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ORIGINAL MANUSCRIPT

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

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Abstract

Objective: This study aimed to estimate the incidence rate and determine the possible associated factors for postoperative sore throat following surgery conducted under general anesthesia using endotracheal intubation.

Methods: Hospital-based prospective observational study design was conducted from June to September 2018 in the referral hospitals in Asmara. The study was conducted at the Ear Nose Throat, Obstetrics and Gynecology and General Surgery departments of Orotta National Referral and Teaching Hospital and the Orthopedic, Burn and General Surgery departments Halibet National Referral Hospital. Data was collected using a structured questionnaire. Data analysis was done using SPSS version 22. Descriptive results were summarized in frequencies and percentages using tables and graphs. Moreover, a modified logistic regression was used to estimate the adjusted relative risk instead of the ordinary logistic regression in order to find out the magnitude and direction of association of postoperative sore throat and the independent variables.

Results: Out of the 336 participants who underwent surgery under general anesthesia using endotracheal intubation, one hundred and three patients (30.7%) have developed postoperative sore throat. Body weight of more than 70Kg (ARR = 2.543, 95% CI: 1.13 - 5.75, p-value: 0.025) and multiple intubation attempts (ARR = 2.19, 95% CI: 1.20-4.00, p-value: 0.01) were the sole factors influencing the occurrence of POST.

Conclusions: The incidence of postoperative sore throat was found to be high in the national referral hospitals in Asmara. Number of intubation attempts and body weight of the participants were identified as the main risk factors. Reduction of multiple trials during tracheal intubation might help in the reduction of postoperative sore throat.

Keywords

Sore throat, Risk factors, Tracheal intubation

Abbreviations

ACHS: Asmara college of health sciences; AOR: Adjusted Odds Ratio; ARR: Adjusted Relative Risk; ASA: American Society of Anesthesiology; BMI: Body Mass Index; CI: Confidence Interval; Cm: Cent-meter; ENT: Ear Nose Throat; ETI: Endotracheal Tube Intubation; ETT: Endotracheal Tube; GA: General Anesthesia; GVL: Glide Scope video-laryngoscope; IQR: Inter Quartile Range; LMA: Laryngeal Mask Airway; M: mean; Mm: Mill -Meter; NGT: Naso-gastric Tube; OR: Odds Ratio; POST: Postoperative Sore Throat; PVC: polyvinylchloride; RR: Relative Risk; SA: Spinal Anesthesia; SPSS: Statistics Package for Social Sciences

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Background

Postoperative sore throat (POST) has been a known complication after general anesthesia using endotracheal intubation (ETI) [1]. Causing dissatisfaction and discomfort, POST has been rated by patients as the eighth-most adverse effect during the postoperative period [2]. It is a common problem following the use of ETI during general anesthesia (GA) [3]. Despite the improvement in anesthesiology, POST following ETI remains a concern [4]. Even though the causation of POST is unknown, the etiology is multifactorial, including patient-related factors such as age [5], sex [6-12], smoking [6,13] , and intubation factors, including duration [1,14,15], tube size [1], type of laryngoscope used [14,16], cuff pressure, [4,17] and multiple intubation trials [1,8]. POST increases analgesic use and other health care costs [18]. Despite its disadvantage in triggering POST, utilization of endotracheal intubation (ETI) during general surgery becomes inevitable as it protects the lungs from aspiration and leakage of air during mechanical ventilation. In Eritrea, published research on this topic is extremely scarce. So the incidence of POST is not known in the country. Knowing the incidence of POST and its influencing factors in our situation helps recognize the magnitude of the problem and initiate actions to reduce its occurrence. This research can also help as a background for future research on the related topics by indicating the incidence rate and associated risk factors of POST. This study aimed to assess the prevalence and factors related to POST among patients who were operated under general anesthesia with endotracheal intubation in the referral hospitals in Asmara.

Methods

Study design and setting

A prospective observational study design was utilized from June 2018 through September 2018 in national referral hospitals in Asmara. The study was conducted at the Ear Nose Throat (ENT), Obstetrics and Gynecology and General Surgery departments of Orotta National Referral and Teaching Hospital situated at the centre of the capital city of Asmara and the orthopedic, burn (skin graft), and general surgery departments of Halibet National Referral Hospital situated at the periphery of the capital city. These are the two main national referral hospitals owned by the government where the majority of surgical procedures in the country are conducted.

Study population and study participants

All adult patients, who visited the selected hospitals during the study period (from June 1st 2018 to September 30th 2018) for surgical intervention under general anesthesia using endotracheal intubation technique, were the study population. All patients who visited the hospitals fulfilling the inclusion criteria were taken as participants in this study. All patients aged 18 years and above who underwent surgeries under general anesthesia using endotracheal intubation technique, with ASA classification of two and less than two, were included in the study. The exclusion criteria for participation were when patients were unwilling to participate, unable to communicate due to critical illness (Comatose, semiconscious, etc…), with an acute upper respiratory infection or with a sore throat before, underwent oro-laryngeal surgery, pregnant mothers

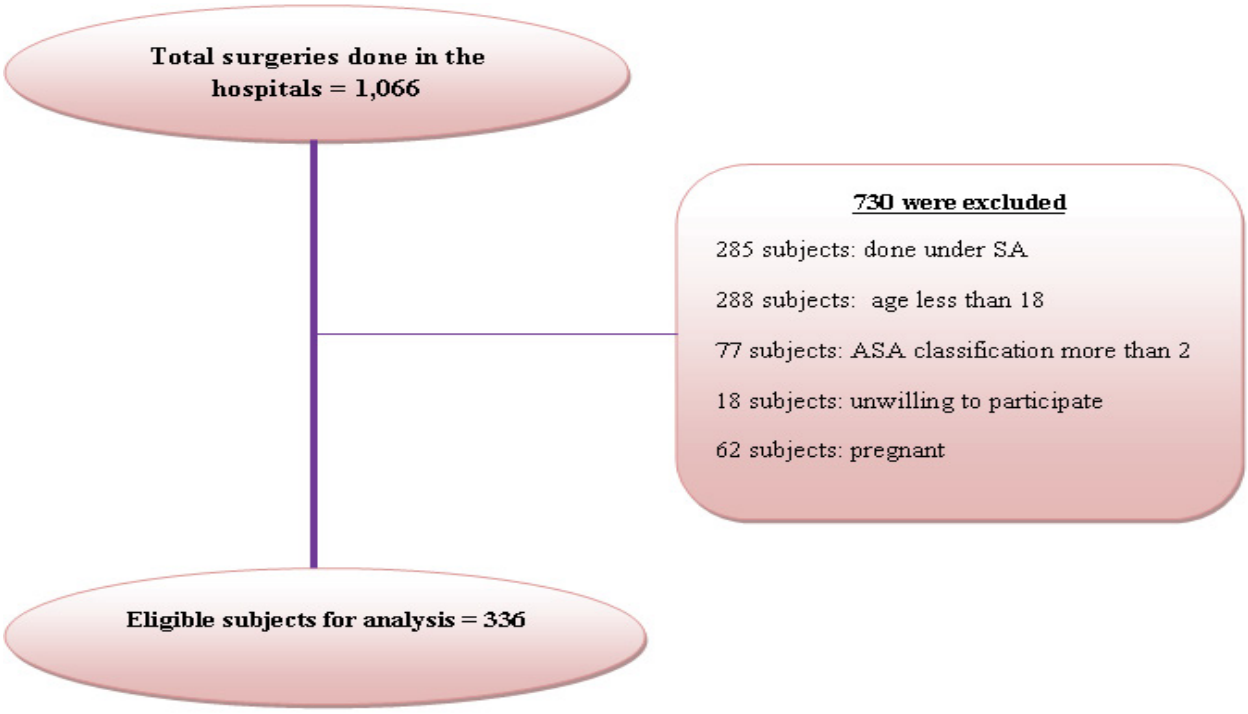

Figure 1: Participants' enrollment process.

and those with a history of psychiatric disorder and currently receiving psychological treatment or sedative, antidepressant, or antianxiety medications (Figure 1).

Research variables

The dependent variable was a postoperative sore throat. The independent variables included: socio-demographic characteristics (age, sex, smoking status, BMI, body weight and height), the experience of anesthetist in charge, anesthetic techniques (type of muscle relaxant and analgesic used, ETT size and type, type of laryngoscope and size of blade, use of airways, use of lubricant for ETT, intubation attempts, insertion of throat pack, insertion of NGT, blood on ETT and duration of intubation time), type of surgeries (obstetric, gynecological, orthopedic, breast, thyroid, abdominal, nasal and ear problems etc…), and position of the patient during surgery.

Data collection tools and methods

Data collection was done using a pretested structured questionnaire covering five main portions: background characteristics, the experience of anesthetist in charge, anesthetic techniques, type of surgery and position of the patient during surgery. The face and content validity of the questionnaire was assessed by a team of experts in the profession. Before the main study was conducted, the questionnaire was tested on 20 participants at Sembel Polyclinic (a private hospital located Southwest of the city) to assess its language clarity, flow, consistency and readability. The dependent variable i.e. development of POST was assessed clinically using 'yes' or 'no' responses. During the pilot study, four responses were used to assess POST, however, it was difficult to differentiate the responses clearly. Hence, only two responses, 'yes' or 'no' were used i.e. patients who were clinically diagnosed with POST at the post-operative ward were coded as 'yes' for POST development. The data collection procedure was conducted through direct face to face interviews with those participants who consented to participate. All patients were followed starting from the preoperative period until 24 hours after surgery to develop POST by the nurse anesthetists assigned at the respective hospitals.

Data analysis procedures

After data collection was completed, questionnaires were checked for their completeness and consistency; and the variables of interest were coded and entered into SPSS (statistics package for social sciences, Version 22). The entered data was cleaned to look over the accuracy, consistency, and avoidance of missed values during entry. Data were presented using tables and graphs. Furthermore, mean (Standard Deviation) and median (Inter Quartile Range) was utilized to summarize continuous variables as appropriate after checking normality. Relative risks (95% CI) of the POST by various demographic and clinical variables were computed at bivariate level. Variables that were significant at bivariate level were further used for multivariate analysis using logistic regression.

Multivariate logistic regression was used to find out the magnitude and direction of association of POST and various categories of the predictor variables after controlling the effect of background information. Adjusted Relative Risk (95% CI) was presented and *p*-values less than 0.05 were considered as statistically significant during the analysis. There is no currently available statistical tool that enables to compute adjusted relative risk. Hence, a modification of the logistic regression in SPSS was highly recommended to approximate the relative risk.

A modification of the logistic regression for estimation of adjusted relative risk was proposed by Diaz–Quijano [19].

Briefly, the modification was done to address the overestimation of the odds ratio for relative risk. Hence, the comparison of cases and non-cases in logistic regression was replaced by comparing cases and cases plus non-cases in the modified one, binomial regression. In a binomial regression model with k covariates, the function is written as: Log [a/ (a+b)] = $ß_0 + ß_1X_1 + \ldots\ldots ß_ix_i$ Where a, is the number of cases and b is the number of non-cases, and X the covariates. Thus, a/ (a + b) is the probability of success (e. g., the proportion of POST in a group), and the ARR (or APR) estimated of a given covariate Xi is $e^{\beta i}$. On the other hand, in a logistic regression model, the function is written as: Log (a/b) = $ß_0 + ß_1X_1 + \ldots + ß_kX_k$. Where a/b is the odds of success and the OR estimated of a given covariate X_i is $e^{\beta i}$.

Results

Socio-demographic characteristics

Out of the 336 participants, almost half (49.7%) of them were aged 18 to 40 years, whereas 30.7% were in the age group of 41 to 60 and the remaining 19.6% had an age of ≥ 61 years. Median age of the study participants was 41.5 years (IQR=29), and more than half (56.3%) of them were females. The average height and weight of the participants were 162 centimeters (SD ± 8.4) and 56.3 kg (SD ± 9.6), respectively. Three-fourths (75%) of the study participants had normal range of body mass index (BMI). About 5% of the participants were smokers. The majority (87.5%) of the participants were intubated by anesthetists in charge, with 43% of them undergoing abdominal surgery (Table 1).

Procedures related to intraoperative anesthetic techniques

The commonly used muscle relaxant for intubation was succinylcholine (69.9%), and the majority (85.4%) of the participants were given fentanyl as analgesics.

Table 1: Socio-demographic characteristics of the study participants, anesthetist experience, position and type of surgery (n=336).

Variables		Frequency (n)	Percentage (%)
Age in years (Median=41.5, IQR=29)			
	18 to 40	167	49.7
	41 to 60	103	30.7
	≥ 61	66	19.6
Gender			
	Male	147	43.8
	Female	189	56.3
Body weight, Kg (M=56.3, SD=9.6)			
	25.01 - 50.00	107	31.8
	50.01 - 70.00	211	62.8
	70.01 - 90.00	18	5.4
Height, Cm (M=162.4, SD=8.4)			
	130 - 150	37	11
	151 - 170	234	69.6
	171 - 190	65	19.3
Body Mass Index (Median = 21.3, IQR= 3.27)			
	Severe Malnutrition	14	4.2
	Under nutrition	39	11.6
	Normal	252	75
	Overweight	28	8.3
	Obesity	3	0.9
Smoking Status			
	Yes	16	4.8
	No	320	95.2
Person in charge of intubation			
	Regular Anesthetist	294	87.5
	Anesthesia Students	42	12.5
**Anesthetist experience in years (Median=4, IQR=9.75)			
	< 2 years	60	20.4
	2 -5 years	124	42.2
	6 - 10 years	35	11.9
	≥ 11 years	75	25.5
Position of the patient during Surgery			
	Supine	326	97
	Prone	1	0.3
	Left lateral	2	0.6
	Right lateral	2	0.6
	Lithotomy	5	1.5
Type of Surgery			
	Gynecological	74	22
	Orthopedic	46	13.7
	Breast	1	0.3
	Thyroid	11	3.3
	Abdominal	144	42.9
	Ear Nose Throat (ENT)	26	7.7
	*others	34	10.1

**Anesthetists experience was analyzed only for the regular employees (n=294), *others: Neurosurgery (n=16), Burn (n=14), and Uro-surgery (n=4).

Table 2: Procedures related to intraoperative anesthetic techniques: analgesics, relaxants, type of laryngoscope and ETT used (n=336).

Variables	Frequency (n)	Percentage (%)
Type of analgesics used		
Pethidine	24	7.1
Morphine	1	0.3
Fentanyl	287	85.5
Other*	24	7.1
Type of Muscle relaxant used for intubation		
Succinylcholine	235	
Rocuronium	88	
Vecuronium	12	
Atracurium	1	
Type of laryngoscope used		
Glide Scope laryngoscope	170	
Macintosh	166	
Size of laryngoscope blade used		
Size no 2	1	
Size no 3	288	
Size no 4	47	
Number of intubation trials		
One	295	
Two	36	
Three and above	5	
Type of Endo tracheal tube used (ETT) used		
Cuffed polyvinylchloride	301	
Cuffed Spiral	35	
Type of lubricant for Endo tracheal tube used (ETT) used		
Water soluble	30	
Non water soluble	2	
Not used	304	

*Others: Alfentanil (n=1), Fentanyl+ pethidine (n=2), and Sufentanil (n=21).

Table 3: Procedures related to intubation and extubation techniques (n=336).

Variables	Frequency (n)	Percentage (%)
Nasogastric tube (NGT) used		
Yes	38	11.3
No	298	88.7
Presence of blood on ETT during extubation		
Yes	37	11
No	299	89
Time from intubation to extubation in min (Median: 60 min, IQR: 24.8)		
10 – 39	28	8.3
40 – 69	205	61
70 - 99	76	22.7
≥100	27	8
Oral airway insertion		
Yes	278	82.7
No	58	17.3
Size of Endo tracheal tube used (ETT) used in mm		

	Six	74	22
	Six point five	133	39.6
	Seven	59	17.6
	Seven point five/ Eight	70	20.8
Intra operative suction used			
	Yes	307	91.4
	No	29	8.6
Throat pack used			
	Yes	3	0.9
	No	333	99.1

mm: millimeter, ETT: Endotracheal tube, min: minutes, NGT: Nasogastric tube

Figure 2: Percentage distribution of the participants who developed POST with the duration for which POST stayed, Asmara, Eritrea, 2018 (n=336).

Almost half (50.6%) of the participants were intubated using Glide Scope video laryngoscope, and around 12% of the participants were observed to have multiple intubation trials (Table 2).

Around eleven percent of the participants who underwent surgery had nasogastric tube insertion. The majority (89.6%) of the participants were intubated using cuffed PVC, with a tube size of 6.5 mm being used in the majority (40%) of the participants. The period from intubation to extubation for the majority (61%) of the participants was between 40-69 minutes with a median time of 60 minutes. During extubation, blood on ETT was observed in 11% of the participants (Table 3).

Incidence of POST

The Incidence of Post-Operative Sore Throat (POST) was found to be 30.7% and its duration of stay was ≤ 4 hours for 70.9% of the study participants, followed by 5 - 9 hours for 27.2% and ≥ 10 hours for 1.9% (Figure 2).

Factors associated with the occurrence of post at bivariate level

Patient-related factors: The risk of POST was compared across different categories of demographic characteristics. The risk of developing POST was not significant across age groups, sex, height, and BMI However, the incidence among overweight (42%) patients was relatively higher than those in normal (29%) range of BMI.

Participants with more than 70 kg were almost three times more likely to develop POST (RR=2.78, 95% CI: 2.05-3.76). Likewise, smokers were 2.15 times more at risk for developing POST than non-smokers (RR=2.15, 95%CI: 1.42-3.26). Patients undergoing Thyroid (45.5%) and ENT (34.6%) surgeries had the highest incidence of POST though no significant association was found between types of surgeries. The results revealed no significant risk of POST with respect to the person in charge of intubation or the years of experience of the anesthetist (Table 4).

Factors related to intraoperative anesthetic techniques and procedures: The study found a statistically significant association between the development of POST and intubation trial of two or more (RR=2.30, 95% CI: 1.69-3.14). No significant occurrence of POST was shown across muscle relaxants used, types of analgesics, type of laryngoscope and blade of different sizes, NGT use, size and type of Endotracheal tube, lubricant or gel use and oral airway insertion. The incidence of POST was observed to be significantly higher (55.6 %) for those patients who have been stayed for more than 100 minutes of intubation (RR: 2.22, 95%

Table 4: Bivariate analysis of socio-demographic characteristics of the patients, person in charge of intubation, anesthetist experience and POST (n=336).

Variable	POST		
	No (%)	Yes (%)	RR (95% CI)
Age			
18 to 40 years	121 (72.5)	46 (27.5)	Referent
41 to 60 years	69 (67.0)	34 (33.0)	1.20 (0.83-1.73)
≥61 years	43 (65.2)	23 (34.8)	1.27 (0.84-1.91)
Gender			
Female	127 (67.2)	62 (32.8)	Referent
Male	106 (72.1)	41 (27.9)	0.85 (0.61-1.18)
Body weight, Kg			
25.01 - 70.00	229 (72.0)	89 (28.0)	Referent
70.01 - 90.00	4 (22.2)	14 (77.8)	2.78 (2.05-3.76)***
Height, Cm			
130 – 150	26 (70.3)	11 (29.7)	Referent
151 - 170	157 (67.1)	77 (32.9)	1.11 (0.65-1.87)
171 - 190	50 (76.9)	15 (23.1)	0.78 (0.40-1.51)
BMI			
Severe malnutrition	37 (69.8)	16 (30.2)	Referent
Normal	178 (70.6)	74 (29.4)	0.97 (0.62-1.530)
Over weight	18 (58.1)	13 (41.9)	0.83 (0.78-2.49)
Smoking Status			
No	227 (70.9)	93 (29.1)	Referent
Yes	6 (37.5)	10 (62.5)	2.15 (1.42-3.26)**
Intubating Person			
Regular Anesthetists	208 (70.7)	86 (29.3)	Referent
Students	25 (59.5)	17 (40.5)	0.72 (0.48-1.09)
Anesthesia Experience∞			
< 2 years	42 (70.0)	18 (30.0)	Referent
2 -5 years	90 (72.6)	34 (27.4)	1.09 (0.68-1.77)
6 - 10 years	26 (74.3)	9 (25.7)	1.17 (0.59-2.31)
≥ 11 years	50 (66.7)	25 (33.3)	0.90 (0.55-1.49)
Type of Surgery			
Gynecology	49 (66.2)	25 (33.8)	**Referent**
Orthopedics	35 (76.1)	11 (23.9)	0.71 (0.39-1.30)
Thyroid	6 (54.5)	5 (45.5)	1.35 (0.65-2.77)
Abdominal	106 (73.6)	38 (26.4)	0.78 (0.51-1.19)
ENT	17 (65.4)	9 (34.6)	1.14 (0.55-1.90)
*Others	19 (55.9)	15 (44.1)	1.31 (0.80-2.14)

**p-value<0.01, ***p-value<0.001, ∞Anesthetists experience was analyzed only for the regular anesthetists (N=294), *Neurosurgery (n=16), Burn (n=14), and Uro-surgery (n=4)

CI: 1.08-4.59, p-value of < 0.05). The presence of blood on ETT during intubation was observed in (62.2%) of the patients who developed POST, and a statistically significant association was found at a p-value < 0.001 (RR=2.32, 95% CI: 1.70 - 3.18). Table 5 illustrates the remaining variables.

Multivariate results of the potential factors adjusted for confounding effect

Variables that were significantly associated with the incidence of POST at the bivariate level were analyzed further using multivariate analysis to find the adjusted relative risk. The risk of POST occurrence was found

Table 5: Bivariate analysis of intraoperative anesthetic techniques and procedures and POST (n=336).

Variable	POST		
	No n (%)	Yes n (%)	RR (95% CI)
Type of Analgesics			
Fentanyl	201 (70.0)	86 (30.0)	Referent
Pethidine	17 (70.8)	7 (29.2)	0.97 (0.51-1.86)
Other[∞]	15 (62.5)	9 (37.5)	0.78 (0.35-1.75)
Type of Muscle relaxant used for intubation			
Succinylcholine	166 (70.6)	69 (29.4)	Referent
Rocuronium	60 (68.2)	28 (31.8)	1.09 (0.75-1.56)
Vecuronium	7 (58.3)	5 (41.7)	1.42 (0.71-2.85)
Type of laryngoscope used			
Macintosh	123 (74.1)	43 (25.9)	Referent
Glide Scope video-laryngoscope	110 (64.7)	60 (35.3)	1.36 (0.98-1.89)
Size of laryngoscope blade used			
Size no 4	30 (63.8)	17 (36.2)	Referent
Size no 3	202 (70.1)	86 (29.9)	0.83 (0.54-1.26)
Number of intubation trials			
One (1)	217 (73.6)	78 (26.4)	Referent
Two (2) or more	16 (39.0)	25 (61.0)	2.30 (1.69-3.14)***
NGT insertion			
NGT used	28 (73.7)	10 (26.3)	0.84 (0.48-1.47)
NGT not used	205 (68.8)	93 (31.2)	
Type of ETT used			
Cuffed polyvinylchloride (PVC)	205 (68.1)	96 (31.9)	Referent
Cuffed Spiral	28 (80.0)	7 (20.0)	1.60 (0.81-3.16)
Size of ETT used in millimeter			
Six point five	99 (74.4)	34 (25.6)	Referent
Seven	40 (67.8)	19 (32.2)	0.76 (0.49-1.16)
Seven point five/Eight	45 (64.3)	25 (35.7)	0.95 (0.58-1.56)
Six mm	49 (66.2)	25 (33.8)	1.06 (0.68-1.66)
Type of lubricant for ETT used			
Gel Used (Water soluble)	26 (81.3)	6 (18.8)	0.59 (0.8-1.23)
Not used	207 (68.1)	97 (31.9)	Referent
Oral airway insertion			
Yes	191 (68.7)	87 (31.3)	1.13 (0.72-1.78)
No	42 (72.4)	16 (27.6)	Referent
Presence of blood on ETT			
Yes	14 (37.8)	23 (62.2)	2.32 (1.70-3.18)***
No	219 (73.2)	80 (26.8)	Referent
Time from intubation to extubation (in Minutes)			
10-39	21 (75.0)	7 (25.0)	Referent
40-69	149 (72.7)	56 (27.3)	1.09 (0.55-2.16)
70-99	51 (67.1)	25 (32.9)	1.32 (0.64-2.70)
≥100	12 (44.4)	15 (55.6)	2.22 (1.08-4.59)*
Intraoperative Suction used			
No	23 (79.3)	6 (20.7)	Referent
Yes	210 (68.4)	97 (31.6)	1.53 (0.74-3.17)

*P-value<0.05, ***p-value<0.001,[∞]others: Alfentanil (n=1), Fentanyl+ pethidine (n=2), and Sufentanil (n=21).

to have a statistically significant association with body weight (p=0.025) and a number of intubation trials (*p*=0.011). However, the remaining variables which have shown significance at the bivariate level had no more significant association after adjusting the confounding factors (Table 6).

Discussion

In the current study, the incidence of postoperative sore throat (POST) was found to be 30.7%. The incidence was lower than studies conducted in low-middle income countries [1,15,20]. On the other hand,

Table 6: Multivariate results of relative risk adjusted for confounding effect (n=336).

Variable		POST (%)	ARR (95% CI)	P value
Body weight	25.01 - 70.00	89(28.0)	Referent	0.025
	70.01 - 90.00	14(77.8)	2.5 (1.13-5.75)	
Smoking status				
	No	93(29.1)	Referent	
	Yes	10(62.5)	1.62(0.65-4.08)	0.302
Number of intubation trial	One	78(26.4)	Referent	
	Two or more	25(61.0)	2.19(1.20-4.00)	0.011
Presence of blood on ETT	No	80(26.8)	Referent	
	Yes	23(62.2)	1.63(0.87-3.04)	0.129
Time from intubation to extubation	10 – 39	7(25.0)	Referent	
	40 – 69	56(27.3)	1.00(0.33-2.53)	
	70 – 99	25(32.9)	0.91(0.27-3.03)	
	≥ 100	15(55.6)	0.70(0.05-10.09)	0.994

ETT: Endotracheal tube, POST: Postoperative sore throat, ARR: Adjusted relative risk, CI: Confidence interval

the incidence was found to be higher compared to studies from developed countries [21,22]. Most of the studies compared showed that the incidence of POST was a common problem in patients who undergo surgery using tracheal intubation [5,21,22]. Yet, the incidence was found to be significantly low with the practice of LMA compared to ETI. Nevertheless, ETI is the commonly practiced procedure for intubation in the study setting. Given the results of the existing studies, the institution of LMA practice in the study area is highly recommended.

Factors influencing the occurrence of post

The majority of the participants were in the age range of 18 to 60 years. Though statistical significance was not found between age and sex as risk factors for POST, as the age of the participants' increases the incidence was observed to increase and it was higher in females than males. Similar studies reported a higher incidence of POST among females [1,6-12]. A higher incidence of POST was documented among older age groups in a study conducted in Pakistan [5]. The higher incidence among females might be due to the narrowness of the female tracheal tract. Likewise, the increased incidence of POST in older patients could possibly be due to the narrowing and kinking of the trachea related to geriatric physiologic changes. About three-fourths of the participants had a BMI within the normal range, nevertheless, the incidence of POST was observed to increase from those with severe malnutrition to those with overweight. Those participants who had a bodyweight of more than 70 kg had a significantly higher incidence. Studies conducted in other countries also revealed a positive correlation between POST and body weight [11,22,23]. The higher incidence of POST among patients with higher body weight might be due to the possibility of difficult intubation related to the limited head tilting during intubation resulting in multiple intubation attempts.

Smoking increased the likelihood of POST studies conducted elsewhere [6,13]. Similarly, our findings indicate a higher incidence of POST among smokers compared to non-smokers. The possible reason for this could be the fact that smoking and tobacco sniffing have the tendency to irritate of the oral cavity, organs of the respiratory and cardiac system. The majority of the study participants were anaesthetized by the anesthetist in charge. Among the study participants who were identified to be intubated by students, two-fifth of them developed POST. The findings of our study is inconsistent with another study that reported a similar incidence of POST in those patients who were intubated by trainees and consultant anesthetists [24]. The findings in our study can be attributed to the minor complications that can happen during the training time.

Though significant association was not observed, the incidence of POST was observed to be higher for those participants where vecuronium was used as a muscle relaxant during intubation. The difference in using analgesics didn't show any association with POST development. Type of laryngoscope and size of blade was found to have no significant association with the development of POST; however, the incidence of POST was higher in those participants who were intubated using GVL compared to Macintosh. Participants intubated with laryngoscope blade number 4 had a higher incidence than those intubated with blade size no 3. Inconsistently, studies conducted in Saudi Arabia, Iran and Ethiopia indicated a higher incidence of POST among patients intubated with Macintosh compared to GVL [1,14,16].

A significant association was seen between multiple intubation trials and POST development. Similar studies

conducted in other countries reported a significantly higher incidence of POST among those patients intubated more than two times [1,8]. The reason can be defined due to the repeated trauma affecting the oro-laryngeal area related to multiple manipulations. In this study, the use of a nasogastric tube (NG), type and size of ETT, use of lubricant, and oral airway insertion were found to have no significant association with POST, however, some studies documented a significant association between NG and the occurrence of POST [1].

Post-operative sore throat has been found to develop in participants who underwent surgery using ETT with excessive cuff pressure [4,17]. In the setting where the study was conducted, there were only two types of cuffed ETT (Poly vinyl chloride and spiral), and the air was inflated to the balloon until air leakage was not heard or by checking the filling of an external balloon (pilot balloon); therefore, the comparability between the pressure on the tracheal wall created due to the amount of air in the balloon was very difficult as it was done manually instead of using the standard manometer (due to unavailability). Using such a method, a third of those with cuffed polyvinylchloride (PVC) and a fifth with cuffed spiral was found to develop POST, indicating the difference between the spiral and PVC ETT. This difference might be due to either the flexibility of the cuffed spiral or the hardness of the cuffed polyvinylchloride. The study findings indicated that the presence of blood on ETT or suction tube, and prolonged intubation time were found to have marginal significance in the development of POST. These results have consistency with other studies that reported bloodstain on the endotracheal tube as a risk factor for POST [6]. Patients with surgical procedures with a longer duration of time were found to develop POST more likely than those with short duration surgeries [1,14,15]. If a patient stays intubated for a long time, the risk of irritation and trauma of the oro-laryngeal and tracheal area is high; this might be the main cause of the development of POST.

This study had several limitations. Firstly, cuff pressure was not measured (due to the unavailability of a manometer); for this reason, the impact of cuff pressure in the development of POST was not assessed. Secondly, various types of surgical procedures (like ENT surgery) were included; this might affect the study results. Thirdly, a binary scale of 'yes' or 'no' responses was used to assess POST. The utilization of four-point scale was difficult to be measured during the pilot study. Despite these limitations, the current study attempted to quantify the incidence of POST and the impact of possible socio-demographic and clinical variables. The study also adds the following: POST studies in Eritrea are limited; thus, the current study will be used as a reference for future studies. The findings open room for developing a prevention strategy as the possible predicting factors are identified.

Conclusions

The incidence of postoperative sore throat was high at the national referral hospitals of Asmara that provided surgery services. The number of intubation attempts and the body weight of the participants were identified as the main risk factors. Reduction of multiple trials during tracheal intubation might help reduce postoperative sore throat.

Declarations

Data availability and materials

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

Ethical approval and consent to participate

An official letter of support from Asmara College of Health Sciences was sent to the Ministry of Health Research and Ethical Committee and Health Facility Management Division, for obtaining a formal research study approval paper that was submitted to the medical directors of the selected hospitals and departments for conducting data collection at the selected National Referral Hospitals. Ethical issue for the study participants was highly respected. A thorough explanation of the study aim and potential benefits of patients in the study were stated, written consent paper was obtained for every participant who underwent surgery, in case he/she didn't agree, the participant was free to resign from the study at any part of the questionnaire. Anonymity and confidentiality were ensured in that the participant name will not appear on the questionnaire, and information will not be shared. During the study period, those patients who developed POST were given the appropriate treatment for relieving their complaint.

Consent for publication

Not applicable.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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Authors' Contributions

YMG, was responsible for study conception; data acquisition, and manuscript drafting. GGB, was advising, supervising and critically reviewed the study. EHT, was the study statistician conducted data analysis and interpretation. IMI, was responsible for data interpretation, manuscript drafting and critical revision. All authors revised and approved the manuscript for publication.

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References

1. Gemechu BM, Gebremedhn EG, Melkie TB (2017) Risk factors for postoperative throat pain after general anaesthesia with endotracheal intubation at the University of Gondar Teaching Hospital, Northwest Ethiopia, 2014. Pan Afr Med J 27: 127.
2. Macario A, Weinger M, Carney S, Kim A (1999) Which clinical anesthesia outcomes are important to avoid? The perspective of patients. Anesthesia & Analgesia 89: 652-658.
3. McHardy F, Chung F (1999) Postoperative sore throat: Cause, prevention and treatment. Anaesthesia 54: 444-453.
4. Lee JY, Sim WS, Kim ES, Lee SM, (2017) Incidence and risk factors of postoperative sore throat after endotracheal intubation in Korean patients. J Int Med Res 45: 744-752.
5. Ahmed A, Abbasi S, Ghafoor HB, Ishaq M (2007) Postoperative sore throat after elective surgical procedures. J Ayub Med Coll Abbottabad 19: 12-14.
6. Biro P, Seifert B, Pasch T (2005) Complaints of sore throat after tracheal intubation: A prospective evaluation. Eur J Anaesthesiol 22: 307-311.
7. Maruyama K, Sakai H, Miyazawa H, Toda N, Linuma Y, et al. (2004) Sore throat and hoarseness after total intravenous anaesthesia. Br J Anaesth 92: 541-543.
8. Jaensson M, A Gupta, Nilsson U (2014) Gender differences in sore throat and hoarseness following endotracheal tube or laryngeal mask airway: A prospective study. BMC Anesthesiol 14: 56.
9. Ríos ÁM, Calvache JA, Gomez JC, Gomez LM, Aguirre OD, et al, (2014) Síntomas laringofaríngeos posoperatorios en cirugía electiva. Incidencia y factores asociados. Revista Colombiana de Anestesiología 42: 9-15.
10. Shrestha S, Maharjan B, Karmacharya RM (2017) Incidence and Associated Risk Factors of Postoperative Sore Throat in Referral Care Hospital. Kathmandu Univ Med J 57: 10-13.
11. Zuccherelli L (2003) Postoperative upper airway problems. Southern African Journal of Anaesthesia and Analgesia 9: 12-16.
12. Christensen A, Willemoes-Larsen H, Lundby L, Jakobsen K (1994) Postoperative throat complaints after tracheal intubation. Br J Anaesth 73: 786-787.
13. Geraci G, Cupido F, Nigro CL, Sciuto A, Sciume C, et al. (2013) Postoperative laryngeal symptoms in a general surgery setting. Clinical study. Ann Ital Chir 84: 377-383.
14. Najafi A, Imani F, Makarem J, Khajavi MR, Etezadi F, et al. (2014) Postoperative sore throat after laryngoscopy with macintosh or glide scope video laryngoscope blade in normal airway patients. Anesth Pain Med 4: e15136.
15. Birhanu Mengistu S, Akalu L (2017) 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 Anesth Res 5: 409-413.
16. Aqil M, Khan MU, Mansoor S, Mansoor S, Khokhar RS, et al. (2017) Incidence and severity of postoperative sore throat: A randomized comparison of Glidescope with Macintosh laryngoscope. BMC Anesthesiol 17: 127.
17. El-Boghdadly K, Bailey CR, Wiles MD (2016) Postoperative sore throat: A systematic review. Anaesthesia, 2016. 71: 706-717.
18. Maruyama K, Yamada T, Hara K (2006) Effect of clonidine premedication on postoperative sore throat and hoarseness after total intravenous anesthesia. J Anesth 20: 327-330.
19. Diaz-Quijano FA (2012) A simple method for estimating relative risk using logistic regression. BMC Med Res Methodol 12: 14.
20. Chawaka HJ, Temesgen MH (2016) Predictors of postoperative sore throat among surgical patients at Ethiopian teaching hospitals. J Cli Med Res 8: 1-11.
21. Higgins PP, Chung F, Mezei G (2002) Postoperative sore throat after ambulatory surgery. Br J Anaesth 88: 582-584.
22. Jones M, Catling S, Evans E, Green D, Green, J (1992) Hoarseness after tracheal intubation. Anaesthesia 47: 213-216.
23. Aigbedia SO, Tobi KU, Amadasun FE (2017) A comparative study of ketamine gargle and lidocaine jelly application for the prevention of postoperative throat pain following general anaesthesia with endotracheal intubation. Niger J Clin Pract 20: 677-685.
24. Inoue S, Abe R, Tanaka Y, Kawaguchi M (2015) 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 115: 463-469.