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Review article

Prevalence and factors associated with postoperative sore throat in Ethiopia: A systemic review and meta-analysis, 2023

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ABSTRACT

Background: Postoperative sore throat (POST) remains a stressful impact of postoperative airway management, and it contributes to mortality and morbidity after general anesthesia. Its pooled prevalence and determinants in Ethiopia have not been fully studied. This study intended to assess the pooled prevalence and risk variables for POST in Ethiopia.

Methods: A systematic review and Meta-analysis were performed as per the recommendation of PRISMA. To evaluate the pooled prevalence and factors significantly associated with POST in Ethiopia, electronic databases were searched till November 30/2023 and publications were chosen based on inclusion criteria. To assess the quality of the included studies, the Joanna Briggs Institute criteria was used. STATA^{MP} 17 software was used for all data analysis.

Results: Databases were searched for possible research using Medical Subject headings or entries or key phrases. Only 12 articles were included in the final analysis after screening by titles, abstracts, and full text based on the qualifying criteria. The pooled prevalence of POST in Ethiopia is 47.3 %. The determinants of POST in Ethiopia were female sex, repeated attempts at intubation, blood visible on the tip of an endotracheal tube or laryngoscope, prolonged duration of intubation, and using endotracheal intubation over laryngeal mask airway.

Conclusion: In Ethiopia, the overall prevalence of postoperative sore throat is substantial. Prolonged intubation for more than 2 h, using ETT over LMA, Sex being female multiple attempts at intubation, and blood seen on the tip of ETT or Laryngoscope were the determinant factors of POST in Ethiopia.

1. Introduction

Postoperative sore throat (POST) is defined as an experience of pain or discomfort in the larynx or pharynx during the postoperative period, whereas a sore throat is simply defined as a nonprofessional explanation of pharyngitis that may include a variety of symptoms such as laryngitis, tracheitis, cough, hoarseness, or dysphagia (Scuderi, 2010; Calder et al., 2012). In terms of coverage and quality, advancement in surgical and anesthetic service care is increasing. Despite these advancements, the postoperative phase is still plagued by unfavorable postoperative sequelae like sore throat (Mitobe et al., 2022; El-Boghdadly et al., 2016; Flexman and Duggan, 2019).

POST is one of the most common complications after general anesthesia only second-ranked among other complications (Piriyapatsom et al., 2013). It is caused by epithelial and mucosal cell damage induced by airway securement, vocal cord damage, congestion, blood clots, and factors such as an inadequately sized tube, cuff shape, cuff pressure, and airway securement (Najafi et al., 2014; Ahmed et al., 2007). POST is the stressful and painful result of tracheal intubation that adds to mortality and morbidity and affects patient satisfaction following general anesthesia and surgery (Obsa et al., 2022; Jaensson et al., 2010).

Evidence from literature (El-Boghdadly et al., 2016; Tanaka et al., 2015; Higgins et al., 2002), suggested the incidence of POST reaches up to 70 % and fluctuates depending on several contributing circumstances. Various factors, including patient demographics and clinical considerations, are thought to play a role in the development of postoperative sore throat. Type of surgery, cigarette smoking, airway suctioning, dehydration, duration of intubation or anesthesia, presence of blood on tip of ETT or laryngoscope or LMA during extubation, use of Nasogastric tube (NGT), and use of larger size endotracheal tube are among identified factors associated with POST (Piriyapatsom et al., 2013; Miskovic et al., 2019; Chawaka and Temesgen, 2016; Lee et al., 2017).

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The pooled prevalence of POST in Ethiopia is not documented. The current systematic review and meta-analysis (SR & MA) seeks to identify the pooled prevalence of POST and its associated variables in Ethiopia. Again, the pooled prevalence of POST in pediatrics, adults, and the region state of Ethiopia is attempted to assist policymakers at the regional and national levels in tackling the problem. As a result, knowing the pooled prevalence of POST and identifying risk factors for POST is critical for improving patient outcomes following surgery.

2. Methods

2.1. Study design, setting, data source, and search strategies

This is a systematic review and meta-analysis study. It is carried out to determine the pooled prevalence of POST utilizing papers published particularly for the Ethiopian study population. Potential studies were identified using Medical Subject heading (MeSH) or entry or key terms from databases such as PubMed/MEDLINE, Cochrane Library, Google Scholar, Scopus, AJOL, and Google for an institutional repository. Additionally, studies were found using key phrases and cross-references to avoid missing potential studies.

2.2. Research questions

The research questions are:
"What is the pooled prevalence of POST in Ethiopia?"
"What are the associating factors to pooled POST in Ethiopia?"

2.3. Protocol and registration

A literature search was conducted to avoid duplication of effort if the research questions were addressed or were scheduled to be answered by other authors before the current study. This study followed the Preferred Reporting Items for Systematic and Meta-analysis version 2020 (Page et al., 2021), and its protocol has been registered in the research registry with registry identification number: reviewregistry1769.

2.4. Eligibility criteria

Based on the CoCoPop (Condition, Context, and Population) approach for inclusion criteria, all research conducted in Ethiopia that documented POST and/or risk factors for it were included. It is a methodological recommendation for observational studies that offer prevalence and cumulative incidence data (Munn et al., 2015) (Table 1).

2.5. Information sources and search strategy

A comprehensive article search was conducted in databases (MEDLINE/PubMed, Cochrane Library, Scopus, African journals online, and Google Scholar). In addition, reference lists from recognized studies and the institutional repository were reviewed for inclusion. To conduct comprehensive literature searches, key phrases, entry terms, and MeSH terms were combined with Boolean operators (online Supplementary file Table 4).

This systematic review and meta-analysis includes articles published in all databases up to November 30, 2023, that met inclusion criteria (Table 1). Preferred Reporting of Systematic Reviews and Meta-Analysis (PRISMA) guidelines were used for systematic data synthesis and report generation to maintain the scientific rigor of the current study (Page et al., 2021).

Table 1
Shows the eligibility criteria for screening studies using CoCoPop to determine the pooled prevalence of POST and its associated factors in Ethiopia, 2023.

Category	Inclusion	Exclusion
Condition	magnitude/prevalence/ incidence of POST/factors associated to POST	No magnitude/prevalence/ incidence of POSTNo factors associated to POST
Context	Ethiopia	Out of Ethiopia
Population	all surgical patients evaluated for POST/it's associated factors	non-surgical related sore throat
Design	Quantitative studies English language Free full text studies	Qualitative studiesNon-English language

2.6. Study selection and data collection

Endnote (version 8) was used to import database search results and remove duplicate articles manually. To assess eligibility, seven reviewers (DT, GM, NG, NZ, KG, AT, BC) worked independently. Disagreements among the seven reviewers were discussed with another member of the review team (EF) until a consensus was reached. The identified articles were thoroughly evaluated in compliance with the eligibility criteria. Using Microsoft Excel 2013, the authors' names, year of publication, study design, sample size, study region or area, magnitude or prevalence of POST, risk variables for POST in Ethiopia, and study population were extracted and collected (Table 2).

2.7. Quality assessment (risk of bias) in individual studies

The data was retrieved independently from eligible papers by the seven authors (DT, GM, NG, NZ, KG, AT, BC). To assess the methodological quality of each study, the Joanna Briggs Institute (JBI) (Peters et al., 2015) quality rating checklist was employed. JBI uses various evaluating points to determine the quality of a specific study. The checking points are eligibility criteria, study subject and setting, sampling technique, representativeness, data quality control, proper analysis, and report. Finally, high-quality research was defined as meeting 60 % or more of the quality assessment checklist criteria. As a result, six studies were of medium quality, whereas six were of high quality (online Supplementary file Table 5).

Table 2
Study characteristics considered in the systematic review and meta-analysis of POST prevalence in Ethiopia, 2023.

First author, Publication year	Study region	Study design	Study Population	Sample size	POST (%)
Assefa et al., 2022	Addis Ababa	Prospective cohort	Pediatrics	28	76.9
Birhanu et al., 2017	Addis Ababa	Cross-sectional	Adults	114	45.6
Chawaka and Temesgen, 2016	Oromia	Cross-sectional	Adults	228	56.6
Fenta et al., 2020	Amhara	Cross-sectional	Adults	123	48.8
Gemechu et al., 2017	Amhara	cross-sectional	Adults	229	59.6
Getachew et al., 2022	Oromia	cross-sectional	Adults	416	54.1
Hailu et al., 2023	Sidama	prospective cohort	Pediatrics	102	26.5
Hassen et al., 2022	Addis Ababa	Cross-sectional	Adults	301	48.5
Jisha et al., 2023	Oromia	Cross-sectional	Adults	370	36.5
Molla et al., 2023	Amhara	prospective cohort	Pediatrics	411	45
Angassa et al., 2023	Sidama	Cross-sectional	Adults	95	30.5
Getaneh et al., 2022	Addis Ababa	Cross-sectional	Adults	100	39

2.8. Data extraction and management

Seven authors (DT, GM, NG, NZ, KG, AT, BC) extracted author name, year of publication, study design, sample size, study population, prevalence of POST with 95 % CI, and factors significantly associated with POST such as prolonged intubation, using ETT over LMA, female sex, multiple attempts at intubation, blood seen at the tip of ETT or laryngoscope, using large size ETT, using NG, and being intubated by a less experienced anesthetist. Any persistent issues were resolved through discussion and consultation with another author (EF). The completed data was entered into a Microsoft Excel spreadsheet. Finally, Stata^{MP} version 17 software was used to do the meta-analysis.

2.9. Assessment of heterogeneity

Statistical heterogeneity was measured with I^2 of 50 % or greater. The presence of substantial heterogeneity indicates the need to perform meta-regression (Higgins et al., 2003) and then subgroup analysis to determine the source of heterogeneity. Finally using a random-effects model may treat the heterogeneity between studies. A sensitivity analysis could also be used to show the potential impact of each study on the overall estimate.

2.10. Assessment of publication bias

The funnel plot's symmetry and an Egger test could indicate the presence of publication bias. If an asymmetric funnel plot is detected, the Eager test should be employed to ensure that the publication bias is statistically significant (a p-value of 0.05) (Egger et al., 1997).

2.11. Measures of outcome and reporting

The two main research issues addressed by this systematic review and meta-analysis are the pooled prevalence of POST in Ethiopia and its associated factors. The findings were presented per the PRISMA guideline version 2020. The pooled prevalence of POST in Ethiopia and its associated characteristics were reported using pooled percentages and odds ratios with 95 % confidence intervals.

3. Results

3.1. Selection of studies

There were 3203 items discovered in total. Before the screening, 2851 records were eliminated (duplicates and irrelevant). Additional screening by titles, abstracts, and full text depending on eligibility criteria. The final analysis includes 12 studies (Fig. 1).

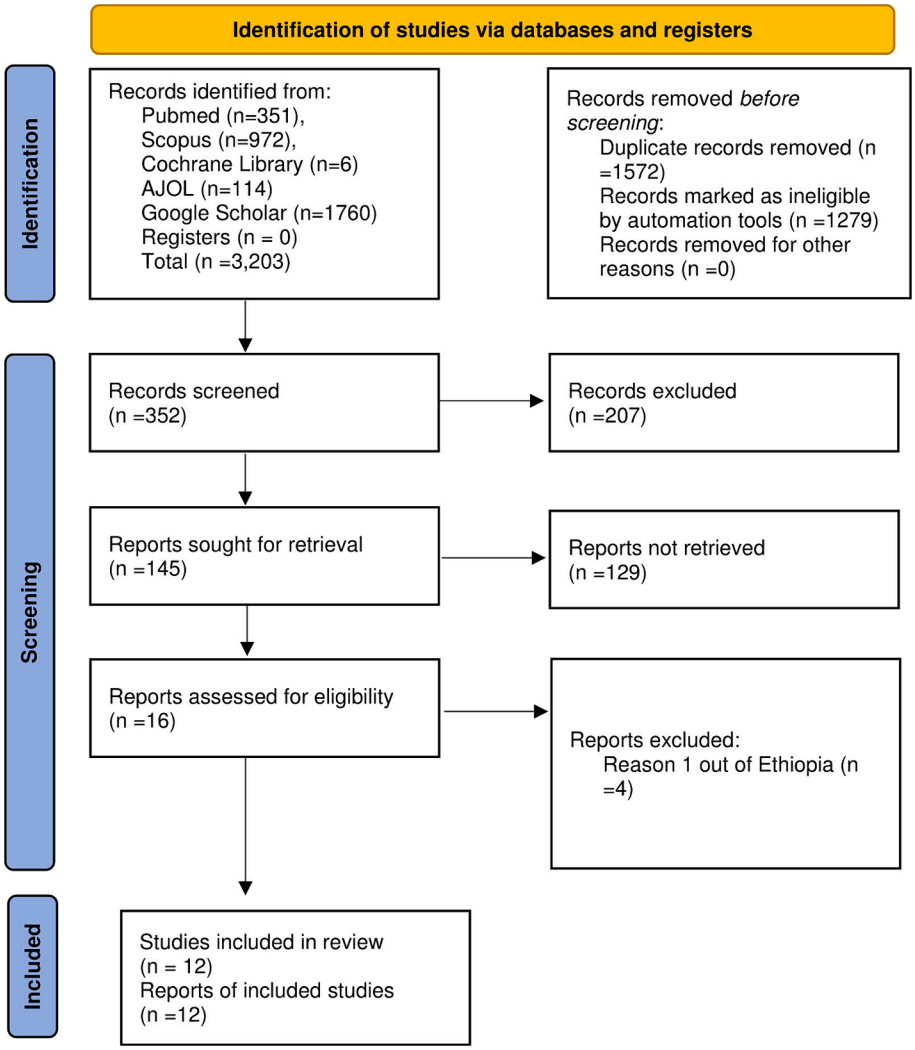

Fig. 1. PRISMA follow diagram depicting search results.

3.2. Characteristics of included studies

Twelve studies (Chawaka and Temesgen, 2016; Assefa et al., 2022; Birhanu et al., 2017; Chawaka and Teshome, 2023; Dugo Angasa and Seyoum, 2023; Fenta et al., 2020; Gemechu et al., 2017; Hailu et al., 2023; Hassen et al., 2022; Molla et al., 2023; Sofoniyas Getaneh et al., 2022; Tamiru Getachew and Mengistu, 2022) with a total of 2,587 patients met our inclusion criteria. The sample size ranged from 28 (Assefa et al., 2022) to 416 (Tamiru Getachew and Mengistu, 2022) in including studies. The prevalence of POST ranged from 26.5 % (Hailu et al., 2023) to 67.4 (Assefa et al., 2022) in the analyzed studies. All research considered was observational (cross-sectional and cohort), with the majority of studies (nine) conducted on adults and three on pediatrics (Table 2).

3.3. Prevalence of POST in Ethiopia

A forest plot (Fig. 2) depicts the overall occurrence of POST. As a result, the national estimated prevalence of POST in Ethiopia was 47.3 % with a 95 % confidence interval (41.35–53.25); $I^2 = 100$ % P<0.001).

3.4. Meta-regression

Meta-regression was employed to identify the cause of heterogeneity by considering study region, year of publication, sample size, and study population as variables. With P-values of 0.006, 0.024, and 0.05, it identified the study region, year of publication, and study population as probable sources of variability (Table 3).

3.5. Subgroup analysis

The Cochrane I^2 statistic in this study was 100 %, P 0.001, indicating significant heterogeneity. To treat heterogeneity, subgroup analyses were used with factors indicated as potential sources of heterogeneity (study region, year of publication, and study population). According to subgroup analyses, the largest POST was found in Addis Ababa region studies (52.5 %), studies published until 2021 (52.65 %), and pediatric population studies (49.47 %) (Online Supplementary file Figs. 4–6). As subgroup analysis did not resolve heterogeneity, we chose random model meta-analysis.

3.6. Sensitivity analysis

The effect of a single study on the overall estimate of POST is confirmed by sensitivity analysis and the result showed there was no single study that influenced the overall estimate significantly (Fig. 3).

3.7. Publication bias

Results from Egger's regression test showed a p-value of 0.27, which confirms an absence of publication bias. Visual inspection of the funnel plot also confirmed an absence of publication bias (Online Supplementary file Fig. 7).

3.8. Factors associated with POST in Ethiopia

In this study, the determinants of POST in Ethiopia were prolonged intubation for more than 2 h, use of ETT over LMA, female sex, repeated attempts at intubation, and blood seen on the tip of the ETT or laryngoscope.

POST was 7.01 times more probable in patients who had been intubated for a prolonged period (more than 2 h) than in their counterparts (AOR=7.01; 95 % CI: 1.81–12.21) (Online Supplementary file Fig. 8). POST was 2.63 times more probable in patients whose airways were managed with ETT than in patients whose airways were secured with LMA (AOR=2.63; 95 % CI: 1.83–3.438) (Online Supplementary file Fig. 9). Female patients had 2.82 times the odds of having POST as their male counterparts (AOR=2.82; 95 % CI: 1.93–3.70) (Online Supplementary file Fig. 10). POST was 4.77 times more probable in patients who had multiple tracheal intubation attempts compared in their counterparts (AOR=4.77; 95 % CI: 2.86–6.68) (Online Supplementary file Fig. 11). Again, individuals whose blood was visible on the

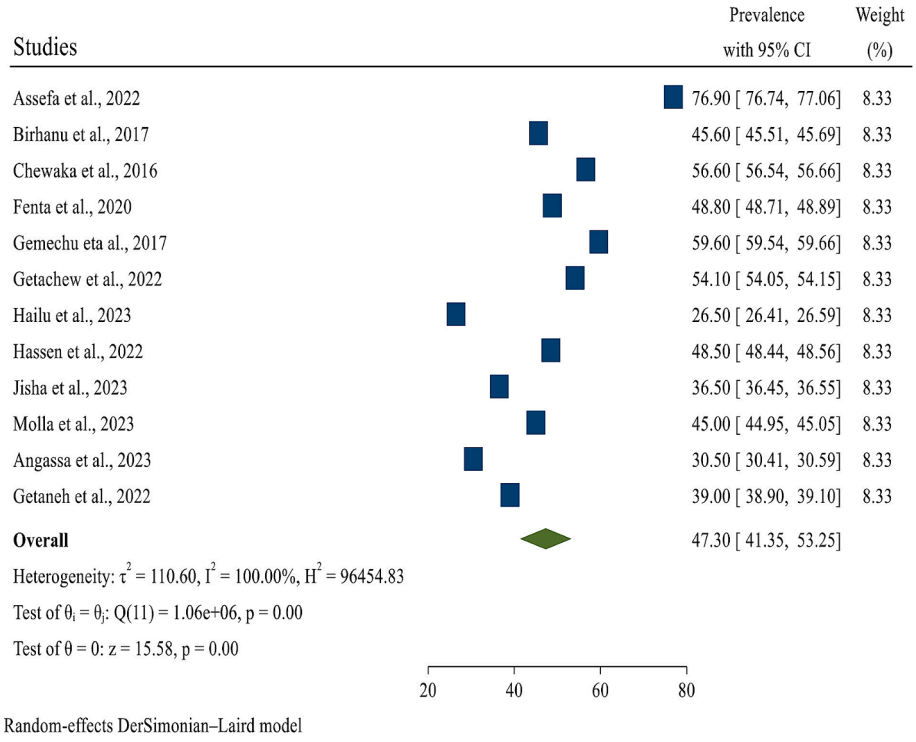

Fig. 2. Forest plot indicating the pooled prevalence of POST in Ethiopia, 2023.

Table 3
Meta-regression analysis depicting potential source of heterogeneity among included studies.

Potential heterogeneity source	Coefficient	Standard error	Z	P-value	95 % confidence interval
Study region	−7.060147	2.561166	−2.76	**0.006**	−12.07994 to −2.040355
Year of publication	−14.97056	6.645415	−2.25	**0.024**	−27.99534 to −1.94579
Sample Size	6.50139	5.799391	1.12	0.262	−4.865207 to −17.86799
Study Population	−14.18679	7.232518	−1.96	**0.05**	−28.36227 to −0.0113169
Constant	103.7528	21.54104	4.82	<0.001	61.53312–145.9724

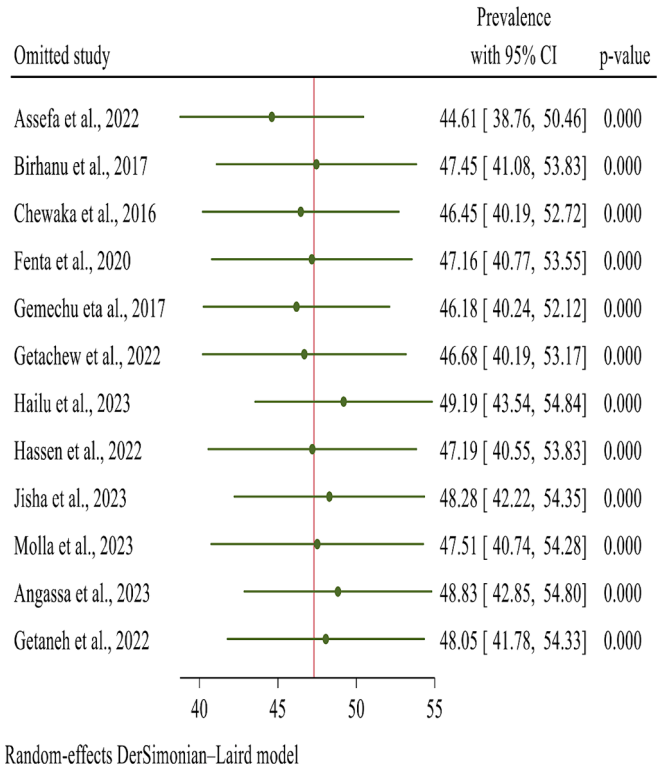

Fig. 3. Sensitivity analysis for included studies.

tip of the ETT or laryngoscope following intubation or extubation were 3.47 times more likely to have POST than their peers (AOR=3.47; 95 % CI: 2.44–4.50) (Online Supplementary file Fig. 12).

4. Discussion

POST is caused by epithelial and mucosal cell damage induced by airway securement, vocal cord damage, congestion, blood clots, and factors such as an inadequately sized tube, cuff shape, cuff pressure, and airway securement (Najafi et al., 2014; Ahmed et al., 2007). It is common after general anesthesia following endotracheal intubation (ETT) and laryngeal mask airway (LMA) (Gambrell, 2019). It is the most unpleasant anesthesia side effect, a painful, stressful result of tracheal intubation that contributes to postoperative mortality and morbidity after general anesthesia (Obsa et al., 2022; Jaensson et al., 2010).

According to the body of literature (El-Boghdadly et al., 2016; Tanaka et al., 2015; Higgins et al., 2002), the incidence of POST ranges from 12.1 % to 70 % and fluctuates depending on several contributing circumstances. Various factors, including patient demographics and clinical considerations, are thought to play a role in the development of postoperative sore throat. Type of surgery, cigarette smoking, airway suctioning, dehydration, duration of intubation or anesthesia, presence of blood on tip of ETT or laryngoscope or LMA during extubation, use of Nasogastric tube (NGT), and use of larger size endotracheal tube are among the factors identified (Piriyapatsom et al., 2013; Miskovic et al., 2019; Chawaka and Temesgen, 2016; Lee et al., 2017).

This study tried to address the overall prevalence of POST in Ethiopia and its determinants. The overall prevalence of POST is presented with a forest plot. Therefore, the national estimated prevalence of POST in Ethiopia was (47.3 %). The finding of this review is in line with a global systematic review and meta-analysis (40.48 %) (Obsa et al., 2022). On the other hand, the result of this review showed a higher prevalence than independent studies conducted in India (27.1 %), Pakistan (30 %), and Thailand (35.7 %) (Ali et al., 2021; Biro et al., 2005; Jaensson et al., 2010). The difference could be justified by differences in clinical care capabilities–providing safe anesthesia and surgery with appropriate equipment and managing patients more safely in minimizing POST.

The subgroup analysis by year of publication, this review demonstrated that studies published before 2021 had a greater prevalence of POST (52.65 %), this could be reasoned out by the change in practice in recent years as previous researchers recommended minimizing POST by managing modifiable factors associated with like using small size endotracheal tubes over larger one, gentle endotracheal intubation with minimum attempts, and gentle laryngoscopic application (El-Boghdadly et al., 2016). Pediatric studies revealed a greater incidence (Biro et al., 2005; Ratajczyk et al., 2013); this higher prevalence in the pediatric population may be due to the immature nature of the pediatric airway (Hailu et al., 2023; El-Boghdadly et al., 2016). Again, a subgroup analysis by study region showed highest POST was recorded in studies from the Addis Ababa region 52.5 %. This might be due to airway management in most of Addis Ababa's Hospitals being managed by undergraduate anesthesia students and resident anesthesiologists as hypothesized by previous research (Molla et al., 2023).

Several studies have shown a strong correlation between the length of intubation and the incidence of a sore throat following surgery (Ahmed et al., 2007; Mokhtar and Choy, 2013). Our review shows that patients who have been under anesthesia for longer than two hours are more likely to experience sore throats. Furthermore, research has shown that the likelihood of developing a sore throat after surgery rises with the length of Anesthesia, which is a self-evident finding (Ahmed et al., 2007; Edomwonyi et al., 2006; El-Boghdadly et al., 2016). Conversely, according to Christensen et al. (Christensen et al., 1994), the length of anesthesia has little bearing on the frequency of sore throats. The increased risk of tissue injury in patient groups undergoing prolonged intubation justifies the higher likelihood of postoperative sore throat development in those whose intubation lasted longer than two hours.

The most important component for POST, as a complication, was the decision made regarding airway management. Evidence from this comprehensive study indicates that the group using a laryngeal mask airway experienced a significantly lower rate of postoperative sore throat than the group using an endotracheal tube. Similar to this investigation, some research has demonstrated that the incidence of POST increases following tracheal intubation (Higgins et al., 2002; Shroff and Kamath, 2006). Following tracheal intubation, an inflated ETT cuff has been suggested as a potential source of postoperative sore throat (POST). It has been shown that the LMA provides less sympathetic stimulation than tracheal intubation (Hung et al., 2010).

Since LMA causes less airway stimulation and damage, its quicker insertion and removal, as well as the fact that it does not come into contact with the vocal cords, are the reasons for this POST-reduction in LMA use (Ratajczyk et al., 2013). On the other hand, Dadmehr et al.

(Mahmoodpoor, 2010) demonstrated that there was no apparent difference between LMA and ETT use for postoperative complications during the first twenty-four hours after surgery.

Many prior studies have shown that women have a higher incidence of sore throats (Ahmed et al., 2007; Biro et al., 2005; Maruyama et al., 2004). The current review also reveals that female patients have a higher incidence of POST. However, other researchers (Edomwonyi et al., 2006; Jaensson et al., 2014) found no apparent difference in the incidence of sore throat between the sexes in the researchers conducted by other researchers.

The etiological elements of POST are believed to be dry mucosa, abrasion of the airway mucosa during intubation, and the rubbing of the intubation tube against the mucosa. Furthermore, the airway mucosa is damaged by the laryngoscope's intense stimulation and the intubation tube's movement, which activates the C fibers linked to secondary pain. The release of neurotransmitters that follows is linked to post-operative sore throat (POST) (Mitobe et al., 2022). This POST difference may be explained by variations in complaints about pain perception rather than true variations in gender pathophysiology.

According to our analysis, the number of laryngoscopy tries was significantly correlated with POST. The findings of another study likewise demonstrated a strong correlation between POST and multiple laryngoscopy attempts (Shariffuddin et al., 2017). It could result from direct trauma to the larynx and cause sore throats after surgery. Other studies did not find a statistically significant correlation between the number of laryngoscopy attempts and POST, which is inconsistent with our finding (Edomwonyi et al., 2006).

Our comprehensive systematic review indicates a strong association between POST and blood visible on the tip of the laryngoscope and ETT. In line with our review, postoperative sore throat may be triggered by trauma sustained during endotracheal tube insertion and manipulation of the airway and surrounding tissues (El-Boghdadly et al., 2016; Splinter et al., 1994). This could be justified as POST might be brought on by physical irritation that lasts from intubation to the end of surgery. To mitigate this, we think that reducing physical stimulation—for instance, by selecting a device that considers the duration of the procedure, intubation, and extubation methods—can help lower the likelihood of a sore throat.

The research done in Madagascar (Rakotondrainibe et al., 2017) provided supportive evidence for this conclusion. It revealed a strong correlation between blood-stained ETT and POST. This result has been explained by direct tissue damage sustained during laryngoscopy and suctioning using a suction catheter.

5. Conclusion and recommendation

The national estimated prevalence of POST in Ethiopia is 47.3 % which is very high and may affect the patient's postoperative outcome. The highest prevalence is found in Addis Ababa (52.5 %) among regions of the country and in pediatric population 49.5 % than adults. Prolonged intubation for more than 2 h, using ETT over LMA, Sex being female multiple attempts at intubation, and blood seen on the tip of ETT or Laryngoscope were the determinant factors of POST in Ethiopia.

Therefore, Stakeholders should design strategies on how to modify factors and bring the prevalence of POST down. Developing a POST management protocol might help in reducing the prevalence of POST and its burden in Ethiopia.

Ethical approval and consent to participate

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Diriba Teshome: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Efrem Fenta:** Visualization, Software, Methodology, Investigation, Formal analysis, Data curation. **Getachew Mekete:** Writing – review & editing, Writing – original draft, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Nega Getachew:** Writing – original draft, Visualization, Software, Resources, Methodology, Investigation, Formal analysis, Conceptualization. **Negesse Zurbachew:** Writing – review & editing, Writing – original draft, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Kumlachew Geta:** Writing – original draft, Visualization, Methodology, Investigation, Conceptualization. **Abebe Tiruneh:** Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Data curation. **Basazinew Chekol:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Appendix A. Supplementary data

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