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Original Research Article

Incidence and Factors Associated with Postoperative Nausea and Vomiting Following Elective Surgery Under General Anaesthesia: A Retrospective Observational Study

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ABSTRACT

Background: Postoperative nausea and vomiting (PONV) remains a frequent perioperative problem despite routine antiemetic use. Risk varies according to patient characteristics, operative exposure and postoperative analgesic requirements.

Objectives: To determine the incidence and severity of PONV after elective surgery under general anaesthesia and to examine associations with routinely documented perioperative risk factors.

Methods: Records of 40 adults undergoing elective surgery under general anaesthesia were analysed retrospectively. Demographic characteristics, ASA physical status, smoking status, previous PONV or motion sickness, type and duration of surgery, antiemetic prophylaxis, postoperative opioid use and documented PONV were extracted. The Apfel score was recalculated from its four standard components because the original score field was internally inconsistent. Categorical associations were examined using Fisher's exact test, and continuous variables using the Mann-Whitney U test.

Results: PONV occurred in 15/40 patients (37.5%). Among affected patients, mild, moderate and severe symptoms were recorded in 2, 8 and 5 patients, respectively. PONV was more frequent in women (13/21 vs 2/19; $p=0.001$), non-smokers (15/32 vs 0/8; $p=0.016$), patients with previous PONV/motion sickness (13/13 vs 2/27; $p<0.001$), those receiving postoperative opioids (15/23 vs 0/17; $p<0.001$), and those undergoing laparoscopic procedures (13/21 vs 2/19; $p=0.001$). Median operative duration was also longer in patients with PONV (155 vs 115 min; $p<0.001$). Antiemetic prophylaxis was not significantly associated with lower observed PONV in this small retrospective cohort ($p=0.101$).

Conclusion: PONV affected more than one-third of the cohort and clustered strongly among patients with recognised risk characteristics, particularly previous PONV or motion sickness, postoperative opioid exposure, female sex and laparoscopic surgery. The findings support structured preoperative risk assessment and risk-adapted multimodal prevention rather than reliance on routine prophylaxis alone.

Keywords: Postoperative Nausea and Vomiting, General Anaesthesia, Apfel Score, Antiemetic Prophylaxis, Postoperative Opioids, Laparoscopic Surgery.

INTRODUCTION

Postoperative nausea and vomiting (PONV) remains one of the most troublesome adverse experiences after anaesthesia. Although usually self-limited, it can delay oral intake and mobilisation, prolong recovery-unit stay, interfere with same-day discharge and reduce patient satisfaction. Contemporary consensus guidance therefore treats PONV prevention as a routine component of perioperative quality rather than a minor symptomatic issue.[1,2]

The risk is not evenly distributed. The simplified Apfel model identifies four readily ascertainable predictors: female sex, non-smoking status, a history of PONV or motion sickness, and anticipated postoperative opioid use.[3] Subsequent evidence has repeatedly confirmed the importance of these factors, while also demonstrating contributions from duration of anaesthesia, volatile anaesthetic exposure and selected surgical procedures.[4] Interpretation of the four Apfel factors also requires consistency in how each predictor is defined and applied across studies.[5] A 2026 systematic review involving more than 350,000 patients similarly found female sex, motion sickness, non-smoking status, postoperative opioid use and longer anaesthetic duration to be associated with increased PONV risk.[6]

For hospitals with high elective surgical throughput, the practical difficulty is less about recognising that PONV exists and more about identifying which combination of routine factors is most informative in the local case mix. This is particularly relevant in Indian practice, where observational work has reported persistent PONV despite prophylaxis and has demonstrated associations with female sex, non-smoking, previous PONV and postoperative opioid exposure.[7] The burden may be especially visible after laparoscopic surgery, where pneumoperitoneum, visceral manipulation and opioid requirements can coexist with established patient-related susceptibility.[8,9]

The present study was designed as a retrospective evaluation of routinely recorded perioperative data. The primary objective was to determine the incidence and severity of PONV following elective surgery under general anaesthesia. Secondary objectives were to examine its association with patient characteristics, surgery type and duration, antiemetic prophylaxis, postoperative opioid use and the simplified Apfel risk profile.

MATERIALS AND METHODS

Study Design

This was a hospital-based retrospective observational study of adult patients who had undergone elective surgery under general anaesthesia. The study was conducted in various operation theatres of PGIMER & Capital Hospital, Bhubaneswar, Odisha from March 2024 to February 2025 for a period of one year. The analysis was restricted to information documented during routine perioperative care; no research-specific intervention or treatment allocation was involved.

Study Population

Forty consecutive records with complete entries for the study variables were available for analysis. The recorded cohort comprised ASA physical status I-II patients undergoing laparoscopic cholecystectomy, laparoscopic appendicectomy, hernia surgery or other open surgical procedures.

Variables and Outcome Definition

Variables extracted were age, sex, body mass index (BMI), ASA physical status, smoking status, history of PONV or motion sickness, surgery type, operative duration, antiemetic prophylaxis, postoperative opioid administration, occurrence of PONV and documented severity. The primary outcome was the presence of PONV during the routinely documented postoperative observation period. Severity was retained as recorded as mild, moderate or severe.

Apfel Risk Score Derivation

For analysis, the simplified Apfel score was derived from the four standard components available in every record: female sex, non-smoking status, history of PONV or motion sickness, and postoperative opioid use, assigning one point to each component.[3] The composite score was generated directly from these component variables to maintain a uniform definition across all records. Surgery labels were standardised for analysis, while the original clinical observations and outcome values were retained.

Ethical Considerations

The study was conducted as a retrospective review of anonymised routine perioperative records, without any alteration of clinical management. Patient confidentiality was maintained throughout, and no identifying information was included in the analytical record or manuscript. Institutional requirements applicable to retrospective record-based research were followed.

Statistical Analysis

Continuous variables were summarised using mean and standard deviation, with medians used for between-group interpretation where appropriate. Categorical variables were reported as frequencies and percentages.

Fisher's exact test was used for 2x2 categorical comparisons because of the small sample and sparse cells. Continuous variables were compared using the Mann-Whitney U test. A two-sided p-value <0.05 was considered statistically significant. Because only 15 outcome events were observed and several predictors showed sparse or zero cells, multivariable logistic regression was not undertaken to avoid unstable over-fitted estimates.

RESULTS

A total of 40 patients were analysed. Mean age was 46.17±11.52 years and mean BMI was 27.51±3.07 kg/m². Women constituted 21 (52.5%) patients, and 27 (67.5%) were ASA physical status II. Antiemetic prophylaxis had been administered to 25 (62.5%), while 23 (57.5%) received postoperative opioids (Table 1).

Characteristic	Value
Age, years	46.17 ± 11.52
BMI, kg/m²	27.51 ± 3.07
Female sex	21 (52.5%)
ASA I	13 (32.5%)
ASA II	27 (67.5%)
Current smoker	8 (20.0%)
Previous PONV/motion sickness	13 (32.5%)
Antiemetic prophylaxis	25 (62.5%)
Postoperative opioids	23 (57.5%)
Operative duration, min	129.15 ± 25.91

Table 1. Baseline demographic and perioperative characteristics (n=40)

Values are mean ± SD or n (%), as appropriate

PONV was documented in 15 patients (37.5%), whereas 25 (62.5%) had no recorded PONV (Figure 1). Among the 15 affected patients, severity was mild in 2 (13.3%), moderate in 8 (53.3%) and severe in 5 (33.3%) (Figure 2).

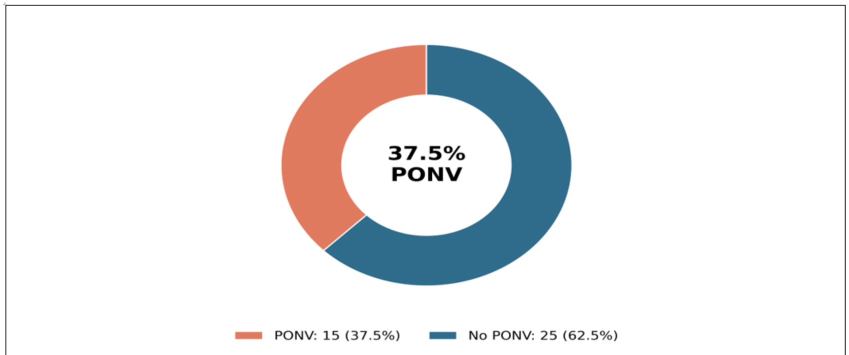

Figure 1. Overall incidence of postoperative nausea and vomiting

Donut chart shows the proportion of patients with and without documented PONV

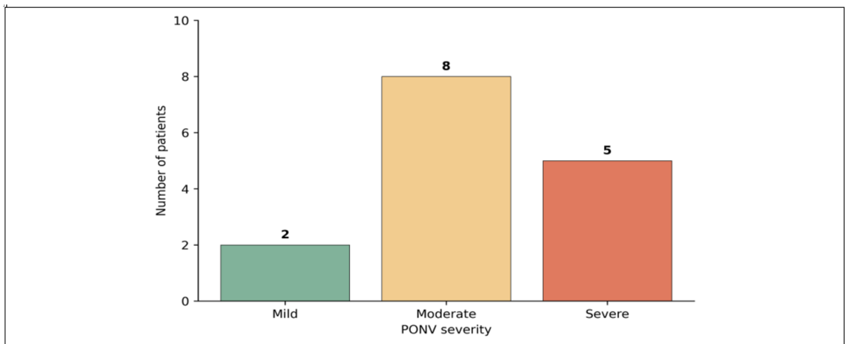

Figure 2. Severity distribution among patients with postoperative nausea and vomiting

Bars represent patient counts within each recorded severity category

Factor	PONV in First Category, n/N (%)	PONV in Second Category, n/N (%)	p-Value
Sex	F: 13/21 (61.9%)	M: 2/19 (10.5%)	0.001
Smoking status	No: 15/32 (46.9%)	Yes: 0/8 (0.0%)	0.016
Previous PONV/motion sickness	Yes: 13/13 (100.0%)	No: 2/27 (7.4%)	<0.001
ASA status	II: 11/27 (40.7%)	I: 4/13 (30.8%)	0.730
Laparoscopic procedure	Yes: 13/21 (61.9%)	No: 2/19 (10.5%)	0.001
Antiemetic prophylaxis	Yes: 12/25 (48.0%)	No: 3/15 (20.0%)	0.101
Postoperative opioid use	Yes: 15/23 (65.2%)	No: 0/17 (0.0%)	<0.001

Table 2. Association of categorical perioperative factors with PONV

Fisher's exact test. Category labels are shown exactly in the comparison cells

Surgical Category	Total n	PONV n	PONV %
Hernia surgery	7	0	0.0%
Other open surgery	12	2	16.7%
Laparoscopic appendicectomy	9	3	33.3%
Laparoscopic cholecystectomy	12	10	83.3%

Table 3. Distribution of PONV according to surgical category

Surgical categories are reported descriptively because of the small cell counts

PONV varied substantially across surgical categories. It occurred in 10/12 patients undergoing laparoscopic cholecystectomy, 3/9 undergoing laparoscopic appendicectomy, 2/12 undergoing other open surgery and none of the seven hernia surgery patients (Table 3; Figure 3). When procedures were grouped as laparoscopic versus non-laparoscopic, PONV occurred in 13/21 (61.9%) and 2/19 (10.5%), respectively (p=0.001).

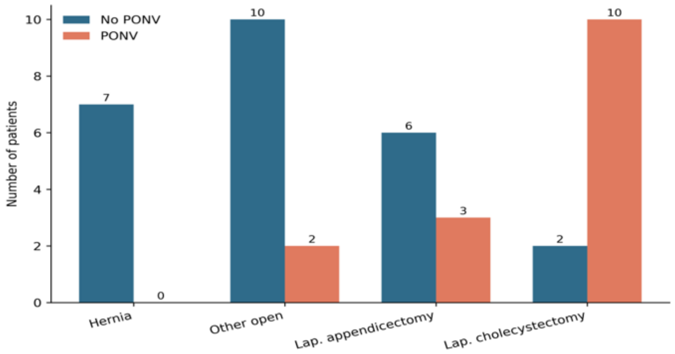

Figure 3. Occurrence of PONV across surgical categories

Grouped bars show the number of patients with and without PONV in each category

Variable	PONV	No PONV	p-value
Age (years)	44.73 ± 10.00; median 44.0	47.04 ± 12.46; median 47.0	0.576
BMI (kg/m²)	27.84 ± 3.75; median 27.6	27.32 ± 2.64; median 27.5	0.716
Operative duration (min)	153.47 ± 16.53; median 155.0	114.56 ± 18.45; median 115.0	<0.001

Table 4. Continuous variables according to PONV status

Values are mean ± SD; median. Mann-Whitney U test used for between-group comparisons

Age and BMI did not differ significantly between patients with and without PONV. Operative duration, however, was longer among patients with PONV: mean 153.47±16.53 minutes (median 155) compared with 114.56±18.45 minutes (median 115) in those without PONV (p<0.001) (Table 4).

Apfel score	Total n	PONV n	PONV %
0	8	0	0.0%
1	9	0	0.0%
3	12	4	33.3%
4	11	11	100.0%

Table 5. PONV according to recalculated simplified Apfel score

The recalculated score uses female sex, non-smoking, previous PONV/motion sickness and postoperative opioid use, one point each

The recalculated Apfel profile showed a marked risk gradient. No PONV was observed among patients with scores 0 or 1; 4/12 (33.3%) patients with score 3 developed PONV, while all 11 patients with score 4 had PONV (Table 5; Figure 4). No patient in this cohort had a recalculated score of 2.

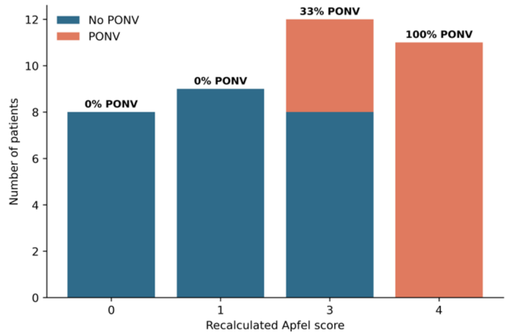

Figure 4. PONV distribution according to recalculated simplified Apfel score

Stacked bars show patients with and without PONV; labels above bars show the observed PONV percentage

DISCUSSION

The present retrospective series found PONV in 37.5% of patients undergoing elective surgery under general anaesthesia. This burden is clinically meaningful, particularly because almost nine in ten affected patients had symptoms documented as moderate or severe rather than mild. The pattern of association was also recognisable: PONV clustered among women, non-smokers, patients with a previous history of PONV or motion sickness, those receiving postoperative opioids, patients undergoing laparoscopic procedures, and those with longer operative duration.

The observed incidence was higher than the 25.6% prevalence reported by Sinha and colleagues in a 1000-patient Indian tertiary-care cohort.[7] Direct comparison should be cautious because the present series is much smaller, includes only general anaesthesia and has a surgical mix enriched with laparoscopic procedures. Even so, the direction of the principal associations is remarkably similar. The Indian study also identified female sex, non-smoking, prior PONV and postoperative opioid use as important correlates. This consistency supports the clinical usefulness of simple bedside risk stratification even where case mix and institutional practice differ.

Female sex showed one of the clearest patient-level associations in the current data, with PONV occurring in 61.9% of women compared with 10.5% of men. Female sex has long been incorporated into validated prediction models and remains one of the most reproducible predictors in systematic reviews.[3,4,6] Non-smoking status also tracked with PONV: none of the eight smokers developed the outcome, whereas 15 of 32 non-smokers did. This should not be interpreted as a beneficial effect of smoking, but rather as confirmation of the epidemiologic association on which the Apfel model is partly based.[3,5]

Previous PONV or motion sickness was the most striking historical marker. All 13 patients with such a history developed postoperative symptoms, compared with only two of 27 without that history. The magnitude is larger than would usually be expected in larger populations, and the small sample should therefore be emphasised. Nevertheless, prior susceptibility is biologically and clinically plausible and remains a core element of contemporary risk assessment.[1,3,6] In practical terms, a carefully elicited history remains one of the least resource-intensive ways to identify patients who may benefit from intensified prophylaxis.

Postoperative opioid exposure also showed a strong relationship with PONV: 15 of 23 opioid recipients developed symptoms, while no event occurred among the 17 patients who did not receive postoperative opioids. Opioid exposure is a recognised emetogenic factor and is explicitly incorporated into the Apfel score.[3,4] Recent evidence continues to support opioid-sparing strategies where clinically appropriate, including in laparoscopic cholecystectomy.[10] The present analysis cannot determine whether opioids caused the observed events, because indication, dose, timing and type of opioid were not available and confounding by surgical complexity or postoperative pain is likely.

Surgical exposure also mattered. Laparoscopic procedures were associated with a substantially higher observed PONV frequency than non-laparoscopic procedures, with the largest proportion occurring after laparoscopic cholecystectomy. Procedure-specific susceptibility has been debated because surgery type may overlap with patient and anaesthetic factors, but cholecystectomy and abdominal surgery continue to appear in contemporary risk analyses.[6] Earlier evidence has also demonstrated the relevance of prophylactic antiemetic strategies in laparoscopic cholecystectomy, including dexamethasone-based regimens and multimodal combinations.[8,9]

Longer operative duration was another prominent finding. Patients with PONV had a median procedure duration of 155 minutes compared with 115 minutes among those without PONV. Duration of anaesthesia has repeatedly emerged as a risk factor in systematic reviews and prediction studies.[4,6,11] Longer procedures may increase cumulative exposure to emetogenic anaesthetic drugs and opioids and may also reflect more extensive surgical stimulation. Large factorial trial evidence has shown that anaesthetic technique itself can modify PONV risk, with propofol-based anaesthesia reducing PONV compared with volatile anaesthesia.[12] Volatile anaesthetics have also been identified as an important contributor to early postoperative vomiting.[13] Because the present records contained operative duration rather than a detailed anaesthetic exposure profile, these mechanisms cannot be separated.

An important finding concerns antiemetic prophylaxis. PONV was observed in 48.0% of patients who received prophylaxis and in 20.0% of those who did not, but this difference was not statistically significant. This should not be interpreted as evidence that prophylaxis is ineffective. In retrospective practice, clinicians tend to administer prophylaxis preferentially to patients already perceived to be at higher risk, creating confounding by indication. Large randomised evidence and consensus guidelines demonstrate benefit from appropriately selected prophylactic interventions, particularly when multiple agents and baseline-risk reduction are used in at-risk patients.[1,2,12] Contemporary reviews similarly emphasise structured risk assessment, multimodal prevention and evidence-based rescue treatment rather than interpreting prophylaxis as a simple yes/no exposure.[14,15] The finding instead suggests that documenting both baseline risk and the exact prophylactic regimen is essential when evaluating real-world effectiveness.

The recalculated Apfel score displayed a steep gradient in this cohort, culminating in PONV among all patients with a score of 4. While this is directionally consistent with the original score, the apparent separation is stronger than expected from the original validation, where risk rose progressively rather than deterministically.[3] The small sample, absence of patients with score 2 and use of actual postoperative opioid exposure rather than purely anticipated opioid use limit calibration assessment. The score is therefore best interpreted here as a descriptive risk-stratification tool rather than as a locally validated prediction model.

This study has several limitations. The sample was small and derived from a single hospital record set, which restricts precision and generalisability. The exact postoperative observation window, individual prophylactic antiemetic drugs, anaesthetic agents, opioid type and dose, rescue antiemetic requirement, postoperative pain scores and fluid balance were not available. Retrospective documentation may also miss mild nausea. Several variables contained sparse or zero cells, precluding reliable multivariable modelling. Finally, prophylaxis was not randomly allocated and its apparent relationship with PONV is therefore highly susceptible to confounding by indication. These limitations do not negate the descriptive findings, but they require restraint in causal interpretation.

CONCLUSION

PONV occurred in 37.5% of this elective general-anaesthesia cohort and was concentrated among patients with established risk characteristics. Previous PONV or motion sickness, postoperative opioid exposure, female sex, non-smoking status, laparoscopic surgery and longer operative duration were associated with higher observed PONV. The findings favour systematic preoperative risk assessment, opioid-sparing approaches where appropriate and risk-adapted multimodal prophylaxis. Larger prospective or well-curated retrospective cohorts with detailed anaesthetic and prophylactic drug information are needed before independent predictors or local risk thresholds can be established.

Source of Funding
Nil.

Conflict of Interest
None declared.

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