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ORIGINAL ARTICLE

Randomized Controlled Trial

Effects of transcutaneous electrical acupoint stimulation on colonic spasm during colonoscopy: A randomized controlled trial

Jia-Qi Chen, Fei Xing, Dan Cheng, Ming-Cui Qu, You-Hong Ren, Zhi-Hu Yang, Ming-Zhu Jing, Ya-Nan He, Ya-Zhuo Yuan, Hui-Xin Li, Na Xing

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Abstract

BACKGROUND

Colonic spasm frequently occurs during painless colonoscopy, directly hindering endoscopic procedures and impairing patient recovery. Pharmacological antispasmodics are commonly used but have limited efficacy and potential adverse effects. Transcutaneous electrical acupoint stimulation (TEAS) has been shown to be beneficial for gastrointestinal regulation. We hypothesized that preoperative TEAS could reduce the incidence of intraoperative colonic spasm and improve postoperative recovery.

AIM

To evaluate the efficacy of TEAS in reducing colonic spasm and its impact on postoperative recovery.

METHODS

A total of 146 outpatients who underwent painless colonoscopy were randomly assigned to two groups: The TEAS group (Group T) and the control group (Group C). TEAS was applied for 20 minutes before anesthesia induction. The control group received electrode attachment but without stimulation. The primary out-

come was the incidence of intraoperative colonic spasm. Secondary endpoints included spasm duration, postoperative pain, intraoperative and postoperative adverse events, polyp detection rate, colonoscope insertion time, awakening time, and patient and physician satisfaction.

RESULTS

There were no significant differences in baseline characteristics between the two groups. Compared with Group C, Group T exhibited a significantly lower incidence of colonic spasm (9.86% *vs* 23.94%; relative risk = 0.41, 95%CI: 0.18-0.93; P = 0.025). Although the colonoscope insertion time and awakening time were shorter in Group T, the differences were not statistically significant. However, Group T demonstrated a shorter spasm duration, reduced postoperative pain, lower incidences of intraoperative hypotension and postoperative adverse events, as well as higher levels of both patient and physician satisfaction. No significant differences were observed in the incidence of intraoperative hypoxemia or polyp detection rate between the groups.

CONCLUSION

Preoperative TEAS reduces colonic spasm and improves postoperative recovery, making it a safe, non-pharmacological option for painless colonoscopy.

Key Words: Transcutaneous electrical acupoint stimulation; Colonoscopy; Colonic spasm; Postoperative pain; Adverse events

Core Tip: This randomized controlled trial demonstrated that preoperative transcutaneous electrical acupoint stimulation (TEAS) significantly reduced the incidence of colonic spasm during painless colonoscopy. Notably, it also improved perioperative hemodynamic stability, decreased postoperative pain and adverse events, and enhanced both patient and physician satisfaction without affecting procedural efficiency. As a non-invasive and non-pharmacological intervention, TEAS represents a novel preventive approach for colonic spasm. It overcomes the limitations of conventional antispasmodic agents and exhibits promising clinical application value in endoscopic anesthesia and perioperative patient care.

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INTRODUCTION

Colonoscopy is currently an essential procedure for the diagnosis and management of colorectal diseases. High-quality colonoscopy improves the polyp detection rate (PDR), facilitating early identification and prevention of colorectal tumors [1,2]. Painless colonoscopy has been widely applied for its comfort and favorable operating environment. However, in clinical practice, intestinal loops are often stimulated by endoscopic manipulation and luminal distension, leading to colonic spasm[3]. The resulting difficulties in examination and postoperative symptoms, such as abdominal pain and distension, increase the rate of missed diagnoses and prolong patient stay in the postanesthesia care unit (PACU)[4,5]. Therefore, effective prevention and management of intraoperative colonic spasm are essential.

At present, several medications are used to alleviate colonic spasm, such as anticholinergic drugs[6] and lidocaine[7]. However, they have certain limitations. Repeated use of glycopyrrolate and scopolamine may have adverse effects, including dry mouth and abdominal distension, which restrict their application in long examination and treatment[8,9]. Lidocaine spray is only suitable for a short part of the colon, and its efficacy for full-colon application still needs further validation[5]. Consequently, such limitations hinder the clinical application of pharmacological interventions for treating colonic spasm.

It is particularly important to adopt non-pharmaceutical, low-risk measures to prevent colonic spasm. Transcutaneous electrical acupoint stimulation (TEAS) is the combination of transcutaneous electrical nerve stimulation and acupoint therapy, which is simple, safe, and non-invasive[10]. Compared with conventional acupuncture or electroacupuncture, it has no risk of infection, patient psychological distress, or operator bias and has been applied to many gastrointestinal diseases[11,12]. In traditional Chinese medicine, Neiguan (PC6) and Zhigou (TE6) are considered to regulate gastrointestinal function, relieve abdominal distension, and exert calming effects[13,14]. Studies have shown that electrical stimulation applied at the Zusanli (ST36) and Shangjuxu (ST37) acupoints can reduce the incidence of postoperative intestinal paralysis, shorten the time to gastrointestinal functional recovery, and alleviate inflammatory responses, thereby improving gastrointestinal function[15-17]. These findings provide a basis for acupoint selection in TEAS to prevent colonic spasm during colonoscopy.

Currently, no application of TEAS in colonoscopy has been documented, and there is a lack of high-quality evidence on its effectiveness in relieving colonic spasm. This study aimed to evaluate the efficacy and safety of preoperative TEAS for preventing colonic spasm and to explore its impact on postoperative recovery, providing a non-pharmacological method for clinical practice.

MATERIALS AND METHODS

Study design

This single-center, prospective, randomized, controlled clinical trial was conducted at the Digestive Endoscopy Center of the First Affiliated Hospital of Zhengzhou University. This study was approved by the Hospital Ethics Committee (No. 2025-KY-1114-003) and was prospectively registered at the Chinese Clinical Trial Registry (ChiCTR2500114656). Written informed consent was obtained from each participant before the study. The CONSORT guidelines were followed in this study.

Participants

Patients scheduled for a painless colonoscopy from December 2025 to January 2026 were screened for potential enrollment. Eligible patients were aged 18-65 years, had a body mass index (BMI) of 18-30 kg/m^2, were classified as American Society of Anesthesiologists (ASA) grade I–II, and had not used anticholinergic drugs, opioid analgesics, or gastrointestinal motility regulators within the past two weeks. The exclusion criteria were as follows: Special populations such as pregnant women or uncooperative patients; a history of severe respiratory, circulatory, or endocrine disease or abnormal liver/renal function; intractable abdominal pain, or intestinal motility disorders; skin lesions or infections precluding electrical stimulation; and known allergies or intolerance to the intervention.

Intervention and randomization

Eligible patients were randomly assigned to the TEAS group (Group T) or control group (Group C) using a random number table, with allocation performed by a researcher who was not involved in subsequent procedures. Group assignments were concealed in opaque, sealed envelopes, which were assigned according to the order of enrollment and opened only immediately before TEAS or sham treatment. Participants were not informed of their group allocation. TEAS was performed using a pulse electrotherapy apparatus (Model KWD-808I; Yingdi Electronic Medical Device, Changzhou, China) by a senior acupuncturist with 20 years of experience. All the investigators received standardized training in acupoint selection.

For Group T, electrode pads were bilaterally applied at acupoints PC6, TE6, ST36, and ST37. The bilateral locations of these four acupoints are illustrated in Figure 1. Stimulation was administered using a dense-disperse wave mode at a frequency of 2/100 Hz, and current intensity was gradually increased to the maximum level tolerated by each patient (eliciting sensations such as soreness, numbness, distension, or tingling). The output intensity of the device was adjustable on a scale of 0-10, with a maximum root mean square output current of no more than 10 mA across a 250-Ω resistive load. The final tolerated output setting was recorded individually for PC6, TE6, ST36, and ST37. In Group C, the electrodes were placed identically at the same acupoints but without electrical current output. Both groups underwent 20 minutes of the assigned intervention prior to anesthesia induction. If hemodynamic instability developed during TEAS or sham treatment, the assigned intervention would be discontinued, appropriate clinical management would be provided, and the event would be recorded as a perioperative adverse event. Outcome assessors were not involved in allocation or intervention delivery and remained blinded to group allocation throughout data collection.

Procedures

An 8-hour fast for solids and a 4-hour fast for clear liquids were strictly required. After bowel preparation using polyethylene glycol electrolyte lavage solution, colonoscopy was carried out by two experienced endoscopists who had completed > 1000 colonoscopies. The examination was performed under sedation with remimazolam, etomidate, and palonosetron without the use of any anticholinergic agents.

All patients underwent standard monitoring, including electrocardiography, continuous pulse oximetry, and non-invasive blood pressure measurement, and received supplemental oxygen *via* a nasal cannula or face mask during anesthesia. Carbon dioxide was used for insufflation during the endoscopic procedure. Anesthesiologists continuously assessed sedation depth using the validated Modified Observer's Assessment of Alertness/Sedation (MOAA/S) scale. The colonoscopy procedure commenced when the MOAA/S score reached ≤ 2, with supplemental boluses of etomidate (0.1-0.3 mg/kg) administered intraoperatively as clinically indicated. Hypoxemia was defined as SpO_2 < 90% and was managed with a jaw-thrust maneuver or nasopharyngeal airway insertion. Hypotension was defined as a mean arterial pressure ≤ 65 mmHg (1 mmHg = 0.133 kPa) and was treated with intravenous norepinephrine. After being transferred to the PACU, patients were discharged once they met a modified Aldrete score ≥ 9.

Outcome measures

The primary outcome was the incidence of intraoperative colonic spasm. Colonic spasm was assessed throughout colonoscope insertion and withdrawal by two experienced endoscopists who had received standardized training in the assessment of colonic spasm. Spasm was recorded only when both endoscopists agreed that the luminal opening of any observed segment had narrowed to less than two-thirds of its maximum diameter when fully dilated[5].

Secondary outcomes included the duration of colonic spasm, measured as the interval from its onset to complete resolution, and all the time is calculated together in the examinations with more spasm times. If the duration of colonic spasm exceeds 180 seconds, 10 mg of intravenous scopolamine would be used as rescue treatment. Then participant would remain in the originally assigned group for analysis. Other outcomes included postoperative pain and intraoperative and postoperative adverse events. Pain was assessed after patients became fully conscious using a 0-10 visual analog scale (VAS), where 0 means no pain and 10 means the worst pain. Intraoperative adverse events included hypotension and hypoxemia. Postoperative adverse events included postoperative nausea and vomiting (PONV) and dry

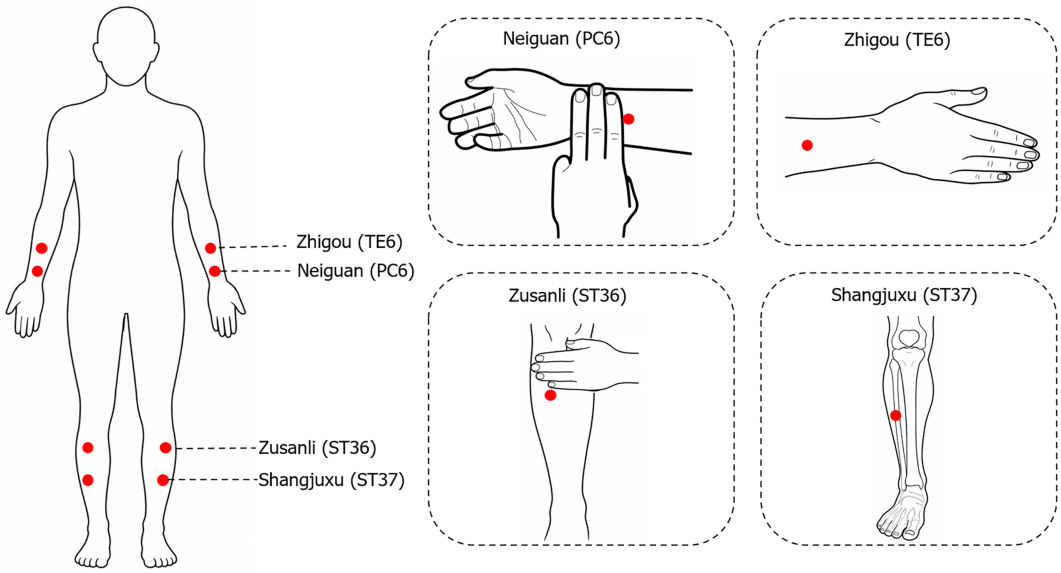

Figure 1 Schematic illustration of the acupoints used for transcutaneous electrical acupoint stimulation. The bilateral locations of Neiguan (PC6), Zhigou (TE6), Zusanli (ST36), and Shangjuxu (ST37), together with enlarged views of each acupoint, are shown. PC6 is located 2 cun proximal to the palmar wrist crease, between the tendons of the palmaris longus and flexor carpi radialis; TE6 is located 3 cun proximal to the dorsal wrist crease, between the radius and ulna; ST36 is located 3 cun below Dubi (ST35), one finger-breadth lateral to the anterior crest of the tibia; and ST37 is located 3 cun below ST36 on the same longitudinal line.

mouth. The study also recorded the PDR. Colonoscope insertion time was measured from insertion of the colonoscope until it reached the ileocecal valve. Awakening time was measured from the end of the procedure to recovery of consciousness. Finally, patient and physician satisfaction were evaluated using an additional VAS.

Sample size calculation

The sample size was calculated using PASS 15.0 (NCSS, Kaysville, UT, United States). Preliminary data revealed event proportions of 4.9% for the intervention group and 21.2% for the control group. To detect this difference with a two-sided alpha error of 0.05 and a power of 0.80, 128 participants were needed. Accounting for an estimated 10% attrition rate, 71 patients were enrolled per group.

Statistical analysis

Demographic and baseline data were summarized using descriptive statistics. SPSS 27.0 (IBM, Armonk, NY, United States) was used for the data analysis. Continuous variables were measured using the mean ± SD or the median with the interquartile range. For the normally distributed continuous variables, comparisons were made using two independent samples *t* tests. For the abnormally distributed continuous variables, comparisons were made using Mann-Whitney *U* tests. Categorical variables are presented as *n* (%) and were analyzed by the χ^2 test or Fisher's exact test as appropriate. For the primary outcome, the relative risk (RR) and corresponding 95%CI were calculated. Subgroup analysis was also conducted to assess the consistency of the effect of TEAS across various baseline characteristics, including age, gender, BMI, and comorbidities. A P value < 0.05 was considered to be statistically significant.

RESULTS

Patient characteristics

From December 2025 to January 2026, a total of 153 patients were assessed for eligibility. Three patients were excluded, and four declined to participate. The remaining 146 patients underwent colonoscopy and were randomly assigned to Group T or Group C. One patient in Group C and three patients in Group T discontinued the intervention. The other 142 patients completed the assigned intervention and were followed in the PACU, with no loss to follow-up. Finally, 71 patients in each group were included in the analysis (Figure 2). Among participants in Group T, the median output intensity settings were 7 (7, 8) at PC6, 8 (7, 8) at TE6, 8 (7, 9) at ST36, and 9 (9, 10) at ST37. The demographic and baseline data were evenly distributed between the groups and were not significantly different (P > 0.05) (Table 1).

Primary outcome

In Group T, intraoperative colonic spasm occurred in 7 of 71 patients (9.86%), which was significantly lower than that in 17 of 71 patients (23.94%) in Group C (RR = 0.41, 95%CI: 0.18-0.93; P = 0.025) (Table 2).

Table 1 Baseline characteristics, *n* (%)/mean ± SD/median (interquartile range)

	TEAS group (*n* = 71)	Control group (*n* = 71)	*P* value
Age (years)	48.91 ± 12.10	48.89 ± 12.44	0.989
Gender			0.131
Female	39 (54.93)	30 (42.25)	
Male	32 (45.07)	41 (57.75)	
ASA grade			0.355
I	53 (74.65)	48 (67.61)	
II	18 (25.35)	23 (32.39)	
BMI (kg/m^2)	23.93 ± 2.78	24.44 ± 3.37	0.322
Number of previous colonoscopies (times)	1 (0-2)	0 (0-1)	0.272
History of chronic constipation	20 (28.17)	15 (21.13)	0.330
History of abdominopelvic surgery	28 (39.44)	21 (29.58)	0.217
Preoperative anxiety VAS score (points)	2 (0-5)	1 (0-4)	0.276
Hypertension	11 (15.49)	17 (23.94)	0.206
Diabetes	2 (2.82)	4 (5.63)	0.677
Cardiovascular disease	6 (8.45)	5 (7.04)	0.754

TEAS: Transcutaneous electrical acupoint stimulation; ASA: American Society of Anesthesiologists physical status classification system; VAS: Visual analog scale; BMI: Body mass index.

Table 2 Comparison of perioperative outcomes, *n* (%)/mean ± SD/median (interquartile range)

	TEAS group (*n* = 71)	Control group (*n* = 71)	*P* value
Colonic spasm	7 (9.86)	17 (23.94)	0.025[a]
Spasm duration (s)	20.71 ± 11.19	40.88 ± 23.59	0.010[a]
Hypotension	14 (19.72)	25 (35.21)	0.039[a]
Hypoxemia	9 (12.68)	7 (9.86)	0.596
Requirement for norepinephrine	11 (15.49)	21 (29.58)	0.045[a]
PDR	33 (46.48)	25 (35.21)	0.172
Colonoscope insertion time[1] (s)	444 (271-615)	482 (333-686)	0.285

[1]The time required from the start of colonoscope insertion until the ileocecal valve was reached.
[a]$P < 0.05$ *vs* the control group.
TEAS: Transcutaneous electrical acupoint stimulation; PDR: Polyp detection rate.

A forest plot of the subgroup analysis is shown in Figure 3. Group T had a lower incidence of colonic spasm than Group C in most subgroups. The overall OR was 0.35 (95%CI: 0.13-0.90). No colonic spasm occurred in Group T among patients younger than 45 years or those with hypertension, and the OR for each subgroup was 0.00 (95%CI: 0.00-1.00). No significant interaction was found (all *P* for interaction > 0.05), suggesting that the effect of TEAS did not differ significantly across subgroups.

Secondary outcomes

The duration of colonic spasm was shorter in Group T than in Group C (20.71 ± 11.19 s *vs* 40.88 ± 23.59 s, $P = 0.010$), and no participant in either group experienced colonic spasm lasting more than 180 seconds or required rescue scopolamine. Regarding the adverse events during the operation, the incidence of hypotension was lower in the TEAS group (19.72% *vs* 35.21%, $P = 0.039$). Consequently, the requirement for norepinephrine was reduced in Group T (15.49% *vs* 29.58%, $P = 0.045$). No significant difference was observed in the incidence of hypoxemia between the two groups. With respect to examination-relevant indicators, there were no statistically significant differences in the PDR or colonoscope insertion time (Table 2).

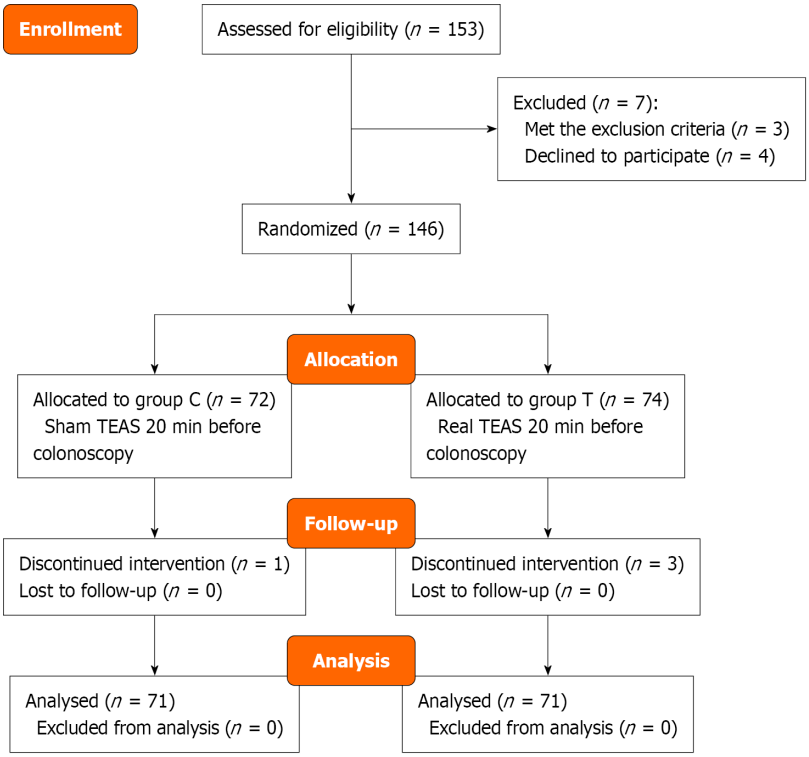

Figure 2 Present study flow chart. After excluding ineligible participants, 146 subjects were randomly assigned to the two groups, and 142 completed the entire colonoscopy. Finally, 71 patients in each group were included in the analysis. TEAS: Transcutaneous electrical acupoint stimulation.

In the PACU, the patient's postoperative pain, as assessed by the VAS score, was lower in Group T than in Group C [1 (0-2) *vs* 2 (0-3), $P = 0.019$]. The incidence of postoperative adverse events, including PONV (2.82% *vs* 11.27%, $P = 0.049$) and dry mouth (33.80% *vs* 50.70%, $P = 0.041$), was lower in Group T. Moreover, compared with Group C, patient and physician satisfaction were significantly higher in Group T [9 (8-10) *vs* 9 (8-10), $P = 0.046$; 9 (9-10) *vs* 9 (8-9), $P = 0.031$]. However, no significant difference was observed in awakening time between the two groups ($P > 0.05$) (Table 3).

Adverse events

No patients in either group reported discomfort or experienced other adverse reactions during or after the assigned intervention, and none developed hemodynamic instability during the intervention.

DISCUSSION

This prospective, single-center, randomized controlled clinical trial demonstrated that, compared with the control group, bilateral multi-acupoint TEAS before anesthesia induction in patients undergoing painless colonoscopy is associated with a decreased incidence of intraoperative colonic spasm and postoperative complications. These findings may have potential clinical significance given the high prevalence of colonic spasm during painless colonoscopy.

The effects of acupuncture on alleviating gastrointestinal motility disorders have been extensively investigated[18,19], but there is currently no consensus on the optimal number of acupoints to be selected for acupuncture therapy. Most previous studies have demonstrated that stimulation of a single acupoint may be less effective than multi-acupoint stimulation[20,21]. Therefore, in the present study, we implemented bilateral TEAS by stimulating PC6, TE6, ST36, and ST37 bilaterally. PC6 is a frequently used acupoint for enhancing gastrointestinal function[22]. According to traditional Chinese medicine theory, TE6 belongs to the triple energizer meridian and can reduce colonic distension through the sympathetic-enteric nervous system axis. ST36 and ST37 are located on the Foot-Yangming Stomach meridian. These two acupoints are often used together to regulate gastrointestinal function. By combining multiple acupoints, we aimed to achieve superior therapeutic outcomes. Notably, the modest differences in tolerated intensity among acupoints may be related to differences in local sensory nerve distribution, resulting in varying sensitivity to electrical stimulation at each site.

The reported incidence of colonic spasm during painless colonoscopy differs among studies. Shah *et al*[23] found an incidence of 54.2% in the placebo group in a United States population. In our control group, the incidence was 23.94%. This difference may be related to the study population, colonoscopy technique, and criteria used to assess colonic spasm. Intraoperative colonic spasm is usually treated with medication when it occurs. Nemoto *et al*[5] reported that topical lidocaine spray increased the spasm inhibition rate by 12.5%, although rebound spasm occurred in 15.6% of patients. In our study, preoperative TEAS was associated with a colonic spasm incidence of 9.86%, suggesting a possible preventive

Table 3 Comparison of postoperative outcomes, *n* (%)/median (interquartile range)

	TEAS group (*n* = 71)	Control group (*n* = 71)	*P* value
Postoperative pain (points)	1 (0-2)	2 (0-3)	0.019[a]
PONV[1]	2 (2.82)	8 (11.27)	0.049[a]
Dry mouth[1]	24 (33.80)	36 (50.70)	0.041[a]
Patient satisfaction (points)	9 (8-10)	9 (8-10)	0.046[a]
Physician satisfaction (points)	9 (9-10)	9 (8-9)	0.031[a]
Awakening time[2] (s)	200 (20-443)	310 (140-443)	0.096

[1]Adverse events: Such as nausea, vomiting, or dry mouth in the PACU.
[2]Awakening time: Interval from surgery conclusion to return of consciousness.
[a]$P < 0.05$ *vs* the control group.
TEAS: Transcutaneous electrical acupoint stimulation; PONV: Postoperative nausea and vomiting.

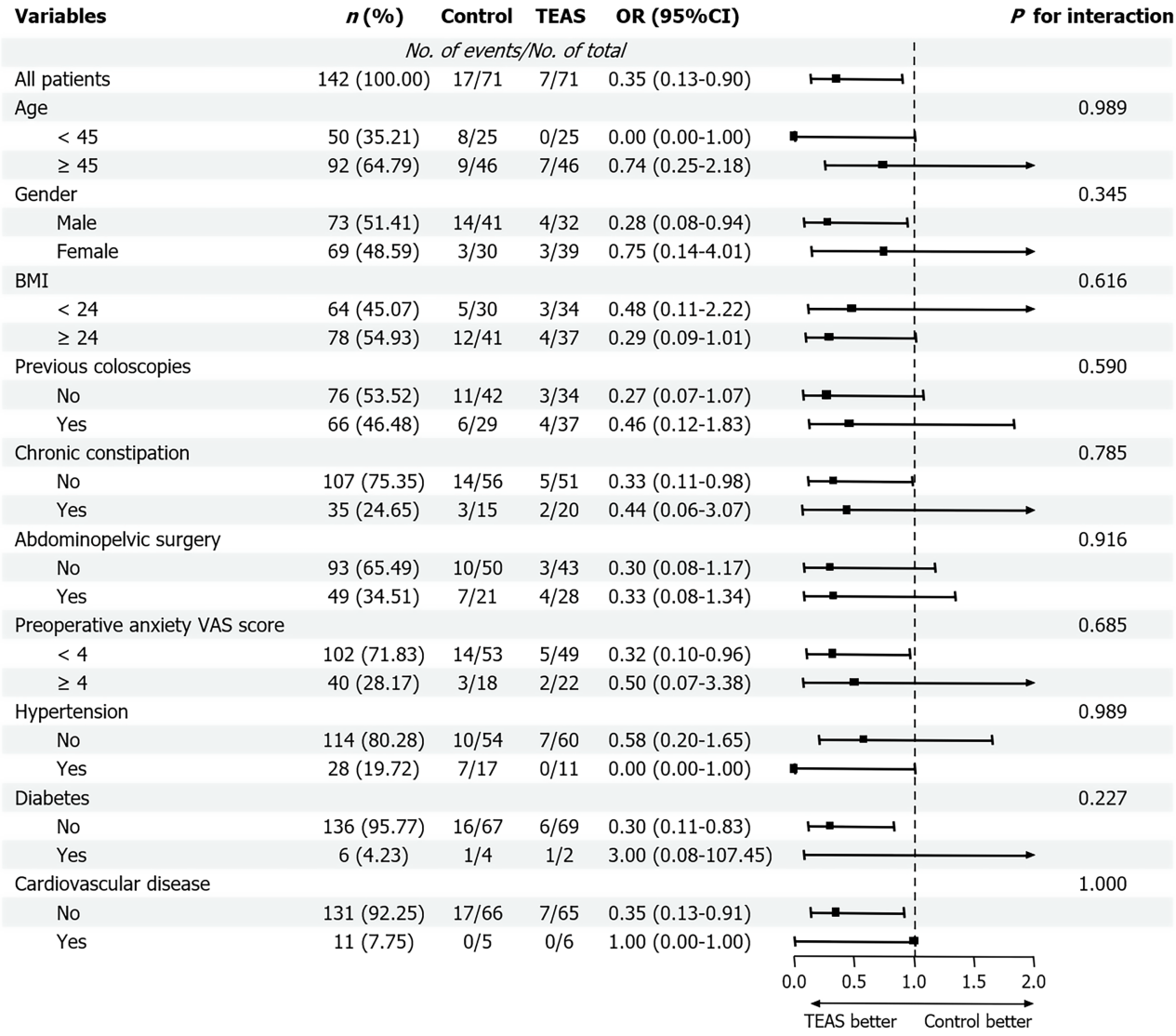

Figure 3 Forest plot of subgroup analysis for the effect of transcutaneous electrical acupoint stimulation on colonic spasm. Odds ratios with 95%CIs are shown for each subgroup. The overall treatment effect is represented by a diamond. *P* for interaction indicates whether the treatment effect differs significantly across subgroups. TEAS: Transcutaneous electrical acupoint stimulation; VAS: Visual analog scale; OR: Odds ratios.

effect. This non-pharmacological method may also reduce the risk of drug-related adverse effects. Thus, preoperative TEAS may be an effective strategy for reducing colonic spasm during painless colonoscopy.

This effect may be attributed to several mechanisms underlying TEAS. Firstly, TEAS can reduce sympathetic activity and increase parasympathetic activity, which may help relieve intestinal spasm and related pain[24]. A recent randomized controlled trial also found that TEAS reduced rectal distension pain in patients with irritable bowel syndrome[25]. Secondly, stimulation of these acupoints can increase the secretion of hormones and reduce serotonin release, thereby helping maintain the normal rhythmic contraction of gastrointestinal smooth muscle[26]. Additionally, TEAS can also promote the passage of intestinal gas, alleviating autonomic nerve stimulation from intestinal wall distension and shortening the duration of spasm. Collectively, these effects may explain the lower incidence of colonic spasms observed in our study.

TEAS has been reported to help maintain hemodynamic stability by regulating autonomic activity and reducing perioperative circulatory fluctuations[27-29]. In our study, hypotension was less common in Group T than in Group C, and norepinephrine use was nearly 50% lower. Because anesthetics used for painless colonoscopy can suppress cardiovascular function, this effect may be clinically relevant for older patients and those with mild cardiovascular disease[30]. Conversely, we found no significant difference in intraoperative hypoxia between the two groups. This result differs from that of Zhou *et al*[31], who reported that TEAS reduced the risk of hypoxia in older patients during the examination. This discrepancy may be attributed to differences in patient characteristics and needs further validation in larger trials. Notably, no significant differences were observed in the PDR or colonoscope insertion time. The comparable PDR results may reflect the underlying prevalence and characteristics of colorectal lesions. Although TEAS reduced colonic spasm, the effect of a single preoperative session may not persist throughout the procedure and may be further limited by ongoing endoscopic manipulation. Therefore, these benefits may not have been sufficient to produce a measurable reduction in colonoscope insertion time, which is influenced by multiple factors. Overall, TEAS mainly improves circulatory stability during colonoscopy.

In addition, our results revealed that patients receiving TEAS showed better recovery in the PACU, which aligns with prior research[32,33]. This intervention alleviates pain by promoting β-endorphin release and activating the endogenous analgesic system[18,34]. Previous studies have shown that preoperative TEAS has analgesic effects, which is consistent with the lower postoperative pain scores observed in Group T in the present study[35,36]. However, as active TEAS was perceptible, the potential influence of placebo effects on subjective outcomes, such as postoperative pain and patient satisfaction, cannot be excluded. Furthermore, patients in the TEAS group experienced a reduction in adverse events such as PONV and dry mouth, which is consistent with established evidence of its efficacy[37,38]. Meanwhile, the similar awakening times observed between the groups are likely attributable to the same anesthesia protocol and the relatively short procedure duration. These results suggest that TEAS may improve the quality of early postoperative recovery without prolonging awakening time while also improving satisfaction for both patients and physicians.

In this study, no patients in the TEAS group were excluded due to skin injury, arrhythmia, or other serious adverse events, indicating its safety during colonoscopy. The non-invasive nature of TEAS underlies its high safety profile. Unlike traditional acupuncture, it applies stimulation through surface electrodes and avoids the risks of tissue injury and infection caused by needle insertion[28]. A randomized double-blind trial in patients undergoing gynecologic laparoscopic surgery found that TEAS improved the primary outcomes, and no serious adverse events were observed[32]. This contrasts with pharmacologic antispasmodics, which often require monitoring for side effects such as cardiovascular reactions.

There were several limitations to the present study. Firstly, this was a single-center study with a relatively small sample, and only patients with ASA grade I-II were included. These factors may limit the generalizability of the findings to broader and higher-risk patient populations. Secondly, patients were only followed up until discharge from the PACU, and the potential impact of TEAS on post discharge recovery was not evaluated. More comprehensive trials are needed to evaluate these extended recovery outcomes. Thirdly, no validated method is currently available for assessing colonic spasm during colonoscopy. Although a literature-based visual threshold and joint assessment by two trained endoscopists were used, some subjectivity remained. Further studies are needed to validate and standardize this assessment method. Finally, the sham procedure without current output may not have completely eliminated placebo effects on subjective outcomes. In addition, only a single 20-minute preoperative TEAS was evaluated, and whether continuous intraoperative stimulation can provide more sustained control of colonic spasm remains to be investigated.

CONCLUSION

This study demonstrated that the preoperative application of TEAS effectively prevents the occurrence of colonic spasm during painless colonoscopy and significantly improves the quality of postoperative recovery. As a non-pharmacological and non-invasive intervention, TEAS has a favorable safety profile and high patient acceptance. Future multi-center, large-sample studies are warranted to validate its clinical value and explore its underlying mechanisms.

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FOOTNOTES

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