ORGINAL ARTICLE

PREVALENCE AND FACTORS ASSOCIATED WITH POSTOPERATIVE NAUSEA AND VOMITING AT THE UNIVERSITY OF GONDAR TEACHING HOSPITAL, NORTHWEST ETHIOPIA, 2012: A CROSS-SECTIONAL STUDY

Endale G/Egziabher G/medhn[1], Jessica Hoyle[2], Danielle Reddi [3], Tadesse Belayneh Melkie[1]*

ABSTRACT

***Background**: Postoperative nausea and vomiting is a common complication of anaesthesia and surgery. Despite modern anaesthetic and surgical techniques, the incidence of postoperative nausea and vomiting remains high. This common complication is unpleasant for patients and delays recovery. Despite the large case load at the University of Gondar Hospital, the magnitude of this problem is not kwon.*

***Objective:** The objective of this study was to determine the prevalence of postoperative nausea, and vomiting, and associated factors.*

***Methods:** A cross-sectional study was conducted from February 27 to April12, 2012 at the University of Gondar Teaching Hospital. A total of 509 patients who were operated on in this period were included in the study. We used a validated Amharic questionnaire to interview patients 24 hours postoperatively.*

***Results:** The prevalence of postoperative nausea and vomiting was 36.2% within 24 hours after operation. Factors that were associated with postoperative nausea were history of motion sickness (AOR=1.77, CI=1.14-2.75), previous history of postoperative nausea and vomiting (AOR=4.26, CI=1.70-10.69) and long duration of anaesthesia (AOR=3.49, CI=1.64-7.43). Factors associated with postoperative vomiting were previous postoperative nausea, vomiting (AOR=3.93, CI=1.70-9.07), major operation (AOR=3.07, CI=1.25-7.55), gynaecology operation (AOR=2.58, CI=1.24-5.39) and long duration of anaesthesia (AOR=3.67, CI=1.73-7.78).*

***Conclusion and recommendations:** The prevalence of postoperative nausea and vomiting was high at the University of Gondar teaching hospital compared with most studies conducted in Africa and the rest of the world. We suggest the use of anti-emetic prophylaxis and the introduction of postoperative nausea and vomiting treatment protocols at the University of Gondar teaching hospital.*

***Key words:** Postoperative nausea, postoperative vomiting, risk factors*

INTRODUCTION

Postoperative nausea and vomiting (PONV) is a common complication of anaesthesia and surgery. It is considered the most common cause of morbidity following anaesthesia and surgery, and has significant effects on patient satisfaction and cost. Despite modern anaesthetic and surgical techniques, the incidence of PONV remains high [1-3]. This common anaesthetic and surgical side effect has been reported to increase patient dissatisfaction and can be more distressing to patients than postoperative pain [4, 5]. Postoperative nausea and vomiting has multi factorial causes; patient anaesthesia and surgery related risk factors have been identified. Young age, female sex, history of PONV, non-smoking history and a history of severe motion sickness are patient related factors [6-8]. Prevention of PONV is important since it has psychological and physical effects, and it can also cause severe complications, such as oesophageal rupture, pneumothorax, incisional hernia, upper airway and postoperative pulmonary complications from the aspiration of vomitus, electrolyte imbalance and results in delayed discharge from hospital or re-admission after outpatient surgery [9-11].

A study done in Olomouc, Czech Republic, found that the prevalence of postoperative nausea was 13.4%. Patients suffering from motion sickness were predisposed to develop PONV. In smokers, the risk of developing PONV was markedly lower (8.7%)

[1]Department of Anaesthesia, School of Medicine, College of Medicine and Health Sciences, the University of Gondar, P.O.Box 196, Gondar, Ethiopia, [2]Department of Anaesthesia, Whipps Cross University Hospital, Whipps Cross Road, Leytonstone, London, E11 1NR, U.K, [3]Department of Anaesthesia, University College Hospital, 235 Euston Road, London, NW1 2BU, U.K
***Corresponding author:** Endale G/Egziabher, endalege@yahoo.com, *Mobile: +251910880117*

when compared to non-smokers (17.7%) [12]; however, the incidence of postoperative nausea and vomiting was relatively high (27%) in Black South Africans who smoked [13].

In a study conducted in Ghana, the incidence of PONV was 34.6%. PONV occurred between 2-6 hours after surgery in 49.0% of the patients and between 6-24 hours in 33.8% of the patients. The highest incidence of PONV occurred between the ages of 20 and 49 years [14].

A study conducted in Seoul, Korea, showed that the incidence of postoperative nausea and vomiting in postanesthesia care unit and on the wards was 27% and 21%, respectively. History of previous PONV or motion sickness and duration of anaesthesia were high risk factors for PONV [15]. Similarly in a study in Uganda patients who had a history of motion sickness were twice more likely to have PONV [2].

In a study in Mashhad, Iran, anaesthetic agents were the main risk factors [16]. Likewise, the incidence of postoperative nausea and vomiting in patients who were given propofol was 50% in ear, nose and throat (ENT) surgery [17]. A study conducted in Saar, Germany, found that the overall institutional incidence of postoperative nausea and vomiting was 36.5% [18].

A study conducted in Romania found that postoperative nausea and vomiting occurred in 77.5% of non-smokers [19]. In another study, female sex was a high risk factor for PONV consisting of 98.9% of all patients [20]. Other research conducted in Switzerland found that the incidence of postoperative vomiting in children was 38.9% within the first 24 hours after operation, [21] and also in children a study from Aligarh (India) found the incidence of postoperative vomiting to be 34% [22].

Despite the large case loads at the Gondar University Hospital, we do not know the magnitude of this problem. The aim of this study was to determine the prevalence of postoperative nausea and vomiting plus associated factors.

METHODS

Study design and period: A cross-sectional study was conducted at the University of Gondar teaching hospital from February 27 to April12, 2012.

Study area: The University of Gondar hospital, one of the largest hospitals in the country, provides health services for about 5 million people. The hospital has seven operating theatres, four for surgery and gynae - Obs, one for ophthalmology and two for fistula. There are two recovery rooms, one used for the recovery of surgery and gynaecology patients and the other for obstetric patients. The hospital has medical intensive care unit (ICU), but no surgical ICU.

Source population: All adult, paediatrics, elective and emergency patients who were operated on under anesthesia at the University of Gondar referral and teaching hospital.

Study population: All adult, paediatrics, elective and emergency patients who were operated on under anesthesia at the University of Gondar referral and teaching hospital during the study period.

Inclusion criteria: All adult, paediatric patients $\geq$ 5 years old, elective and emergency patients operated on under anesthesia in the study period were included.

Exclusion criteria: Patients unconscious postoperatively, operations that were performed in the Outpatient Department (OPD) and Emergency Outpatient Department (EOPD), patients who were re-operated on during the study period, eye operations that were performed under peripheral nerve block, surgical patients with concomitant medical illness that could lead to nausea and vomiting, and patients discharged before 24 hours postoperatively were excluded.

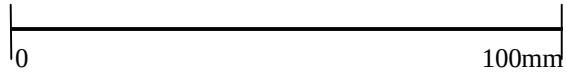
Dependent variables: Nausea and vomiting (yes/ no).

Independent variables: Socio-demographic variables (age, sex, religion and ethnicity), smoking history, previous history of PONV, history of motion sickness, history of surgery, history of anaesthesia, American Society of Anesthesiologists' (ASA) status, premedication, perioperative use of opioids, type of anaesthesia and anaesthetic drugs, analgesia and duration of surgery.

Operational Definitions

- ***Postoperative nausea:*** When the patient experienced at least one episode of nausea or more within 24 hours postoperatively
- ***Postoperative vomiting:*** When the patient experienced at least one episode of vomiting or more within 24 hours postoperatively
- ***Severity of postoperative nausea and vomiting:*** Is assessed using visual analog scale (VAS). Patients who experienced nausea and / or vomiting were

ordered to mark on a 100 millimeter long line to indicate the severity of post operative nausea and vomiting. The marked points were measured in millimeter by data collectors, and severity levels were scored as 0 to 4 mm= no nausea and vomiting, 5 to 44 mm= mild nausea and vomiting, 45 to 74 mm= moderate nausea and vomiting, and 75 to 100 mm= severe nausea and vomiting.



Sample size and sampling procedure: All consecutive patients who were operated on under anesthesia during the study period were included.

Data collection procedures: A pilot test was done on 25 patients and changes were made before the data collection. Amharic questionnaire was used to interview patients 24 hours postoperatively. The parents and/ or guardians were interviewed for children < 15 years old. Type of anaesthesia, anaesthetic drugs used, ASA status, premedication, perioperative opioid use, analgesia given, type of operation, duration of surgery and anaesthesia were collected from the anesthetic record sheet, patients' chart, surgery, ophthalmology and gynae-obs operation registration books. Two BSc degree anaesthetists were selected, and a one day training was given on complete data collection, and they were supervised by the investigators.

Data quality control: A pilot test was done; local language was used; data was cleaned and checked, and double data entry method was employed.

Data management and analysis: The data were coded, entered and analyzed using SPSS16. The Odds ratios and 95% confidence interval, binary and multiple logistic regressions were used to assess the association between dependent and independent variables. Each variable was first analyzed using binary logistic regression to identify the variables that could fit with regression table model (p-value<0.2), and those variables with P-value <0.2 were entered and further analyzed using multiple logistic regression. Tables used to show the frequency of variables.

Ethical considerations: Ethical clearance and official permission letters were obtained from the Institutional Ethical Review Board of the University of Gondar and the University of Gondar hospital, respectively. A written informed consent was obtained from the study subjects before the interview and patients who had postoperative nausea and vomiting during the study period were given advice, and their respective physicians and nurses were informed about the problem. Collected data were coded and kept locked.

RESULTS

Socio-demographic characteristics of the respondents:

A total of 525 patients were operated on during the study period. Sixteen patients were excluded from the study. Nine patients were discharged before 24 hours after operation, two due to incomplete records and five due to refusal to participate in the study.

Out of 525 patients, 509 were included in the study with a response rate of 99.6%. Females accounted for 60.7% of the patients. The age of 13.5% of the patients was in the range of 5-18, 71.5% in the range of 19-49, and 14.9% $\geq$50 years old.

The majority (92.7%) of the patients were Christians, and 7.3% Muslims. Most (94.7%) of the patients were Amhara while the rest (5.3%) were Tigray and Oromo by ethnicity.

Preoperative risk factors, types of anaesthesia and surgery:

The majority of the patients, 483 (94.9%), had no history of smoking; 129 (25.3%) had a history of motion sickness, and 26(5.1%) had a previous history of PONV. The majority, 359 (70.5%), were operated on under general anaesthesia with endotracheal intubation (GA with ETTI) and laryngeal mask airway (LMA).

The majority of the patients (60.1%) were given ketamine, (14.1%) propofol, (9.04%) thiopentone, (41.8%), suxamethonium, and (5.7%) pancuronium. For maintenance of anesthesia, 67.2% of the patients were given inhalational (halothane) and 8.7% intravenous anaesthetic drugs.

Pethidine was given to 4.5%, 5.5% and 2.8% of the patients preoperatively, intraoperatively and postoperatively, respectively. None of the operated patients were given anti-emetics during the perioperative period. The majority of the patients were given analgesia, (12.8%) pethidine, (44.4%) diclofenac, (0.4%) paracetamol, (1.4%) tramadol, and (0.2%) local infiltration (Table 1).

Table 1: The frequency of perioperative factors, University of Gondar teaching hospital, 2012 (N=509).

Factor		Frequency	Percentage (%)
Smoking	No	483	94.9
	Yes	26	5.1
Motion sickness	Yes	129	25.3
	No	380	74.7
Previous PONV	yes	26	5.1
	No	483	94.9
Type of anaesthesia	GA with ETT or LMA	359	70.5
	GA with sedation	65	12.8
	RA with SA	85	16.7
Postop pethidine	No	444	87.2
	Yes	65	12.8
Analgesia (pain)	No	273	53.63
	Yes	236	46.36

Types of operations performed were ear, nose, throat (ENT) and ophthalmology 67(13.2%), abdominal 157(30.8%), orthopedics 72 (14.1%), gynaecology 36 (7.5%), obstetrics 146 (28.7%) and urology 31 (6.1%) (Figure 1).

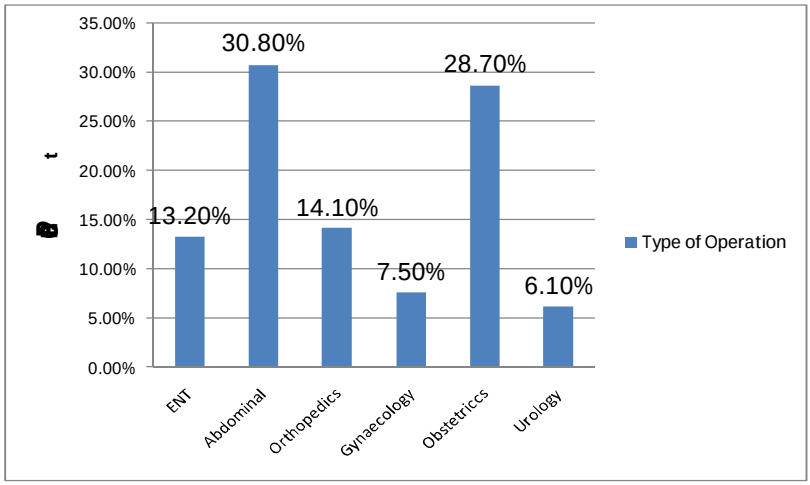


Figure 1: *Types of operations performed in University of Gondar teaching hospital, February27 to April12, 2012*

Prevalence of postoperative nausea and vomiting: The overall prevalence of postoperative nausea and vomiting at the University of Gondar teaching hospital among post surgical patients was 36.2% (95% CI=32.1%-40.4%).Ninety-seven patients (19.1%) suffered from both nausea and vomiting. Out of 509 patients, 325 (63.8%) were free from complications.

The overall prevalence of postoperative nausea was 35.2%, and nausea without vomiting occurred in 82 (16.1%) patients. Out of 179 patients who experienced nausea, 109 (60.89%) were females and 70 (39.1%) males. Of these, 9.0%, 18.3% and 7.9% patients experienced nausea within 0-2 hours, 2-6 hours and 6-24 hours after surgery, respectively, and on the visual analog scale, 10.6%, 10.2% and 14.3% of the patients had mild, moderate and severe nausea, respectively.

The overall prevalence of postoperative vomiting was 20.0%, and vomiting without nausea occurred in 5 patients (1%). Out of 102 patients who had vomiting, 65 (63.7%) were females while 37 (36.3%) males. Among these, 5.9%, 9.0% and 5.1% of the patients vomited within 0-2 hours, 2-6 hours and 6-24 hours after surgery, respectively, and on the visual analog scale 5.1%, 5.7% and 9.2% patients had mild, moderate and severe vomiting, respectively.

There was also a strong association between the outcome variables. Among 179 patients with nausea, 97 (54.2%) experienced vomiting. Conversely, among 102 patients with vomiting, 97 (95.1%) patients had nausea (Table2).

Table 2: Distribution of patients based on postoperative nausea and vomiting, University of Gondar teaching hospital, 2012 (N=509).

		Vomiting	
Nausea	**No**	**Yes**	**Total**
No	325	5	330
Yes	82	97	179
Total	**405**	**102**	**509**

Factors associated with postoperative nausea and vomiting:

Factors that were significantly (P value< 0.05) associated with postoperative nausea (PON), following multivariate analysis were non-smoking (AOR=18.04, CI=2.34-138.89), history of motion sickness (AOR=1.77, CI=1.14-2.75), previous history of PONV (AOR=4.26, CI=1.70-10.69) and long duration of anaesthesia (AOR=3.49, CI=1.64-7.43). The variables with a p-value of <0.2 from the binary logistic regression that had no association with postoperative nausea in the multivariate analysis were type of anaesthesia, muscle relaxant, opioid use, duration of surgery, and induction and maintenance drugs (Table 3).

Table3: Factors associated with postoperative nausea (PON): results of multivariate logistic regression analysis, University of Gondar teaching hospital, 2012 (N=509)

	Nausea				
Variable	**Yes**	**No**	**AOR**	**95% CI**	**P-Value**
Smoking					
No	178	305	18.04	2.34-138.89	0.005
Yes	1	25	1		
Motion sickness					
Yes	61	68	1.77	1.14-2.75	0.011
No	118	262	1		
Previous PONV					
Yes	19	7	4.26	1.70-10.69	0.002
No	160	323	1		
Duration of anaesthesia					
>60 minutes	111	153	3.49	1.64-7.43	0.001
<60minutes	68	77	1		
Gynae-Obs					
Obstetrics	41	104	0.53	0.29-0.54	0.03
Gynaecology	20	17	2.09	0.96-4.52	0.062
No	118	209	1		

Category reference: AOR=adjusted odds ratio, CI=confidence interval

Factors which had an association with postoperative vomiting (POV) after multivariate analysis were previous PONV (AOR=3.93, CI=1.70-9.07), major operation (AOR=3.07, CI=1.25-7.55), gynaecology operation (AOR=2.58, CI=1.24-5.39) and long duration of anaesthesia (AOR=3.67, CI=1.73-7.78). The variables with a p-value of <0.2 from the binary logistic regression that had no association with postoperative vomiting in multivariate analysis were smoking, motion sickness, type of anaesthesia, muscle relaxants, induction and maintenance anaesthetics drugs , and opioid use (Table 4).

Table 4: Factors associated with postoperative vomiting (POV): results of multivariate logistic regression analysis, University of Gondar teaching hospital, 2012 (N=509).

Variable	Vomiting		AOR	95% CI	P value
	Yes	No			
Previous PONV					
Yes	12	14	3.93	1.70-9.07	0.001
No	90	393	1		
Type of operation					
Major	95	331	3.07	1.25-7.55	0.015
Minor	7	76	1		
Gynae-obs					
Obstetrics	26	119	0.480	0.24-0.95	0.037
Gynaecology	15	22	2.58	1.24-5.39	0.012
No	61	266	1		
Duration of surgery					
>60 minutes	45	151	0.28	0.13-0.64	0.002
< 60minutes	57	256	1		
Duration of anaesthesia					
>60 minutes	67	197	3.67	1.73-7.78	0.001
<60minutes	35	210	1		

Category reference: AOR=adjusted odds ratio, CI=confidence interval

DISCUSSION

This study showed that the prevalence of postoperative nausea and vomiting (PONV) in the University of Gondar teaching hospital was 36.2%. This finding was high compared with previous studies conducted in Nigeria (4%) [1], South Africa (27%) [13], and Ghana (34%) [14].This high difference in prevalence may be due to differences in surgery and anesthesia techniques and study designs.

But this finding was low compared with a study conducted in Uganda where the prevalence was 40.7% [2].This difference might be due to the fact that many patients were given propofol in Uganda which has anti-emetic effect (14% VS 1.6%). Since children were included in this study, they could not remember what they experienced.

In this study, history of motion sickness had a positive association with postoperative nausea (p=0.011). Patients who had history of motion sickness were twice more likely to have postoperative nausea which was similar to studies conducted in Uganda [2], Czech Republic [12], India [23] and the Netherlands [29]. This could be because such patients have well-developed reflex arc for PONV which could be aggravated by moment of patient's head during the transfer of the patient from the operation table to the stretcher and from stretcher to bed after operation which might also cause vestibular apparatus moment that could cause postoperative nausea and vomiting.

Although non cigarette smoking is one of the main predictive factors for postoperative nausea and vomiting (from Apfel's predictive model), we found no association with postoperative vomiting (PON) in this study. Although, it has a strong statistical association with postoperative nausea (P value=0.005, AOR=18.04, 95%CI=2.34-138.89), but it is difficult to generalize since 95% CI is too wide. This might be due to the small sample size of our study.

Previous history of PONV had a significant association with postoperative nausea (PON) and postoperative vomiting (p=.0.002 and p=0.001), respectively. Patients with previous history of postoperative nausea and vomiting were four times more likely to develop nausea and vomiting than their counter parts. This finding was in agreement with studies in Uganda [2] and the Netherlands [29]. This could be because these patients had overdeveloped reflex arc for postoperative nausea and vomiting.

Even though, female sex and opioid use were among the main predictive factors for PONV from Apfel's predictive model, they had no association with

PONV in this study. This might be due to the small number of patients in this study compared with Apfel's study where 1040 patients were included [20, 26].

Duration of anaesthesia (greater than an hour) had an association with postoperative nausea (p=0.001) and postoperative vomiting (p=0.001). Similar findings were reported by a study conducted in the Czech Republic [12]. This could be because as the duration of anaesthesia increases, more anaesthetic drugs which increases side effects including POV are likely to be given. The other possible explanation could be that since most anesthetic drugs have cardiovascular depressants and vasodilatation effects, they could cause hypotension which leads to intestinal hypoperfusion. Intestinal hypoperfusion might cause releases of serotonin which could lead to PONV through stimulation of vagal afferents in the gastrointestinal tract.

Gynaecology operations were positively associated with postoperative vomiting (p=0.012).This finding was consistent with studies conducted in Nigeria [1], Belgium [8], Czech Republic [12], India [23], Carolina [24], Brazil [28], and the Netherland [29].This could be because of hormonal effects like progesterone which have emetogenic effects.

In this study, major operations had an association with postoperative vomiting (p=0.015).This association could be due to the release of serotonin from damaged tissues, and the release of catecholamines due to surgery and anaesthesia induced stress. In addition to this, during major operation, more anaesthetic drugs could be deposited in the body tissues which could increase the side effect of anaesthetic drugs, including PONV. No association was found between major operations and postoperative vomiting in Germany [25, 27]. The possible explanation for this difference might be the differences in anaesthetic and surgical techniques, and postoperative patient management.

Strength of the study: The strength of this study was that all disciplines were addressed,: gynecology and obstetrics, surgery, ophthalmology, ENT, emergency, elective, adult and paediatric patients. We also used a very sensitive data collection method.

Limitations of the study: Some factors, such as body mass index, intraoperative vital signs, postoperative hypoxia and hypotension, and time of first postoperative oral intake were not addressed due to constraint of time.

CONCLUSION

The overall prevalence of postoperative nausea and vomiting was high in the University of Gondar teaching hospital compared with most studies conducted in Africa and the rest of the world. History of motion sickness, previous history of PONV and long duration of anaesthesia were predictors of postoperative nausea (PON). Previous history of PONV, major operations, gynaecology operations, and long duration of anaesthesia were associated with postoperative vomiting (POV).

RECOMMENDATIONS

We suggest the use of anti - emetic prophylaxis and introduction of postoperative nausea and vomiting treatment protocols in the University of Gondar teaching hospital.

We feel that the incorporation of history of motion sickness and previous history of postoperative nausea and vomiting (PONV) are valuable in the preoperative anaesthetic assessment form.

Anaesthetists and surgeons need to discuss the time management during operation.

We suggest a further study with a large sample size to determine the effect of non-cigarette smoking on the prevalence of postoperative nausea and vomiting in our population.

Conflict of interest: The authors declare that they have no any conflict of interests.

Authors' contribution: EG conceived the study and developed the proposal, participated in data collection, analyzed the data and drafted the paper. JH, DR and TB approved the proposal with some revisions, participated in data collection and analysis. All authors participated in the preparation of the manuscript and approved the final manuscript.

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