Journal of Clinical and Nursing Research, 2026, Volume 10, Issue 6
http://ojs.bbwpublisher.com/index.php/JCNR
Online ISSN: 2208-3693
Print ISSN: 2208-3685

Study on the Correlation Between Preoperative Anemia and Postoperative Nausea and Vomiting in Patients Undergoing Laparoscopic Cholecystectomy

Xu Hu, Shengping Zheng, Lun Mao, Chaolong Liu, Mingquan Wang*

Department of Anesthesiology, Zizhong County People's Hospital, Neijiang 641200, Sichuan, China

Author to whom correspondence should be addressed.

Copyright: © 2026 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: *Objective:* To investigate the correlation between preoperative anemia and postoperative nausea and vomiting (PONV) in patients undergoing laparoscopic cholecystectomy (LC), and to analyze 14 influencing factors of PONV to provide references for clinical prevention and treatment. *Methods:* A prospective cohort study was conducted, including 400 patients who underwent LC in our hospital from June 2024 to May 2026. Patients were grouped based on the occurrence of postoperative PONV, and the incidence of PONV was compared between anemic and non-anemic patients. Univariate and multivariate logistic regression analyses were used to analyze the influencing factors of PONV. *Results:* In the PONV group, the proportion of anemic patients was higher than that of non-anemic patients, but the difference was not statistically significant ($p = 0.069$). There were statistically significant differences in baseline data, such as gender, history of motion sickness, and postoperative opioid analgesia, between the two groups (all $p < 0.05$). Univariate regression analysis of five potential factors showed that three factors, namely female gender, history of motion sickness, and postoperative opioid analgesia, were significantly associated with PONV (all $p < 0.05$). Multivariate regression analysis revealed that female gender, history of motion sickness, and postoperative opioid analgesia were independent risk factors for PONV after LC ($p < 0.05$). *Conclusion:* Female gender, history of motion sickness, and postoperative opioid analgesia are closely related to PONV and are independent risk factors for PONV in patients undergoing LC, while preoperative anemia is not a risk factor for PONV after LC.

Keywords: Laparoscopic cholecystectomy; Preoperative anemia; Postoperative nausea and vomiting; Risk factors

Online publication: Jun 30, 2026

1. Introduction

Laparoscopic cholecystectomy (LC) is the preferred minimally invasive surgical procedure for treating benign gallbladder diseases, offering advantages such as minimal trauma and rapid recovery. However,

the incidence of postoperative nausea and vomiting (PONV) remains high [1]. PONV not only increases patient discomfort but may also lead to complications such as wound dehiscence, aspiration, and electrolyte disturbances, prolonging hospital stays and affecting postoperative recovery. Preoperative anemia is a common comorbidity in surgical patients, with an incidence of approximately 30% to 40%. Anemia can lead to inadequate tissue oxygenation, abnormal gastrointestinal mucosal perfusion, and neurotransmitter disturbances, potentially increasing the risk of postoperative complications [2]. Current research on the influencing factors of PONV after LC primarily focuses on gender, smoking history, anesthesia method, and surgical duration, with limited studies directly examining the correlation between preoperative anemia and PONV, and lacking a systematic analysis of multiple influencing factors. This study employed a prospective cohort design, including 400 LC patients, to clarify the correlation between preoperative anemia and PONV and comprehensively analyze potential influencing factors, providing evidence-based guidance for the precise clinical prevention and treatment of PONV, while enriching the prevention and control system for perioperative complications of LC.

2. Materials and methods

2.1. General information

A prospective cohort study design was used, selecting 400 patients who underwent elective LC in the hepatobiliary surgery department of our hospital from June 2024 to May 2026 as the study subjects.

2.1.1. Inclusion criteria

(1) Age 18 to 75 years;
(2) Diagnosed with benign diseases such as gallstones or chronic cholecystitis via ultrasound/CT;
(3) First-time LC with a smooth surgical procedure;
(4) Complete clinical data, with informed consent obtained and signed by the patient

2.1.2. Exclusion criteria

(1) Emergency surgery
(2) Comorbid gastrointestinal diseases, liver or kidney failure, or coagulopathy;
(3) History of blood transfusion or chemotherapy within 3 months before surgery;
(4) Allergy to anesthetics or antiemetics;
(5) Conversion to laparotomy or death within 24 hours postoperatively.

2.2. Definition of indicators

(1) Definition of preoperative anemia

According to the World Health Organization (WHO) criteria, anemia is defined as Hb < 130 g/L for males and Hb < 120 g/L for females.

(2) Diagnostic criteria for PONV

Nausea or vomiting occurring within 24 hours postoperatively, classified by severity as: mild (slight nausea without vomiting), moderate (nausea with 1–2 episodes of vomiting), and severe (severe nausea with ≥ 3 episodes of vomiting); PONV positivity is defined as moderate or severe vomiting.

2.3. Surgical and anesthesia methods

All patients underwent general anesthesia with tracheal intubation. Anesthesia induction: propofol 1.5–2.0 mg/kg, fentanyl 2–4 μg/kg, and rocuronium 0.6 mg/kg; anesthesia maintenance: intravenous infusion of propofol and remifentanil, maintaining a bispectral index (BIS) of 40–60. All surgeries were performed by the same surgical team, with routine establishment of a CO_2 pneumoperitoneum at a pressure of 12 mmHg, using a three-port technique, routine hemostasis, and no routine placement of a nasogastric tube. Postoperative analgesia was administered as needed using nonsteroidal or opioid analgesics based on pain levels.

2.4. Observation indicators

(1) Preoperative baseline data

Gender, age, smoking history, history of motion sickness, comorbidities (diabetes, hypertension), preoperative Hb, albumin, and Self-Rating Anxiety Scale (SAS) score.

(2) Intraoperative data

Surgical duration, anesthesia recovery time, and intraoperative hypotension (systolic blood pressure < 90 mmHg for ≥ 5 minutes).

(3) Postoperative data

Occurrence of PONV within 24 hours, use of postoperative analgesics, and pain score (NRS).

2.5. Statistical methods

Data analysis was performed using SPSS 27.0 software. Continuous data are presented as mean ± standard deviation ($\overline{x} \pm s$), with comparisons between groups using the *t*-test; categorical data are presented as rates (%), with comparisons between groups using the χ^2 test; ordinal data were compared using the rank-sum test. Univariate analysis was used to screen factors related to PONV, and factors with $p < 0.05$ were included in multivariate logistic regression analysis to identify independent risk factors. A p-value < 0.05 was considered statistically significant, with data rounded to two decimal places.

2. Results

2.1. Comparison of baseline data between the two groups

Among the 400 patients, 105 cases experienced PONV, with an overall incidence rate of 26.25%. There were 117 anemic patients, accounting for 29.25% of the total. In the PONV group, 38 patients were anemic, representing 35.18%; while in the non-PONV group, 79 patients were anemic, representing 26.77%. The incidence of PONV was higher in anemic patients compared to non-anemic patients, but the difference was not statistically significant. There were statistically significant differences in baseline data, such as gender, history of motion sickness, and postoperative opioid analgesia, between the two groups (all $p < 0.05$), as shown in **Table 1**.

Table 1. Comparison of baseline data between the two groups

Variable	PONV group (n = 105)	Non-PONV group (n = 295)	χ^2 value	*p* value
Preoperative anemia (yes)	38 (35.18%)	79 (26.77%)	3.314	0.069
Gender (female)	71 (68.31%)	161 (54.57%)	5.407	0.020

Age (< 50 years)	53 (50.47%)	131 (44.40%)	1.148	0.284
Smoking history (no)	36 (34.28%)	88 (29.83%)	0.719	0.397
Motion sickness history (yes)	19 (18.09%)	26 (8.81%)	6.681	0.010
Preoperative anxiety (yes)	16 (15.23%)	59 (20.00%)	1.153	0.283
Diabetes (yes)	18 (17.14%)	43 (14.57%)	0.395	0.530
Hypertension (yes)	24 (22.85%)	49 (16.61%)	2.025	0.155
Preoperative albumin (< 35g/L)	47 (44.76%)	105 (35.59%)	2.764	0.096
Operation time (> 90 min)	16 (15.23%)	48 (16.27%)	0.062	0.804
Postoperative opioid analgesia (yes)	41 (39.04%)	71 (24.06%)	8.620	0.003
Postoperative pain (NRS ≥ 4)	43 (40.95%)	108 (36.61%)	0.622	0.430
Anesthesia recovery time (> 30 min)	39 (37.14%)	109 (36.94%)	0.001	0.972
Intraoperative hypotension (yes)	9 (8.57%)	34 (11.52%)	0.704	0.401

2.2. Correlation between preoperative anemia and PONV and univariate analysis

Univariate analysis was conducted on factors such as preoperative anemia, gender, history of motion sickness, preoperative albumin, and postoperative opioid analgesia. The results showed that three factors, female gender, history of motion sickness, and the use of postoperative opioid analgesics, were significantly associated with PONV, as shown in **Table 2**.

Table 2. Univariate analysis of factors influencing PONV

Variable	PONV group (n = 105)	Non-PONV group (n = 295)	χ^2 value	*p* value	OR (95% CI)
Preoperative anemia (yes)	38 (36.19%)	79 (26.77%)	3.314	0.069	1.55 (0.97–2.49)
Gender (female)	71 (68.31%)	161 (54.57%)	5.407	0.020	1.74 (1.09–2.78)
History of motion sickness (yes)	19 (18.09%)	26 (8.81%)	6.681	0.010	2.29 (1.21–4.34)
Preoperative albumin (< 35 g/L)	47 (44.76%)	105 (35.59%)	2.764	0.096	1.47 (0.93–2.31)
Postoperative opioid analgesia (yes)	41 (39.04%)	71 (24.06%)	8.620	0.003	2.02 (1.26–3.25)

2.3. Multivariate logistic regression analysis of factors influencing PONV

Five potential influencing factors were included in the multivariate logistic regression analysis. The results indicated that female gender, motion sickness, and postoperative opioid analgesia were independent risk factors for PONV after LC ($p < 0.05$), as shown in **Table 3**.

Table 3. Results of multivariate logistic regression analysis

Variable	Adjusted OR	95% CI	*p* value
Anemia (yes vs no)	1.49	(0.92–2.42)	0.101
Gender (female vs male)	1.66	(1.03–2.69)	0.038
Motion sickness (present vs absent)	2.19	(1.15–4.16)	0.017
Low albumin (< 35 vs ≥ 35)	1.44	(0.92–2.27)	0.112
Opioid analgesia (present vs absent)	1.96	(1.22–3.15)	0.005

3. Discussion

Laparoscopic cholecystectomy (LC) is the mainstream minimally invasive surgical procedure for treating

benign gallbladder lesions in clinical practice. Postoperative nausea and vomiting (PONV), as one of the most common perioperative complications of this surgery, not only exacerbates patients' physical discomfort but may also interfere with the postoperative recovery process. Therefore, identifying the relevant influencing factors of PONV and implementing targeted prevention and control measures holds significant clinical practical value [3–5].

The results of this study indicate that the incidence of preoperative anemia in LC patients is 29.25%, and the incidence of PONV in LC patients is 26.25%. Among PONV patients, the proportion of anemic patients is 35.18%, which is higher than that of non-PONV patients, but the difference is not statistically significant. The reasons for this are analyzed as follows:

(1) The sample size is too small. Although there is a trend, the significance is not obvious, and a larger sample size is needed.

(2) Although we defined anemia, its severity was not differentiated. While anemia can cause gastrointestinal mucosal ischemia and hypoxia, damage to the mucosal barrier, gastrointestinal motility disorders, delayed gastric emptying, and easily induce nausea and vomiting, the anemia in most LC patients is not severe, so the impact in this regard is limited.

(3) Although some studies have shown that anemic patients have a more intense perioperative stress response, with sympathetic nervous system excitation exacerbating gastrointestinal dysfunction and increasing the risk of PONV, LC surgery, due to its short duration and minimal trauma, results in limited stress persistence and intensity, so anemia cannot play a synergistic role in this regard [6].

This study incorporated 14 common clinical indicators for grouped comparison and univariate analysis. The results confirmed that three factors, female gender, a history of motion sickness, and postoperative opioid analgesia, are significantly associated with the occurrence of PONV ($p < 0.05$). These factors cover multiple dimensions, including demographic characteristics, personal medical history, preoperative status, and surgery- and anesthesia-related indicators, confirming that PONV after LC is a complication caused by the combined effects of multiple factors, rather than being attributed to a single cause [7–9].

Further multivariate logistic regression analysis, after eliminating the interference of confounding variables, revealed that female gender, a history of motion sickness, and postoperative opioid analgesia are independent risk factors for PONV in LC patients ($p < 0.05$). Based on physiological characteristics, women have relatively higher estrogen levels, which can enhance the sensitivity of the central nervous system to external stimuli, making the vomiting center more easily activated. At the same time, women generally have higher vestibular function sensitivity, and when combined with the effects of surgical position changes and anesthetic drug stimulation, the probability of PONV is further increased. This conclusion is generally consistent with the views obtained from most current clinical studies and also suggests that female patients should be identified as a key population for PONV prevention and control in clinical practice [10]. Similarly, in patients with motion sickness, their vestibular system is more easily activated under surgical anesthesia, and the activated vestibular signals are directly transmitted to the vomiting center in the brainstem, triggering the nausea and vomiting reflex [11]. The use of postoperative opioid analgesia can directly stimulate the chemoreceptor trigger zone located in the area postrema of the brain, which is a receptor station for emetic signals. Once activated, it produces a feeling of nausea and vomiting and issues vomiting commands. At the same time, opioid drugs also significantly slow down gastrointestinal motility and emptying, leading to gastric content retention. This functional gastroparesis can cause abdominal distension and discomfort, which

are common causes of nausea and vomiting [12].

This study is a single-center prospective cohort study with a sample size of 400 cases. Although it meets the requirements of clinical research, it has certain limitations:

(1) Single-center data may have selection bias, and the results need to be verified by multicenter studies.

(2) No stratified analysis was conducted on the severity of8 anemia (mild, moderate, severe), making it impossible to clarify the dose-response relationship between different degrees of anemia and PONV.

(3) Gastrointestinal hormones, neurotransmitters, and other indicators were not detected, so the molecular mechanisms by which anemia induces PONV could not be explored in depth. In the future, multicenter, large-sample studies can be conducted to analyze the severity of anemia in strata and combine laboratory indicators to further reveal its mechanisms of action.

4. Conclusion

Preoperative anemia in patients undergoing laparoscopic cholecystectomy is not an independent risk factor for postoperative nausea and vomiting. However, female gender, a history of motion sickness, and postoperative opioid analgesia together constitute high-risk factors for PONV. Clinically, individualized perioperative management plans need to be formulated for high-risk patients, optimizing surgical anesthesia procedures and strengthening postoperative care to effectively reduce the incidence of PONV and promote rapid patient recovery.

Funding

Zizhong County Science and Technology Support Program (Project No.: Z24-14)

Disclosure statement

The authors declare no conflict of interest.

References

[1] Li N, Dou Y, Liu R, 2025, Comparative Study on the Short-Term Effects and Indicators of Body Stress Response Between Laparoscopic and Small-Incision Cholecystectomy for Gallstones. Henan Journal of Surgery, 31(1): 134–136.

[2] Zhan Z, Bao C, Tang H, et al., 2022, Analysis of 65 Cases of Clinical Experience and Technical Improvements in Stent-Free Laparoscopic Cholecystectomy + Common Bile Duct Incision and Stone Extraction with Primary Suture. Shanxi Medical Journal, 51(15): 1737–1739.

[3] Ni L, Li G, Bao Y, et al., 2026, Relationship Between Serum CCK, D-Lactic Acid, sICAM-1 and Postoperative Gastrointestinal Function Recovery in Elderly Patients Undergoing Laparoscopic Cholecystectomy. Chinese Journal of Gerontology, 46(10): 1745–1748.

[4] Qi X, Hu J, Jia J, 2026, Analysis of Risk Factors for Conversion to Laparotomy in Patients Undergoing Laparoscopic Cholecystectomy. Clinical Research and Practice, 11(14): 77–80.

[5] Ni S, 2026, Analysis of Risk Factors for Conversion to Laparotomy in Laparoscopic Surgery for Calculous

Cholecystitis. Zhejiang Journal of Traumatic Surgery, 31(4): 738–741.

[6] Chen L, 2024, The Effect of Electroacupuncture on Postoperative SIRS in Patients Undergoing Laparoscopic Radical Resection of Gastrointestinal Tumors, thesis, Fujian University of Traditional Chinese Medicine.

[7] Liu P, Liu F, Zhao X, et al., 2026, Establishment and Validation of a Nomogram Prediction Model for the Influencing Factors of Surgical Timing Selection and Postoperative Complication Risks in Early Versus Delayed Laparoscopic Surgery for Acute Cholecystitis Patients. Journal of Hepatobiliary Surgery, 34(1): 48–55.

[8] Li C, 2023, Comparison of Surgical Indicators and Postoperative Complications Between Primary Suture and T-Tube Drainage After Laparoscopic Common Bile Duct Incision and Stone Extraction for Common Bile Duct Stones. China Medical Innovation, 20(12): 112–115.

[9] Wang L, Ma L, Wang X, et al., 2026, Report of 1 Case of Deep Cystic Gastritis Diagnosed and Endoscopically Resected by Endoscopic Ultrasonography. Journal of Gastroenterology and Hepatology, 35(4): 519–521.

[10] Li H, Du Y, Lu Z, et al., 2022, The Effect of Different Postoperative Analgesic Methods on Postoperative Nausea and Vomiting in Female Patients Undergoing Laparoscopic Surgery. Inner Mongolia Medical Journal, 54(11): 1299–1304 + 1308.

[11] Sun Y, 2024, The Effect of Remifentanil Target-Controlled Infusion Combined with Ibuprofen Injection on Postoperative Nausea and Vomiting in Female Patients with Motion Sickness Undergoing Gynecological Laparoscopic Surgery, thesis, Jilin University.

[12] Ma J, Wei X, 2021, Research Progress on Opioid Receptor Antagonists in Preventing Postoperative Nausea and Vomiting After General Anesthesia. Clinical Journal of Military Medicine, 49(12): 1406–1408 + 1410.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.