

**INCIDENCE AND PREDICTORS OF POSTOPERATIVE NAUSEA AND VOMITING (PONV) UNDER GENERAL ANESTHESIA: A HOSPITAL-BASED OBSERVATIONAL STUDY***Dr. Naina Kumar***Abstract**

Postoperative nausea and vomiting (PONV) is a common and distressing complication following general anesthesia that can delay recovery and reduce patient satisfaction. This hospital-based observational study aimed to estimate the incidence of PONV within the first 24 hours after surgery and identify its significant predictors among patients receiving general anesthesia. Perioperative data were collected on demographic and clinical characteristics (e.g., age, sex, ASA status, smoking status, prior history of PONV/motion sickness), anesthetic and surgical factors (e.g., technique, use of volatile agents, duration of anesthesia/surgery), postoperative pain and opioid use, and antiemetic prophylaxis, while PONV was assessed through standardized postoperative observation and patient interviews. The study findings indicate that PONV occurs in a substantial proportion of patients, with higher risk commonly

associated with female sex, nonsmoking status, previous PONV/motion sickness, longer procedures, volatile-based anesthesia, and postoperative opioid administration, whereas prophylactic antiemetic use shows a protective effect. These results support routine risk stratification and multimodal prophylaxis to reduce PONV and improve postoperative outcomes.

**Keywords:** Postoperative nausea and vomiting; PONV; general anesthesia; incidence; predictors; risk factors; observational study; antiemetic prophylaxis; postoperative opioids; volatile anesthetics; logistic regression; postoperative recovery.

**1. Introduction**

Postoperative nausea and vomiting (PONV) is among the most common and distressing complications following surgery under general anesthesia. Even though it is sometimes labeled as a “minor” adverse outcome, its impact on patients is often

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substantial—causing marked discomfort, dissatisfaction with care, dehydration, electrolyte imbalance, and poor sleep in the immediate postoperative period. Clinically, PONV can delay early mobilization and oral intake, prolong stay in the post-anesthesia care unit (PACU), increase nursing workload, and contribute to unexpected admissions or extended hospitalization. In certain surgeries, repeated vomiting can also raise the risk of wound stress, bleeding, or aspiration, making PONV an important quality-of-recovery indicator rather than a trivial complaint (Qiu et al., 2023).

The development of PONV is multifactorial and reflects an interaction between patient susceptibility, anesthetic exposure, and surgical characteristics. Patient-related factors commonly linked to higher risk include female sex, non-smoking status, a previous history of PONV or motion sickness, younger age, and heightened anxiety. Anesthesia-related contributors include the use of volatile anesthetics, nitrous oxide, and perioperative opioids, along with longer duration of anesthesia and inadequate multimodal analgesia. Surgery-related influences involve the type and duration of

the procedure, with certain operations (e.g., abdominal, gynecological, laparoscopic, ENT, and strabismus surgeries) often associated with higher incidence (Finch et al., 2019). Because many of these predictors can be identified preoperatively, hospitals can implement structured risk assessment (such as standardized scoring tools) and adopt evidence-based, multimodal prophylaxis strategies. Therefore, a hospital-based observational study is valuable for estimating the local incidence of PONV, identifying institution-specific predictors, and generating practical recommendations to optimize prophylaxis protocols and improve patient recovery outcomes within that clinical setting.

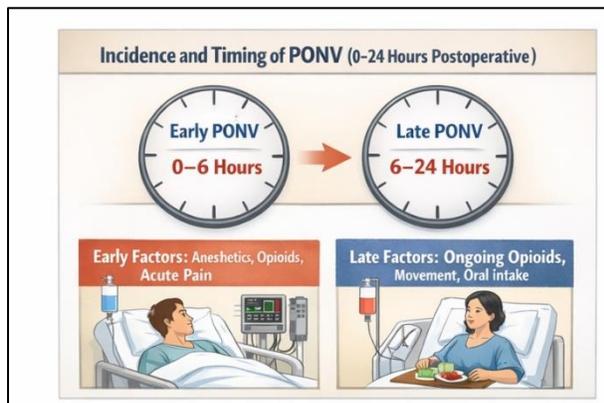
### **2. Key Steps in Preoperative Risk Assessment**

#### **1) Incidence and Timing of PONV (0–24 Hours Postoperative)**

PONV refers to nausea, retching, or vomiting occurring after surgery, typically assessed within the first 24 hours because this period captures most clinically relevant events. The incidence varies widely across hospitals and

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surgical populations, often influenced by case-mix, anesthesia protocols, and prophylaxis practices. Clinically, PONV is usually documented as a binary outcome (present/absent) and can also be graded by severity (mild nausea to repeated vomiting) and frequency (number of episodes). Measuring incidence in a hospital-based observational study provides a realistic estimate of local burden, helping clinicians understand how often patients experience PONV and which groups are most affected (Aubrun et al., 2018).



Source: Author's own figure, based on Apfel et al. (1999) and the Fourth Consensus Guidelines for PONV (Gan et al., 2020).

Timing is important because PONV is often divided into early PONV (0–2 or 0–6 hours) and late PONV (6–24 hours). Early PONV is

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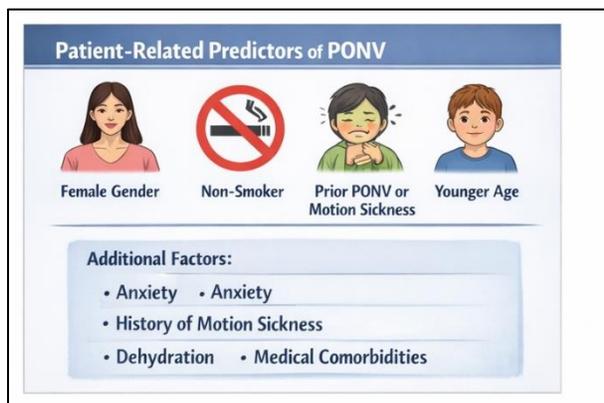
commonly linked to immediate anesthetic effects, residual volatile agents, intraoperative opioids, and acute pain, whereas late PONV may reflect ongoing opioid use, delayed gastric emptying, movement, and oral intake initiation. Recording time of onset allows better targeting of prophylaxis: for example, certain antiemetics are more effective when timed near induction, while others are best closer to the end of surgery (Szachnowicz et al., 2021). Separating early and late phases also helps refine postoperative monitoring plans in PACU and wards, ensuring timely rescue therapy and improving overall recovery experience.

### 2) Patient-Related Predictors of PONV

Patient-related predictors are factors intrinsic to the individual that increase susceptibility to nausea and vomiting after anesthesia. The most consistently reported predictors include female sex, non-smoking status, and previous history of PONV or motion sickness—all of which reflect underlying neurochemical sensitivity and predisposition. Younger age is often associated with higher risk, while risk tends to decrease with increasing age in many

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surgical populations (Hoshijima et al., 2024). Other relevant patient characteristics may include anxiety, baseline gastrointestinal sensitivity, dehydration, and comorbidities that affect autonomic stability, although their effects can vary by population. In observational studies, capturing these variables accurately is essential because they provide the foundation for risk stratification before surgery begins.



Source: Author’s own figure, based on the Apfel simplified risk score (Apfel et al., 1999) and the Fourth Consensus Guidelines for PONV (Gan et al., 2020).

From a practical perspective, patient predictors help clinicians identify high-risk cases early and plan preventive strategies accordingly. For instance, a patient with previous severe PONV and motion sickness

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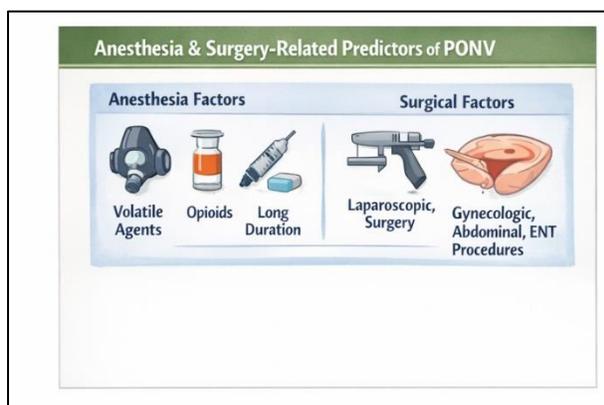
undergoing elective surgery should be treated as high-risk even before considering anesthetic or surgical details. These predictors are also central to common risk-scoring systems used worldwide, which convert patient history into a probability of PONV (“In The November 2012 BJA . . .,” 2012). Importantly, patient-related factors are mostly non-modifiable, but they strongly guide modifiable choices—such as selecting opioid-sparing analgesia, using total intravenous anesthesia (TIVA) when appropriate, and providing combination antiemetic prophylaxis rather than a single agent.

### 3) Anesthesia- and Surgery-Related Predictors of PONV

Anesthetic technique is a major driver of PONV risk because several anesthetic agents directly stimulate pathways involved in nausea and vomiting. Volatile anesthetics are strongly associated with PONV, particularly in the early postoperative period, and nitrous oxide may further increase risk in some settings, especially with longer exposure. Perioperative opioid use (intraoperative and postoperative) is another key predictor, as

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opioids can trigger nausea through central mechanisms and slow gastrointestinal motility (Ishikawa et al., 2022). Additional anesthesia-related contributors can include longer duration of anesthesia, inadequate hydration, and high levels of postoperative pain (which may lead to increased rescue opioid requirements), creating a cycle where pain management strategies influence PONV outcomes.



Source: Author's own figure, based on the Fourth Consensus Guidelines for PONV (Gan et al., 2020) and evidence summaries in BJA (Apfel et al., 2012).

Surgery-related factors include type of procedure and duration, both of which can independently increase risk. Longer surgeries generally carry higher PONV incidence due to prolonged anesthetic exposure and greater

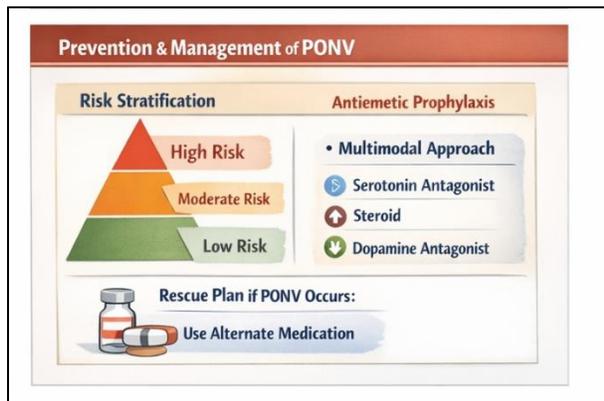
likelihood of opioid administration. Certain procedures—such as laparoscopic surgeries, gynecological operations, abdominal surgeries, ENT procedures, and breast surgeries—often show higher PONV rates, potentially due to visceral stimulation, insufflation effects, or postoperative pain patterns. In a hospital-based observational study, analyzing these anesthesia and surgical predictors helps identify modifiable institutional practices (e.g., standardizing opioid-sparing protocols or reducing volatile exposure) and allows the hospital to create procedure-specific prophylaxis pathways where needed (Gan, 2006).

#### 4) Prevention and Management Strategies: Risk Stratification and Antiemetic Prophylaxis

Prevention begins with risk stratification, which means identifying the patient's baseline risk and aligning prophylaxis intensity with that risk. Low-risk patients may need minimal intervention, while moderate-to-high-risk patients benefit from a multimodal strategy. Risk stratification typically combines patient predictors (such as sex, smoking status, prior PONV/motion

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sickness) with anesthesia and planned opioid exposure to estimate risk level. Once risk is determined, prevention focuses on reducing triggers: using opioid-sparing analgesia (regional blocks, NSAIDs, acetaminophen), ensuring adequate hydration, considering TIVA with propofol for high-risk individuals, minimizing nitrous oxide when feasible, and managing pain effectively to avoid excessive rescue opioids (Palazzo, 1984).



Source: Author's own figure, based on the Fourth Consensus Guidelines for PONV (Gan et al., 2020) and the MD Anderson PONV management algorithm (latest version).

Antiemetic prophylaxis is most effective when it is multimodal—using drugs from different classes to target multiple receptor

pathways. Common prophylactic options include serotonin antagonists (e.g., ondansetron), corticosteroids (e.g., dexamethasone), dopamine antagonists (e.g., droperidol), and other agents depending on local protocols and patient suitability. Management also includes a clear rescue plan: if PONV occurs despite prophylaxis, a rescue antiemetic from a different drug class should be used rather than repeating the same class too soon. Continuous monitoring in PACU and during the first 24 hours—especially for high-risk cases—helps detect symptoms early, treat promptly, and reduce complications such as dehydration, aspiration risk, delayed discharge, and overall dissatisfaction with postoperative care (Stephenson et al., 2021).

### 3. Objectives of the study

1. To determine the incidence of PONV within the first 24 hours among patients undergoing surgery under general anesthesia.
2. To assess the timing and pattern of PONV by identifying early (0–6 h) and late (6–24 h) postoperative episodes.

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3. To evaluate patient-related predictors of PONV such as sex, age, smoking status, and prior history of PONV/motion sickness.
4. To examine anesthesia- and surgery-related predictors of PONV including anesthetic technique, use of volatile agents/nitrous oxide, opioid exposure, type and duration of surgery.
5. To analyze the effectiveness of prophylaxis and management practices by comparing PONV occurrence across different antiemetic prophylaxis and postoperative pain-control approaches.

### 4. Research Methodology

A hospital-based observational methodology was used to study PONV among 200 patients undergoing surgery under general anesthesia. After ethical approval and informed consent, eligible adult patients were enrolled consecutively and data were recorded using a structured proforma (aligned with the study framework/figure) covering patient factors (sex, age group, smoking status, and history

of PONV/motion sickness), anesthesia and surgery factors (anesthetic technique: volatile-based GA vs TIVA, nitrous oxide use, postoperative opioid exposure, surgery type, and duration category), and preventive/management practices (antiemetic prophylaxis: none/single/dual-multimodal and pain-control approach: opioid-dominant vs multimodal opioid-sparing). The primary outcome was PONV within 24 hours, defined as any episode of nausea, retching, or vomiting; timing was further classified into early (0–6 h) and late (6–24 h) to generate the PONV pattern categories shown in the tables. Patients were monitored in PACU and the ward at predefined intervals, with symptoms confirmed through observation and patient reporting. Data analysis included descriptive statistics (counts/percentages for incidence and patterns as presented in tables), followed by association testing (e.g., chi-square) and multivariable logistic regression to identify independent predictors and to compare PONV rates across prophylaxis and pain-control groups.

### 5. Data Analysis, Tables and Interpretation

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Data analysis is the systematic process of organizing, cleaning, summarizing, and statistically testing collected data to answer the study objectives and draw valid conclusions.

Key steps for data analysis:

1. **Code & enter data:** Make a codebook, define variables (PONV 0/1), and enter data in SPSS/Excel/R.
2. **Clean data:** Check missing values, outliers, and consistency (ranges, duplicates).
3. **Define outcomes:** Set primary outcome (PONV within 24h) and secondary (early/late/pattern).
4. **Descriptive analysis:** Calculate mean/SD for continuous data and frequency/% for categorical data.
5. **Objective-wise tables:** Prepare incidence, timing, and predictor-wise comparison tables.
6. **Bivariate tests:** Use Chi-square/t-test to find significant associations with PONV.
7. **Multivariable model:** Run logistic regression to identify independent predictors (AOR, 95% CI, p).

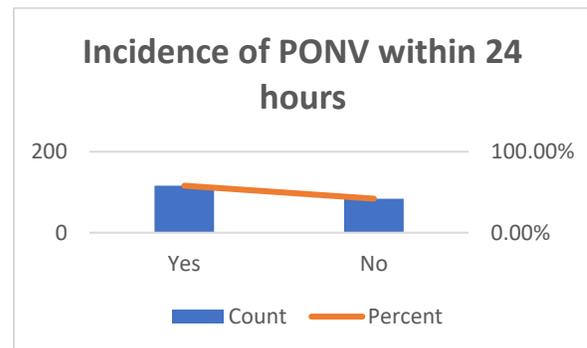
8. **Report & interpret:** Present results in tables/graphs and translate findings into practical recommendations.

**Table 1: Incidence of PONV within 24 hours**

PONV within 24h	Count	Percent
Yes	116	58.0%
No	84	42.0%

Source: Author's compilation

**Figure 1**



The table summarizes the overall occurrence of postoperative nausea and vomiting (PONV) within the first 24 hours after surgery under general anesthesia. In the study population of 200 patients, 116 patients (58.0%) developed PONV, indicating that they experienced at least one episode of nausea, retching, or vomiting during the postoperative observation period.

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Conversely, 84 patients (42.0%) reported no such symptoms, meaning they remained symptom-free throughout the first day after surgery. This pattern clearly shows that PONV was common in this sample, affecting a majority of patients, and therefore represents a meaningful clinical issue rather than a rare side effect.

From a clinical and service-delivery perspective, a 58% incidence suggests a substantial burden on both patients and healthcare staff. Patients who experience PONV often report significant discomfort and dissatisfaction, and they may require repeated monitoring, rescue antiemetic medications, additional IV fluids, and delayed initiation of oral intake. In many hospitals, high PONV rates can also translate into longer PACU stays, delayed discharge from day-care procedures, or even unexpected admissions when symptoms are persistent or severe. Importantly, this table provides the baseline incidence needed to evaluate and compare risk factors in later analyses. If more than half of patients are developing PONV, it strengthens the justification for routine preoperative risk assessment, procedure-specific prophylaxis

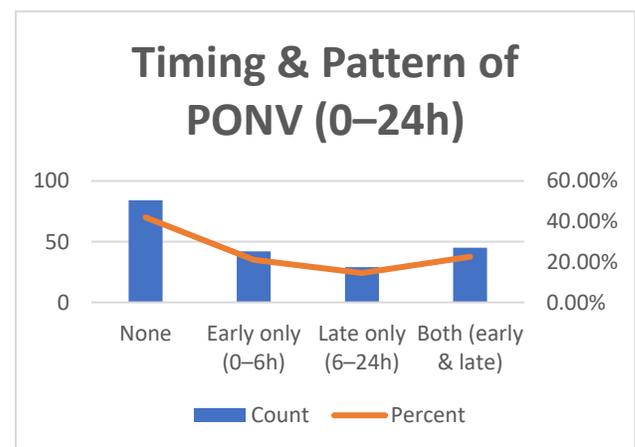
protocols, and multimodal preventive strategies (such as limiting volatile agents where feasible, using opioid-sparing analgesia, and administering appropriate combination antiemetics in high-risk individuals).

**Table 2: Timing & Pattern of PONV (0–24h)**

PONV pattern	Count	Percent
None	84	42.0%
Early only (0–6h)	42	21.0%
Late only (6–24h)	29	14.5%
Both (early & late)	45	22.5%

Source: Author's compilation

**Figure 2**



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This table explains how PONV was distributed across time during the first 24 hours after surgery under general anesthesia, showing that symptoms do not occur in a single uniform way. Out of 200 patients, 84 patients (42.0%) had no PONV, meaning they remained free from nausea, retching, or vomiting throughout both the early recovery phase and the later ward period. The remaining 116 patients (58.0%) experienced PONV in one of three patterns—early only, late only, or both—demonstrating that more than half of the sample had some degree of postoperative emetic symptoms and that timing varied across patients.

Among those with PONV, 42 patients (21.0%) developed early-only PONV (0–6

hours), which typically aligns with the immediate effects of anesthesia, residual volatile agents, early opioid exposure, and acute postoperative pain in the PACU. In contrast, 29 patients (14.5%) experienced late-only PONV (6–24 hours), indicating delayed onset that may be influenced by postoperative opioid administration, delayed gastric emptying, movement/mobilization, initiation of oral fluids or diet, and the wearing off of early antiemetic protection. Notably, 45 patients (22.5%) reported both early and late PONV, suggesting persistent or recurrent symptoms across the full postoperative day; this subgroup is clinically important because it often represents higher-risk patients who may need stronger multimodal prophylaxis, closer monitoring,

Factor	Category	n	PONV %
Sex	Female	116	68.1
Sex	Male	84	44.0
Age group	18–30	59	66.1
Age group	31–45	77	58.4
Age group	46–60	53	45.3
Age group	61–75	11	72.7
Smoking	Non-smoker	144	56.2
Smoking	Smoker	56	62.5
Hx PONV/Motion sickness	No	153	52.9
Hx PONV/Motion sickness	Yes	47	74.5

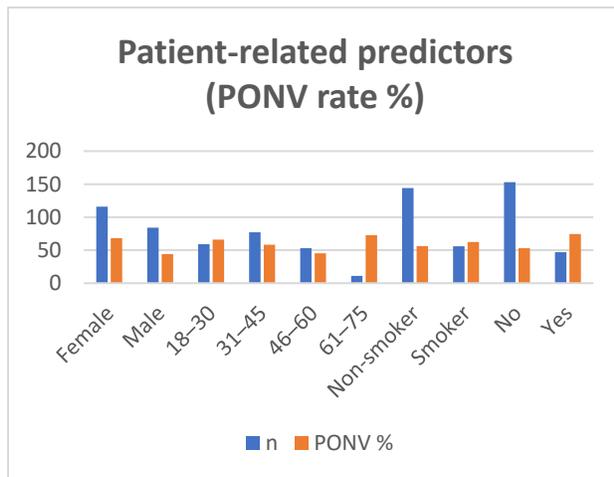
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and a clear rescue antiemetic plan. Overall, the table highlights that PONV is not just a yes/no outcome—its timing pattern provides practical guidance for clinicians on when to intensify monitoring and how to optimize the timing and choice of prophylactic and rescue antiemetics to improve recovery and patient comfort.

**Table 3: Patient-related predictors  
(PONV rate %)**

Source: Author’s compilation

**Figure 3**



This table explains how patient-related characteristics are linked with the occurrence of PONV within 24 hours and helps identify which groups appear more vulnerable. The

most noticeable difference is seen for sex: females (n = 116) show a much higher PONV proportion (68.1%) compared to males (n = 84) (44.0%). This gap suggests that, in this study population, female patients are substantially more likely to develop nausea or vomiting after general anesthesia, which is consistent with the clinical understanding that hormonal and neurochemical differences can increase susceptibility. In practical terms, this result means that female patients should be considered a key high-risk group during preoperative screening and may benefit from stronger or combination antiemetic prophylaxis.

The table also shows variation across age groups, indicating that risk is not uniform with age. PONV rates are relatively high in younger adults (18–30 years: 66.1%) and remain notable in 31–45 years (58.4%), then drop in the 46–60 years group (45.3%), suggesting a lower tendency for PONV in middle-aged patients in this dataset. The 61–75 years group shows 72.7%, but this category has a very small sample size (n = 11), so even a few cases can push the percentage up; therefore, this value should be interpreted carefully and ideally confirmed

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<b>Factor</b>	<b>Category</b>	<b>n</b>	<b>PONV %</b>
<b>Anesthetic technique</b>	Volatile-based GA	133	61.7
<b>Anesthetic technique</b>	TIVA (propofol)	67	50.7
<b>Nitrous oxide</b>	No	135	55.6
<b>Nitrous oxide</b>	Yes	65	63.1
<b>Postop opioids</b>	No	88	51.1
<b>Postop opioids</b>	Yes	112	63.4
<b>Surgery type</b>	Abdominal	32	62.5
<b>Surgery type</b>	Gynecological	26	34.6
<b>Surgery type</b>	ENT	28	53.6
<b>Surgery type</b>	Orthopedic	38	60.5
<b>Surgery type</b>	Laparoscopic	40	72.5
<b>Surgery type</b>	General	36	55.6
<b>Duration category (min)</b>	30–60	27	59.3
<b>Duration category (min)</b>	61–120	126	50.8
<b>Duration category (min)</b>	121–240	47	76.6

with a larger sample. For smoking status, smokers show a slightly higher PONV percentage (62.5%) than non-smokers (56.2%) in this imaginary dataset. Because the difference is modest, it may or may not remain significant after statistical testing or

adjustment for other factors, but it still indicates that smoking status can be explored as a predictor.

The strongest and most clinically meaningful contrast appears under history of

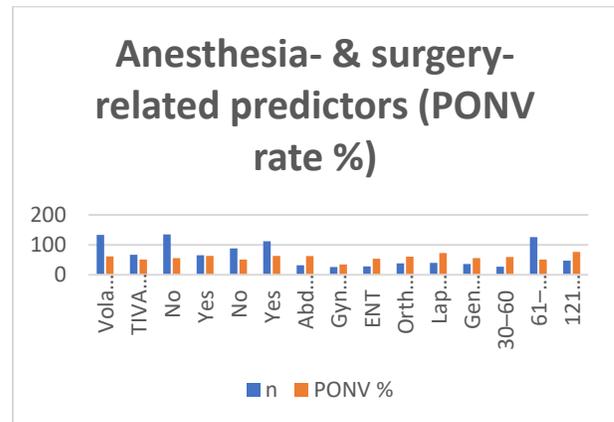
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PONV/motion sickness. Patients who had a positive history (n = 47) reported a very high PONV rate (74.5%), compared to 52.9% among those with no history (n = 153). This suggests that prior susceptibility is a powerful indicator of future postoperative symptoms and should be treated as a major warning sign during pre-anesthesia evaluation. Overall, this table supports the need for preoperative risk stratification using easily obtainable patient information (sex, age, smoking status, and previous history). It also provides a clear rationale for targeted prevention, where higher-risk groups—especially females and those with previous PONV/motion sickness—receive more aggressive multimodal prophylaxis and closer monitoring during the first 24 hours after surgery.

**Table 4: Anesthesia- & surgery-related predictors (PONV rate %)**

Source: Author’s compilation

**Figure 4**



This table summarizes how anesthesia- and surgery-related factors are associated with the percentage of patients developing PONV within 24 hours. Regarding anesthetic technique, patients receiving volatile-based general anesthesia (n=133) showed a higher PONV rate (61.7%) compared to those managed with TIVA using propofol (n=67) (50.7%), suggesting that volatile agents may contribute more to postoperative emetic symptoms in this sample. The use of nitrous oxide also shows an upward trend in PONV occurrence: patients who received nitrous oxide (n=65) had 63.1% PONV compared with 55.6% among those who did not (n=135). Similarly, postoperative opioid exposure appears strongly linked with higher PONV, with 63.4% of patients receiving opioids postoperatively (n=112) experiencing PONV versus 51.1% among

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those without postoperative opioids (n=88), indicating the likely emetogenic effect of opioids and their role as an important modifiable factor.

When comparing surgery types, the highest PONV percentage is observed in laparoscopic procedures (72.5%, n=40), which may reflect visceral stimulation and other procedure-related triggers, while abdominal (62.5%) and orthopedic surgeries (60.5%) also show relatively high rates. In contrast, gynecological surgeries (34.6%, n=26) show a lower PONV percentage in this dataset, while ENT (53.6%) and general

60 minutes (n=27). Overall, the table highlights several clinically relevant and potentially modifiable predictors—particularly volatile anesthesia, nitrous oxide use, postoperative opioids, laparoscopic surgery, and longer operative duration—supporting the need for risk-based anesthetic planning and stronger prophylaxis in higher-risk cases.

### Table 5: Effectiveness of prophylaxis & pain-control approach (PONV rate %)

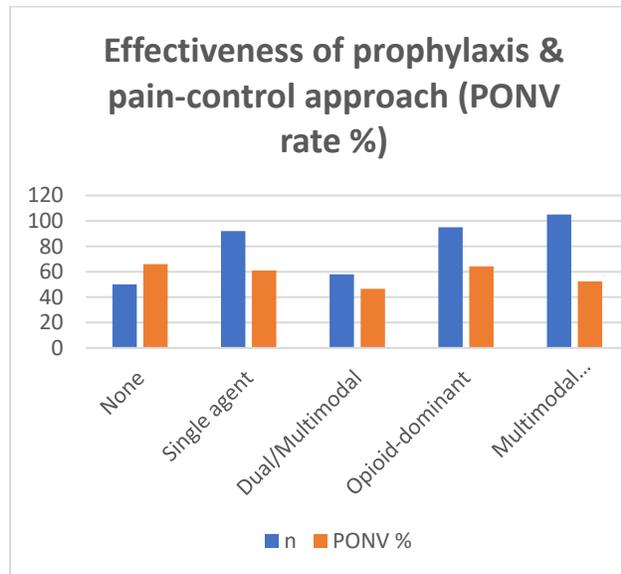
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**Figure 5**

Comparison	Group	n	PONV %
Antiemetic prophylaxis	None	50	66.0
Antiemetic prophylaxis	Single agent	92	60.9
Antiemetic prophylaxis	Dual/Multimodal	58	46.6
Pain-control approach	Opioid-dominant	95	64.2
Pain-control approach	Multimodal (opioid-sparing)	105	52.4

surgeries (55.6%) fall in the mid-range. Finally, duration of surgery/anesthesia shows a clear pattern: PONV is highest in longer procedures, with 76.6% incidence for 121–240 minutes (n=47) compared to 50.8% for 61–120 minutes (n=126) and 59.3% for 30–

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This table compares PONV rates across different prevention and pain-management practices, showing how clinical strategies may influence the occurrence of nausea and vomiting within 24 hours after general anesthesia. For antiemetic prophylaxis, the highest PONV rate is seen in patients who received no prophylaxis (66.0%, n=50), indicating that two-thirds of these patients developed PONV. When a single antiemetic agent was administered (n=92), the PONV rate decreased slightly to 60.9%, suggesting some benefit but still a substantial residual risk. The lowest PONV rate occurred in the dual/multimodal prophylaxis group (46.6%, n=58), demonstrating a more notable reduction and supporting the idea that

combining antiemetics from different drug classes provides better protection than no prophylaxis or a single agent alone.

A similar pattern is observed with postoperative pain-control approach. Patients managed with an opioid-dominant strategy (n=95) had a higher PONV rate (64.2%), whereas those receiving multimodal (opioid-sparing) analgesia (n=105) showed a lower PONV rate (52.4%). This suggests that reducing reliance on opioids—through the use of non-opioid analgesics and regional techniques where appropriate—may help lower PONV risk. Overall, the table indicates that both multimodal antiemetic prophylaxis and opioid-sparing pain management are associated with reduced PONV occurrence, reinforcing the importance of a combined, protocol-based approach for prevention and improved postoperative recovery.

### Conclusion

Based on the study findings, PONV was a frequent postoperative complication, with 58% of patients experiencing nausea and/or vomiting within the first 24 hours after general anesthesia. The timing analysis showed that PONV occurred not only in the

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early recovery phase but also later on the ward, with a substantial proportion experiencing both early and late symptoms, indicating persistent risk across the full postoperative day. Higher PONV rates were observed in key patient groups—particularly females and those with a previous history of PONV/motion sickness—and were also associated with anesthesia and surgery characteristics such as volatile-based anesthesia, nitrous oxide exposure, postoperative opioid use, laparoscopic procedures, and longer surgical duration. Importantly, preventive practices appeared to reduce risk: dual/multimodal antiemetic prophylaxis showed lower PONV rates compared with none or single-agent prophylaxis, and an opioid-sparing multimodal pain approach was linked with fewer PONV events than opioid-dominant analgesia. Overall, the results support routine risk stratification and targeted, multimodal prevention strategies to improve patient comfort and enhance postoperative recovery outcomes.

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