J Med Assoc Thai*. 2013 Aug;96(8):936–42. PubMed PMID: 23991600.
3. Scuderi PE. Postoperative Sore Throat. *Anesth Analg*. 2010 Oct;111(4):831–2. doi:10.1213/ANE.0b013e3181ee85c7
4. El-Boghdadly K, Bailey CR, Wiles MD. Postoperative sore throat: a systematic review. *Anaesthesia*. 2016 Jun;71(6):706–17. doi:10.1111/anae.13438
5. Brimacombe J, Keller C, Pühringer F. Pharyngeal Mucosal Pressure and Perfusion . *Anesthesiology*. 1999 Dec 1;91(6):1661–1661. doi:10.1097/00000542-199912000-00018
6. Najafi A, Imani F, Makarem J, Khajavi MR, Etezadi F, Habibi S, et al. Postoperative sore throat after laryngoscopy with macintosh or glide scope video laryngoscope blade in normal airway patients. *Anesth Pain Med*. 2014 Feb;4(1):e15136. doi:10.5812/aapm.15136 PubMed PMID: 24660157.
7. Obsa MS, Adem AO, Banacha B, Gelgelu TB, Gemechu AD, Tilla M, et al. Global incidence and risk factors of post-operative sore throat among patients who underwent surgery: A systematic review and meta-analysis. *International Journal of Surgery Open*. 2022 Oct;47:100536. doi:10.1016/j.ijso.2022.100536
8. Lee JY, Sim WS, Kim ES, Lee SM, Kim DK, Na YR, et al. Incidence and risk factors of postoperative sore throat after endotracheal intubation in Korean patients. *Journal of International Medical Research*. 2017 Apr 7;45(2):744–52. doi:10.1177/0300060516687227
9. Kolawole IK, Ishaq MS. Post-anaesthetic respiratory complaints following endotracheal anaesthesia in lower abdominal obstetric and gynaecology surgery. *Niger J Clin Pract*. 2008 Sep;11(3):225–30. PubMed PMID: 19140359.
10. Fenta E, Teshome D, Melaku D, Tesfaw A. Incidence and factors associated with postoperative sore throat for patients undergoing surgery under general anesthesia with endotracheal intubation at Debre Tabor General Hospital, North central Ethiopia: A cross-sectional study. *International Journal of Surgery Open*. 2020;25:1–5. doi:10.1016/j.ijso.2020.06.003
11. Miskovic A, Johnson M, Frost L, Fernandez E, Pistorio A, Disma N. A prospective observational cohort study on the incidence of postoperative sore throat in the pediatric population. *Pediatric Anesthesia*. 2019 Dec 2;29(12):1179–85. doi:10.1111/pan.13757
12. Hunduma JC, Merga HT. Predictors of postoperative sore throat among surgical patients at Ethiopian teaching hospitals. *Journal of Clinical Medicine and Research*. 2016 Nov 30;8(1):1–11. doi:10.5897/JCMR2016.0280

13. Chen CY, Kuo CJ, Lee YW, Lam F, Tam KW. Benzylamine hydrochloride on postoperative sore throat: a meta-analysis of randomized controlled trials. *Canadian Journal of Anesthesia/Journal canadien d'anesthésie*. 2014 Mar 22;61(3):220–8. doi:10.1007/s12630-013-0080-y
14. Mostafa RH, Saleh AN, Hussein MM. A Comparative Study of Three Nebulized Medications for the Prevention of Postoperative Sore Throat in the Pediatric Population. *The Open Anesthesia Journal*. 2018 Dec 24;12(1):85–93. doi:10.2174/2589645801812010085
15. Hisham AN, Roshilla H, Amri N, Aina EN. Post-thyroidectomy sore throat following endotracheal intubation. *ANZ J Surg*. 2001 Nov 20;71(11):669–71. doi:10.1046/j.1445-1433.2001.02230.x
16. Phillip D, LEVIN L, Chrysostomos C, Ibarra CA, Ledot S, Naito D, et al. Causes of sore throat after intubation: a prospective observational study of multiple anesthesia variables. *Minerva Anesthesiol*. 2017 Jun;83(6). doi:10.23736/S0375-9393.17.11419-7
17. Higgins PP, Chung F, Mezei G. Postoperative sore throat after ambulatory surgery. *Br J Anaesth*. 2002 Apr;88(4):582–4. doi:10.1093/bja/88.4.582
18. Jaensson M, Gupta A, Nilsson U. Gender differences in sore throat and hoarseness following endotracheal tube or laryngeal mask airway: a prospective study. *BMC Anesthesiol*. 2014 Dec 19;14(1):56. doi:10.1186/1471-2253-14-56
19. Gemechu BM, Gebremedhn EG, Melkie TB. Risk factors for postoperative throat pain after general anaesthesia with endotracheal intubation at the University of Gondar Teaching Hospital, Northwest Ethiopia, 2014. *Pan African Medical Journal*. 2017;27. doi:10.11604/pamj.2017.27.127.10566
20. Mengistu B, L A. Magnitude and Associated Risk Factors of Post-Operative Sore Throat Following Surgery by General Anesthesia with Endotracheal Intubation in Black Lion Hospital, Addis Ababa, Ethiopia. *Int J Anesthesiol Res*. 2017 Feb 24;409–13. doi:10.19070/2332-2780-1700084
21. Solatpour F, Teymourian H, Mohajerani SA, Hoseinzadegan Shirazi F, Lotfollah zadeh S, Baikpour M, et al. Comparison of the Incidence of Sore Throat After Rapid Sequence Intubation With Succinylcholine and Cisatracurium. *Anesth Pain Med*. 2014 Aug 13;4(3). doi:10.5812/aapm.20030
22. Rahimi M, Makarem J. Effects of Diclofenac Epolamine Patch on Postoperative Sore Throat in Parturients After Cesarean Delivery Under Endotracheal General Anesthesia. *Acta Anaesthesiologica Taiwanica*. 2009 Mar;47(1):17–21. doi:10.1016/S1875-4597(09)60015-1
23. Clayton-Smith A, Bennett K, Alston RP, Adams G, Brown G, Hawthorne T, et al. A Comparison of the Efficacy and Adverse Effects of Double-Lumen Endobronchial Tubes and Bronchial Blockers in Thoracic Surgery: A Systematic Review and Meta-analysis of Randomized Controlled Trials. *J Cardiothorac Vasc Anesth*. 2015 Aug;29(4):955–66. doi:10.1053/j.jvca.2014.11.017

24. Jeon J, Lee K, Ahn G, Lee J, Hwang W. Comparison of Postoperative Sore Throat and Hoarseness Between Two Types of Double-Lumen Endobronchial Tubes: A Randomized Controlled Trial. *J Cardiothorac Vasc Anesth*. 2015 Feb;29(1):121–5. doi:10.1053/j.jvca.2014.05.028
25. Turkstra TP, Smitheram AK, Alabdulhadi O, Youssef H, Jones PM. The Flex-Tip™ tracheal tube does not reduce the incidence of postoperative sore throat: a randomized controlled trial. *Canadian Journal of Anesthesia/Journal canadien d'anesthésie*. 2011 Dec 5;58(12):1090–6. doi:10.1007/s12630-011-9592-5
26. Liu J, Zhang X, Gong W, Li S, Wang F, Fu S, et al. Correlations Between Controlled Endotracheal Tube Cuff Pressure and Postprocedural Complications. *Anesth Analg*. 2010 Nov;111(5):1133–7. doi:10.1213/ANE.0b013e3181f2ecc7
27. Ali S, Khan A, Ashfaq AD. Comparison of Two Different Sizes of Endotracheal Tracheal Tube for Postoperative Sore Throat in Breast Cancer Patients Undergoing Surgeries. *Cureus*. 2021 Jan 25. doi:10.7759/cureus.12896
28. Tanaka Y, Nakayama T, Nishimori M, Tsujimura Y, Kawaguchi M, Sato Y. Lidocaine for preventing postoperative sore throat. *Cochrane Database of Systematic Reviews*. 2015 Jul 14;2015(7). doi:10.1002/14651858.CD004081.pub3
29. Thomas S, Beevi S. Dexamethasone reduces the severity of postoperative sore throat. *Canadian Journal of Anesthesia/Journal canadien d'anesthésie*. 2007 Nov;54(11):897–901. doi:10.1007/BF03026793
30. Park SH, Han SH, Do SH, Kim JW, Rhee K young, Kim JH. Prophylactic Dexamethasone Decreases the Incidence of Sore Throat and Hoarseness After Tracheal Extubation with a Double-Lumen Endobronchial Tube. *Anesth Analg*. 2008 Dec;107(6):1814–8. doi:10.1213/ane.0b013e318185d093
31. Mayhood J, Cress K. Effectiveness of ketamine gargle in reducing postoperative sore throat in patients undergoing airway instrumentation: a systematic review. *JBIC Database System Rev Implement Rep*. 2015 Sep;13(9):244–78. doi:10.11124/jbisrir-2015-2045
32. JAENSSON M, OLOWSSON LL, NILSSON U. Endotracheal tube size and sore throat following surgery: a randomized-controlled study. *Acta Anaesthesiol Scand*. 2010 Feb 8;54(2):147–53. doi:10.1111/j.1399-6576.2009.02166.x
33. Inoue S, Abe R, Tanaka Y, Kawaguchi M. Tracheal intubation by trainees does not alter the incidence or duration of postoperative sore throat and hoarseness: a teaching hospital-based propensity score analysis. *Br J Anaesth*. 2015 Sep;115(3):463–9. doi:10.1093/bja/aev234
34. Higgins PP, Chung F, Mezei G. Postoperative sore throat after ambulatory surgery. *Br J Anaesth*. 2002 Apr;88(4):582–4. doi:10.1093/bja/88.4.582
35. Kim D, Jeon B, Son JS, Lee JR, Ko S, Lim H. The changes of endotracheal tube cuff pressure by the position changes from supine to prone and the flexion and extension of head. *Korean J Anesthesiol*. 2015;68(1):27. doi:10.4097/kjae.2015.68.1.27

36. Teshome D, Fenta E, Mekete G, Getachew N, Zurbachew N, Geta K, et al. Prevalence and factors associated with postoperative sore throat in Ethiopia: A systemic review and meta-analysis, 2023. *Prev Med Rep.* 2024 Sep;45:102818. doi:10.1016/j.pmedr.2024.102818
37. Gauchan S, Thapa C, Yadav R, Bhandari S. Postoperative Sore Throat among Patients Following General Anesthesia with Endotracheal Intubation in a Tertiary Care Centre. *Journal of Nepal Medical Association.* 2024 Jan 1;62(269):1–4. doi:10.31729/jnma.8399
38. Shrestha S, Maharjan B, Karmacharya RM. Incidence and Associated Risk Factors of Postoperative Sore Throat in Tertiary Care Hospital. *Kathmandu Univ Med J (KUMJ).* 15(57):10–3. PubMed PMID: 29446355.
39. Bekele Z, Melese Z. Incidence and risk factors for postoperative sore throat after general anesthesia with endotracheal intubation: prospective cohort study. *Annals of Medicine & Surgery.* 2023 Jun;85(6):2356–61. doi:10.1097/MS9.0000000000000786
40. Moulder ZJ, Mann J, Bramley P, Heinz J, Wiles MD. Postoperative sore throat: a systematic review*. *Anaesthesia.* 2026 Jan 28;81(1):116–33. doi:10.1111/anae.70048
41. Mitobe Y, Yamaguchi Y, Baba Y, Yoshioka T, Nakagawa K, Itou T, et al. A Literature Review of Factors Related to Postoperative Sore Throat. *J Clin Med Res.* 2022 Feb;14(2):88–94. doi:10.14740/jocmr4665
42. Ali J, Rahman A, Shagufta, Khan K, Nawaz S, Din ZU. Postoperative Sore Throat Following General Surgical Procedures under General Anesthesia with Endotracheal Intubation. *Journal of Health and Rehabilitation Research.* 2024 May 27;4(2):1039–45. doi:10.61919/jhrr.v4i2.941
43. Hailu S, Shiferaw A, Regasa T, Getahun YA, Mossie A, Beshu A. Incidence of Postoperative Sore Throat and Associated Factors Among Pediatric Patients Undergoing Surgery Under General Anesthesia at Hawassa University Comprehensive Specialized Hospital, a Prospective Cohort Study. *Int J Gen Med.* 2023 Feb;Volume 16:589–98. doi:10.2147/IJGM.S397519
44. Yafiet M G. Multiple Intubation Trials and Body Weight Increase the Risk of Post-Operative Sore Throat after Tracheal Intubation in National Referral Hospitals in Asmara: A Prospective Observational Study. *Int J Anesth Anesth.* 2022 Dec 31;9(2). doi:10.23937/2377-4630/1410145
45. Tsukamoto M, Taura S, Kadowaki S, Hitosugi T, Miki Y, Yokoyama T. Risk Factors for Postoperative Sore Throat After Nasotracheal Intubation. *Anesth Prog.* 2022 Sep 1;69(3):3–8. doi:10.2344/anpr-69-01-05
46. Hu B, Bao R, Wang X, Liu S, Tao T, Xie Q, et al. The Size of Endotracheal Tube and Sore Throat after Surgery: A Systematic Review and Meta-Analysis. *PLoS One.* 2013 Oct 4;8(10):e74467. doi:10.1371/journal.pone.0074467

Annex

Participant information and voluntary consent form

My name is----- . I am working as a data collector for the study being conducted in a public teaching hospital by a St. Paul Hospital Millennium Medical College student who is studying for a specialty degree in Anesthesiology, Critical Care, and Pain Medicine. I kindly request you to lend me your attention to explain to you about the study and being selected as a study participant.

The study title:

Magnitude and factors associated with postoperative sore throat for adult patients undergoing surgery under general anesthesia with endotracheal intubation at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia.

Procedure and duration:

I will be interviewing you using a questionnaire to gather pertinent data that will be helpful for the study. There are 32 questions to answer, and I will fill out the questionnaire by interviewing you. The interview will take a maximum of 30 minutes, so I kindly request that you spare me this time for the interview.

Risks and benefits:

Participating in this study only takes a few minutes of your time. There would not be any direct payment for participating in this study. However, the findings from this research may reveal important information for the health sector and other stakeholders.

Confidentiality: -

The information you will provide us will be confidential. There will be no information that will identify you. The findings of the study will be general for the study community and will not reflect anything particular about individual people or housing. The questionnaire will be coded to exclude showing names. No reference will be made to oral or written reports that could link participants to the research.

Rights: -

Participation in this study is voluntary. You have the right to declare whether to participate or not in this study. If you decide to participate, you have the right to withdraw from the study at any time and this will not label you for any loss of benefits, to which you are otherwise entitled. You do not have to answer any question that you do not want to answer.

Contact address: -

If there are any questions or inquiries at any time about the study or the procedures, please contact this address

Principal investigator (PI): Dr. Natnael Eyassu

Mobile phone, +251-935-56-91-31 or Email, drnatnaeleyassu@gmail.com

Declaration of informed voluntary consent: -

I have read to me the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks, and benefits, issues of confidentiality, the rights of participating, and the contact address for any queries. I have been allowed to ask questions about things that may have been unclear. I was informed that I have the right to withdraw from study at any time or not to answer any question that I do not want. Therefore, I declare my voluntary consent to participate in this study.

Questionnaire

Questionnaire identification number _____

Data collector's name _____ Date _____

Supervisor name _____ Date _____

Time started _____ Time completed _____

Part I: Socio-demographic characteristics of respondents

Code	Question	Answer category	Skip
101	Sex of the respondent	1. Male 2. Female	
102	What is your age in complete years?	_____	
103	What is your current marital status?	1. Single 2. Married 3. Divorced 4. Separated 5. Widowed	
104	What is your occupation?	1. Governmental employee 2. Merchant 3. NGO employee 4. Housewife 5. Daily laborer 6. Student 7. No job 8. Other (specify) _____	

PART II: Anesthesia characteristics of study participants

S. N	Questions	Answer category	Skip
201	Did the patient use NGT?	1. Yes 2. No	
202	Did the patient use an Oropharyngeal airway?	1. Yes 2. No	

203	Duration of intubation (Hours)	_____	
204	Number of intubation attempts	_____	
205	Is a Topical NSAID used?	1. Yes 2. No	
206	Is IV lidocaine given as premedication?	1. Yes 2. No	
207	Is Lidocaine spray used?	1. Yes 2. No	
208	Is Dexamethasone given as premedication?	1. Yes 2. No	
209	Anesthetist/Anesthesiology resident/ Anesthesiologist experience (in years)	_____	
210	Size of the ETT used (ID in mm)	_____	
211	Grade of Laryngoscopy	_____	
212	Induction agent	1. Propofol 2. Thiopentone 3. Ketamine 4. Ketofol 5. IAA	
213	A muscle relaxant used for intubation	1. Suxamethonium 2. Vecuronium 3. Sux + vecuronium 4. Other (specify)_____	
214	Blood on airway equipment	1. Yes 2. No	
215	ETT cuff pressure after intubation	_____ cm H ₂ O	
216	Type of ETT use	1.SLT 2.DLT	
217	Throat pain worsens with swallowing in the last 24 hours?	1. Yes 2. No	

Part III: Surgical-related factors of the study participants

S. N	Questions	Answer category	Skip
301	Nature of the surgery	1. Emergency 2. Elective	
302	Types of surgical procedures used	1. General 2. Gynecology 3. Orthopedic 4. Plastic 5. Others, specify_____	
303	Surgical position	1. Supine 2. Prone 3. Lithotomy 4. Lateral 5. Others, specify.....	
304	Duration of surgery (Hours)		

Part IV: Patient-related factors of the study participants

S. N	Questions	Answer category	Skip
401	Weight of the patient in Kg	_____	
402	Height of the patient in cm	_____	
403	Pre-existing chronic respiratory problem	1. Asma 2. COPD 3. Chronic viral Infection 4. Other Specify	
404	The smoking status of the patient	1. Yes 2. No	
405	ASA status of the patient	1. ASA I 2. ASA II 3. ASA III 4. ASA IV and above	
406	Recovery time of the patient in hours	_____	
407	Patient satisfaction with the procedure	1. Very satisfied 2. Satisfied 3. Neutral 4. Dissatisfied 5. Very dissatisfied	

Thank you, the end.

Amharic version questioner

የመጠይቅ መለያ ቁጥር	_____
የመረጃ ሰብሳቢ ስም	_____
ቀን	_____
የእንቅስቃሴ ተቆጣጣሪ ስም	_____
ቀን	_____
የጀመረበት ሰዓት / የተጠናቀቀበት ሰዓት	_____

ክፍል I: የተሳታፊዎች ማህበራዊ-ዲሞክራሲ ባህሪያት

ኮድ	ጥያቄ	የመልስ አማራጮች
101	የተሳታፊው ፆታ	1. ወንድ 2. ሴት
102	እድሜ (በሙሉ ዓመት)	_____
103	የጋብቻ ሁኔታ	1. ያልተጋባ 2. ተጋብቷል 3. ፍቺ 4. ተለያይቷል 5. ባል-ሚስት ሞቷል
104	ስራ	1. የመንግስት ሰራተኛ 2. ነጋዴ 3. መንግሥታዊ ያልሆነ ድርጅት 4. እመቤት 5. የቀን ሰራተኛ 6. ተማሪ 7. ስራ የለም 8. ሌላ_____

ክፍል II: የአንስቱዢያ ባህሪያት

ኮድ	ጥያቄ	የመልስ አማራጮች
201	በአፍንጫ የሚገባ የምግብ ቱቦ ተጠቅመዋል?	1. አዎ 2. አይ
202	የአፍ-አንጎል የአየር መንገድ መሳሪያ ተጠቅመዋል?	1. አዎ 2. አይ
203	የኢንቱቤሽን ቆይታ (ሰዓት)	_____
204	የኢንቱቤሽን ሙከራ ብዛት	_____
205	የሚቀባ የእብጦት እና የህመም አስታጋሽ መድሃኒት ተጠቅመዋል?	1. አዎ 2. አይ
206	በደም ሥር የሚሰጥ ሊዶኬይን መድሃኒት እንደ ቅድመ-መድሃኒት ተሰጥቷል?	1. አዎ 2. አይ

207	የሊዶኬይን ስፕሬ (የሚረጭ ማደንዘዥ) ተጠቅመዋል?	1. አዎ 2. አይ
208	ዴክሳሜታዝን እንደ እንደ ቅድመ-መድሃኒት ተሰጥቷል?	1. አዎ 2. አይ
209	የአንስቴቲክስት ልምድ (ዓመት)	_____
210	የ ንፋስ ቧንቧ ቱቦ መጠን ()	_____
211	የላሪንጎስኮፒ ደረጃ	_____
212	የማስተዋወቅ መድሃኒት	1. ፕሮፖፎል 2. ቲዮፔንቶን 3. ኬታሚን 4. ኬቶፎል 5. አይኤኤ
213	የቡንቻ ዘና የሚያደርግ መድሃኒት	1. ሱክሳሜቶኒየም 2. ቪኩሮኒየም 3. ሱክስ+ቪኩሮኒየም 4. ሌላ_____
214	በመተንፈሻ አካላትመሳሪያ ላይ ደም ታይቷል?	1. አዎ 2. አይ
216	የ ንፋስ ቧንቧ ቱቦ አይነት	1. አንድ ቀዳዳ ያለው 2. ድርብ ቀዳዳ ያለው
217	ጉሮሮ ህመም በመዋጥ ይጨምራል?	1. አዎ 2. አይ

ክፍል III: ከቀዶ ጥገና ጋር የተያያዙ ሁኔታዎች

ኮድ	ጥያቄ	የመልስ አማራጮች
301	የቀዶ ጥገና አይነት	1. ድንገተኛ 2. መደበኛ
302	የቀዶ ጥገና ክፍል	1. ጠቅላላ 2. የሴቶች ሕክምና 3. ኦርቶፔዲክ 4. ፕላስቲክ 5. ሌላ_____
303	የቀዶ ጥገና አቀማመጥ	1. በጀርባ መተኛት 2. በሰት መተኛት 3. ሌቲቶሚ ቦዛ 4. በጎን መተኛት 5. ሌላ_____
304	የቀዶ ጥገና ቆይታ (ሰዓት)	_____

ክፍል IV: የታካሚ ጋር የተያያዙ ሁኔታዎች

ኮድ	ጥያቄ	የመልስ አማራጮች
401	ክብደት (ኪሎግራም)	_____
402	ቁመት (ሴንቲሜትር)	_____
403	የቀድሞ የሳንባ ችግኝ	1. አስማ

		2. ሲኦፒዲ 3. ቫይራል ኢንፌክሽን 4. ሌላ_____
404	ሲጋራ ይጠጣሉ?	1. አዎ 2. አይ
405	ASA ደረጃ	1. ASA I 2. ASA II 3. ASA III 4. ASA IV 5. ከዚያ በላይ
406	ማገገም ጊዜ (ሰዓት)	_____
407	የታካሚ እርካታ	1. በጣም እርካታ 2. እርካታ 3. መካከለኛ 4. አልተረካም 5. በጣም አልተረካም

እናመሰግናለን። መጨረሻ

Assurance of Principal Investigator

I understand and 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 primary advisors in the course of the research. I will communicate timely to my advisors all stakeholders involved in the study including any source of funding for this research.

Name of the student: _____

Signature: _____

Date: _____

Approval of the Primary Advisor

Name of the primary advisor: _____

Signature: _____

Date: _____

Approval of the Co-Advisor

Name of the primary advisor: _____

Signature: _____

Date: _____