

# Incidence and Risk Factors associated with Post-operative Nausea and Vomiting in Elective Adult Surgical Patients at Wolaita Sodo Teaching Referral Hospital: *An Institutional Based Cross-sectional Study*

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## Research

**Keywords:** Postoperative nausea and vomiting, Risk factors, Ethiopia

**Posted Date:** August 26th, 2020

**DOI:** <https://doi.org/10.21203/rs.3.rs-61502/v1>

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# Abstract

## Background

Postoperative nausea and vomiting is among the most common postoperative complications, despite modern anesthetics and surgical techniques. It can occur during the operation and persisting in the postoperative period cause reduces patient comfort, delayed discharge from the hospital and an increase in costs. The risk factors that affect the incidence of post-operative nausea and vomiting are multifactorial in origin and occur in 20 to 30% of all patients and can extend up to 60–70% in high-risk patients. The objective of this study was to determine the incidence and associated risk factors of postoperative nausea and vomiting.

## Methods

An institution-based, cross-sectional study was conducted from March to August 2019 in Wolaita Sodo University teaching referral hospital (WSUTRH). A total of 371 adult elective patients who operated during this period were included in the study. Data were collected by interviewing patients and reviewing their cards then entered and analyzed using SPSS version 25. Variables with *P* value less than  $< 0.2$  in the bivariate analysis were fitted into the multivariable logistic regression analysis to identify factors associated with postoperative nausea and vomiting and a *P* value of  $< 0.05$  was considered statistically significant.

## Results

The incidence of postoperative nausea and vomiting 24hour after surgery was 29.1%. In multivariable analysis, previous history of PONV (AOR = 5.1, 95%CI = 4.00-6.58), use of opioids (AOR = 4.91, 95%CI = 3.08–10.37), use of inhalational anesthetic agent (AOR = 2.38, 95%CI = 1.45–5.30), and long duration of surgery AOR = 6.65, 95%CI = 5.52–8.30) were significantly associated with the incidence of postoperative nausea and vomiting.

## Conclusions

The incidence of postoperative nausea and vomiting was high compared to other studies done in different settings. Previous history of PONV, use of opioids, use of inhalational anesthetic agents and long duration of surgery are predictors of postoperative nausea and vomiting. We recommend routine preoperative PONV risk evaluation and give antiemetic premedication for those high-risk patients.

## 1. Background

Postoperative nausea and vomiting (PONV) is one of the most common complications after general anesthesia, occurring in up to 80% [1, 2]. PONV is the most frequent complication to patients as more uncomfortable than postoperative pain[3].

Determination of the true incidence of PONV is difficult due to multiple risk factors and the lack of a single stimulus of onset [4]. PONV is associated with several risk factors, including age, sex, previous history of PONV, history of motion sickness, smoking, obesity, surgical and anesthetic related factors [5–8].

Apfel et al. developed a simplified risk score consisting of four predictors for PONV: female sex, history of motion sickness or PONV, nonsmoking status and the use of opioids for postoperative analgesia. If none, one, two, three or four of these risk factors were present, the incidences of PONV were 10%, 21%, 39%, 61% and 79%, respectively[1, 9].

A study done at a Japanese cancer center shows the incidence of PONV was 42.6% within the first 48hrs after operation. Female sex, previous history of PONV, prolonged anesthesia and remifentanil use during surgery were identified as risk factors for both nausea and vomiting [10].

The study done at Korea shows the incidence of PONV within the first 48 postoperative hours is 23%. In multivariate analysis, female, non-smoker, history of motion sickness or PONV, long duration of anesthesia (> 180 min), use of desflurane and intraoperative remifentanil infusion were independent risk factors for PONV [11].

Several adverse outcomes were encountered in concomitant with PONV, even though the quality of medical care gets improved through time. Studies done previously on PONV shows varied results and indicative values of previous studies initiated us to do this research.

The purpose of this study was to determine the incidence and associated risk factors of PONV 0-48hours after anesthesia in elective adult surgical patients at WSUTRH.

## **2. Methods**

### **2.1 Study design, setting and period**

Institutional based cross sectional study design was employed in adult elective surgical patients at wolaita sodo university teaching referral hospital from February 1 to August 30, 2019G.C. The hospital is one of the governmental teaching Hospitals, located in SNNPR region, wolaita zone, 330 km away from the capital Addis Ababa in south of Ethiopia.

### **2.2 Source Population**

All adult elective surgical patients operated under anesthesia during study period were included

### **2.3 Inclusion and Exclusion criteria**

All adult elective surgical patients  $\geq 18$  years were included in the study whereas Day case surgical patients who discharged before 24 hours and unconscious/uncooperative patients postoperatively were excluded from study.

## 2.4 Variables of the study

The outcome variable was postoperative nausea and vomiting. The independent variables were patient related factors (sex, age, BMI, previous history of PONV or motion sickness, non-smoking status and ASA physical status), Surgical factors (Type of surgery, duration of surgery and postoperative pain) and Anesthesia factors (Type of anesthetic techniques, use of volatile anesthetic agents, use of reversal agents, use of opioids either intra- or post-operatively).

## 2.5 Operational Definitions

### Postoperative nausea and vomiting

when a patient experienced at least one episode of nausea and vomiting within 24 h postoperatively

## 2.6 Sample size determination and sampling technique

The sample size determined by using a single proportion for a finite population with assumptions of CI = 95%, marginal error (d) = 5% and prevalence (p) = 0.362 taken from the study done in Ethiopia [12] and q = 1-p = 0.638. Therefore, this proportion was used to determine the sample size.

$$n = \frac{((Z_{\alpha/2})^2 \times (p) \times (q))}{d^2}$$
$$= \frac{((1.96)^2 \times (0.362) \times (0.638))}{(0.05)^2}$$

$$n = 355$$

When 5% of the nonresponse rate was added, the total number of patients who participated in the study was  $N = 373$ .

Every consecutive participants operated under anaesthesia during the study period was included.

## 2.6 Data management and data collection procedure

A data collector was trained by principal Investigators. Check list was prepared in English which includes socio demographic data, patient related factors, anesthesia related factors and surgery related factors. Questionnaires were prepared in English which includes nausea intensity assessment scale and incidence and severity of nausea and vomiting and the patients were interviewed by data collector. Data

collection was under taken by anesthetists in the OR and surgical nurses at the ward. Principal Investigator was cross check for completeness and consistency of data every day.

## **2.7 Data Processing and Analysis**

Data will be checked manually for completeness and then coded and entered into SPSS version 25 software package for analysis. Descriptive analysis will be performed to describe the number and percentage of socio-demographic characteristics of the sample and other variables. Binary logistic regression analysis will be made to obtain odds ratio and the confidence interval of statistical associations. Those variables with P-value of less than or equal to 0.2 will be selected for further analysis. The strength of statistical association will be measured by adjusted odds ratios and 95% confidence intervals and statistical significance will be declared at ( $P < 0.05$ ). Finally the results will be presented in text, tables, and graphs based on the types of data.

## **3. Results**

### **3.1 Sociodemographic and Patient Related Variables**

A study was conducted on 371 patients of which 212(57.1%) were males and 159(42.9%) were females. The age of the patient was in the range of 18–75 years with a mean age  $\pm$  SD of  $40.14 \pm 14.06$ . Majority of study participants 266(71.7%) were ASA I, while the remaining 87(23.5%) and 18(4.9%) were ASA II and ASA III, respectively. In this study 27(7.27%) of the study participants were having history of PONV, 9(3.32%) were having motion sickness and 13(3.5%) of patients were smokers. In addition the mean BMI  $\pm$  SD of the patient were  $23.12 \pm 3.76$  (Table 1).

Table 1  
Sociodemographic and patient related variables of adult patient underwent surgery in WSUTRH from March 1 to August, 2019GC. Data are in (mean  $\pm$  SD), number of participants and percentage (%).

Variables	(n = 371)
Age	40.14 $\pm$ 14.06
Sex	
Male	212(57.1%)
Female	159(42.9%)
BMI(Kg/m <sup>2</sup> )	23.12 $\pm$ 3.76
History of PONV	27(7.27%)
Presence of motion sickness (yes)	9(3.32%)
Smoking status (yes)	13(3.5%)
ASA physical status	
ASA I	266(71.7%)
ASA II	87(23.5%)
ASA III	18(4.9%)

## 3.2 Surgery Related Variables

The types of operations performed were abdominal 127(34.2%), orthopedics 84(22.6%), ENT, ophthalmology and maxillofacial 41(11.1%), gynecological 56(15.1%), urology 45(12.1%) and others 18(4.9%). The mean duration of surgery was 89.72  $\pm$  49.24 (mean  $\pm$  SD). Most of the patients 225(60.66%) have no postoperative pain but 99(26.54%) and 47(12.8%) complain mild and moderate pain respectively (Table 2).

Table 2  
Frequency of surgery related variables of adult patients underwent surgery in  
WSUTRH from March 1 to August, 2019GC.

Variables	Frequency (n)	Percentage (%)
Type of surgery		
Abdominal surgery	127	34.2%
Orthopedics	84	22.6%
ENT, ophthalmology and maxillofacial surgery	41	11.1%
Gynecological surgery	56	15.1%
Urology	45	12.1%
Others	18	4.9%
Duration of surgery		
≤ 90 minutes	254	68.5%
≥ 90 minutes	117	31.5%
Postoperative pain		
None	225	60.66%
Mild	99	26.54%
Moderate	47	12.8%

### 3.3 Anesthesia related variables

A total of 223 (60.1%) of patients were operated under General Anesthesia, 115(31%) and 33(8.9%) were under spinal anesthesia and peripheral nerve blocks respectively. In this study 105 (28.3%) of patients were premedicated with metoclopramide as an antiemetic preoperatively. Inhalational agent (halothane and isoflurane) were given to 152(41.1%) of the patients, 108(29.1%) was given reversal agent neostigmine and 146(39.46%) of patients were given opioids (morphine and pethidine) during intraoperative and postoperative time (Table 3).

Table 3  
Frequency of anesthesia related variables of adult patients underwent surgery at WSUTRH from March 1 to August, 2019GC.

Variables	Frequency (n)	Percentage (%)
Type of Anesthesia techniques		
General anesthesia	223	60.1%
Spinal anesthesia	115	31%
Peripheral nerve block	33	8.9%
Use of Antiemetic premedication	105	28.3%
Use of inhalational agent	152	41.1%
Use of reversal agent neostigmine	108	29.1%
Use of opioids intera and postoperatively	146	(39.46%)

### 3.4 Incidence of Postoperative Nausea and Vomiting

The overall incidence of postoperative nausea and vomiting was 108(29.1%). Of the total incidence of PONV, 91(24.53%) were having nausea and 17(4.58%) patients were having vomiting (Table 4).

Table 4  
Distribution of adult patients underwent surgery in WSUTRH based on postoperative nausea and vomiting from March 1 to August, 2019GC.

Variables	Frequency (n)	Percentage (%)
Nausea	91	24.53%
Vomiting	17	4.58%
Postoperative Nausea and Vomiting		
Yes	108	29.1%
No	263	70.9%

### 3.5 Factors associated with Postoperative Nausea and Vomiting

In multivariate analysis, factors associated with postoperative nausea and vomiting (PONV) were previous history of PONV (AOR (CI) of 5.1 (4.00–6.58)), use of opioids intera and postoperatively (AOR (CI) of 4.91 (3.08–10.37)), use of inhalational anesthetic agents (AOR (CI) of 2.38 (1.45–5.30)) and long duration of surgery (AOR (CI) of 6.65 (5.52–8.30)) (Table 5).

Table 5

Factors fitted into the multivariable logistic regression analysis in adult surgical patients who underwent surgery at WSUTRH from March 1 to August 30, 2019GC.

Variables		Postoperative nausea and vomiting		AOR	95% CI	P value
		Yes	No			
History of PONV	Yes	19	8	5.1	4.00-6.58	0.004
	No	89	218	1		
Use of opioids intra and postoperatively	Yes	63	83	4.91	3.08-10.37	0.001
	No	45	326	1		
Use of inhalational anesthetic agents	Yes	47	105	2.38	1.45-5.30	0.02
	No	61	310	1		
Duration of surgery	≤ 90 minutes	36	218	6.65	5.52-8.30	0.002
	≥ 90 minutes	72	45	1		

## 4. Discussion

This study was conducted to find out the incidence and associated factors of PONV in 24 postoperative hours. The overall incidence of PONV was 29.1%. This incidence was low compared with the previous studies conducted in the same study area Ethiopia in 2012 (36.2%) [12]. This may be explained by in the current study most of patients were premedicated with antiemetic as well patients operated under spinal and peripheral nerve block were incorporated.

The incidence of this study was slightly lower than a study done in Ghana (34%) [13] and Tanzania (41.4%) [14]. However, it was still higher than studies done in South Africa (27%) [15], and in Nigeria (4%) [16]. The discrepancies could be due to the differences in surgery and anaesthesia techniques and many patients were premedicated with antiemetic metoclopramide preoperatively (28.3%).

Related to the associated factors, having previous history PONV in adult surgical patients was about 2.91 times (AOR: 5.1, 95% CI: 4.00-6.58), more likely to had PONV when compared with no previous history of PONV. This result was in agreement with studies done in different setting like Ethiopia [12], Tanzania [14], Korea [17] and Uganda [18]. This might be due to over stimulated reflex arc for postoperative nausea and vomiting.

Use of opioids intra or postoperatively were 4.91 [AOR = 4.91; 95% CI (3.08–10.37)] more likely to have PONV compared to patients those didn't take opioid. This finding was similar to the study done in Malawi [18]. This might be due to opioids direct effect of stimulating the CTZ and vestibular apparatus, and also decreases motility of the gut which indirectly increases the occurrence of nausea and vomiting.

In our study use of inhalational anesthetic agents halothane and isoflurane were significant ( $p = 0.469$ ) and associated with PONV. This finding is in contrast to the study done in Japan and Nigeria [10, 16]. The reason for this could be usage of inhalational anesthetic agents for majority of patients which operated under general anesthesia in the study population (60.1%).

In contrast to Apfel's predictive model [1, 9] nonsmokers and female by gender which were among the main predictive factors were had no association with PONV. This might be due to incorporation of small number of elective adult participants in our study than Apfel's study in large participant.

Regarding duration of surgery (greater than 90 minutes) had an association with postoperative nausea and vomiting ( $p = 0.002$ ). This result was agreed with the studies conducted in Czech Republic [19] Korea [17] and Netherlands [20]. The explanation could be that as the duration of surgery increases anesthesia time also increase and more side effects of anesthetic agent may occur which result PONV. The other explanation might be an increase in surgery time which leads to excess fluid loss and hypotension which leads to intestinal hypoperfusion that results releases of a hormone serotonin which could lead to PONV.

Finally incorporation of study participants from different disciplines like gynecology ophthalmology, ENT and maxillofacial surgery were taken as the strength of the study. A potential limitation of this study is that it was conducted at a single center.

## 5. Conclusion

It is to conclude that the overall incidence of Postoperative nausea and vomiting were 29.1% which was higher compared with most studies conducted in the world. Previous history of PONV, use of opioids, use of inhalational anesthetic agent and long duration of surgery were significantly associated and predictors of postoperative nausea and vomiting (PONV).

## 6. Recommendations

We recommend routine preoperative PONV risk evaluation and give antiemetic premedication for those patients having high risk of PONV.

## Abbreviations

CTZ

Chemoreceptor triggering zone

GA

General Anesthesia  
GIT  
Gastro-intestinal System  
ICU  
Intensive Care Unit  
PACU  
Post-anesthesia care unite  
PONV  
Postoperative Nausea and Vomiting  
RA  
Regional Anesthesia  
SA  
Spinal Anesthesia  
WSU  
Wolaita Sodo University  
WSUTRH  
Wolaita Sodo University Teaching Referral Hospital

## **Declarations**

### **Ethics approval and consent to participate:**

Before data collection, ethical clearance and approval was obtained from Wolaita Sodo university ethical review committee and written consent taken from study participants.

#### **Consent for publication:**

Not applicable

#### **Availability of data and materials:**

The data sets used and analyzed during the study are available from the corresponding author on reasonable request.

#### **Competing interests:**

The authors declare that they have no competing interests.

### **Funding:**

It is self-funded

# Authors' contributions:

Both authors have participated equally.

# Acknowledgment:

The authors would like to thank Wolaita Sodo University, the research team and data collectors for their valuable works.

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