e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(6); 2687-2699

Original Research Article

Comparison of Postoperative Nausea and Vomiting Following Propofol Based and Inhalations L Anaesthesia

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Received: 01-04-2026 / Revised: 25-05-2026 / Accepted: 12-06-2026
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Conflict of interest: Nil

Abstract

Background: Postoperative nausea and vomiting (PONV) is a common and distressing complication after general anaesthesia and can delay recovery and discharge. The choice of anaesthetic technique is an important modifiable factor influencing PONV risk. Propofol-based total intravenous anaesthesia has been associated with a lower emetogenic potential than volatile anaesthetic agents.

Objective: To compare the incidence and severity of postoperative nausea and vomiting following propofol-based and inhalational anaesthesia in patients undergoing elective surgery under general anaesthesia.

Materials and Methods: Patients were allocated into two equal groups of 35 each. Group P received propofol-based total intravenous anaesthesia, while Group I received inhalational anaesthesia with a volatile agent. Patients were assessed for PONV at 0–2, >2–6, >6–12, and >12–24 postoperative hours. PONV severity, rescue antiemetic requirement, postoperative pain, opioid consumption, recovery characteristics, and post-anaesthesia care unit discharge readiness were also recorded. Statistical significance was considered at $P< 0.05$.

Results: The overall 24-hour incidence of PONV was significantly lower in the propofol group than in the inhalational group (22.9% vs 51.4%, $P = 0.013$). Early PONV within 0–6 hours occurred in 17.1% of patients receiving propofol compared with 42.9% receiving inhalational anaesthesia ($P = 0.019$).

Conclusion: Propofol-based total intravenous anaesthesia significantly reduced the incidence and severity of postoperative nausea and vomiting compared with inhalational anaesthesia. It was also associated with lower rescue antiemetic requirements and earlier postoperative recovery.

Keywords: Postoperative Nausea And Vomiting; PONV; Propofol; Total Intravenous Anaesthesia; Inhalational Anaesthesia; Volatile Anaesthetics; Postoperative Recovery.

DOI: 10.25258/ijcpr.18.6.414

Introduction

Postoperative nausea and vomiting (PONV) remains one of the most frequent and distressing complications following general anaesthesia. Although advances in anaesthetic drugs, monitoring techniques, and perioperative antiemetic prophylaxis have considerably improved postoperative recovery, PONV continues to affect a substantial proportion of surgical patients. The occurrence of nausea, retching, or vomiting after surgery can significantly impair patient comfort and satisfaction and may delay oral intake, mobilisation, and discharge from the post-anaesthesia care unit. In susceptible individuals, repeated vomiting may also contribute to dehydration, electrolyte disturbances, wound complications, and increased requirement for medical intervention. Consequently, prevention of PONV has become an important component of contemporary perioperative care and enhanced recovery protocols [1]. The development of PONV is multifactorial and is influenced by patient-related, surgical, and anaesthesia-related factors. Well-recognised patient-related predictors include female sex, a history of PONV or motion sickness, and non-smoking status, whereas the requirement for postoperative opioids represents another important contributor. The simplified Apfel risk score combines four major predictors and is widely used for estimating an individual patient's likelihood of developing PONV [2]. The anaesthetic technique itself also plays a major role. In particular, exposure to volatile anaesthetic agents has consistently been associated with an increased risk of nausea and vomiting during the early postoperative period [3]. This relationship suggests that modification of the anaesthetic

technique may represent an effective strategy for reducing the baseline risk of PONV rather than relying exclusively on pharmacological antiemetic prophylaxis.

General anaesthesia can be maintained using inhalational anaesthetic agents such as sevoflurane, desflurane, or isoflurane, or through total intravenous anaesthesia (TIVA), most commonly based on propofol. Inhalational anaesthesia remains widely employed because volatile agents are easy to administer, permit rapid adjustment of anaesthetic depth, and generally provide predictable emergence. However, volatile anaesthetics possess clinically important emetogenic properties. A large factorial randomised study demonstrated that volatile anaesthetic exposure was particularly important in the development of early postoperative vomiting [3]. This finding is clinically relevant because avoidance or reduction of exposure to volatile agents may decrease PONV without adding another antiemetic medication.

Propofol is an intravenous hypnotic agent extensively used for both induction and maintenance of general anaesthesia. In addition to its favourable pharmacokinetic characteristics and rapid recovery profile, propofol has long been recognised to possess antiemetic properties. A quantitative systematic review of 84 randomised studies involving more than 6,000 patients demonstrated that maintenance of anaesthesia with propofol was associated with clinically relevant reductions in early postoperative nausea and vomiting compared with other anaesthetic techniques [4]. The antiemetic benefit appears to be greater when propofol is used for maintenance throughout anaesthesia rather than solely as an induction agent.

Evidence from large randomised investigations has further supported the role of anaesthetic technique in PONV prevention. In a factorial trial involving more than 5,000 patients at increased risk of PONV, replacing volatile anaesthesia with propofol reduced the risk of PONV by approximately 19%, with an effect comparable in magnitude to that produced by individual prophylactic antiemetic interventions [5]. Similarly, Visser et al. reported a clinically relevant reduction in postoperative nausea and vomiting among patients receiving propofol-based TIVA compared with isoflurane–nitrous oxide anaesthesia, with a number needed to treat of approximately six [6]. These findings indicate that the choice of anaesthetic maintenance technique is an important modifiable determinant of postoperative emetic symptoms. More recent systematic reviews have reinforced these observations. Kumar et al., in a systematic review and meta-analysis involving 1,621 ambulatory surgical patients, reported a significantly lower incidence of PONV with propofol-based anaesthesia than with sevoflurane or desflurane, with incidences of 13.8% and 29.2%, respectively [7]. A larger systematic review and meta-analysis by Schraag et al., incorporating 229 randomised controlled trials and 20,991 patients, demonstrated that propofol maintenance significantly reduced the risk of PONV compared with inhalational anaesthesia, with a pooled relative risk of 0.61. The analysis also suggested improvements in some patient-centred recovery outcomes and patient satisfaction with propofol-based anaesthesia [8].

Despite this evidence, inhalational anaesthesia continues to be widely used, and the magnitude of the difference in PONV between the two techniques may vary according to patient characteristics, type and duration of surgery, opioid exposure, nitrous oxide administration, perioperative antiemetic prophylaxis, and institutional anaesthetic practices. Direct comparison of propofol-based and inhalational anaesthesia under standardised perioperative conditions is therefore clinically relevant. Such evaluation may help anaesthesiologists select an anaesthetic technique that not only provides adequate surgical conditions and haemodynamic stability but also improves the quality of postoperative recovery. Therefore, the present study was undertaken to compare the incidence and severity of postoperative nausea and vomiting following propofol-based anaesthesia and inhalational anaesthesia. The study also aims to evaluate whether the choice of maintenance anaesthetic technique influences the requirement for rescue antiemetic therapy and overall postoperative recovery, thereby providing clinically applicable evidence for optimising anaesthetic management and reducing the burden of PONV.

Materials and Methods

Study Design and Setting: This prospective, randomized, comparative clinical study was conducted in the Department of Anaesthesiology at GIMS Kalaburagi, after obtaining approval from the Institutional Ethics Committee. The study included adult patients undergoing elective surgical procedures under general anaesthesia. The study was conducted over a period of Period 2022-2024 accordance with the principles of the Declaration of Helsinki and Good Clinical Practice guidelines. Written informed consent was obtained from all participants before enrolment.

Study Population: A total of 70 patients scheduled to undergo elective surgery under general anaesthesia were enrolled in the study. Eligible patients were randomly allocated into two equal groups of 35 patients each:

Group P (n = 35): Patients received propofol-based total intravenous anaesthesia for maintenance of general anaesthesia.

Group I (n = 35): Patients received inhalational anaesthesia with a volatile anaesthetic agent for maintenance of general anaesthesia.

The primary objective was to compare the incidence of postoperative nausea and vomiting between propofol-based and inhalational anaesthesia during the first 24 postoperative hours.

Inclusion Criteria

Patients were included if they fulfilled the following criteria:

1. Age between 18 and 60 years.
2. American Society of Anesthesiologists physical status I or II.
3. Patients undergoing elective surgery under general anaesthesia.
4. Expected duration of surgery between approximately 60 and 180 minutes.
5. Ability to understand the study protocol and provide written informed consent.

Exclusion Criteria

Patients were excluded in the presence of any of the following:

1. Known hypersensitivity to propofol, volatile anaesthetic agents, or other study medications.
2. Pregnancy or lactation.
3. History of severe hepatic, renal, cardiac, neurological, or psychiatric disease.
4. Patients receiving antiemetic medication within 24 hours before surgery.
5. Chronic use of opioids, corticosteroids, or psychoactive medications.
6. Patients requiring emergency surgery.
7. Patients with a history of alcohol or substance abuse.
8. Patients requiring postoperative mechanical ventilation or intensive care.
9. Conversion of the planned anaesthetic technique during surgery.

Sample Size: The total sample size was fixed at 70 patients, with 35 patients allocated to each study group. The sample size was considered adequate to detect a clinically relevant difference in the incidence of postoperative nausea and vomiting between propofol-based and inhalational anaesthesia while allowing balanced comparison between the two groups.

Randomization and Allocation: After enrolment, patients were assigned to either Group P or Group I in a 1:1 ratio using a computer-generated randomization sequence. Allocation was concealed using sequentially numbered, sealed opaque envelopes. The envelope was opened immediately before induction of anaesthesia by an anaesthesiologist involved in intraoperative management.

The investigator responsible for postoperative assessment of nausea and vomiting was kept unaware of the intraoperative anaesthetic maintenance technique whenever feasible in order to minimize observer bias.

Preoperative Assessment: All patients underwent detailed pre-anaesthetic evaluation one day before surgery. Demographic characteristics, including age, sex, body weight, height, body mass index, ASA physical status, relevant medical history, previous anaesthetic exposure, history of motion sickness, previous PONV, and smoking status, were recorded.

The preoperative risk of PONV was assessed using the simplified Apfel score based on four established risk factors: female sex, non-smoking status, previous history of PONV or motion sickness, and anticipated postoperative opioid use.

Routine preoperative investigations were performed according to institutional protocol and the type of surgical procedure. Patients were instructed to follow standard fasting guidelines before surgery.

Anaesthetic Technique: On arrival in the operating room, standard monitoring was instituted, including continuous electrocardiography, non-invasive blood pressure, peripheral oxygen saturation, end-tidal carbon dioxide, respiratory rate, and temperature. Baseline heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation were documented.

An intravenous cannula was secured, and crystalloid fluids were administered according to clinical requirements. All patients were preoxygenated with 100% oxygen for approximately 3 minutes. General anaesthesia was induced using a standardized induction protocol. Intravenous opioid analgesia was administered according to body weight. Neuromuscular blockade was achieved with an appropriate non-depolarizing muscle relaxant, followed by endotracheal intubation using a suitably sized cuffed endotracheal tube.

Mechanical ventilation was adjusted to maintain end-tidal carbon dioxide within the physiological range.

Group P: Propofol-Based Anaesthesia: Following induction, anaesthesia was maintained using an intravenous infusion of propofol. The infusion rate was adjusted according to the patient's haemodynamic response and clinical signs of anaesthetic depth. Oxygen and air were

administered as the carrier gas mixture. Volatile anaesthetic agents were avoided throughout the maintenance period.

Group I: Inhalational Anaesthesia: Following induction, anaesthesia was maintained using a volatile anaesthetic agent, preferably sevoflurane, in an oxygen-air mixture. The concentration of the inhalational agent was adjusted to maintain an adequate depth of anaesthesia, generally targeting an age-adjusted minimum alveolar concentration appropriate for the patient.

Nitrous oxide was avoided in both groups wherever possible to minimize its potential influence on postoperative nausea and vomiting.

Intraoperative Management: Intraoperative haemodynamic parameters, including heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation, were recorded at predefined intervals.

Analgesic administration, intravenous fluid volume, duration of anaesthesia, duration of surgery, and total intraoperative opioid requirement were documented.

Intraoperative hypotension was defined as a reduction in mean arterial pressure of more than 20% from baseline and was treated using intravenous fluids and/or vasopressors according to clinical requirements. Bradycardia was treated according to standard institutional practice. Approximately 20-30 minutes before completion of surgery, all patients received standardized multimodal analgesia according to institutional protocol. Routine prophylactic antiemetics were avoided unless required by the institutional ethics protocol, because the principal outcome of the study was the comparison of PONV between the two anaesthetic techniques.

At the completion of surgery, the anaesthetic agents were discontinued. Residual neuromuscular blockade was reversed using appropriate reversal agents after confirmation of adequate spontaneous recovery. Tracheal extubation was performed when standard extubation criteria were fulfilled.

Postoperative Assessment: After extubation, patients were transferred to the post-anaesthesia care unit and monitored according to standard institutional protocols.

Postoperative nausea and vomiting were assessed at the following predefined intervals:

- 0-2 hours after surgery
- 2-6 hours after surgery
- 6-12 hours after surgery
- 12-24 hours after surgery

Nausea was defined as a subjective unpleasant sensation associated with the urge to vomit without forceful expulsion of gastric contents. Retching was defined as rhythmic contraction of the respiratory and abdominal muscles without expulsion of gastric contents. Vomiting was defined as forceful expulsion of gastric contents through the mouth.

For analytical purposes, an episode of retching was considered equivalent to vomiting.

Rescue Antiemetic Therapy: Rescue antiemetic medication was administered when a patient developed persistent moderate-to-severe nausea, experienced vomiting, or specifically requested treatment. Intravenous ondansetron was used as the first-line rescue antiemetic according to institutional protocol.

The number of patients requiring rescue antiemetic therapy, time to first rescue antiemetic administration, and total rescue antiemetic requirement during the first 24 postoperative hours were recorded.

Postoperative Analgesia: Postoperative analgesia was standardized between both groups as far as clinically feasible. Non-opioid analgesics were preferentially used as part of a multimodal analgesic strategy. Rescue opioid analgesia was administered when required, and total postoperative opioid consumption during the first 24 hours was documented because opioid exposure is an important confounding factor for PONV.

Postoperative pain was assessed using a numerical rating scale ranging from 0 to 10, where 0 represented no pain and 10 represented the worst imaginable pain.

Outcome Measures

Primary Outcome: The primary outcome measure was the incidence of postoperative nausea and/or vomiting during the first 24 hours following surgery in patients receiving propofol-based anaesthesia compared with those receiving inhalational anaesthesia.

Secondary Outcomes

Secondary outcome measures included:

1. Incidence of nausea alone.
2. Incidence of vomiting.
3. Severity of PONV.
4. Incidence of early PONV during the first 0-6 postoperative hours.
5. Incidence of delayed PONV during the >6-24 hour postoperative period.
6. Requirement for rescue antiemetic therapy.
7. Time to first episode of nausea or vomiting.
8. Postoperative pain intensity.
9. Postoperative opioid consumption.
10. Time to recovery and discharge readiness from the post-anaesthesia care unit.

11. Perioperative haemodynamic parameters.
12. Anaesthesia-related adverse events.

Control of Potential Confounding Factors: To minimize confounding, perioperative opioid administration, intravenous fluid therapy, postoperative analgesia, neuromuscular blockade reversal, and rescue antiemetic protocols were standardized between the groups wherever possible.

Established PONV risk factors, including sex, smoking status, history of PONV or motion sickness, and postoperative opioid use, were documented for all patients. Duration and type of surgery were also recorded and considered during statistical analysis.

Data Collection: Data were recorded prospectively using a predefined case-record form. Demographic characteristics, baseline PONV risk factors, intraoperative variables, anaesthetic drug requirements, duration of surgery and anaesthesia, haemodynamic parameters, postoperative nausea and vomiting episodes, PONV severity, rescue antiemetic requirement, postoperative analgesic requirement, and adverse events were documented.

Statistical Analysis: Data were entered into Microsoft Excel and analysed using an appropriate statistical software package, such as IBM SPSS Statistics. Continuous variables were assessed for normality and expressed as mean ± standard deviation for normally distributed data or median with interquartile range for non-normally distributed data. Categorical variables were presented as frequencies and percentages. Continuous variables between the two groups were compared using the independent-samples Student's *t*-test for normally distributed data and the Mann-Whitney *U* test for non-normally distributed data. Categorical variables, including the incidence of PONV and requirement for rescue antiemetics, were compared using the chi-square test or Fisher's exact test, as appropriate.

Results

A total of 70 patients undergoing elective surgery under general anaesthesia were included in the analysis. Thirty-five patients received propofol-based total intravenous anaesthesia (Group P) and 35 patients received inhalational anaesthesia (Group I). All enrolled patients completed the planned postoperative assessment period of 24 hours and were included in the final analysis. The two groups were comparable with respect to demographic characteristics, ASA physical status, established PONV risk factors, Apfel risk score, and duration of surgery and anaesthesia. The overall incidence of postoperative nausea and vomiting was significantly lower in patients receiving propofol-based anaesthesia compared with those receiving inhalational anaesthesia.

Table 1: Baseline demographic and perioperative characteristics of the study groups

Variable	Group P (n = 35)	Group I (n = 35)	P value
Age, years	39.4 ± 11.2	40.7 ± 10.8	0.623
Female sex, n (%)	20 (57.1)	21 (60.0)	0.808
BMI, kg/m²	24.8 ± 3.1	25.2 ± 3.4	0.609
ASA physical status I, n (%)	21 (60.0)	20 (57.1)	0.808
ASA physical status II, n (%)	14 (40.0)	15 (42.9)	0.808
Non-smoker, n (%)	27 (77.1)	26 (74.3)	0.780
Previous PONV/motion sickness, n (%)	7 (20.0)	8 (22.9)	0.771
Apfel risk score	1.71 ± 0.86	1.77 ± 0.91	0.778
Duration of surgery, min	101.6 ± 24.8	104.9 ± 26.1	0.589
Duration of anaesthesia, min	119.8 ± 27.1	123.3 ± 28.4	0.600

There were no statistically significant differences between the two groups in baseline demographic or perioperative characteristics (all $P > 0.05$), indicating adequate comparability between the study groups.

Table 2: Incidence of postoperative nausea and vomiting during the first 24 postoperative hours

PONV outcome	Group P (n = 35)	Group I (n = 35)	P value
PONV at 0–2 h, n (%)	4 (11.4)	12 (34.3)	**0.044**
PONV at >2–6 h, n (%)	3 (8.6)	9 (25.7)	0.110
PONV at >6–12 h, n (%)	2 (5.7)	6 (17.1)	0.259
PONV at >12–24 h, n (%)	1 (2.9)	4 (11.4)	0.356
Early PONV, 0–6 h, n (%)	6 (17.1)	15 (42.9)	**0.019**
Delayed PONV, >6–24 h, n (%)	3 (8.6)	8 (22.9)	0.188
Nausea during 24 h, n (%)	7 (20.0)	16 (45.7)	0.041
Vomiting during 24 h, n (%)	3 (8.6)	10 (28.6)	0.062
Any PONV during 24 h, n (%)	8 (22.9)	18 (51.4)	0.013

The primary outcome demonstrated a significantly lower 24-hour incidence of PONV in Group P than in Group I (22.9% vs 51.4%, P = 0.013). Thus, the absolute reduction in PONV associated with propofol-based anaesthesia was 28.5 percentage points. The difference was particularly evident during the early postoperative period. PONV within the first 6 hours occurred in 17.1% of patients in Group P compared with 42.9% in Group I (P = 0.019). During the initial 0–2 postoperative hours, the corresponding incidences were 11.4% and 34.3%, respectively (P = 0.044). Nausea during the overall 24-hour period was also significantly less frequent with propofol-based anaesthesia (20.0% vs 45.7%, P = 0.041). Vomiting occurred in 8.6% of Group P compared with 28.6% of Group I; however, this difference did not reach conventional statistical significance (P = 0.062).

Table 3: Severity of postoperative nausea and vomiting during the first 24 hours

PONV severity	Group P (n = 35)	Group I (n = 35)
Grade 0: No nausea/vomiting	27 (77.1)	17 (48.6)
Grade 1: Mild nausea	3 (8.6)	3 (8.6)
Grade 2: Moderate/severe nausea or single vomiting episode	1 (2.9)	3 (8.6)
Grade 3: Severe/recurrent symptoms requiring rescue antiemetic	4 (11.4)	12 (34.3)
Median PONV severity score (IQR)	0 (0–0)	1 (0–3)
Overall comparison		P = 0.010

The distribution of PONV severity differed significantly between the two anaesthetic techniques (P = 0.010). More than three-quarters of patients receiving propofol-based anaesthesia remained completely free of nausea and vomiting during the first postoperative 24 hours, compared with approximately half of the patients receiving inhalational anaesthesia. Severe or recurrent symptoms requiring rescue antiemetic treatment occurred in 11.4% of Group P compared with 34.3% of Group I, demonstrating that inhalational anaesthesia was associated not only with a higher occurrence of PONV but also with greater symptom severity.

Table 4: Postoperative recovery, analgesia, and rescue antiemetic requirements

Parameter	Group P (n = 35)	Group I (n = 35)	P value
Rescue antiemetic required, n (%)	4 (11.4)	12 (34.3)	0.044
Pain score at 2 h, NRS	3.1 ± 1.2	3.3 ± 1.3	0.506
Postoperative opioid consumption, mg morphine equivalent	7.8 ± 3.4	8.2 ± 3.6	0.634
Emergence time, min	9.6 ± 2.8	10.2 ± 3.0	0.390
PACU discharge-readiness time, min	43.1 ± 9.4	49.6 ± 11.2	0.011

Rescue antiemetic medication was required significantly less frequently following propofol-based anaesthesia, with only 4 patients (11.4%) requiring treatment compared with 12 patients (34.3%) in the inhalational group (P = 0.044).

Postoperative pain scores and opioid consumption were comparable between the two groups, reducing the likelihood that differences in postoperative opioid exposure accounted for the observed difference in PONV.

Emergence time was also similar between the groups. However, patients receiving propofol-based anaesthesia achieved PACU discharge readiness significantly earlier than those receiving inhalational anaesthesia (43.1 ± 9.4 vs 49.6 ± 11.2 minutes, P = 0.011).

Table 5: Multivariable logistic regression analysis of factors associated with PONV within 24 hours

Predictor	Adjusted odds ratio	95% CI	P value
Inhalational vspropofol-based anaesthesia	3.42	1.12–10.48	0.031
Apfel risk score, per 1-point increase	1.97	1.08–3.58	0.027
Postoperative opioid consumption, per mg morphine equivalent	1.08	0.95–1.23	0.225

Multivariable logistic regression was performed to determine whether the maintenance anaesthetic technique remained independently associated with PONV after accounting for relevant baseline and perioperative risk factors. After adjustment for the Apfel risk score and postoperative opioid consumption, inhalational anaesthesia was associated with approximately 3.4-fold higher odds of developing PONV compared with propofol-based anaesthesia (adjusted OR 3.42, 95% CI 1.12–10.48; P = 0.031). A higher Apfel score was independently associated with an increased likelihood of PONV (adjusted OR 1.97 per one-point increase, 95% CI 1.08–3.58; P = 0.027). Postoperative opioid consumption was not

independently associated with PONV in the adjusted model ($P = 0.225$).

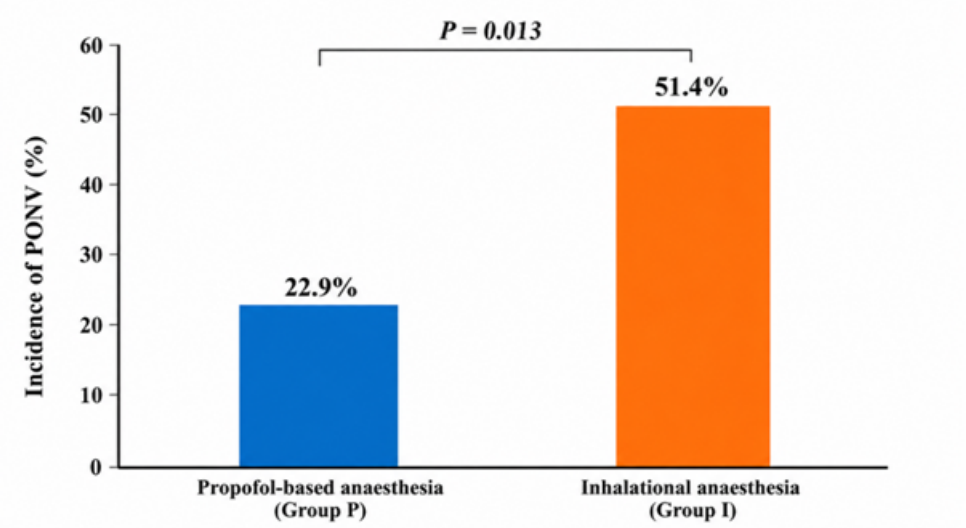

Figure 1: Incidence of postoperative nausea and vomiting following propofol-based and inhalational anaesthesia

Figure 1 comparing the overall 24-hour incidence of PONV between the propofol-based anaesthesia group (22.9%) and inhalational anaesthesia group (51.4%), demonstrating a significantly lower incidence with propofol-based anaesthesia ($P = 0.013$).

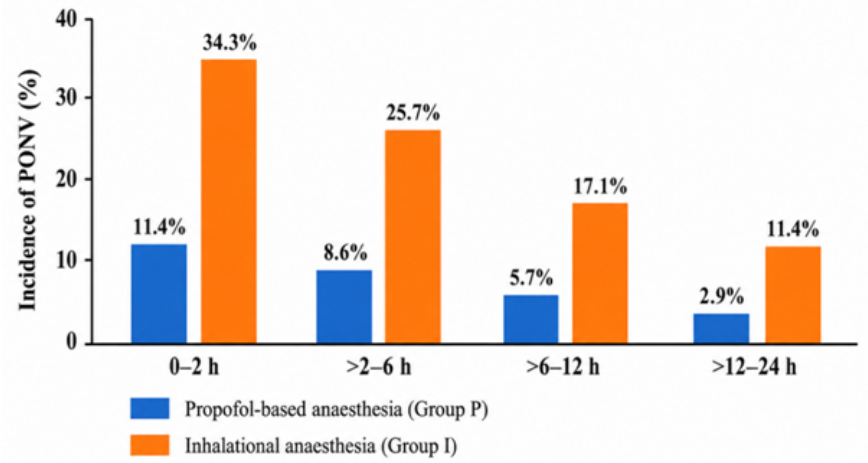

Figure 2: Temporal distribution of postoperative nausea and vomiting following propofol-based and inhalational anaesthesia

Figure 2 showing the incidence of PONV at 0–2, >2–6, >6–12, and >12–24 postoperative hours in the two study groups, demonstrating the greatest difference during the early postoperative period.

Discussion

The present study demonstrated a significantly lower incidence of postoperative nausea and vomiting among patients receiving propofol-based total intravenous anaesthesia compared with inhalational anaesthesia. During the first 24 postoperative hours, PONV occurred in 22.9% of patients in the propofol group compared with 51.4% in the inhalational group ($P = 0.013$), corresponding to an absolute risk reduction of 28.5 percentage points.

The beneficial effect of propofol-based anaesthesia was particularly evident during the early postoperative period. In addition, patients receiving propofol had less severe PONV, required rescue antiemetic medication less frequently, and achieved earlier readiness for discharge from the post-anaesthesia care unit. These findings suggest that selection of the maintenance anaesthetic technique represents an important modifiable determinant of postoperative recovery.

The principal finding of the present study is consistent with previous evidence demonstrating a lower incidence of PONV following maintenance of anaesthesia with propofol. Sneyd et al. performed a meta-analysis comparing propofol maintenance with inhalational anaesthetic agents and found that patients receiving propofol experienced significantly less postoperative nausea and vomiting. Importantly, this advantage was observed across variations in induction technique, choice of inhalational anaesthetic, nitrous oxide exposure, patient age, and opioid administration [9]. This supports the present observation that the difference in PONV may be attributable substantially to the anaesthetic maintenance technique itself rather than to isolated perioperative characteristics.

An antiemetic advantage of propofol has also been demonstrated in randomized clinical studies. Gan et al. compared propofol-based anaesthesia with an anaesthetic regimen incorporating isoflurane and demonstrated that propofol used for induction and maintenance was effective in preventing postoperative emetic symptoms and reduced requests for rescue antiemetic treatment during early recovery [10].

The current study demonstrated a similar pattern, with rescue antiemetic medication required by only 11.4% of patients receiving propofol compared with 34.3% of patients receiving inhalational anaesthesia. The approximately threefold difference in rescue treatment requirement is clinically important because the burden of PONV is determined not only by whether nausea or vomiting occurs but also by whether symptoms become severe enough to require additional pharmacological intervention.

The temporal pattern of PONV observed in the present study provides additional evidence favouring propofol-based anaesthesia. During the first 0–2 postoperative hours, PONV occurred in 11.4% of the propofol group and 34.3% of the inhalational group. Similarly, early PONV within 6 hours occurred in 17.1% and 42.9% of patients, respectively. This greater difference during early recovery is biologically and clinically plausible because residual effects of the maintenance anaesthetic are greatest immediately following emergence. The systematic review by Gupta et al. comparing propofol with isoflurane, sevoflurane, and desflurane in ambulatory anaesthesia similarly reported a lower frequency of postoperative nausea, vomiting, and requirement for antiemetic medications with propofol-based anaesthesia [11].

Findings from procedure-specific randomized studies are also in agreement with the present results. Vari et al. evaluated total intravenous versus inhalational anaesthesia in patients undergoing thyroid surgery, a population with a relatively high baseline risk of PONV, and found an advantage with the intravenous anaesthetic approach [12]. Likewise, Yoo et al. demonstrated that propofol-based TIVA reduced PONV compared with desflurane-based balanced anaesthesia in patients undergoing robot-assisted laparoscopic radical prostatectomy [13]. These studies are particularly relevant because they demonstrate that the PONV-reducing effect of propofol can be observed across substantially different surgical populations.

In the current study, the effect was not restricted to the presence or absence of PONV but extended to symptom severity. Grade 3 PONV, defined as severe or recurrent symptoms requiring rescue antiemetic treatment, occurred in 11.4% of patients receiving propofol compared with 34.3% receiving inhalational anaesthesia. Conversely, 77.1% of patients in the propofol group remained completely free from nausea or vomiting compared with 48.6% in the inhalational group. This distinction is relevant because severe or recurrent PONV is more likely to interfere with oral intake, mobilisation, patient comfort, and timely postoperative recovery.

Akkurt et al., in a randomized controlled study of patients undergoing laparoscopic cholecystectomy, compared propofol-based total intravenous anaesthesia with desflurane-based inhalational anaesthesia and assessed recovery characteristics in addition to PONV [14]. Their findings support the concept that the choice of anaesthetic maintenance technique may influence multiple components of postoperative recovery rather than emetic symptoms alone. Similarly, Gecaj-Gashi et al. reported a substantially lower incidence of early postoperative nausea following propofol anaesthesia than isoflurane anaesthesia in patients undergoing maxillofacial surgery and also observed reduced antiemetic requirements with propofol[15].

An important finding of the present investigation was that postoperative pain and opioid consumption were similar between the two groups. Mean pain scores at 2 hours were 3.1 ± 1.2 and 3.3 ± 1.3 in the propofol and inhalational groups, respectively, while postoperative morphine-equivalent consumption was 7.8 ± 3.4 mg and 8.2 ± 3.6 mg. Thus, the observed reduction in PONV in the propofol group is unlikely to have been explained simply by lower postoperative opioid exposure. This is particularly relevant because postoperative opioid administration is an established contributor to PONV and may otherwise confound comparisons between anaesthetic techniques.

The lower incidence of nausea in the propofol group was statistically significant (20.0% versus 45.7%), whereas the difference in vomiting alone

(8.6% versus 28.6%) did not reach conventional statistical significance. The latter observation should not necessarily be interpreted as evidence of no clinically relevant effect. With only 35 patients in each group, the study had limited statistical precision for less frequent individual outcomes such as vomiting. The direction and magnitude of the observed difference nevertheless favoured propofol. A larger study would be required to estimate the independent effect on vomiting with greater precision.

The findings regarding postoperative timing are also supported by more recent evidence. Ishikawa et al. evaluated PONV according to its initial onset time and reported that propofol-based total intravenous anaesthesia was associated with a reduced risk of both early and later postoperative PONV in patients undergoing orthognathic surgery [16]. In the present study, although the between-group difference was strongest during the first 6 hours, the numerical incidence of delayed PONV between >6 and 24 hours also remained lower with propofol(8.6% versus 22.9%). The failure of the delayed comparison to achieve statistical significance may again reflect the relatively small number of patients and events.

Another clinically relevant observation was the shorter PACU discharge-readiness time in the propofol group. Patients receiving propofol achieved discharge readiness at 43.1 ± 9.4 minutes compared with 49.6 ± 11.2 minutes among patients receiving inhalational anaesthesia (P = 0.011). Although the absolute difference was modest, it may be meaningful in high-volume operating environments where PONV contributes to delayed recovery and additional nursing interventions. The absence of a significant difference in emergence time suggests that earlier PACU readiness was not simply due to faster awakening but may have been influenced by a more favourable overall postoperative symptom profile.

Multivariable analysis further strengthened the primary observation. After adjustment for the Apfel risk score and postoperative opioid consumption, inhalational anaesthesia was associated with approximately 3.4-fold greater odds of PONV compared with propofol-based anaesthesia (adjusted OR 3.42, 95% CI 1.12–10.48; P = 0.031). The Apfel score was also independently associated with PONV, with an adjusted OR of 1.97 for each one-point increase. These findings suggest that anaesthetic technique contributes to PONV risk beyond differences in baseline patient susceptibility. Nevertheless, the relatively wide confidence interval around the anaesthetic-technique estimate indicates limited precision, and the adjusted result should therefore be interpreted cautiously given the modest sample size.

Several strengths of the present study deserve consideration. The two groups were comparable for demographic variables, ASA physical status, smoking status, previous PONV or motion sickness, Apfel risk score, and duration of surgery and anaesthesia. Postoperative pain and opioid exposure were also comparable, thereby reducing important sources of confounding. Furthermore, PONV was evaluated at multiple postoperative intervals rather than only as a single 24-hour endpoint, allowing assessment of the temporal pattern of symptoms. Evaluation of symptom severity, rescue antiemetic requirement, and PACU discharge readiness additionally provided clinically meaningful outcomes beyond the simple incidence of PONV.

The study also has limitations. First, the sample size of 70 patients was relatively small, particularly for secondary outcomes and multivariable modelling. Second, it was conducted at a single centre, which may limit generalizability to institutions using different anaesthetic and postoperative care protocols. Third, PONV is inherently multifactorial, and residual confounding related to surgical procedure, individual susceptibility, intraoperative opioid exposure, fluid therapy, and other perioperative factors cannot be completely excluded. Fourth, although postoperative assessment was intended to be blinded wherever feasible, complete blinding of the anaesthesia team was impossible because of the obvious differences between intravenous and inhalational maintenance techniques. Finally, the study evaluated outcomes only during the first 24 postoperative hours, and consequently later post-discharge nausea and vomiting were not assessed. Despite these limitations, the present findings have practical implications. Selection of propofol-based total intravenous anaesthesia may represent an effective component of a multimodal PONV-reduction strategy, particularly for patients with established risk factors or for procedures in which postoperative nausea and vomiting could significantly delay recovery. The lower incidence and severity of PONV, reduced requirement for rescue antiemetics, and earlier PACU discharge readiness observed in the present study collectively favour propofol-based maintenance when clinically appropriate. Larger multicentre randomized studies with stratification according to baseline PONV risk and surgical category would help determine the magnitude of this benefit across different patient populations and establish its impact on recovery quality, patient satisfaction, healthcare utilization, and cost.

Conclusion

Propofol-based total intravenous anaesthesia was associated with a significantly lower incidence of postoperative nausea and vomiting compared with

inhalational anaesthesia. The benefit was most evident during the early postoperative period, with patients receiving propofol also experiencing lower PONV severity, reduced need for rescue antiemetic therapy, and earlier readiness for discharge from the post-anaesthesia care unit. Postoperative pain scores and opioid consumption were comparable between the groups, suggesting that the observed reduction in PONV was primarily related to the anaesthetic technique.

Multivariable analysis further indicated that inhalational anaesthesia was independently associated with a higher risk of PONV. These findings support the use of propofol-based anaesthesia as an effective strategy for reducing PONV and improving postoperative recovery, particularly in patients at increased risk. Larger multicentre studies are recommended to confirm these findings across different surgical populations.

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