Original Article
Association of tongue diagnosis-guided acupuncture with postoperative nausea and vomiting in high-risk laparoscopic surgery patients

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Abstract: Objectives: This study investigated whether using tongue diagnosis-guided acupuncture in combination with drugs could reduce the incidence of postoperative nausea and vomiting (PONV) in high-risk patients undergoing laparoscopic surgery. Methods: We retrospectively reviewed and analyzed data from female patients who underwent laparoscopic surgery between April 2023 and March 2025. The patients were divided into four groups: the drug group, acupuncture plus drug (AD) group, constitution-based drug (CD) group, and constitution-based acupuncture plus drug (CAD) group. The primary outcomes included the incidence, onset time, and severity of PONV within 24 hours after surgery. Secondary outcomes included indicators of gastrointestinal function recovery, as well as the use of postoperative analgesic and antiemetic drugs. Univariate and multivariate logistic regression analyses were performed to identify independent risk factors for PONV. Results: Among 248 patients, the CAD group had the lowest PONV incidence (18.97% vs. drug group: 79.17%, AD group: 46.97%, CD group: 61.54%; all P<0.05). Gastrointestinal recovery was significantly faster in the CAD group, with shorter times to bowel sound recovery, first flatus, and first defecation (all p<0.05). The CAD group also showed the highest serum motilin levels and the lowest vasoactive intestinal peptide levels (both P<0.05). Opioid consumption and rescue antiemetic requirements were significantly lower in the CAD group (both P<0.05). Conclusions: Constitution-based stratification guided by tongue diagnosis, combined with targeted acupuncture was associated with reduced PONV incidence, accelerated gastrointestinal recovery, and decreased opioid and antiemetic requirements in high-risk patients undergoing laparoscopic surgery.

Keywords: Postoperative nausea and vomiting, laparoscopic surgery, tongue diagnosis, precision medicine, constitution-based acupuncture, gastrointestinal function recovery

Introduction

Postoperative nausea and vomiting (PONV) is a common complication following laparoscopic surgery, causing significant patient discomfort [1]. Its incidence ranges from approximately 20% to 37% in general surgical populations, and can reach 70% to 80% in high-risk groups [2, 3]. PONV typically occurs within the first 24 to 48 hours after surgery, manifesting as nausea, the subjective urge to vomit, or active vomiting [4]. It can delay recovery and lead to complications such as dehydration, electrolyte imbalances, an increased risk of aspiration pneumonia, impaired wound healing, and prolonged hospital stay [5, 6]. The mechanism of PONV involves the integrated regulation of mul-

tiple neural pathways, where surgical stress and drug stimulation act on the vomiting center and chemorecepter trigger zone through different neurotransmitter systems [7]. Currently, the primary antiemetic drugs used for PONV prophylaxis are 5-hydroxytryptamine type 3 (5-HT3) and neurokinin-1 receptor antagonists, with an efficacy of approximately 50% to 80% [8]. However, their effects remain unsatisfactory for some high-risk patients, and they may cause adverse reactions such as headache and, rarely, arrhythmia [9]. In addition, personalized treatment strategies for different patients are still lacking. Therefore, exploring more effective PONV management approaches is necessary. Recent years have seen continuous advances in pain mechanism research and

personalized therapy. Some studies suggest that acupuncture, as an adjunctive therapy, can not only relieve postoperative pain but also help reduce the incidence of PONV, offering a new direction for improving its clinical management [10, 11].

According to previous research, individualized treatment plans guided by traditional Chinese medicine (TCM) theory may help reduce the occurrence of PONV, such as selecting appropriate drugs based on the patient's physical characteristics [12]. Recent studies have found that gastrointestinal hormones such as motilin and vasoactive intestinal peptide (VIP) are involved in the pathophysiologic process of PONV [13-15]. Among non-drug interventions, acupuncture functions by stimulating specific acupoints to regulate relevant physiologic mechanisms; commonly used acupoints include Neiguan (PC6) and Zusanli (ST36). Stimulating PC6 can affect vagal tone and reduce serotonin release, while stimulating ST36 can help improve gastric motility and inhibit VIP expression [16]. In addition, TCM tongue diagnosis can be used to distinguish different constitution types and provide a reference for assessing PONV risk. A thick and greasy tongue coating often indicates a phlegm-dampness constitution, which is frequently accompanied by weakened gastrointestinal motility. A thin and white tongue coating is more common in cases of qi and blood insufficiency and is often associated with autonomic nervous system dysfunction [17]. Treatment plans based on such constitution analysis can better reflect individual differences, making the intervention more tailored to the patient's specific condition and thereby improving its effectiveness. Currently, research on the combination of acupuncture and the constitution classification system in the perioperative period remains insufficient. With the growing emphasis on precision medicine in modern surgery, it is particularly important to fill this knowledge gap.

This study retrospectively explored the relationship between tongue diagnosis-guided constitutional stratification combined with targeted acupuncture and high-risk PONV after laparoscopic surgery. It aimed to analyze whether constitution-specific acupoint selection (e.g., PC6 for phlegm-dampness constitution and ST36 for qi and blood deficiency constitution),

when combined with drug therapy, can reduce PONV incidence, promote gastrointestinal function recovery, and reduce the use of opioid analgesics. Through this investigation, we hope to provide evidence-based support for integrating TCM diagnostic methods into routine perioperative care.

Materials and methods

Patient selection

A retrospective analysis was conducted on 248 female patients who underwent laparoscopic surgery in the operating room of Hankou Hospital between April 2023 and March 2025. The inclusion criteria were follows: (a) age between 18 and 70 years; (b) American Society of Anesthesiologists (ASA) [18] classification of I-II; (c) being a high-risk patient with an Apfel simplified risk score of 4 (i.e., meeting all four risk factors: female sex, non-smoker, history of PONV or motion sickness, and postoperative use of opioids). The exclusion criteria were: (a) preoperative nausea and vomiting or intake of antiemetic drugs within 24 hours before surgery; (b) history of central nervous system, gastrointestinal system, or other disorders predisposing to nausea and vomiting; (c) history of gastrointestinal diseases, surgeries, or chemotherapy; (d) surgery duration exceeding 2 hours.

Grouping criteria

This study focused on patients at high risk for PONV, which was defined as the occurrence of nausea, dry heaving, or vomiting within 24 hours after surgery [19]. Patients were divided into four groups based on the treatment for high-risk PONV and whether constitution stratification by tongue diagnosis was applied: the drug group, acupuncture plus drug (AD) group, constitution-based drug (CD) group, and constitution-based acupuncture plus drug (CAD) group. The initial grouping occurred naturally, meaning patients non-randomly received one of four antiemetic protocols during clinical practice, which subsequently defined our post hoc study groups. Group assignment was primarily based on preoperative patient preferences, especially their acceptance of TCM acupuncture. The procedure was as follows: First, the same TCM practitioner (with over ten years of experience) classified each patient's constitu-

tion by tongue diagnosis within 24 hours pre-operatively, blinded to subsequent anesthesia and surgical plans. Then, the anesthesiologist explained the four antiemetic protocols, and patients selected their preferred option. For the CD and CAD groups, the choice between palonosetron and granisetron was guided solely by the tongue diagnosis-derived constitution type, following predefined criteria. All patients were observed for 24 hours postoperatively before discharge. Based on PONV occurrence within 24 hours post-surgery, patients were further categorized into PONV non-occurrence and occurrence groups. Patient data were collected from the medical record system.

Tongue diagnosis

All tongue diagnoses were performed by a single TCM practitioner with over ten years of clinical experience, who held an advanced degree in TCM and was certified by the relevant national medical board. This extensive clinical experience enabled the practitioner to achieve expertise in tongue coating recognition and classification. The tongue diagnosis process followed standardized operating procedures, and with each patient's tongue image observed under uniform lighting conditions. The practitioner assessed the tongue coating based on established criteria: a thick and greasy coating indicated a phlegm-dampness constitution, while a thin and white coating indicated a qi and blood deficiency constitution. High-resolution tongue images were captured for each evaluation to ensure diagnostic accuracy and reproducibility. All tongue diagnoses were conducted by the same individual to guarantee the consistency and reliability of the results.

Treatment protocol

Patients in the drug and AD groups received an intramuscular injection of 0.075 mg palonosetron (Approval No. H20205024, Qilu Pharmaceutical (Hainan) Co., Ltd., Hainan Province, China) 30 minutes before laparoscopic surgery. Additionally, patients in the AD group underwent the insertion of a special needle (sterile, 0.25 mm in diameter, 25 mm in length) (Approval No. 20162200970, Suzhou Medical Supplies Factory Co., Ltd., Jiangsu Province, China) at the PC6 point, which is located between the palmaris longus and flexor carpi radialis tendons, approximately two cun (5 cm) above the wrist crease.

Patients in the CD and CAD groups were stratified by constitution based on tongue diagnosis. Those with a thick and greasy tongue coating received an intramuscular injection of palonosetron (identical to the drug group), while those with a thin and white tongue coating received an intramuscular injection of 3 mg of granisetron (Approval No. H20066674, Shandong Shenglu Pharmaceutical Co., Ltd., Shandong Province, China). This selection was based on the pharmacologic profiles of the drugs and emerging evidence suggesting varying efficacy across different patient subtypes. Palonosetron, a second-generation 5-HT3 receptor antagonist, has demonstrated particular efficacy in managing delayed nausea and vomiting [20]. Since the damp-phlegm constitution is often associated with prolonged gastrointestinal motility disorders and autonomic nervous system dysfunction, the long half-life and potent antiemetic effect of palonosetron are well-suited to address these symptoms. In contrast, granisetron, another 5-HT3 receptor antagonist, has been shown to effectively reduce acute PONV [21]. Patients with qi and blood deficiency often exhibit lower tolerance to surgical stress and may experience more immediate postoperative nausea. The rapid onset of action of granisetron makes it a suitable choice for this subgroup.

Additionally, patients in the CAD group received constitution-based acupuncture: those with a thick and greasy tongue coating were needled at the PC6 point (identical to the AD group), while those with a thin and white tongue coating were needled at the ST36 point. The ST36 point is located approximately three cun below the knee (equivalent to four finger widths) and one cun lateral to the anterior border of the tibia (approximately one thumb width). In this study, all acupuncture procedures were performed using disposable sterile acupuncture needles (Su Medical Device Approval No. 20172201874, Jiangsu Huawei Medical Instrument Co., Ltd., Jiangsu Province, China; specification: 0.25 mm × 25 mm). For the AD group, bilateral PC6 acupoints were needled. In the CAD group, both PC6 and ST36 acupoints were needled bilaterally. Each needle was inserted to a depth of 10-15 mm and

retained for 30 minutes. During needle retention, each needle was gently rotated clockwise and counterclockwise every 5 minutes to maintain the De Qi sensation. The characteristics of De Qi include sensations of soreness, heaviness, distension, or numbness around the needle site, indicating effective stimulation.

Anesthesia and surgical procedures

After intravenous access was established, anesthesia was induced with sufentanil (3 μg/kg; Approval No. H20203650, Jiangsu Nhwa Pharmaceutical Co., Ltd., Jiangsu Province, China), propofol (1-1.5 mg/kg; Approval No. H20051843, Guangzhou Xinji Pharmaceutical Technology Co., Ltd., Guangdong Province, China), and atracurium (0.1 mg/kg; approval number H20213438, Hangzhou Hongyou Pharmaceutical Technology Co., Ltd., Zhejiang Province, China). After loss of consciousness, an oropharyngeal airway (laryngeal mask) was inserted, checked for leakage, and fixed before connecting to the anesthesia machine for controlled ventilation. Anesthesia was maintained with continuous inhalation of sevoflurane at 1.0-1.5 minimum alveolar concentration (Approval No. H20213735, Shanghai Hengrui Pharmaceutical Co., Ltd., Shanghai, China) and a continuous infusion of remifentanil at 0.2-0.3 μg/(kg·min) (Approval No. H20030199, Yichang Renfu Pharmaceutical Co., Ltd., Hubei Province, China). Sevoflurane administration was discontinued at the start of skin closure, and the remifentanil infusion was stopped at the end of surgery. Throughout the procedure, electrocardiogram, blood pressure, heart rate, oxygen saturation, and end-tidal carbon dioxide pressure were continuously monitored.

Postoperative analgesia plan

All patients received a standardized patient-controlled intravenous analgesia (PCIA) protocol postoperatively [22]. The analgesic solution consisted of sufentanil 1.5 μg/kg and flurbiprofen axetil 100 mg (Approval No. H20041508, Beijing Tide Pharmaceutical Co., Ltd., Beijing, China) diluted with normal saline to a total volume of 100 mL, administered via a PCIA pump (CADD-Solis™, Smiths Medical, Minnesota, USA). The pump was set to a background infusion rate of 2 mL/h, with a bolus dose of 0.5 mL per demand and a lockout interval of 15 minutes, allowing patients to autonomously manage their analgesia. If the patient's resting visual analog scale (VAS) score was ≥4 or the active VAS score was ≥6, supplemental sufentanil was administered by the anesthesia nurse. Repeat doses were permitted every 30 minutes, with a maximum cumulative additional dose not exceeding 400 μg within 24 hours.

Postoperative antiemetic rescue

If patients experienced two or more episodes of PONV within the first 2 hours postoperatively, an intramuscular injection of 10 mg metoclopramide (Approval No. H20045756, Penglai Nuokang Pharmaceutical Co., Ltd., Shandong Province, China) was administered as first-line rescue therapy. If two consecutive metoclopramide injections administered at 30-minute intervals were ineffective, 4 mg ondansetron (Approval No. H20063166, Shandong North China High-Tech Huatai Pharmaceutical Co., Ltd., Shandong Province, China) was administered intravenously.

Outcome measures

The primary outcomes were the incidence, time to onset, and severity of PONV within 24 hours postoperatively. The severity of PONV was assessed using a VAS ranging from 0 to 10 cm. A score of 0 indicated no nausea or vomiting, and a score of 10 represented the most severe, intolerable nausea and vomiting; higher scores indicated more severe symptoms. The Cronbach's alpha for the scale was 0.70 [23].

Secondary outcomes included the consumption of rescue antiemetic medication and indicators of gastrointestinal function recovery within 24 hours postoperatively. Gastrointestinal recovery indicators included the time to bowel sound recovery, time to first flatus, time to first defecation, gastric motility index, and serum of levels motilin and VIP. Bowel sounds were assessed by auscultating the lower right abdomen for 1 minute every 30 minutes postoperatively using an electronic stethoscope (3M™ Littmann® Classic III, 3M Company, Minnesota, USA); the time when ≥3 bowel sounds per minute were first detected was recorded. If the first flatus or defecation occurred after 24 hours, the time was obtained via telephone follow-up. The gastric motility index was calculated by measuring the frequency and amplitude of antral contractions using an ultrasound system

(LOGIQ E10, General Electric, Illinois, USA) at 24 hours postoperatively. Serum levels of motilin and VIP were measured at 24 hours using the Human Motilin ELISA Kit (Catalog No. E-EL-H2271c, Elabscience, Hubei Province, China) and the Human VIP ELISA Kit (Catalog No. E-EL-H0109c, Elabscience, Hubei Province, China), respectively.

The effectiveness of acupuncture was evaluated by comparing the drug group with the AD group, and the CD group with the CAD group. The necessity of constitution-based risk stratification based on tongue diagnosis was assessed by comparing the drug group with the CD group, and the AD group with CAD group. The efficacy of constitution-based acupuncture (guided by tongue diagnosis) for PONV prevention and treatment was further evaluated by comparing the drug group with the CAD group.

Ethical approval

This study was formally approved by the Institutional Review Board and Ethics Committee of Hankou Hospital. As all patient data used in this study were anonymized and the research posed no potential risks or adverse effects to participants, the Institutional Review Board and Ethics Committee waived the requirement for informed consent in accordance with regulatory and ethical guidelines for retrospective studies.

Statistical analysis

In this retrospective observational study, the sample size was determined by a consecutive cohort of patients who met all inclusion and exclusion criteria during the study period (April 2023 to March 2025). No *a priori* power analysis was performed; however, a *post hoc* power analysis for the primary outcome (PONV incidence) indicated that the obtained sample size (N=248) had sufficient statistical power (>80%) at $\alpha=0.05$ and met the requirements for multivariable model stability (events per variable >10). All statistical analyses were performed using SPSS (version 29.0; IBM Corp., Armonk, NY, USA). Based on the Shapiro-Wilk test, all continuous variables were normally distributed (all P>0.05) and are presented as mean ± standard deviation. Group differences for these continuous variables were analyzed using independent samples t-tests. Categorical variables were expressed as frequencies and percentages [n (%)] and were analyzed using chi-square tests. Symbols (*, #, \$) in the results denote statistical significance (P<0.05). To identify independent risk factors for PONV, univariate and multivariate logistic regression analyses were performed using its 24-hour occurrence as the dependent variable. Independent variables included age, body mass index (BMI), treatment method (with the drug group as reference: AD, CD, and CAD), surgical and anesthesia duration, and intraoperative and postoperative sufentanil doses. All between-group comparisons were reported with corresponding test statistics (t or χ^2 values).

Results

Overall patient outcomes

Baseline demographic and clinical characteristics: Comparative analysis of the four groups revealed no statistically significant differences in age, BMI, years of education, marital status, history of acupuncture, or ASA physical status classification (all P>0.05; **Table 1**). The distribution of ethnicity was also similar across all groups with Han ethnicity being predominant, and no significant difference was observed (P>0.05). Tongue diagnosis, which was performed only in the CD and CAD groups, indicated that a majority of participants in both groups presented with a thick-greasy tongue coating. No significant difference was found between the CD and CAD groups in the distribution of tongue coating types (P>0.05), suggesting comparable baseline characteristics in TCM.

The anesthesia and surgical characteristics were comparable across the four groups (all P>0.05; **Table 2**). The distribution of surgical types - such as cholecystectomy, appendectomy, and fundoplication - was similar among the groups, with no significant differences observed. Similarly, no significant differences were found in the dosages of anesthetic drugs, including sufentanil, propofol, atracurium, sevoflurane, and remifentanil. Intraoperative vital signs, including preoperative and intraoperative heart rate, mean arterial pressure, and end-tidal carbon dioxide pressure, were also comparable across the groups. Furthermore, both surgical duration and anesthesia duration showed no significant differences among the groups. These results indicate consistent base-

Table 1. Comparison of baseline demographic and clinical characteristics among the four study groups

Characteristic	Drug group (n=72)	AD group (n=66)	CD group (n=52)	CAD group (n=58)	Statistic 1	Statistic 2	Statistic 3	Statistic 4	Statistic 5
Age (years)	45.32 ± 12.85	42.35 ± 12.64	41.18 ± 13.27	44.73 ± 11.92	1.371	1.748	0.270	1.075	1.476
BMI (kg/m^2)	24.56 ± 3.15	23.68 ± 3.74	24.35 ± 3.42	23.94 ± 3.58	1.507	0.345	1.053	0.392	0.614
Ethnicity [n (%)]					0.629	0.215	0.047	0.041	0.043
Han	65 (90.28%)	62 (93.94%)	49 (94.23%)	53 (91.38%)					
Other	7 (9.72%)	4 (6.06%)	3 (5.77%)	5 (8.62%)					
Education (years)	13.74 ± 3.38	14.26 ± 3.44	14.05 ± 3.21	13.68 ± 3.57	0.893	0.518	0.095	0.919	0.572
Marital status [n (%)]					0.001	0.001	0.031	0.019	0.036
Married	58 (80.56%)	53 (80.30%)	42 (80.77%)	46 (79.31%)					
Unmarried	14 (19.44%)	13 (19.70%)	10 (19.23%)	12 (20.69%)					
Acupuncture history [n (%)]					0.485	0.061	0.013	0.301	0.115
Yes	18 (25.00%)	20 (30.30%)	12 (23.08%)	15 (25.86%)					
No	54 (75.00%)	46 (69.70%)	40 (76.92%)	43 (74.14%)					
ASA classification [n (%)]					0.008	0.005	1.315	1.460	1.014
I	55 (76.39%)	50 (75.76%)	40 (76.92%)	49 (84.48%)					
II	17 (23.61%)	16 (24.24%)	12 (23.08%)	9 (15.52%)					
Tongue coating [n (%)]					-	-	-	-	0.039
Thick and greasy	-	-	35 (67.31%)	38 (65.52%)					
Thin and white	-	-	17 (32.69%)	20 (34.48%)					

AD, acupuncture plus drug; CD, constitution-based drug; CAD, constitution-based acupuncture plus drug; BMI, body mass index; ASA, American Society of Anesthesiologists; Statistic 1, Drug-only group vs. AD group; Statistic 2, Drug-only group vs. CD group; Statistic 3, Drug-only group vs. CAD group; Statistic 4, AD group vs. CAD group; Statistic 5, CD group vs. CAD group.

Table 2. Comparison of anesthesiological and surgical characteristics among the four study groups

Characteristic	Drug group (n=72)	AD group (n=66)	CD group (n=52)	CAD group (n=58)	Statistic 1	Statistic 2	Statistic 3	Statistic 4	Statistic 5
Surgical type [n (%)]					0.069	0.505	0.039	0.076	0.272
Cholecystectomy	40 (55.56%)	36 (54.55%)	28 (53.85%)	32 (55.17%)					
Appendectomy	18 (25.00%)	17 (25.76%)	12 (23.08%)	14 (24.14%)					
Fundoplication	6 (8.33%)	5 (7.58%)	4 (7.69%)	5 (8.62%)					
Other[a]	8 (11.11%)	8 (12.12%)	8 (15.38%)	7 (12.07%)					
Anesthetic Dosage									
Sufentanil (μg)	23.16 ± 2.35	23.47 ± 2.22	23.37 ± 2.75	23.48 ± 2.67	0.795	0.459	0.724	0.021	0.215
Propofol (mg)	103.45 ± 12.17	107.43 ± 13.48	107.44 ± 10.18	105.42 ± 18.19	1.823	1.927	0.706	0.691	0.730
Atracurium (mg)	8.52 ± 1.74	8.85 ± 2.13	8.65 ± 2.11	8.59 ± 2.47	1.020	0.378	0.184	0.618	0.133
Sevoflurane (mL)	24.83 ± 5.47	25.16 ± 5.92	23.95 ± 4.86	24.32 ± 5.13	0.341	0.926	0.544	0.846	0.382
Remifentanil (mg)	1.38 ± 0.29	1.42 ± 0.31	1.35 ± 0.27	1.41 ± 0.33	0.716	0.482	0.517	0.261	0.990
Vital sign monitoring									
Preoperative heart rate (bpm)	79.85 ± 11.63	78.42 ± 12.34	78.96 ± 10.85	80.62 ± 8.59	0.700	0.430	0.435	1.163	0.894
Preoperative MAP (mmHg)	90.86 ± 11.59	92.14 ± 9.27	91.68 ± 10.53	92.05 ± 10.73	0.713	0.404	0.603	0.052	0.179
Intraoperative heart rate (bpm)	67.43 ± 11.72	66.82 ± 12.31	67.23 ± 11.92	67.45 ± 11.68	0.298	0.095	0.010	0.289	0.100
Intraoperative MAP (mmHg)	82.49 ± 12.42	84.71 ± 10.63	83.93 ± 11.32	84.58 ± 10.86	1.126	0.658	1.007	0.069	0.306
Intraoperative $PETCO_2$ (mmHg)	31.36 ± 3.52	31.43 ± 2.96	31.59 ± 2.92	30.98 ± 2.27	0.118	0.387	0.742	0.960	1.213
Duration of surgery (mins)	85.47 ± 14.96	83.63 ± 15.48	84.82 ± 14.61	85.36 ± 13.38	0.711	0.240	0.043	0.662	0.204
Duration of anesthesia (mins)	126.42 ± 27.85	124.85 ± 33.62	124.92 ± 29.39	123.48 ± 26.71	0.299	0.290	0.609	0.250	0.270

AD, acupuncture plus drug; CD, constitution-based drug; CAD, constitution-based acupuncture plus drug; MAP, mean arterial pressure; $PETCO_2$, end-tidal carbon dioxide pressure; [a]Other procedures included ovarian cystectomy, diagnostic laparoscopy, hernia repair, and adhesiolysis; Statistic 1, Drug-only group vs. AD group; Statistic 2, Drug-only group vs. CD group; Statistic 3, Drug-only group vs. CAD group; Statistic 4, AD group vs. CAD group; Statistic 5, CD group vs. CAD group.

line anesthesia and surgical conditions across all groups, which helps control for potential confounding factors in the comparison of intervention effects.

Incidence of PONV: The incidence of PONV within the first 24 hours after surgery differed significantly among the four groups (**Table 3**). The total PONV incidence was significantly lower in the AD, CD, and CAD groups than in the drug group (all P<0.05). The CAD group demonstrated the lowest total PONV incidence, which was significantly lower not only than the drug group but also than the CD and AD groups (all P<0.05). Regarding nausea alone, its incidence was significantly lower in the AD and CAD groups than in the drug group (both P<0.05), whereas no significant difference was observed between the CD and drug groups. A similar trend was observed for vomiting incidence, which was significantly reduced in the AD and CAD groups compared with the drug group (both P<0.05), with no significant difference between the CD and drug groups. These results indicate that supplementing drug therapy with acupuncture (as in the AD and CAD groups) more effectively reduces PONV incidence than drug therapy alone (drug group). The regimen combining constitution-based stratification with acupuncture (CAD group) appeared most effective in reducing PONV, suggesting that integrating traditional medical theory with modern therapeutic techniques may offer a distinct advantage.

Recovery of gastrointestinal function: Significant differences in gastrointestinal function recovery within the first 24 postoperative hours were observed among the four groups (**Table 4**). The time to bowel sound recovery was shorter in the AD and CAD groups than in the drug group (both P<0.05). The times to first flatus and first defecation were also significantly shorter in these two intervention groups compared to the drug only group (both P<0.05). The CAD group demonstrated the most pronounced improvement, with significantly shorter durations for all these time indicators than the AD group (all P<0.05). Regarding the gastric motility index, values were significantly higher in the AD and CAD groups than in the drug group (both P<0.05), and the value in the CAD group was also significantly higher than that of the AD

group (p<0.05). Serum motilin levels were significantly elevated in the two intervention groups (AD and CAD) compared to the drug group (both P<0.05). Conversely, serum VIP levels were significantly lower in the AD and CAD groups than in the drug group (both P<0.05), with the CAD group showing a more pronounced reduction than the AD group (p<0.05). Among all indicators, the CAD group showed superior results compared to the CD group (all P<0.05), while there were no significant differences between the CD group and the drug group (all P>0.05). These findings indicate that supplementing drug therapy with acupuncture (as in the AD and CAD groups) promotes postoperative gastrointestinal recovery more effectively than drug therapy alone. The constitution-based approach combined with acupuncture (CAD group) appeared particularly effective, demonstrating significant enhancements across multiple aspects of gastrointestinal recovery.

Postoperative analgesia usage: Significant differences in postoperative analgesia usage within the first 24 hours were observed among the four groups (**Figure 1**). The number of PCIA bolus attempts was significantly lower in the AD and CAD groups than in the drug group (both P<0.05), with the CAD group showing the most significant reduction compared to the AD group (P<0.05). Compared to the drug group, the total sufentanil consumption was significantly lower in the AD, CD, and CAD groups (all P<0.05), and the CAD group also consumed significantly less than both the AD and CD groups (both P<0.05). The proportion of patients requiring supplemental analgesia was significantly lower in the AD and CAD groups than in the drug group (both P<0.05), with this proportion being significantly lower in the CAD group compared to the AD group (P<0.05). These results indicate that supplementing drug therapy with acupuncture (as in the AD and CAD groups) improves postoperative pain management, as reflected by reduced PCIA bolus attempts, decreased sufentanil consumption, and a lower need for supplemental analgesia. The constitution-based approach combined with acupuncture (CAD group) was particularly effective, demonstrating greater improvement than the drug-alone and the CD-group regimens.

Table 3. Comparison of PONV incidence within 24 hours among the four study groups

Outcome	Drug group (n=72)	AD group (n=66)	CD group (n=52)	CAD group (n=58)	Statistic 1	Statistic 2	Statistic 3	Statistic 4	Statistic 5
Total PONV [n (%)]	57 (79.17%)	31 (46.97%)*	32 (61.54%)*	11 (18.97%)*,#,$	15.450	4.631	46.667	10.809	20.871
Nausea [n (%)]	29 (40.28%)	16 (24.24%)*	18 (34.62%)	6 (10.34%)*,#,$	4.029	0.411	14.629	4.086	9.468
Vomiting [n (%)]	28 (38.89%)	15 (22.73%)*	14 (26.92%)	5 (8.62%)*,#,$	4.193	1.930	15.538	4.541	6.428

AD, acupuncture plus drug; CD, constitution-based drug; CAD, constitution-based acupuncture plus drug; PONV, postoperative nausea and vomiting; *P<0.05, compared to the drug group; #P<0.05, compared to the CD group; $P<0.05, compared to the AD group; Statistic 1, Drug-only group vs. AD group; Statistic 2, Drug-only group vs. CD group; Statistic 3, Drug-only group vs. CAD group; Statistic 4, AD group vs. CAD group; Statistic 5, CD group vs. CAD group.

Table 4. Comparison of gastrointestinal function recovery within 24 hours among the four study groups

Outcome	Drug group (n=72)	AD group (n=66)	CD group (n=52)	CAD group (n=58)	Statistic 1	Statistic 2	Statistic 3	Statistic 4	Statistic 5
Time to bowel sounds recovery (h)	7.42 ± 2.16	6.64 ± 1.82*	6.81 ± 1.93	6.05 ± 1.23*,#,$	2.263	1.622	4.567	2.140	2.425
Time to first flatus (h)	17.17 ± 3.85	15.53 ± 3.76*	15.81 ± 3.81	14.26 ± 3.05*,#,$	2.533	1.958	4.686	2.039	2.373
Time to first defecation (h)	26.63 ± 6.42	24.38 ± 4.83*	24.75 ± 6.17	22.48 ± 4.76*,#,$	2.344	1.633	4.223	2.198	2.168
Gastric motility index	0.43 ± 0.12	0.49 ± 0.14*	0.48 ± 0.12	0.52 ± 0.11*,#,$	2.675	2.282	4.687	1.209	2.017
Serum motilin (pg/mL)	225.17 ± 45.52	242.53 ± 38.47*	239.85 ± 42.16	256.48 ± 36.23*,#,$	2.408	1.827	4.262	2.069	2.224
Serum VIP (pg/mL)	65.46 ± 12.71	61.24 ± 10.81*	62.51 ± 11.64	57.43 ± 8.32*,#,$	2.091	1.318	4.331	2.213	2.607

AD, acupuncture plus drug; CD, constitution-based drug; CAD, constitution-based acupuncture plus drug; VIP, vasoactive intestinal peptide; *P<0.05, compared to the drug group; #P<0.05, compared to the CD group; $P<0.05, compared to the AD group; Statistic 1, Drug-only group vs. AD group; Statistic 2, Drug-only group vs. CD group; Statistic 3, Drug-only group vs. CAD group; Statistic 4, AD group vs. CAD group; Statistic 5, CD group vs. CAD group.
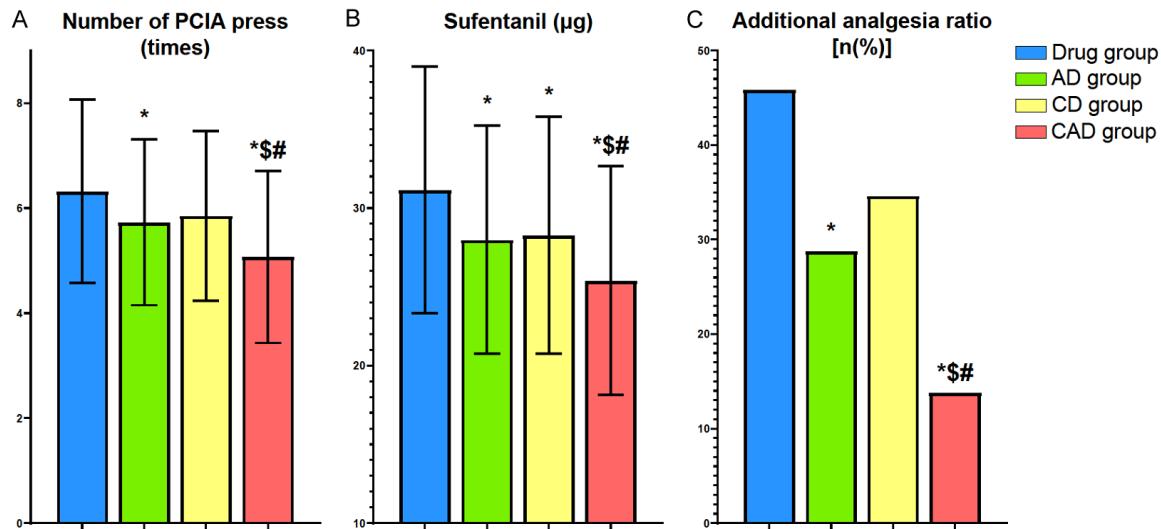
Figure 1. Comparison of postoperative analgesia use within 24 hours among the four study groups. A: Number of PCIA bolus attempts (times); B: Total sufentanil consumption (µg); C: Proportion of patients requiring supplemental analgesia [n (%)]. AD, acupuncture plus drug; CD, constitution-based drug; CAD, constitution-based acupuncture plus drug; PCIA, patient-controlled intravenous analgesia; *P<0.05, compared to the drug-only group; #P<0.05, compared to the CD group; $P<0.05, compared to the AD group.

Table 5. Comparison of the time to first onset of PONV within 24 hours among the four study groups

Time to onset	Drug group (n=57)	AD group (n=31)	CD group (n=32)	CAD group (n=11)	Statistic 1	Statistic 2	Statistic 3	Statistic 4	Statistic 5
0-6 h [n (%)]	29 (50.88%)	4 (12.90%)*	20 (62.50%)	2 (18.18%)*,#	12.354	1.119	3.974	0.000	6.435
6-12 h [n (%)]	7 (12.28%)	14 (45.16%)*	9 (28.12%)	9 (81.82%)*,#	11.948	3.489	21.065	3.048	7.616
12-24 h [n (%)]	21 (36.84%)	13 (41.94%)	3 (9.38%)*,$	0 (0.00%)*,$	0.220	7.851	4.264	4.863	0.135

AD, acupuncture plus drug; CD, constitution-based drug; CAD, constitution-based acupuncture plus drug; PONV, postoperative nausea and vomiting; *P<0.05, compared to the drug-only group; #P<0.05, compared to the CD group; $P<0.05, compared to the AD group; Statistic 1, Drug-only group vs. AD group; Statistic 2, Drug-only group vs. CD group; Statistic 3, Drug-only group vs. CAD group; Statistic 4, AD group vs. CAD group; Statistic 5, CD group vs. CAD group.

Characteristics and management of PONV patients

Time to onset of PONV: The time to first onset of PONV within the initial 24 postoperative hours differed significantly among the groups (**Table 5**). During the 0-6 hour period, the proportion of patients experiencing PONV was significantly lower in the AD and CAD groups than in the drug-only group (both P<0.05), and the incidence in the CAD group was also significantly lower than that in the CD group (P<0.05). Between 6 and 12 hours, the incidence of PONV was higher in the AD group than in the drug-only group (P<0.05), while the incidence in the CAD group was higher than that in both the drug-only and CD groups (both P<0.05). From 12 to 24 hours, the incidence of PONV in the CD group was significantly lower than in the AD group (P<0.05). No PONV cases were recorded

in the CAD group during this final period, a finding that differed significantly from the AD and drug-only groups (both P<0.05). These results suggest that supplementing drug therapy with acupuncture (as in the AD and CAD groups) can alter the timing of PONV onset compared to drug therapy alone. The CAD regimen appeared most effective in reducing early PONV incidence and delaying symptom onset. Notably, 81.8% of PONV cases in the CAD group occurred between 6 and 12 hours post-surgery, with no cases observed from 12 to 24 hours. This pattern of concentrated and controlled late onset may reflect the sustained neuromodulator effects of constitution-based acupuncture.

Severity of PONV symptoms: Comparison of VAS scores among the four groups of patients who experienced PONV revealed significant differences in symptom severity during the first 24
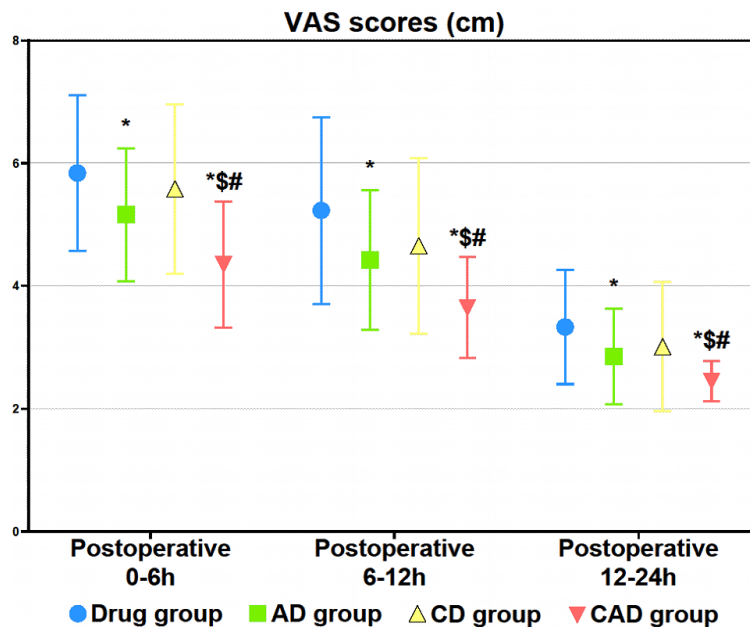
Figure 2. Comparison of symptom severity using a VAS among the four study groups. AD, acupuncture plus drug; CD, constitution-based drug; CAD, constitution-based acupuncture plus drug; VAS, visual analogue scale; *P<0.05, compared to the drug-only group; #P<0.05, compared to the CD group; $P<0.05, compared to the AD group.

the drug-only, CD, and AD groups (all P<0.05). The use of ondansetron was also significantly lower in the CAD group compared to the drug-only group (P<0.05). These results demonstrate that supplementing drug therapy with acupuncture (AD and CAD groups) significantly reduces the need for rescue antiemetics compared to drug therapy alone. The constitution-based approach combined with acupuncture (CAD group) proved particularly effective in minimizing antiemetic consumption.

Univariate analysis of PONV risk factors

Univariate logistic regression analysis identified several factors significantly associated with the occurrence of PONV (**Table 7**). The CAD regimen was associated with a substantially lower risk of PONV compared to the drug-only regimen (P<0.001), followed by the AD (P=0.002) and CD regimens (P=0.032). Regarding medication dosage, both intraoperative sufentanil dosage (P=0.020) and postoperative sufentanil dosage (P<0.001) were significant risk factors, where an increase in dosage was associated with a higher risk of PONV. These results suggest that using drug therapy alone was associated with a higher risk of PONV, whereas supplementing drug therapy with constitution-based acupuncture may help prevent PONV in high-risk patients. Furthermore, strict control of opioid dosage during and after surgery appears crucial for mitigating PONV risk.

Multivariate analysis of independent predictors for PONV

Multivariate logistic regression analysis identified several independent predictors for PONV after laparoscopic surgery (**Table 8**). Compared to the drug-only group, the CAD regimen was associated with a significantly reduced risk of PONV (P=0.001). The AD regimen was also associated with a significantly lower risk than the drug-only group (P=0.012). In contrast the risk

postoperative hours (**Figure 2**). At all assessed time points (0-6 h, 6-12 h, and 12-24 h), the VAS scores in the AD and CAD groups were significantly lower than those in the drug-only group (all P<0.05). The CAD group demonstrated the greatest reduction in VAS scores, which were significantly lower than not only the drug-only group but also than the CD and AD groups at all time points (all P<0.05). These findings suggest that supplementing drug therapy with acupuncture (as in the AD and CAD groups) more effectively alleviated PONV-related discomfort than drug therapy alone. The constitution-based acupuncture approach (CAD group) appeared most effective in reducing symptom severity.

Consumption of rescue antiemetic medications: Significant differences were observed in the requirement for rescue antiemetics among patients who experienced PONV across the four groups within the first 24 postoperative hours (**Table 6**). The proportion of patients requiring metoclopramide was significantly lower in the AD and CAD groups than in the drug-only group (both P<0.05). The reduction was most pronounced in the CAD group, where the proportion was significantly lower than in

Table 6. Comparison of the use of rescue anti-emetic medications within 24 hours among the four study groups

Medication usage	Drug group (n=57)	AD group (n=31)	CD group (n=32)	CAD group (n=11)	Statistic 1	Statistic 2	Statistic 3	Statistic 4	Statistic 5
Metoclopramide [n (%)]	50 (87.72%)	21 (67.74%)*	24 (75.00%)	3 (27.27%)*,#,$	5.141	2.366	16.237	3.903	6.069
Ondansetron [n (%)]	25 (43.86%)	9 (29.03%)	11 (34.38%)	0 (0.00%)*	1.862	0.765	5.860	2.523	3.436

AD, acupuncture plus drug; CD, constitution-based drug; CAD, constitution-based acupuncture plus drug; *P<0.05, compared to the drug-only group; #P<0.05, compared to the CD group; $P<0.05, compared to the AD group; Statistic 1, Drug-only group vs. AD group; Statistic 2, Drug-only group vs. CD group; Statistic 3, Drug-only group vs. CAD group; Statistic 4, AD group vs. CAD group; Statistic 5, CD group vs. CAD group.

Table 7. Univariate logistic regression analysis of risk factors for PONV

Variable	Coefficient	Standard error	Wald	P value	OR	95% CI
AD vs. Drug	-0.983	0.321	9.372	0.002	0.374	0.199-0.702
CD vs. Drug	-0.725	0.338	4.602	0.032	0.484	0.250-0.938
CAD vs. Drug	-1.421	0.385	13.625	<0.001	0.241	0.113-0.512
Intraoperative sufentanil	0.123	0.053	2.319	0.020	1.130	1.021-1.257
Postoperative sufentanil	0.077	0.019	4.131	<0.001	1.080	1.043-1.122

PONV, postoperative nausea and vomiting; AD, acupuncture plus drug; CD, constitution-based drug; CAD, constitution-based acupuncture plus drug; OR, odds ratio; CI, confidence interval.

Table 8. Multivariate logistic regression analysis of independent risk factors for PONV

Variable	Coefficient	Standard error	Wald	P value	OR	95% CI
AD vs. Drug	-0.894	0.356	6.305	0.012	0.409	0.203-0.823
CD vs. Drug	-0.682	0.372	3.362	0.067	0.506	0.244-1.049
CAD vs. Drug	-1.536	0.418	13.502	0.001	0.215	0.095-0.488
Intraoperative sufentanil	0.119	0.062	1.932	0.053	1.126	0.998-1.271
Postoperative sufentanil	0.066	0.021	3.208	0.001	1.069	1.026-1.113

PONV, postoperative nausea and vomiting; AD, acupuncture plus drug; CD, constitution-based drug; CAD, constitution-based acupuncture plus drug; OR, odds ratio; CI, confidence interval.

reduction associated with the CD regimen did not reach significance (P=0.067). Regarding anesthetic dosage, intraoperative sufentanil was marginally associated with an increased PONV risk (P=0.053), while postoperative sufentanil dosage was a significant independent risk factor, with an increase in dosage associated with a higher risk of PONV (P=0.001). These results indicate that the risk of PONV was higher with drug therapy alone, whereas a constitution-based approach combined with acupuncture (CAD) could significantly reduce this risk. Furthermore, postoperative sufentanil dosage substantially influenced PONV incidence, underscoring the need for careful management of postoperative analgesia to mitigate PONV risk.

Discussion

Findings from this retrospective observational study suggest that combining TCM tongue diag-

nosis for constitution stratification with targeted acupuncture may improve the prevention and treatment of high-risk PONV following laparoscopic surgery. The results indicate that this precision strategy may offer clinical advantages. However, it is essential to first acknowledge the inherent limitations of the study design, including its non-randomized nature and possible confounding factors. Therefore, the current findings should be regarded as hypothesis-generating rather than conclusive. The clinical value of these observations requires validation through high-quality prospective studies.

In the constitution-based combined acupuncture and drug regimen, we observed a greater reduction in PONV incidence compared to conventional antiemetic therapy and non-stratified acupuncture combined with drugs. This finding underscores the value of patient stratification, aligning with the core principle of precision medicine - optimizing treatment based on indi-

vidual biological characteristics. Our results also provide support for TCM theory, suggesting that phlegm-dampness constitution (thick and greasy tongue coating) and qi-blood deficiency (thin and white tongue coating) represent distinct pathophysiologic states. These constitutions are thought to increase PONV risk primarily through two pathways: delayed gastrointestinal motility and autonomic nervous system dysfunction [24, 25]. Selecting the PC6 acupoint for patients with phlegm-dampness constitution and the ST36 acupoint for those with qi-blood deficiency may more effectively address these specific functional disturbances compared to a non-selective approach [26, 27]. Recent studies have further indicated that a thick-greasy tongue coating after abdominal surgery is associated with delayed gastrointestinal recovery, while a pale tongue suggests poorer tolerance to surgical stress [28], which is consistent with the constitution-based stratification employed in our study.

Constitution-based acupuncture accelerated the recovery of gastrointestinal function, offering a new perspective for understanding its antiemetic mechanism. Improvements in bowel sounds, shortened times to first flatus and defecation, and an increased gastric motility index collectively indicate that acupuncture positively promotes gastrointestinal function. Changes in key gastrointestinal hormones provide a possible explanation: In the CAD group, serum motilin levels increased while VIP levels decreased, suggesting that acupuncture may simultaneously enhance gastrointestinal motility and suppress its inhibitory pathways [29]. Previous studies have found that stimulating ST36 can modulate vagal nerve activity and promote motilin release, thereby improving gastric motility and accelerating gastric emptying, which aligns with our findings [30-33]. Similarly, stimulating PC6 may increase vagal activity, reduce brainstem nausea signaling, decrease serotonin release from enterochromaffin cells, and help balance the autonomic nervous system [34]. Precise acupoint selection based on TCM constitution appears to elicit more pronounced hormonal responses and functional improvements than non-stratified acupuncture, as evidenced by higher motilin levels, lower VIP levels, and a better gastric motility index in the CAD group compared to the AD and CD groups. This indicates that matching acupoints to the

patient's constitution produces synergistic effects, optimizing neurohormonal regulation of postoperative gastrointestinal function. However, while this study observed significant differences in motilin and VIP levels between the CAD group and others, these results cannot fully establish a temporal relationship between hormonal changes and PONV, nor can they directly confirm causality. Due to a lack of dynamic monitoring in the early postoperative period (e.g., at 6 and 12 hours), it remains unclear whether hormonal changes preceded or resulted from PONV alleviation. Although elevated motilin and reduced VIP in the CAD group may have contributed to improved gastrointestinal motility and reduced PONV incidence, the direct relationship requires further correlation analysis. Previous studies have shown that perioperative motilin fluctuations often occur before PONV symptom relief, and VIP - also involved in gastrointestinal motility and nausea regulation - may similarly change prior to symptomatic improvement [15]. Future research should incorporate multiple perioperative time points for hormone detection to better assess temporal sequences and causal links.

The reduced opioid consumption and lower demand for supplemental analgesia in patients receiving acupuncture represent an important additional benefit. This approach not only alleviates pain but also mitigates opioid-related adverse reactions. These findings are consistent with existing evidence that acupuncture stimulates specific acupoints to activate the endogenous analgesic system, promote the release of endogenous opioids, modulate descending inhibitory pathways, and exert anti-inflammatory effects [35, 36]. By effectively relieving pain, acupuncture reduces the need for opioids, which are known to provoke PONV [37]. Our univariate and multivariate analyses confirmed that postoperative sufentanil dosage is an independent risk factor for PONV. Therefore, constitution-based acupuncture indirectly yet significantly enhances the overall antiemetic effect through its analgesic properties. This dual benefit aligns well with the Enhanced Recovery After Surgery philosophy, which advocates multimodal, opioid-sparing analgesia. The variation in response among patients with different constitutions underscores the importance of individualized treat-

ment [38]. The superior reduction in supplemental analgesia requirements observed with constitution-based acupuncture further highlights the clinical value of TCM theory in guiding personalized therapy.

Patients receiving acupuncture experienced delayed onset and reduced severity of PONV symptoms, providing further insight into its mechanism. In the AD and CAD groups, the occurrence of PONV shifted from the early postoperative period (0-6 hours) to a later phase (6-24 hours), with almost no PONV observed in the CAD group between 12-24 hours. This suggests that acupuncture may modulate pathways involved in delayed PONV and alleviate effects of sustained surgical stress, inflammatory mediators, or opioid-induced gastrointestinal dysmotility [39]. At each observation time point, patients who received acupuncture had low VAS scores, indicating significantly reduced discomfort even when symptoms occurred. In addition, the requirement for rescue antiemetics was significantly lower in the AD and CAD groups. This is an especially noteworthy outcome, as it implies fewer drug-related side effects, lower medical costs, and improved patient satisfaction. These findings align with existing literature reporting that adjunct acupuncture can reduce the need for rescue antiemetics by 30%-50% [40]; the constitution-based approach adopted in this study appears to enhance this benefit. It should be noted that the percentages in **Table 5** were based on the number of patients who experienced PONV in each group, not the total group size. This approach aims to characterize the temporal distribution of symptom onset among affected individuals. From the overall patient perspective, although the incidence of PONV in the CAD group increased during the 6-12 hour period compared to the phase, the absolute risk remained relatively low and was comparable to that of the drug-only group during the same interval. This situation clarifies any potential misinterpretation of an "abnormally increased risk" based solely on **Table 5**. Furthermore, as shown in **Figure 2**, VAS scores of PONV patients in the CAD group were significantly lower than in other groups during this period. This pattern of "delayed onset with mitigated severity" may reflect sustained neuromodulatory effects of constitution-based acupuncture. We hypothesize that PC6/ST36 acupuncture exert-

ed strong inhibitory effects on the acute vomiting reflex early after surgery (0-6 hours), transitioning over time from complete suppression to effective symptom relief. This may explain the relative increase in mid-term incidence compared with the early period, alongside successful "passivation" of symptom intensity. By 12-24 hours, the synergy between constitution-guided acupuncture and pharmacotherapy was fully established, leading to complete control of symptoms. Overall, when evaluated across all patients, the CAD strategy transformed frequent and severe PONV into occasional, mild, and readily manageable symptoms, demonstrating its clinical value.

This study also found that constitution-based acupuncture reduces the requirement for rescue antiemetics, confirming the practicality of tongue diagnosis as a perioperative stratification tool and suggesting its clinical practice. Compared to the drug-only group, the CD group achieved a reduction in the incidence of PONV by using granisetron for patients identified with qi and blood deficiency. This finding suggests that different TCM constitution types may affect patient responses to specific antiemetic drugs. Although palonosetron is generally the preferred long-acting 5-HT3 receptor antagonist, our preliminary results suggest that granisetron may be more suitable for treating autonomic nervous system dysfunction associated with qi and blood deficiency. This discovery warrants further validation through pharmacogenomic or receptor affinity studies. Furthermore, the clinical value of tongue diagnosis was reinforced when used to guide acupoint selection, indicating that its application extends beyond pharmacotherapy. This non-invasive and user-friendly method could serve as an effective tool for preoperative risk assessment and personalized intervention. While previous studies have reported the ability of acupuncture to reduce antiemetic use, this study was the first to systematically integrate TCM constitution theory, highlighting the advantages of this integrated approach.

This study primarily employed tongue diagnosis for constitution classification, yet it is important to acknowledge the limitations of this method. Patients with different constitutions exhibit variations in underlying physiological states, such as inflammatory factor levels and

heart rate variability (HRV). Analyzing these differences may help clarify the mechanisms of acupuncture. For example, previous studies have found that individuals with a phlegm-dampness constitution often show higher levels of pro-inflammatory cytokines (e.g., interleukin-6 and tumor necrosis factor-alpha) compared to other constitution types. These elevated inflammatory markers may increase sensitivity to PC6 stimulation, which is known to modulate parasympathetic activity and mitigate inflammatory responses [41]. Patients with qi and blood deficiency, on the other hand, often exhibit reduced HRV, especially lower standard deviation of normal-to-normal intervals (SDNN) values [42]. Stimulation of the ST36 acupoint may improve HRV by enhancing vagal tone and reducing sympathetic activity [43, 44], possibly explaining its efficacy in this subgroup. Future studies should incorporate objective measures such as interleukin-6, tumor necrosis factor-alpha, and HRV parameters (e.g., SDNN) to better elucidate the physiological mechanisms underlying constitution-specific responses to acupoint stimulation. Such work would provide stronger validation for the present findings and establish a more solid mechanistic foundation for individualized acupuncture therapy.

This study has several inherent limitations due to its retrospective, single-center design. First, data collection relying on medical records may introduce documentation bias, particularly for subjective symptoms such as nausea severity and the precise timing of gastrointestinal events, which cannot be entirely avoided even with standardized tools such as VAS. Second, although it was reasonable to include only female patients given their higher PONV risk according to the Apfel score, this design limited the generalizability of the findings to male patients. Third, the 24-hour postoperative observation period was relatively short. While it covers the peak incidence of PONV, extending this duration would help capture more comprehensive outcomes, including symptom persistence, delayed PONV, and long-term gastrointestinal recovery. Fourth, constitution classification and acupuncture protocol formulation were based solely on tongue diagnosis. Although convenient, it should be noted that TCM constitution identification typically involves a comprehensive assessment using the four diagnostic methods (inspection, auscultation-olfaction, inquiry, and palpation). Relying exclusively on tongue diagnosis may have omitted important clinical information such as pulse characteristics, specific symptoms, and detailed medical history. Future studies should adopt more comprehensive TCM diagnostic procedures to improve the accuracy and applicability of the results. Fifth, as an exploratory retrospective analysis, this study primarily investigates associations between tongue diagnosis-guided combination therapy and PONV outcomes; all analyses were based on observational data, and causality cannot be inferred. Sixth, the patient preference-based grouping was non-randomized and potentially subject to confounding. However, no significant differences were observed in key prognostic factors - such as age, BMI, and ASA classification - among the four groups, indicating that selection preferences did not lead to systematic bias. In addition, multivariate logistic regression that incorporated potential confounders continued to supported an independent effect of the intervention. Subsequent research should implement strict randomization and blinding procedures to minimize bias and enhance the reliability of the conclusions.

Future research should be conducted from multiple perspectives. Large-scale, multicenter, prospective randomized controlled trials with strict blinding procedures are needed to validate the current findings and establish causality. Furthermore, advanced techniques such as functional magnetic resonance imaging or continuous autonomic nervous system monitoring could be employed to investigate the neurohumoral regulatory mechanisms in depth. Focusing on how acupuncture modulates vagal nerve activity, dynamic changes in gastrointestinal hormones, inflammatory factor profiles, and their interactions within the central vomiting pathways will help elucidate its mechanisms of action. Subsequent research could also integrate this TCM-based precision strategy into existing Enhanced Recovery After Surgery programs to evaluate its effect on patient satisfaction, quality of recovery scores, hospital length of stay, and cost-effectiveness. Another promising direction involves exploring the preoperative optimization of TCM constitution to determine whether constitutional modulation can enhance patient tolerance to surgi-

cal stress, potentiallyopening avenues for perioperative medicine research.

Conclusion

This exploratory study suggested that constitution-based acupuncture guided by tongue diagnosis was associated with improved outcomes in high-risk PONV following laparoscopic surgery. These preliminary findings warrant further validation through rigorously designed randomized controlled trials.

Acknowledgements

Disclosure of conflict of interest

None.

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