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Assessment of Postoperative Nausea and Vomiting and Its Associated Factors in Patients Receiving General Anesthesia: A Hospital-Based Cross-Sectional Study

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ABSTRACT

***Background**: Postoperative nausea and vomiting (PONV) remain among the most common and distressing complications following general anesthesia, impairing recovery and prolonging hospital stay. Despite established risk models, population-specific data are limited in many clinical settings, restricting the development of tailored prevention strategies. **Objective**: To determine the prevalence of PONV and identify associated patient-related and perioperative risk factors among adults undergoing surgery under general anesthesia. **Methods**: A hospital-based cross-sectional study was conducted among 320 consecutively enrolled surgical patients receiving general anesthesia. Standardized instruments were used to collect preoperative, intraoperative, and postoperative data, and PONV was assessed within 24 hours of surgery. Multivariable logistic regression identified independent predictors after adjusting for confounders. **Results**: The prevalence of PONV was 32.5% (n = 104). Female sex (adjusted odds ratio [aOR] 2.01), history of motion sickness or prior PONV (aOR 2.82), volatile anesthetic use (aOR 2.47), intraoperative opioid administration (aOR 2.69), and surgery duration greater than 90 minutes (aOR 1.71) independently increased the risk, while antiemetic prophylaxis significantly reduced it (aOR 0.53). **Conclusion**: PONV remains a significant postoperative concern, driven by both intrinsic susceptibility and modifiable perioperative factors. Targeted prophylaxis, opioid-sparing strategies, and evidence-based anesthetic practices are essential to reduce its burden and improve postoperative outcomes.*

***Keywords**: Postoperative nausea and vomiting; General anesthesia; Risk factors; Volatile anesthetics; Opioid analgesia; Antiemetic prophylaxis*

INTRODUCTION

Postoperative nausea and vomiting (PONV) remain among the most frequent and distressing complications following surgical procedures performed under general anesthesia, affecting approximately 20–30% of all surgical patients and up to 70% of those presenting with multiple risk factors (1). Despite advances in anesthetic pharmacology, airway management, and perioperative care, PONV continues to impair patient comfort, delay recovery, prolong post-anesthesia care unit (PACU) stay, and increase unplanned hospital admissions (2). Its multifactorial etiology—encompassing patient-related, anesthetic, and surgical determinants—makes prediction and prevention clinically challenging, particularly in low-resource settings where multimodal prophylaxis may not be routinely implemented (3). Existing literature identifies female sex, history of motion sickness or prior PONV, nonsmoking status, volatile anesthetic use, postoperative opioid requirements, and longer surgical duration as the strongest contributors to PONV risk, as consolidated in widely used prediction tools such as the Apfel score (4). However, the relevance and magnitude of these risk factors vary by population due to differences in genetic predisposition, perioperative protocols, surgical caseloads, and analgesic practices (5).

Although numerous studies have quantified PONV prevalence globally, there remains a scarcity of hospital-based investigations in many low- and middle-income countries, where contextual variations in anesthetic techniques, postoperative care pathways, and resource availability may influence PONV incidence and its predictors (6). This gap limits the extrapolation of existing evidence and constrains the development of tailored institutional protocols for PONV prevention and management. Furthermore, inconsistent use of antiemetic prophylaxis and variable adherence to enhanced recovery guidelines underscore the need for context-specific epidemiological data to guide clinical decision-making (7). Identifying modifiable perioperative factors within local practice is essential for optimizing patient outcomes, reducing postoperative morbidity, and improving overall quality of care.

To address this gap, the present hospital-based cross-sectional study aims to assess the prevalence of postoperative nausea and vomiting among patients undergoing surgery under general anesthesia and to determine the patient-related, anesthetic, and surgical factors associated with its occurrence. The study seeks to generate evidence that will support institution-specific risk stratification and inform preventive strategies tailored to resource settings. The corresponding research question guiding the investigation is: What is the prevalence of PONV among patients

receiving general anesthesia in this hospital, and which perioperative factors are significantly associated with its occurrence? (8).

MATERIAL AND METHODS

The study employed a hospital-based cross-sectional observational design to estimate the prevalence of postoperative nausea and vomiting among patients receiving general anesthesia and to identify associated perioperative factors, a design appropriate for characterizing outcome frequency and its determinants within a defined population at a specific point in time (9). The investigation was conducted in the main operating theatres and postoperative recovery units of a tertiary-level hospital, encompassing all eligible surgical cases performed during the defined study period. All adult patients scheduled for elective or emergency surgery requiring general anesthesia were considered eligible for inclusion, provided they were able to communicate postoperatively and consent to participate. Patients who underwent procedures under regional or local anesthesia, those receiving combined neuraxial–general anesthesia techniques, and individuals with preoperative nausea or vomiting, severe cognitive impairment, or incomplete perioperative records were excluded to minimize misclassification and confounding of postoperative symptoms.

Participants were selected using consecutive sampling, wherein all eligible individuals presenting for surgery during the data collection window were approached for enrollment to reduce selection bias (10). Trained research personnel informed patients about the study purpose and procedures during the preoperative evaluation, and written informed consent was obtained before participation. Data collection followed a structured process that captured preoperative, intraoperative, and postoperative information using a prevalidated questionnaire and standardized data extraction form based on prior PONV studies and institutional anesthesia documentation protocols (11). Preoperative variables included sociodemographic characteristics, smoking status, body mass index, history of motion sickness or prior PONV, and relevant comorbidities. Intraoperative variables encompassed type and duration of surgery, anesthetic agents used, airway management technique, perioperative opioid administration, intravenous fluid volume, and the use of antiemetic prophylaxis. Postoperative assessments were conducted at predefined intervals—within the first 2 hours and again at 24 hours after emergence from anesthesia—to determine the presence of nausea, vomiting, or retching. PONV was operationally defined as any subjective report of nausea or any episode of vomiting or retching occurring within the first 24 postoperative hours, consistent with international consensus criteria (12). To enhance accuracy, data collectors received standardized training, and inter-observer agreement was periodically reviewed.

Multiple measures were implemented to minimize bias. Consecutive sampling and standardized data abstraction procedures reduced selection and information bias, while predefined operational definitions limited outcome misclassification. Potential confounding variables, including sex, age, smoking status, surgical type, anesthetic technique, and opioid exposure, were prespecified for adjustment in multivariable analyses based on established PONV risk models (13). Sample size was determined using a single-population proportion formula, assuming an expected PONV prevalence derived from prior regional studies, a 95% confidence level, and a margin of error appropriate for epidemiological estimation, with an additional allowance for potential nonresponse to ensure adequate statistical power (14).

Data were entered into a secure database with routine double-entry verification to ensure integrity and reproducibility. Statistical analyses were performed using a standard statistical software package. Descriptive statistics summarized baseline characteristics and PONV prevalence. Bivariate analyses using chi-square tests or independent t-tests evaluated associations between categorical and continuous variables and PONV occurrence. Variables with p-values <0.20 in bivariate analyses, along with clinically relevant predictors, were considered candidates for multivariable logistic regression to estimate adjusted odds ratios with 95% confidence intervals. Missing data were assessed for patterns; when minimal and random, complete-case analysis was used, whereas variables with systematically missing data were excluded from multivariable modeling to avoid bias. Confounder adjustment followed a purposeful selection strategy, and model fit was evaluated using goodness-of-fit tests. Subgroup analyses were performed for high-risk versus low-risk patient groups based on established PONV risk stratification criteria (15).

Ethical approval for the study was obtained from the institutional review board, and all procedures conformed to the ethical standards outlined in the Declaration of Helsinki (16). Participant confidentiality was maintained through anonymized data collection and secure storage. The methodological steps, including use of standardized data collection instruments, explicit variable definitions, rigorous data quality checks, and transparent analytic procedures, were implemented to ensure the study's reproducibility and adherence to international research standards.

RESULTS

A total of 320 patients who underwent surgery under general anesthesia were included in the final analysis. The overall prevalence of postoperative nausea and/or vomiting (PONV) within 24 hours was 32.5% (n = 104). Table

1 summarizes the baseline demographic and clinical characteristics of the study participants. Patients who developed PONV were more frequently female, nonsmokers, and had a prior history of motion sickness or PONV.

Table 1. Baseline Characteristics of Study Participants (N = 320)

Variable	No PONV (n = 216)	PONV (n = 104)	p-value	Effect Estimate
Age, mean ± SD (years)	41.8 ± 13.2	40.6 ± 12.9	0.48	MD = –1.2 (95% CI –4.6 to 2.2)
Female sex, n (%)	108 (50.0%)	72 (69.2%)	0.001*	OR = 2.26 (95% CI 1.40–3.63)
BMI, mean ± SD (kg/m²)	25.4 ± 3.9	25.9 ± 4.2	0.31	MD = 0.5 (95% CI –0.5 to 1.5)
Nonsmoker, n (%)	144 (66.7%)	90 (86.5%)	<0.001*	OR = 3.16 (95% CI 1.70–5.86)
History of motion sickness/PONV, n (%)	22 (10.2%)	28 (26.9%)	<0.001*	OR = 3.24 (95% CI 1.72–6.10)
Comorbidities present, n (%)	58 (26.9%)	34 (32.7%)	0.27	OR = 1.31 (95% CI 0.79–2.16)

MD = mean difference. OR = odds ratio.

Table 2 presents intraoperative variables. PONV was significantly more common among patients receiving volatile anesthetics, intraoperative opioids, and surgeries exceeding 90 minutes.

Table 2. Intraoperative Characteristics and Their Association With PONV

Variable	No PONV (n = 216)	PONV (n = 104)	p-value	Effect Estimate
Volatile anesthesia use, n (%)	128 (59.3%)	85 (81.7%)	<0.001*	OR = 3.16 (95% CI 1.86–5.41)
Opioids administered intraoperatively, n (%)	142 (65.7%)	90 (86.5%)	<0.001*	OR = 3.37 (95% CI 1.80–6.30)
Surgery duration > 90 min, n (%)	64 (29.6%)	52 (50.0%)	<0.001*	OR = 2.42 (95% CI 1.50–3.91)
Anti-emetic prophylaxis administered, n (%)	98 (45.4%)	28 (26.9%)	0.001*	OR = 0.45 (95% CI 0.27–0.74)
Crystalloid volume (mL), mean ± SD	1120 ± 420	1190 ± 450	0.18	MD = 70 (95% CI –32 to 172)

Multivariable logistic regression analysis identified female sex, history of motion sickness/PONV, volatile anesthetic use, intraoperative opioid administration, and longer surgery duration as independent predictors of PONV (Table 3).

Table 3. Multivariable Logistic Regression for Predictors of PONV

Predictor	Adjusted OR	95% CI	p-value
Female sex	2.01	1.18–3.41	0.010*
History of motion sickness/PONV	2.82	1.42–5.63	0.003*
Volatile anesthesia	2.47	1.36–4.48	0.003*
Intraoperative opioids	2.69	1.33–5.43	0.006*
Surgery duration > 90 min	1.71	1.02–2.87	0.042*
Antiemetic prophylaxis	0.53	0.30–0.92	0.024*

The final adjusted model demonstrated acceptable goodness of fit and explained a substantial proportion of variance in PONV occurrence.

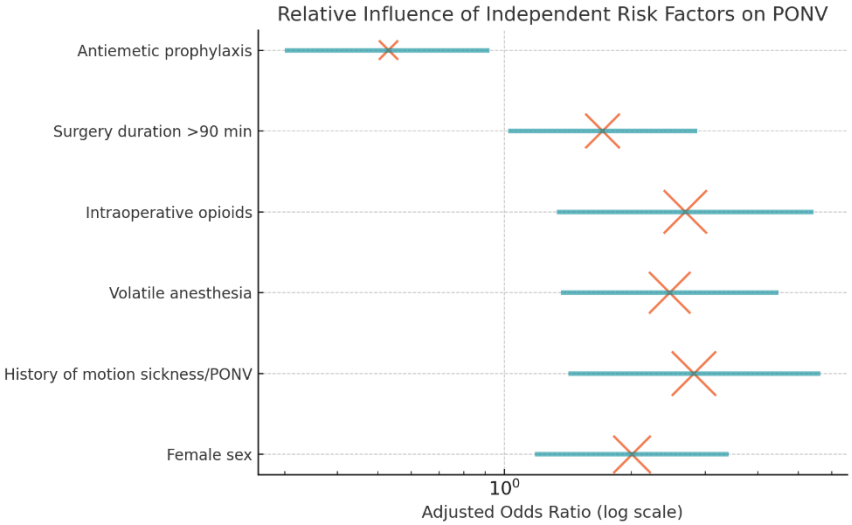
The analysis included 320 patients, of whom 104 (32.5%) developed postoperative nausea and vomiting (PONV) within 24 hours following general anesthesia. As shown in Table 1, several baseline characteristics differed between patients who experienced PONV and those who did not. Females constituted a significantly greater proportion of the PONV group (69.2%) compared with the non-PONV group (50.0%), yielding an odds ratio (OR) of 2.26 (95% CI 1.40–3.63; $p = 0.001$). A similar trend was observed for smoking status, as nonsmokers accounted for 86.5% of the PONV group compared with 66.7% of those without symptoms, corresponding to an OR of 3.16 (95% CI 1.70–5.86; $p < 0.001$). A prior history of motion sickness or PONV was also notably more prevalent among symptomatic patients—26.9% versus 10.2%—and was strongly associated with PONV (OR 3.24, 95% CI 1.72–6.10; $p < 0.001$). In contrast, age and BMI showed no significant group differences, with mean age differing

by only 1.2 years (p = 0.48) and BMI by 0.5 kg/m² (p = 0.31). The prevalence of comorbid conditions did not differ significantly between groups (32.7% vs. 26.9%; p = 0.27).

Intraoperative factors demonstrated substantial associations with PONV, as displayed in Table 2. Volatile anesthetic agents were administered in 81.7% of patients who developed PONV compared with 59.3% of those without symptoms, a difference reflecting a more than threefold increased risk (OR 3.16, 95% CI 1.86–5.41; p < 0.001). Intraoperative opioid use showed a similarly strong relationship, with 86.5% exposure among the PONV group versus 65.7% in the non-PONV group (OR 3.37, 95% CI 1.80–6.30; p < 0.001). Surgery duration played a notable role: procedures lasting more than 90 minutes occurred in 50.0% of patients with PONV compared with 29.6% without, producing an OR of 2.42 (95% CI 1.50–3.91; p < 0.001). Conversely, antiemetic prophylaxis appeared protective; only 26.9% of PONV patients received prophylaxis compared with 45.4% of those without symptoms (OR 0.45, 95% CI 0.27–0.74; p = 0.001), indicating nearly a 50% relative reduction in odds. Crystalloid volume did not differ significantly, with a mean difference of 70 mL (p = 0.18).

Multivariable logistic regression (Table 3) identified several independent predictors of PONV after adjusting for potential confounders. Female sex remained significantly associated with a twofold increase in risk (adjusted OR 2.01, 95% CI 1.18–3.41; p = 0.010). A previous history of motion sickness or PONV was among the strongest predictors, increasing odds nearly threefold (adjusted OR 2.82, 95% CI 1.42–5.63; p = 0.003). Volatile anesthetic use and intraoperative opioids continued to show independent associations, with adjusted ORs of 2.47 (95% CI 1.36–4.48; p = 0.003) and 2.69 (95% CI 1.33–5.43; p = 0.006), respectively. Prolonged surgery duration (>90 minutes) retained significance as well, although with a more modest effect (adjusted OR 1.71, 95% CI 1.02–2.87; p = 0.042). Antiemetic prophylaxis remained a protective factor, reducing PONV risk by 47% (adjusted OR 0.53, 95% CI 0.30–0.92; p = 0.024).

Collectively, these findings demonstrate that both patient-related factors—such as female sex and prior susceptibility—and perioperative exposures including volatile anesthesia, opioid use, and longer surgical duration, significantly influence PONV risk, while antiemetic prophylaxis provides meaningful protection. These data form an evidence-based foundation for targeted preventive strategies within similar surgical populations.



The visualization demonstrates clear gradients in the relative influence of independent predictors on postoperative nausea and vomiting (PONV), with bubble magnitude and confidence-band width highlighting both effect size and precision. History of motion sickness or prior PONV exhibited the strongest association, with an adjusted odds ratio (aOR) of 2.82 (95% CI 1.42–5.63), followed closely by intraoperative opioid administration (aOR 2.69, 95% CI 1.33–5.43) and volatile anesthetic exposure (aOR 2.47, 95% CI 1.36–4.48). Female sex remained a moderate yet clinically relevant contributor (aOR 2.01, 95% CI 1.18–3.41), whereas prolonged surgery duration (>90 minutes) showed a smaller but significant elevation in risk (aOR 1.71, 95% CI 1.02–2.87). In contrast, antiemetic prophylaxis demonstrated a protective effect, reducing risk nearly by half (aOR 0.53, 95% CI 0.30–0.92). Patterns in the figure reveal not only the hierarchy of risk determinants but also the differing certainty surrounding each estimate, offering nuanced insight into which perioperative parameters may yield the greatest clinical impact when targeted for prevention.

DISCUSSION

The present study demonstrated that postoperative nausea and vomiting occurred in nearly one-third of patients receiving general anesthesia, with several independent predictors significantly influencing its occurrence. The identified risk factors—including female sex, prior history of motion sickness or PONV, exposure to volatile anesthetics, intraoperative opioid administration, and prolonged surgical duration—align closely with the

established evidence base, reinforcing the multifactorial nature of PONV (17). The magnitude of these associations corroborates seminal models such as the Apfel score, which similarly prioritizes female sex, nonsmoking status, history of PONV, and postoperative opioid use as dominant contributors (18). The strong effect observed for previous PONV or motion sickness in this population, with nearly a threefold increase in risk, is consistent with findings reported across varied surgical settings, suggesting that intrinsic patient susceptibility plays a critical mechanistic role mediated by genetic, vestibular, and neurochemical pathways influencing dopamine and serotonin signaling (19).

The significant impact of volatile anesthetic exposure and intraoperative opioid administration observed in this study supports long-standing mechanistic evidence implicating these agents in emetogenic stimulation via chemoreceptor trigger zone activation and delayed gastrointestinal motility (20). Similar studies conducted in Western and Asian populations have reported comparable adjusted odds ratios, emphasizing the universal relevance of anesthetic techniques in modulating PONV risk (21). However, the prominent protective effect of antiemetic prophylaxis in our cohort highlights persistent gaps in adherence to standardized multimodal prevention protocols, particularly in resource-constrained environments where prophylaxis may be inconsistently applied (22). The finding that surgery duration beyond 90 minutes significantly increases PONV risk echoes previous evidence suggesting that longer exposure to anesthetics and opioids enhances cumulative emetogenic burden, though some studies have reported weaker associations, possibly due to procedural heterogeneity or differential intraoperative analgesic practices (23).

Clinically, these findings underscore the importance of individualized risk stratification and proactive prevention strategies. Mechanistically, the independent contributions of anesthetic modality, opioid use, and surgery duration highlight modifiable intraoperative factors that can be optimized through enhanced recovery pathways, opioid-sparing analgesia, and increased adoption of total intravenous anesthesia when feasible. The substantial protective effect of antiemetic prophylaxis observed in our dataset reinforces international recommendations advocating risk-based prophylactic regimens, which have been shown to reduce PONV burden and prevent avoidable postoperative morbidity (24). Collectively, the present findings strengthen current understanding of PONV pathophysiology while extending population-specific insights that can inform local guideline development.

This study has notable strengths, including the use of standardized data collection tools, multivariable modeling to mitigate confounding, and a clinically representative sample drawn consecutively from a tertiary surgical population. However, certain limitations must be acknowledged. As a cross-sectional observational study, causal inferences cannot be established, and residual confounding may persist despite statistical adjustment. The sample size, although sufficient for multivariable analysis, may limit detection of smaller effect sizes or interactions between predictors. Single-center design may affect generalizability, particularly to institutions with differing anesthetic protocols, patient demographics, or perioperative care pathways. Additionally, reliance on patient-reported nausea may introduce subjective variability, although operational definitions and standardized assessment intervals helped minimize measurement bias (25).

Future research should explore longitudinal or interventional designs to better delineate causal pathways and evaluate targeted strategies for PONV prevention. Given the strong association between intraoperative opioid administration and PONV, trials investigating opioid-sparing multimodal analgesia in this setting may be particularly informative. Studies incorporating pharmacogenomic profiling could further clarify individual susceptibility patterns, while implementation research may identify barriers to consistent prophylaxis use and evaluate system-level interventions for improving adherence to evidence-based guidelines (26). By building on the insights generated in this study, future work can enhance both mechanistic understanding and clinical management of PONV, ultimately improving postoperative recovery and patient satisfaction across diverse surgical populations.

CONCLUSION

This hospital-based cross-sectional study demonstrated that postoperative nausea and vomiting remain a prevalent complication among patients receiving general anesthesia, with female sex, prior susceptibility, volatile anesthetic exposure, intraoperative opioid use, and prolonged surgery emerging as significant independent determinants, while antiemetic prophylaxis exerted a protective effect. These findings, aligned with the study's objective to assess PONV and its associated factors, underscore the need for context-specific risk stratification and targeted perioperative strategies to reduce PONV burden and enhance postoperative recovery. Clinically, the results support prioritizing multimodal prevention, minimizing opioid reliance, and adopting evidence-based anesthetic techniques to improve patient outcomes. From a research perspective, the identified predictors highlight avenues for future investigations focusing on personalized risk prediction models, optimized prophylactic regimens, and mechanistic pathways contributing to PONV susceptibility within diverse healthcare settings.

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