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Original Research Article

Retrospective Analysis of the Prevalence and Time Course of Postoperative Nausea and Vomiting in Patients Receiving General Anesthesia

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Abstract:

Background: Postoperative nausea and vomiting (PONV) is a frequent and problematic complication after general anesthesia that negatively impacts patient comfort, recovery and healthcare resource consumption. To optimize peri-operative management, it is essential to understand its prevalence, temporal distribution and risk factors.

Aim: To assess the incidence and temporal trends of PONV and to determine patient, surgical and anesthetic factors associated with PONV in patients undergoing surgery under general anesthesia.

Methodology: A retrospective Observational study was carried out at PARAS HMRI Hospital, Patna, Bihar, India. Records of 90 adult patients who had general anesthetic surgery for one year were examined in the hospital. Information from medical records was collected regarding demographic, clinical, surgical, anesthetic, and postoperative data. The presence of PONV was determined and divided into four postoperative time periods: 0-6, 6-12, 12-18 and 18-24 hours. Data was subjected to statistical analysis using SPSS version 26.0 and p value <0.05 was taken as statistically significant.

Results: Overall, the prevalence of PONV was 37.8%, with nausea alone being seen in 18.9%, vomiting alone in 7.8% and both in 11.1% of patients. Over half (52.9%) of the PONV episodes took place in the first 6 hours after surgery. Female sex, non-smoking status, previous history of PONV, history of motion sickness, prolonged surgery (>2 hours), intraoperative opioid use and absence of prophylactic antiemetic therapy were all significant risk factors for PONV ($p<0.05$), while ASA physical status was not.

Conclusion: PONV continues to be a common postoperative complication, with the greatest being in the early postoperative period. Stratification of risk at an early stage, tailored antiemetic prophylaxis, judicious use of opioids and close monitoring after surgery can significantly decrease the impact of PONV and enhance peri-operative outcomes.

Keywords: Postoperative nausea and vomiting; General anesthesia; Prevalence; Time course; Risk factors; Retrospective study; Antiemetic prophylaxis; Opioid use.

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Introduction

Although the use of general anesthesia has advanced and the monitoring and prophylaxis of its complications have improved, postoperative nausea and vomiting (PONV) is still one of the most common and uncomfortable side effects of general anesthesia. PONV is not a life-threatening condition but has significant clinical consequences such as patient discomfort, delayed recovery, longer post anesthesia care unit (PACU) stays, unexpected hospital admission, greater healthcare costs and decreased patient satisfaction. Incidence of PONV is reported for the general surgical population at 20-30% and may be over 70-80% in high-risk patients with multiple predisposing risk factors including female gender, non-smoking, history of motion sickness, and postoperative opioid use. PONV is therefore still regarded as one of the most frequent problems in patients undergoing surgical procedures under general anesthesia and is an important quality indicator in postoperative care [1–3].

The physiopathology of PONV is complex and multifactorial, with central and peripheral nervous system interactions. The vomiting center in the medulla receives input from the chemoreceptor trigger zone, the vestibular apparatus, the cerebral cortex and the gastrointestinal tract via various neurotransmitters, such as serotonin (5-HT3), dopamine, histamine, acetylcholine and neurokinin-1. The use of general anesthetic agents, volatile inhalational anesthetic

agents, nitrous oxide, opioids and surgical stress can activate those pathways, thus increasing the risk of postoperative nausea and vomiting. In addition, patient-associated factors, including age, gender, BMI, smoking history, and prior history of PONV, and surgery-associated factors (such as the duration and type of surgical procedure) are important factors that affect the occurrence of this complication [4,5].

A number of predictive models have been developed to identify patients with a higher risk of PONV, the most widely accepted, and clinically applicable, being the simplified Apfel model. This model uses four independent variables (female sex, no smoking, previous history of PONV or motion sickness, and postoperative opioid administration) to predict the likelihood of a patient having PONV. Being able to identify high-risk patients enables the anesthesiologist to take evidence-based steps to reduce postoperative nausea, including implementing multimodal antiemetic therapy, reducing opioid doses or using anesthetic techniques with lower emetogenic potential. However, even when prophylactic anti-emetic drugs are routinely used, significant numbers of patients still report having nausea and vomiting during the postoperative period, suggesting that other variables such as the timing of symptoms may need further consideration [6,7].

Previous studies have shown that PONV is not evenly distributed during the postoperative period. Rather, the incidence depends on the length of time after the surgery, recovery from the anesthesia and need for post-surgery pain medicine. Early PONV is predominantly related to volatile agents and the residual effects of anesthetic agents and is likely to occur within the first 2–6 hours after surgery, while delayed PONV is likely to occur between 6 and 24 hours or later, and is mainly related to opioid analgesics, gastrointestinal dysfunction and postoperative mobility. Thus, knowledge of the time course of PONV is important to help maximize the effectiveness of prophylactic and rescue antiemetic therapy and to maximize the comfort of these patients and their postoperative recovery [8,9].

Postoperative nausea and vomiting also are strongly influenced by pain management. Postoperative analgesia promotes early mobilization and recovery, but opioids are still a significant cause of nausea and vomiting due to their effects on gut motility (causing delayed gastric emptying) and the opioid receptors in the chemoreceptor trigger zone (CRTZ). The optimization of pain management and avoidance of opioid-related complications has emerged as one of the hallmarks of the enhanced recovery movement. Multimodal methods of analgesia (such as regional methods of anesthetic techniques and non-opioid analgesics) have been found to be beneficial in their effects on postoperative pain and incidence of PONV [10].

Retrospective observational studies offer valuable information on the real-world burden and clinical features of PONV as they make use of routinely collected hospital records. These studies can allow for prevalence estimation, identification of risk factors (patient and procedure related), assessment of current preventive practices, and measurement of temporal trends without affecting standard clinical management. These findings add to the evidence based on enhancing perioperative management for patients, especially in tertiary care centers where diverse surgical procedures are carried out under general anesthesia. Further, retrospective analyses can reveal institutional trends that could be different from those reported internationally due to varying patient characteristics, anesthetic techniques, surgical practice and follow-up care [11].

The present retrospective study was conducted in the Department of Anesthesia, PARAS HMRI, Patna, Bihar, India due to the persistent problem of PONV and scarcity of Indian data to evaluate the time distribution of postoperative nausea and vomiting after general anesthesia. The study is to examine the prevalence and time course of postoperative nausea and vomiting in patients undergoing general anesthesia, and to investigate demographic and peri-operative factors associated with this condition. The results will help to add institution-specific evidence that can help identify early on those at risk, fine-tune the timing of antiemetic treatments, optimize postoperative recovery, enhance patient satisfaction, and develop effective perioperative management strategies.

Methodology

Study Design: This study was a retrospective observational study in a hospital setting to assess the prevalence and time course of postoperative nausea and vomiting (PONV) in patients who had received surgery under general anesthesia. The study consisted of a systematic review of the hospital medical records, looking at the presence, time of onset, and clinical features of PONV in the first 24 hours after surgery. Since this was a retrospective investigation, no intervention or routine patient management change was done.

Study Area: The study was performed in the Department of Anesthesiology, PARAS HMRI Hospital, Patna, Bihar.

Study Duration: Patients who were operated on during a one-year period from January 2025 to December 2025.

Sample Size: 90 patients who met the eligibility criteria participated in the study. The sample included patients who were under general anesthesia during surgery, and who had a perioperative and postoperative history to evaluate PONV.

Study Population: The respondents in the study were adult patients who were subjected to elective

or emergency surgical operations under general anesthesia in PARAS HMRI Hospital. Standard perioperative anesthetic care was provided to all eligible patients as per the institutional protocols and patients were monitored routinely in the post-operative period.

Data Collection: Data was gathered using a structured data extraction form from anesthesia records, inpatient case files, hospital electronic medical record system and postoperative nursing charts. Demographic data obtained were age, sex, body mass index (BMI); clinical data included the American Society of Anesthesiologists (ASA) physical status, smoking history, history of motion sickness, history of postoperative nausea and vomiting (PONV), and associated comorbidities. In addition, surgical data including surgical type, surgical time and anesthetic time were also documented. Intra-operative variables were the anesthetic agents used, opioids used, intravenous fluid administration, prophylactic antiemetic therapy, intra-operative hemodynamic events and postoperative analgesic regimen. Postoperative data included the presence of nausea and/or vomiting, time to first episode if documented, the severity of each episode if documented, and rescue antiemetic medication needed, postoperative pain scores, and hospital length of stay. Postoperative nausea and vomiting (PONV) were assessed at 0–6, 6–12, 12–18, and 18–24 hours after surgery.

Inclusion Criteria

The following patients were included in the study:

- Adults are 18 years old or older.
- Patients who had general anesthesia.
- American Society of Anesthesiologists (ASA) physical status I–III.
- Patients with fully completed medical records of both pre- and post-surgical procedures.
- Patients whose postoperative records showed whether they had or did not have nausea and vomiting within the first 24 hours post-surgery.

Exclusion Criteria

Patients were excluded who had any of the following:

- Children aged less than 18 years.
- Patients who had surgery while having regional anesthesia, spinal anesthesia, epidural anesthesia, or local anesthesia (only).
- Patients who are directly admitted to the intensive care unit (ICU) and are on prolonged postoperative mechanical ventilation.
- Patients with incomplete medical records or who have not yet had their medical records.
- Patients with known neurological diseases that cause nausea and vomiting, and those who persist in vomiting prior to surgery, as well as those with pre-existing gastrointestinal obstruction.
- Chemotherapy or long-term antiemetic therapy is provided prior to surgery.

Study Procedure: Patients' medical records from a hospital were reviewed and those who had surgery under general anesthesia in the period of the study were screened for eligibility. Patients who met the inclusion criteria were included. A standardized data collection format was used to extract demographic, clinical, anesthetic, surgical and postoperative variables.

The main outcome of the study was the incidence of postoperative nausea and vomiting (PONV) for 24 hours postoperatively. Secondary outcomes were the time course of PONV (0–6, 6–12, 12–18, and 18–24 hours after surgery), number of nausea and vomiting episodes, need for rescue anti-emetic therapy, and risk factors for PONV.

Statistical Analysis: The collected data were fed to MS. EXCEL and analyzed using the SPSS (26.0) software program (IBM Corp., Armonk, NY, USA). Normality of continuous variables was assessed by the Shapiro–Wilk test and data are reported as mean ± standard deviation (SD) or as a median (IQR) if not normally distributed. Categorical variables were presented in percentages and numbers. Frequencies of categorical variables were compared with the Chi-square or Fisher's exact test as appropriate. Independent Student's t-test or the Mann–Whitney U test was used to compare continuous variables between groups, depending on whether or not they were normally distributed. The Chi-square test with a Bonferroni correction was used to compare the incidence of PONV between the four postoperative periods (0-6, 6-12, 12-18, and 18-24 hours) when appropriate. For all statistical analyses a p value of <0.05 was regarded as statistically significant".

Result

The demographic and clinical characteristics of the 90 patients included in the study are shown at baseline in table 1. The largest proportion of patients belonged to the 31–45 years age group (32.2%), followed by 46–60 years (28.9%), 18–30 years (22.2%), and more than 60 years (16.7%). The proportion of females (54.4%) were slightly higher than males (45.6%) in the study population. Regarding body mass index (BMI), 43.3% of patients had a BMI of 25–29.9 kg/m², while 36.7% had a BMI below 25 kg/m² and 20.0% were obese (BMI ≥30 kg/m²). Patients were most commonly ASA physical status II (51.1%), ASA I (31.1%) and ASA III (17.8%). 26.7% of patients had a history of smoking and 73.3% were non-smokers. Twenty-one per cent (21.1%) had a history of motion sickness and 15.6% had a previous history of postoperative nausea and vomiting (PONV).

Table 1: Baseline Demographic and Clinical Characteristics of the Study Population (N = 90)		
Variables	**Frequency (n)**	**Percentage (%)**
Age Group (years)		
18–30	20	22.2
31–45	29	32.2
46–60	26	28.9
>60	15	16.7
Gender		
Male	41	45.6
Female	49	54.4
BMI (kg/m²)		
<25	33	36.7
25–29.9	39	43.3
≥30	18	20
ASA Physical Status		
I	28	31.1
II	46	51.1
III	16	17.8
Smoking History		
Yes	24	26.7
No	66	73.3
History of Motion Sickness		
Yes	19	21.1
No	71	78.9
Previous History of PONV		
Yes	14	15.6
No	76	84.4

Surgical and anesthetic parameters of the study group are summarized in Table 2. The most common surgery performed was general surgery at 26.7% followed by orthopedic, gynecological, urological, other surgery and ENT surgery each at 22.2%, 17.8%, 13.3% and 11.1% respectively. Almost half of the surgeries (46.7%) lasted for 1 to 2 hours while 33.3% lasted for over 2 hours and 20.0% took less than 1 hour. Anesthetic time was 2 hours or more in 64.4% of patients and less than 2 hours in 35.6% of patients. 70.0% received intraoperative opioids and 67.8% were administered with prophylactic antiemetic pre-surgery.

Table 2: Surgical and Anesthetic Characteristics of Patients (N = 90)		
Variables	**Frequency (n)**	**Percentage (%)**
Type of Surgery		
General Surgery	24	26.7
Orthopedic	20	22.2
Gynecological	16	17.8
Urological	12	13.3
ENT	10	11.1
Others	8	8.9
Duration of Surgery		
<1 hour	18	20
1–2 hours	42	46.7
>2 hours	30	33.3
Duration of Anesthesia		
<2 hours	32	35.6
≥2 hours	58	64.4
Intraoperative Opioid Use		
Yes	63	70
No	27	30
Prophylactic Antiemetic Given		
Yes	61	67.8
No	29	32.2

The overall prevalence of postoperative nausea and vomiting (PONV) in the first 24 hours following general anesthesia surgery is shown in Table 3. In the 90 patients studied, 34 (37.8%) patients had at least one episode of PONV, while 56 (62.2%) patients did not have PONV. Among those patients that developed PONV, 18.9% had nausea alone, 7.8% vomiting alone and 11.1% had nausea and vomiting. A significant number of affected patients needed additional postoperative management as 21 patients (23.3%) needed rescue antiemetic medication.

Table 3: Overall Prevalence of Postoperative Nausea and Vomiting (PONV) within 24 Hours (N = 90)

Variables	Frequency (n)	Percentage (%)
No PONV	56	62.2
PONV Present	34	37.8
Nausea only	17	18.9
Vomiting only	7	7.8
Both nausea and vomiting	10	11.1
Rescue Antiemetic Required	21	23.3

Table 4 shows the time distribution of PONV episodes occurring in the 34 patients who developed PONV in the first 24 hours after surgery. Most of the patients with PONV had it within the first 6 h after surgery (18 patients, 52.9%). The frequency then decreased with time with 9 patients (26.5%) developing the symptoms after 6-12 hours, 4 patients (11.8%) after 12-18 hours and only 3 patients (8.8%) after 18-24 hours. The results suggest that the first 24 hours after surgery are the most critical period for occurrence of PONV.

Table 4: Time Course of Postoperative Nausea and Vomiting during the First 24 Hours (Patients with PONV = 34)

Postoperative Interval	Number of Patients	Percentage (%)
0–6 hours	18	52.9
6–12 hours	9	26.5
12–18 hours	4	11.8
18–24 hours	3	8.8
Total	**34**	**100**

Selected patient-related risk factors and postoperative nausea and vomiting are shown in Table 5. The incidence of PONV was significantly higher in females than males (23 vs. 11 patients, P = 0.032). Patients who had a history of motion sickness had a significantly higher rate of PONV than patients without a history of motion sickness (12 vs. 22 patients; p = 0.003). Similarly, patients with a history of PONV had a significant increase in the incidence of postoperative symptoms than patients without a history of PONV (10 vs. 24 patients; p = 0.001). A statistically significant association was also seen with smoking status, with non-smokers having a higher rate of PONV than smokers (29 vs. 5 patients; p = 0.041). In all, female gender, history of PONV, motion sickness and non-smoking status were identified as important patient-related factors for PONV.

Table 5: Association between Selected Risk Factors and Occurrence of PONV (N=90)

Variables	PONV Present (n=34)	No PONV (n=56)	p-value
Gender			
Male (41)	11	30	**0.032**
Female (49)	23	26	
Smoking History			
Yes (24)	5	19	**0.041**
No (66)	29	37	
History of Motion Sickness			
Yes (19)	12	7	**0.003**
No (71)	22	49	
Previous History of PONV			
Yes (14)	10	4	**0.001**
No (76)	24	52	

The relationship between surgical and anesthetic factors and postoperative nausea and vomiting is shown in table 6. The number of patients with PONV was significantly higher in surgeries lasting over 2 hours (17 patients) than shorter surgeries (p = 0.004). Likewise, the use of opioids during surgery was a significant risk factor for PONV; of the 63 patients that received opioids during surgery 29 developed PONV, while 5 of 27 patients who did not receive opioids did develop PONV (p = 0.015). The prophylactic antiemetic therapy group also had a significantly lower incidence of PONV compared to the non-prophylactic antiemetic group (16 vs. 18 patients; p = 0.019). However, the ASA physical status was not significantly associated with postoperative nausea and vomiting (p = 0.486), indicating that, in this study, the physical status of the patients before surgery did not significantly affect the occurrence of PONV.

Table 6: Association of Surgical and Anesthetic Factors with PONV (N=90)

Variables	PONV Present (n=34)	No PONV (n=56)	p-value
Duration of Surgery			
<1 hour (18)	3	15	**0.004***
1–2 hours (42)	14	28	
>2 hours (30)	17	13	
Intraoperative Opioid Use			
Yes (63)	29	34	**0.015***
No (27)	5	22	
Prophylactic Antiemetic			
Yes (61)	18	43	**0.019***
No (29)	16	13	
ASA Physical Status			
I (28)	7	21	**0.486**
II (46)	18	28	
III (16)	9	7	

Discussion

This retrospective study aimed to assess the prevalence, time course and risk factors of postoperative nausea and vomiting (PONV) in 90 patients who underwent general anesthesia surgery. Baseline characteristics showed that most patients were between 31 and 45 years old (32.2%), 46 and 60 years old (28.9%), and that females made up a slightly higher proportion (54.4%) compared to males. Majority of the patients had a BMI of 25–29.9 kg/m² (43.3%) and ASA physical status II (51.1%). In addition, 21.1% of patients experienced motion sickness in their past, and 15.6% experienced PONV in the past, all of which have been known to be predictive factors for nausea and vomiting after surgery. The demographic distribution is similar to that reported by Apfel et al, who found that female sex, history of PONV, non-smoking and history of motion sickness were the strongest independent predictors of PONV which are all comparable to the characteristics seen in this study [2]. Similarly, Gan et al. stated patient-related factors are the basics of PONV regardless of the surgical procedure or anesthetic technique" [3].

Surgical profile of the present study revealed general surgery being the most common surgery (26.7%) followed by orthopedic surgery (22.2%) and gynecological surgery (17.8%). Almost half of the procedures required 1 to 2 hours of anesthesia (46.7%), and 64.4% required more than 2 hours. Intraoperative opioids were used in 70.0% and prophylactic antiemetics were used in 67.8% of patients. Other previous research has also shown that long surgical procedures and opioid use during surgery significantly increase the occurrence of postoperative nausea and vomiting due to the delayed exposure to volatile anesthetic agents and the opioid's effect on chemoreceptor trigger zone [4,6]. Gan et al. also advised routine prophylactic antiemetic therapy for patients with several risk factors, emphasizing its contribution to decreasing postoperative morbidity.

In the current study, 34 of 90 patients (37.8%) had PONV (at least one episode) in the first 24 hours after surgery. Nausea alone occurred in 18.9% of patients, vomiting alone in 7.8% and both in 11.1% of patients. A significant number (23.3%) of patients needed antiemetic rescue therapy, showing that a large percentage of patients needed rescue despite prophylactic treatment. The reported prevalence is similar to others who have reported an incidence between 20% and 40% in the general surgical population and > 60% in high-risk patients [7]. Apfel et al also found a prevalence rate of almost 39% in patients with multiple risk factors. The overall prevalence of this study was slightly different, however, with the present study showing a somewhat higher incidence (37.8%) than the base study (31.9%)

(possibly due to different patient characteristics, surgical case mix, anesthetic practice, and retrospective study design) [12].

The temporal distribution of PONV showed that the majority of cases (52.9%) occurred within the first 6 hours of surgery, 26.5% between 6 and 12 hours and 20.6% after 12 hours. These findings suggest that the first few days after surgery are the greatest risk for nausea and vomiting. This is consistent with other studies that have found PONV to be highest in the early post-operative recovery period due to the effects of residual anesthetic agents, opioid effects and post-operative pain [9]. The base study also showed that PONV was most common in the initial 0–6 post-operative hours with almost 40.4% of patients experiencing it in the first 2 hours after surgery and continuing it for the next 4 hours. The results of the present study are very similar to earlier reports and emphasize the need for careful postoperative monitoring and prompt rescue antiemetics in the early recovery period.

Risk factor analysis revealed a significant difference between the incidence of PONV in female and male patients (23 vs. 11 patients, p=0.032). Similarly, patients with a history of motion sickness had a significantly higher prevalence of PONV (12 vs. 22 patients, P=0.003), and the same was true for those who had a history of PONV (10 vs. 24 patients, P=0.001). PONV was significantly higher in non-smokers compared with smokers (29 vs. 5 patients, p=0.041). These observations accord well with the reduced Apfel risk score that identifies the four main independent risk factors for postoperative nausea and vomiting: female gender, previous PONV, motion sickness and non-smoking status. These predictors have been consistently confirmed in numerous systematic reviews in various surgical specialties and anesthetic procedures. The statistically significant results found in the current study further support the clinical value of the existing predictors in the identification of high-risk patients prior to surgery.

Other surgical and anesthetic factors also were significantly related to PONV. The incidence of PONV was much higher in patients who had an operation with a duration of >2 hours compared with patients who had an operation with a duration of <2 hours (p=0.004). Likewise, the number of patients with postoperative symptoms was significantly higher in the group receiving intraoperative opioid (29/63) as compared to the group without (5/27; p=0.015); and patients without antiemetic therapy had a significantly higher number of PONV patients than those receiving prophylaxis (16 vs. 18; p=0.019). On the other hand, there was no statistically significant relationship between the ASA physical status and PONV (p=0.486). These results are similar to the previous reports, which have shown that PONV is significantly related to prolonged surgery, use of opioids and inadequate prophylactic antiemetic administration, while ASA classification alone has limited predictive value for PONV [13]. The current analysis also showed that residual opioids and inhalational anesthetics also play a significant role in early postoperative nausea and vomiting, which was also reported in the base study.

Overall, the results of the present retrospective study are largely in line with previous international literature and confirm that PONV is one of the most common postoperative complications after general anesthetic. The observed prevalence of 37.8% coupled with the clustering of symptoms during the first 6 hours postoperatively, highlights the need for careful postoperative monitoring particularly in female patients, non-smokers, patients with a history of PONV or motion sickness, and patients who underwent longer surgical procedures with opioid administration. Prophylactic antiemetic strategies based on evidence and risk stratification can significantly decrease postoperative discomfort and distress, increase patient satisfaction, shorten recovery time, and optimize the recovery experience.

Conclusion

From the present retrospective study, it is concluded that postoperative nausea and vomiting (PONV) is still a frequent problem after general anesthesia surgery, especially during the early postoperative period. Female sex and non-smoking status, a history of motion sickness, previous PONV, prolonged surgical duration, intraoperative opioid use and inadequate prophylactic antiemetic administration were determined as important factors associated with the development of PONV, and ASA physical status showed no significant association. The results highlight the need for a careful evaluation of the risk before surgery, an adequate risk reduction strategy, careful use of opioids, and proper postoperative monitoring, especially in the first hours after surgery. A patient- and procedure-specific approach of preventive measures could help to lower the incidence of PONV, to increase patient comfort and satisfaction, to increase patient recovery rate after surgery and to improve the overall quality of perioperative care.

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