



## Patient and Perioperative Correlates of Nausea and Vomiting after General Anesthesia: A Cross-Sectional Study

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### ABSTRACT

Postoperative nausea and vomiting (PONV) remain a frequent complication of general anesthesia, a drug-induced state characterized by unconsciousness and suppression of protective reflexes. The present investigation examined which patient and perioperative characteristics were related to PONV at Royal Prima Hospital in Medan. An analytical cross-sectional observational design was applied to 86 patients who satisfied the inclusion and exclusion criteria and were recruited through convenience (accidental) sampling. Evaluated characteristics comprised age, gender, smoking history, previous motion sickness and/or PONV, anesthetic technique, opioid exposure, and surgical type and duration. Bivariate comparisons employed chi-square, Fisher's exact, and Kolmogorov-Smirnov tests, as applicable. Statistical evidence of an association was found for smoking history, prior motion sickness and/or PONV, gender, anesthetic technique, and surgical duration ( $p < 0.05$ ). Age, opioid exposure, and surgical type did not meet the threshold for significance ( $p > 0.05$ ). These results identify a combination of patient characteristics and procedural factors associated with PONV in the hospital's general anesthesia population.

**Keywords:** General anesthesia; general anesthetic technique; use of opioids; postoperative nausea and vomiting

### INTRODUCTION

Pharmacological suppression of consciousness and protective reflexes allows surgery to proceed under general anesthesia [1]. Although general anesthesia is essential for facilitating surgical procedures, patients may experience adverse effects during the postoperative recovery period. Nausea, retching, or vomiting may occur after anesthesia and are collectively termed postoperative nausea and vomiting (PONV). PONV remains one of the most common complications following general anesthesia despite continuous improvements in anesthetic agents, techniques, and perioperative care [2]. The occurrence of these symptoms can affect patient comfort and may interfere with the early stages of recovery following surgery.

The consequences of PONV extend beyond temporary postoperative discomfort. Repeated nausea and vomiting may contribute to dehydration and electrolyte imbalance and can increase postoperative pain and discomfort. Vomiting may also place stress on surgical wounds and potentially contribute to wound complications. In addition, the possibility of aspiration represents an important clinical concern, particularly in patients who have not fully recovered from the effects of anesthesia. PONV may further delay recovery and require longer observation in the recovery room, potentially increasing healthcare resource utilization and expenditure [3]. Therefore, understanding factors

associated with PONV is important not only for improving patient comfort but also for supporting efficient postoperative recovery. Identifying patients who may be more susceptible to PONV can provide a basis for appropriate perioperative monitoring, preventive strategies, and postoperative management.

The occurrence of PONV is influenced by multiple factors that can be broadly categorized as patient-related and perioperative characteristics. Patient-related factors include age, gender, smoking status, and a history of motion sickness or previous PONV. These characteristics may reflect individual differences in susceptibility to nausea and vomiting following anesthesia and surgery. Meanwhile, perioperative factors include the general anesthetic technique, exposure to volatile anesthetic agents, opioid administration, surgical type, and the duration of the procedure [4], [5], [6], [7]. The interaction between these patient and perioperative characteristics may contribute to differences in the occurrence of PONV among patients undergoing general anesthesia.

The relationship between these factors and PONV, however, is not necessarily consistent across different clinical settings. Variation in the characteristics of patients included in individual studies, operative case mix, anesthetic and medication regimens, use of antiemetic prophylaxis, and methods of assessing PONV may produce different patterns of association.

Consequently, findings regarding particular patient or perioperative characteristics may not always be directly transferable from one hospital or patient population to another. Examining these correlates within a specific clinical setting is therefore important for determining whether previously reported associations are also observed among patients receiving general anesthesia in that setting.

Hospital-specific evidence is particularly relevant when differences in patient populations and anesthetic practices may limit the transferability of findings. Previous investigations have identified associations between PONV and gender and the length of surgery, whereas findings concerning age, smoking, anesthetic technique, opioid administration, and surgical type have been inconsistent [8], [9]. Such inconsistencies suggest that the contribution of individual patient and perioperative characteristics may vary according to the population and clinical circumstances being studied. Further investigation is therefore warranted to clarify the patterns of association between these characteristics and PONV.

In this context, Royal Prima Hospital in Medan provides a relevant clinical setting for examining patient and perioperative correlates of nausea and vomiting following general anesthesia. A cross-sectional assessment of patients undergoing surgery can provide information on whether the occurrence of PONV differs according to selected patient-related characteristics, including age, gender, smoking history, and history of motion sickness, as well as perioperative characteristics, including general anesthetic technique, opioid use, surgical type, and duration of the procedure. Accordingly, this study aims to examine the association between these patient and perioperative characteristics and the occurrence of PONV after general anesthesia at Royal Prima Hospital in Medan. The findings are expected to contribute to a better understanding of factors associated with PONV in the local clinical setting and provide evidence that may support more targeted perioperative assessment and postoperative monitoring.

## RESEARCH METHODS

Between February and August 2026, 86 eligible patients receiving general anesthesia for surgery were

recruited from the inpatient wards of Royal Prima Hospital in Medan through convenience (accidental) sampling. Their data were examined using an analytical observational design with a cross-sectional approach.

Enrollment was restricted to adults aged 18-60 years undergoing elective procedures under general anesthesia and classified as American Society of Anesthesiologists (ASA) physical status I-II. Pregnancy, preoperative nausea or vomiting, and a need for intensive care after surgery were grounds for exclusion.

The occurrence of PONV within the postoperative observation period constituted the dependent variable. Medical records, structured questionnaires, and observation forms supplied information for evaluating age, gender, smoking history, motion sickness history, general anesthetic technique, opioid administration, surgical type, and procedure duration as independent variables. Surgery was categorized separately by specialty, purpose, and risk level.

Participant distributions were described using counts and percentages, and categorical associations were judged against a significance threshold of  $p < 0.05$ . Pearson's chi-square test was used where its assumptions were satisfied. For  $2 \times 2$  comparisons, a continuity correction was applied when expected cell frequencies were adequate; tables that did not meet chi-square assumptions were assessed using a two-sided Fisher's exact test. Multicategory tables containing low expected cell frequencies were evaluated with the likelihood ratio test. The protocol was submitted for review to the Research and Health Ethics Committee of Royal Prima Hospital in Medan.

## RESULT AND DISCUSSION

A total of 86 respondents were analyzed. PONV occurred in 33 respondents (38.4%), whereas 53 (61.6%) did not experience PONV. The most common age group was 31-45 years (41.9%); most respondents were female (58.1%), had no smoking history (72.1%), received inhalational anesthesia (57.0%), and received opioids (88.4%). The most common surgical specialty was ear, nose, and throat-head and neck surgery (ENT-HNS; 50.0%). Most operations were curative (94.2%) and classified as major surgery (91.9%), while the most common duration was more than 120 minutes (41.9%).

**Table 1.** Characteristics of respondents and associations between study factors and PONV (n=86)

| Factor                       | Category     | Total, n (%) | PONV, n/N (%) | p                   |
|------------------------------|--------------|--------------|---------------|---------------------|
| Age                          | 18-30 years  | 24 (27.9)    | 12/24 (50.0)  | 0.197 <sup>a</sup>  |
|                              | 31-45 years  | 36 (41.9)    | 10/36 (27.8)  |                     |
|                              | 46-60 years  | 26 (30.2)    | 11/26 (42.3)  |                     |
| Gender                       | Male         | 36 (41.9)    | 8/36 (22.2)   | 0.017 <sup>b</sup>  |
|                              | Female       | 50 (58.1)    | 25/50 (50.0)  |                     |
| Smoking history              | Yes          | 24 (27.9)    | 20/24 (83.3)  | <0.001 <sup>b</sup> |
|                              | No           | 62 (72.1)    | 13/62 (21.0)  |                     |
| History of motion sickness   | Yes          | 36 (41.9)    | 21/36 (58.3)  | 0.002 <sup>d</sup>  |
|                              | No           | 50 (58.1)    | 12/50 (24.0)  |                     |
| General anesthetic technique | Intravenous  | 30 (34.9)    | 3/30 (10.0)   | <0.001 <sup>c</sup> |
|                              | Inhalational | 49 (57.0)    | 28/49 (57.1)  |                     |
|                              | Balanced     | 7 (8.1)      | 2/7 (28.6)    |                     |
| Opioid use                   | Yes          | 76 (88.4)    | 28/76 (36.8)  | 0.497 <sup>d</sup>  |

| Factor              | Category                 | Total, n (%) | PONV, n/N (%) | p                  |
|---------------------|--------------------------|--------------|---------------|--------------------|
|                     | No                       | 10 (11.6)    | 5/10 (50.0)   |                    |
| Surgical specialty  | Gastrointestinal surgery | 21 (24.4)    | 10/21 (47.6)  | 0.916 <sup>c</sup> |
|                     | Oral surgery             | 10 (11.6)    | 4/10 (40.0)   |                    |
|                     | Ophthalmology            | 2 (2.3)      | 1/2 (50.0)    |                    |
|                     | Oncology                 | 6 (7.0)      | 2/6 (33.3)    |                    |
|                     | Orthopedics              | 4 (4.7)      | 1/4 (25.0)    |                    |
|                     | ENT-HNS                  | 43 (50.0)    | 15/43 (34.9)  |                    |
| Surgical purpose    | Diagnostic               | 5 (5.8)      | 1/5 (20.0)    | 0.645 <sup>d</sup> |
|                     | Curative                 | 81 (94.2)    | 32/81 (39.5)  |                    |
| Surgical risk level | Minor                    | 7 (8.1)      | 4/7 (57.1)    | 0.421 <sup>d</sup> |
|                     | Major                    | 79 (91.9)    | 29/79 (36.7)  |                    |
| Duration of surgery | <30 minutes              | 1 (1.2)      | 1/1 (100.0)   | 0.028 <sup>c</sup> |
|                     | 30-60 minutes            | 19 (22.1)    | 4/19 (21.1)   |                    |
|                     | 61-90 minutes            | 13 (15.1)    | 3/13 (23.1)   |                    |
|                     | 91-120 minutes           | 17 (19.8)    | 5/17 (29.4)   |                    |
|                     | >120 minutes             | 36 (41.9)    | 20/36 (55.6)  |                    |

Note: PONV percentages were calculated using the number of respondents in each category as the denominator. <sup>a</sup> Pearson's chi-square test; <sup>b</sup> continuity correction; <sup>c</sup> likelihood ratio test; <sup>d</sup> two-sided Fisher's exact test. Values of 0.000 in the statistical output are reported as  $p < 0.001$ .

The bivariate comparisons identified patient-related associations for gender ( $p=0.017$ ), smoking history ( $p<0.001$ ), and motion sickness history ( $p=0.002$ ); the corresponding result for age was nonsignificant ( $p=0.197$ ). Regarding perioperative factors, PONV was associated with general anesthetic technique ( $p<0.001$ ) and surgical duration ( $p=0.028$ ). Neither opioid use ( $p=0.497$ ) nor classification of surgery by specialty ( $p=0.916$ ), purpose ( $p=0.645$ ), or risk level ( $p=0.421$ ) showed a statistically significant association.

The incidence of PONV in this study was 38.4%, indicating that PONV remains a clinically relevant concern among patients undergoing general anesthesia. A descriptive study in Indonesia also showed that PONV remains common in postoperative practice [3], whereas a study examining similar variables indicated that the pattern of associated factors may differ according to the population and local anesthetic practices [4].

Age was not significantly associated with PONV ( $p=0.197$ ), although the proportion of patients with PONV was descriptively highest among those aged 18-30 years. This finding is consistent with the study by Al-Ghanem et al., which did not identify age as an independent predictor of PONV [9], but differs from the studies by Karnina and Salmah and by Lestishiyami et al., which reported an association between age and PONV [7], [8]. Differences in age category boundaries, surgical procedures, sample sizes, and patterns of anesthetic exposure may explain these inconsistent findings.

Gender was significantly associated with PONV ( $p=0.017$ ). Half of the female respondents experienced PONV, compared with 22.2% of the male respondents. The direction of this association is consistent with several studies identifying greater susceptibility to PONV among women [8], [10]. This finding supports the inclusion of gender as an important component of preoperative risk assessment, although individual risk assessment should also account for other factors.

Smoking history was also significantly associated with PONV ( $p<0.001$ ); however, the direction of this association warrants cautious interpretation. PONV occurred in 83.3% of respondents with a smoking history, compared with 21.0% of those without such a history. This pattern differs from the findings of Farhat et al., who reported a lower frequency of PONV among smokers [11]. Because the present study used only bivariate analysis, this association cannot be interpreted as a causal effect of smoking. Imbalances in group characteristics, differences in smoking intensity or status, misclassification, and unmeasured confounding factors may have influenced the results.

A history of motion sickness was associated with PONV ( $p=0.002$ ), which occurred in 58.3% of respondents with such a history and 24.0% of those without it. This finding is consistent with the role of vestibular sensitivity in activating emetic pathways and supports studies identifying a history of motion sickness or previous PONV as a patient risk factor [5]. This information can be readily obtained during history taking and used in preoperative screening.

General anesthetic technique was significantly associated with PONV ( $p<0.001$ ). The highest proportion of PONV occurred with inhalational anesthesia (57.1%), compared with balanced anesthesia (28.6%) and intravenous anesthesia (10.0%). The pharmacological properties and adverse effects of inhalational anesthetic agents may contribute to nausea and vomiting [12]. An association between sevoflurane use and PONV [13]. Nevertheless, the balanced anesthesia group in the present study comprised only seven respondents; comparisons among techniques should therefore be interpreted in light of this small sample size.

Opioid use was not significantly associated with PONV ( $p=0.497$ ). This finding does not negate the emetogenic potential of opioids, which are known to cause nausea and vomiting as adverse effects [14]. In this study, 88.4% of respondents received opioids; this

highly imbalanced exposure distribution reduced the ability of the analysis to detect differences between groups. In addition, opioid type, dose, route, and timing of administration were not analyzed separately.

Type of surgery, whether classified by surgical specialty, surgical purpose, or surgical risk level, was not significantly associated with PONV. This finding may have been influenced by the very small sizes of several subgroups and the predominance of ENT-HNS procedures. The literature indicates that the incidence of PONV may vary across specific procedures, including oral and maxillofacial surgery [15]. However, the effect of surgery type may interact with patient characteristics, procedure duration, and anesthetic technique. Thus, the absence of an association in this analysis does not necessarily indicate that all procedures carry the same risk.

Duration of surgery was significantly associated with PONV ( $p=0.028$ ). Among respondents undergoing surgery lasting more than 120 minutes, 55.6% experienced PONV, compared with 21.1%-29.4% across the 30–120-minute categories. This finding is consistent with studies linking longer anesthesia or surgical duration to an increased incidence of PONV [8], [16]. Prolonged exposure to anesthetic agents and greater analgesic requirements may increase emetogenic stimulation during the perioperative period. Findings for procedures lasting less than 30 minutes cannot be interpreted reliably because this group included only one respondent.

Clinically, these findings support preoperative assessment that includes gender, history of motion sickness, the planned anesthetic technique, and the anticipated duration of surgery. The association with smoking history, which differs in direction from some published findings, requires verification before it can inform clinical decision-making. Patients with a combination of several significantly associated factors may be prioritized for monitoring and PONV prevention strategies based on clinical judgment.

Several features of the dataset restrict interpretation: some categories had few participants, opioid exposure was common, and information on anesthetic agent types and doses, opioid dosage, antiemetic prophylaxis, and other relevant clinical characteristics was unavailable. In addition, recruitment by convenience sampling from one hospital narrows the applicability of the findings to other populations. The cross-sectional approach and reliance on bivariate testing cannot establish causation or isolate associations independent of confounding. Subsequent research would benefit from prospective enrollment of a larger sample, consistent PONV definitions and observation periods, and multivariable analysis.

## CONCLUSION

PONV occurred in 33 of 86 respondents (38.4%) undergoing general anesthesia at Royal Prima Hospital, Medan. Gender, smoking history, history of motion sickness, general anesthetic technique, and duration of surgery were significantly associated with PONV,

whereas age, opioid use, and type of surgery were not. These findings support the systematic assessment of PONV risk before surgery. Because the direction of the association with smoking history differs from some published findings and the analysis was limited to bivariate comparisons, these results require confirmation in prospective studies that control for confounding factors.

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