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Randomized Controlled Trial

Effects of transcutaneous electrical acupoint stimulation (TEAS) 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

Jia-Qi Chen, Fei Xing, Dan Cheng, Ming-Cui Qu, Zhi-Hu Yang, Ming-Zhu Jing, Ya-Nan He, Ya-Zhuo Yuan, Hui-Xin Li, Na Xing, Department of Anesthesiology, Pain and Perioperative Medicine, The First Affiliated Hospital of Zhengzhou University, Zhengzhou 450052, Henan Province, China

You-Hong Ren, Department of Rehabilitation Medicine, The First Affiliated Hospital of Zhengzhou University, Zhengzhou 450052, Henan Province, China

ORCID number: Jia-Qi Chen 0009-0007-7202-895X; Hui-Xin Li 0009-0007-5895-5351; Na Xing 0000-0003-2712-3222.

Co-first authors: Jia-Qi Chen and Fei Xing

Co-corresponding authors: Hui-Xin Li and Na Xing

Corresponding author: Na Xing, MD, PhD, Department of Anesthesiology,

Pain and Perioperative Medicine, The First Affiliated Hospital of Zhengzhou University, No.1 East Jianshe Road, Zhengzhou 450052, Henan, China.
fccxingn@zzu.edu.cn

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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 benefit in 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 outcome 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 (9.80% vs. 23.90%, 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.

Keywords: 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.

INTRODUCTION

Colonoscopy is currently an essential instrument 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 clinically used to alleviate colonic spasm, such as anticholinergic drugs [6] and lidocaine [7]. However, they have certain limitations. Repeated administration of glycopyrrolate and scopolamine may lead to adverse effects, including dry mouth, palpitations, and postoperative abdominal distension, which restrict their application in prolonged examinations and treatments [8,9]. Intraoperative lidocaine spray is only suitable for short segments of the colon, and its efficacy for full-colon application still requires 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) demonstrate a significant

correlation with gastrointestinal function, regulating qi, harmonizing the stomach, and inducing sedation [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 alternative 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 registered at ClinicalTrials.gov (ChiCTR2500114656). Written informed consent was obtained from each participant before the study. The Consolidated Standards of Reporting Trials (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. Patients were excluded from the final analysis if they developed persistent hemodynamic instability during TEAS or required supplemental antispasmodics during the endoscopic examination.

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. TEAS was performed using a pulse electrotherapy apparatus (Model KWD-808I) 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. 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). 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. The outcome assessors remained blinded to group allocation during 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 (MAP) ≤ 65 mmHg (1 mmHg = 0.133 kPa) and was treated with intravenous norepinephrine. Following transfer to the PACU, patients were discharged once they met a modified Aldrete score ≥ 9.

Outcome measures

The primary outcome of this study was the incidence of intraoperative colonic spasm, which was defined as lumen patency less than two-thirds of the maximum diameter [5].

Secondary outcomes included the duration of colonic spasm, measured as the interval from its onset to complete resolution, with the total duration calculated for procedures involving multiple spastic episodes. Any spasm persisting beyond 180 seconds was terminated using 10 mg of intravenous

scopolamine, and such cases were excluded from the per-protocol analysis. Additional metrics included postoperative pain assessed following full recovery of consciousness using the visual analog scale (VAS), where 0 indicates no pain, and 10 represents the worst pain; the incidence of intraoperative adverse events such as hypotension and hypoxemia; and postoperative adverse events, including postoperative nausea and vomiting (PONV) and dry mouth. The study also recorded the PDR, the time required for colonoscope insertion from initiation to reaching the ileocecal valve, and the patient awakening time from the conclusion of surgery to the return 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, USA). 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, USA) was used for the data analysis. Continuous variables were measured using the mean and standard deviation ($\bar{x}\pm s$) or the median with the interquartile range (IQR). 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 frequencies (percentages) and were analyzed by the chi-square test or Fisher's

exact test as appropriate. 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 probability (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 initially assessed as eligible and enrolled. Three patients met the exclusion criteria, and four declined to participate in the study. The remaining 146 patients underwent colonoscopy and were randomly allocated to either Group T or Group C. One patient in Group C and three patients in Group T discontinued the intervention, and no patients were lost to follow-up. Finally, 71 patients in each group were included in the analysis (Figure 1). 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 (9.80%), which was significantly lower than that in 17 of 71 patients (23.90%) in Group C (P = 0.025) (Table 2).

A forest plot of the subgroup analysis is shown in Figure 2. Compared with Group C, Group T showed a lower incidence of colonic spasm in most subgroups, with an overall odds ratio (OR) of 0.35 (95% CI: 0.13–0.90). Notably, among patients aged less than 45 years and those with hypertension, no events were reported in Group T, resulting in ORs of 0.00 (95% CI: 0.00–1.00). Interaction tests revealed no statistically significant subgroup effects (all P for interaction > 0.05), indicating that the beneficial effect of TEAS in reducing colonic spasm was consistent across patient subgroups.

Secondary outcomes

The duration of colonic spasm was significantly shorter in Group T than in Group C (20.71 ± 11.19 s vs. 40.88 ± 23.59 s, $P = 0.010$). Regarding intraoperative adverse events, the incidence of hypotension was lower in the TEAS group (19.70% vs. 35.20%, $P = 0.039$). Consequently, the requirement for norepinephrine was reduced in Group T (15.50% vs. 29.60%, $P = 0.045$). 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).

In the PACU, the patient's postoperative pain, as assessed by the VAS score, was lower in Group T than in Group C [2 (0, 3) vs. 1 (0, 2), $P = 0.019$]. The incidence of postoperative adverse events, including PONV (4.23% vs. 11.27%, $P = 0.049$) and dry mouth (33.80% vs. 50.70%, $P = 0.041$), was lower in Group C. 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 the TEAS group reported discomfort during or after the process of electrical stimulation, and no significant differences were found between the two groups.

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 both key points on the Stomach meridian of Foot-Yangming and are frequently used in combination to regulate gastrointestinal function. By combining multiple acupoints, we aim to achieve superior therapeutic outcomes.

The incidence of colonic spasm during painless colonoscopy varies across previous studies. Shah et al. reported a 54.2% incidence rate among U.S. patients who underwent colonoscopy in the placebo group [23]. In our study, the incidence in the control group was 23.9%, with differences likely stemming from variations in population, technique, and assessment criteria. Traditionally, the management of intraoperative colonic spasm has relied on real-time pharmacological interventions. For example, Nemoto et al. reported that immediate topical lidocaine spraying increased the spasm inhibition rate by 12.5%, but was still associated with a 15.6% incidence of rebound spasm [5]. In contrast, our preoperative TEAS protocol achieved a significantly lower incidence of only 9.8%, demonstrating superior preventive efficacy. This non-

pharmacological approach also avoids potential drug-related adverse effects. Thus, preoperative TEAS represents an effective strategy for reducing colonic spasm during painless colonoscopy.

This effect may be attributed to several mechanisms underlying TEAS. Firstly, TEAS can modulate the balance of the autonomic nervous system by suppressing sympathetic activity while enhancing parasympathetic activity, thereby alleviating intestinal spasms and associated pain [24]. This finding is consistent with that of a recent randomized controlled trial demonstrating that TEAS significantly reduced rectal distension pain in patients with irritable bowel syndrome [25]. Secondly, stimulation of these acupoints can promote the secretion of hormones such as motilin and inhibit serotonin release, thereby helping maintain the normal rhythmic contraction of gastrointestinal smooth muscle [26]. Additionally, TEAS can directly facilitate the expulsion of intestinal gas, alleviating autonomic nerve stimulation from intestinal wall distension and thus shortening the duration of intestinal spasms. Collectively, these mechanisms may explain the significant reduction in the incidence of intestinal spasms observed in this study.

Previous studies have indicated that TEAS can stabilize hemodynamics by modulating the balance of the autonomic nervous system and attenuating perioperative circulatory fluctuations [27-29]. Compared with Group C, the incidence of hypotension was significantly lower in Group T, with a nearly 50% reduction in norepinephrine usage. Given the cardiovascular depressive effects of anesthetics used in painless colonoscopy, this intervention is particularly suitable for elderly patients and those with mild cardiovascular comorbidities [30]. Conversely, no significant difference in intraoperative hypoxia was observed, which differs from the finding of Zhou et al. [31] that TEAS could reduce the risk of hypoxia in elderly patients during examination. This discrepancy may be attributed to differences in patient characteristics and warrants further validation in larger trials. Notably, we found no significant

differences in the other intraoperative outcomes. The comparable PDR results may reflect individual patient variability, while the unchanged insertion time is likely related to the time-limited effect of preoperative TEAS on colonic spasm. Overall, TEAS predominantly improves circulatory stability during colonoscopy.

In addition, our results revealed that patients who underwent TEAS exhibited better recovery in the PACU, which aligns with prior research [32,33]. This intervention alleviates pain by facilitating the release of β-endorphin, thereby activating the endogenous analgesic system [18,34]. Studies indicate that the optimal effect is achieved at a stimulation frequency of 2/100 Hz for at least 20 minutes, corresponding to the postoperative pain reduction observed in our study [35,36]. Furthermore, patients who underwent TEAS experienced a significant reduction in adverse events such as PONV and dry mouth, which is consistent with established evidence of its efficacy [37,38]. However, the similar awakening times observed between the groups are likely attributable to the standardized anesthesia protocol and the relatively short procedure duration. These findings suggest that TEAS optimizes the quality of early postoperative recovery without extending the PACU stay 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 delivers stimulation via surface electrodes, completely avoiding the risks of tissue injury and infection associated with needle insertion [28]. A randomized double-blind trial in gynecologic laparoscopic surgery demonstrated that TEAS significantly improved primary outcomes, with no serious adverse events reported [32]. This contrasts with pharmacologic antispasmodics, which often require monitoring for side effects such as cardiovascular reactions and dry mouth.

There were several limitations to the present study. Firstly, the sample size was not large enough and lacked the support of multicenter data, which may have compromised the reliability of the statistical analysis results and increased the risk of Type I error. Secondly, patients were only followed up until discharge from the PACU, and the potential impact of TEAS on postdischarge recovery was not evaluated. More comprehensive trials are needed to evaluate these extended recovery outcomes. Thirdly, the lack of a standardized scoring system for colonic spasm may affect the consistency of the outcome assessment. In the present study, we adopted objective criterion for identifying colonic spasm based on the previously established scoring system. Future studies are needed to further validate its scientific validity.

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 favorable safety and 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

Specialty type: Gastroenterology and hepatology

Country of origin: China

Author contributions: Na Xing and Hui-Xin Li designed and planned the study as co-corresponding authors; Jia-Qi Chen and Fei Xing contributed equally as co-first authors; Jia-Qi Chen, Fei Xing, Dan Cheng and You-Hong Ren recruited and followed up patients; Jia-Qi Chen and Ming-Cui Qu analyzed the data; Jia-Qi Chen and Fei Xing drafted the manuscript; Zhi-Hu Yang, Ming-Zhu Jing, Ya-Nan He and Ya-Zhuo Yuan provided critical revisions to the manuscript and supervised the research. All authors have approved the final manuscript and had full access to all the data in the study.

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Institutional review board statement: The study was reviewed and approved by the First Affiliated Hospital of Zhengzhou University Ethics Committee, No. 2025-KY-1114-003.

Clinical trial registration statement: This study is registered at ClinicalTrials.gov. The identification number is ChiCTR2500114656.

Informed consent statement: All study participants or their legal guardian provided informed written consent prior to study enrolment.

Conflict-of-interest statement: All authors declare no potential conflicts of interest.

Data sharing statement: The datasets generated and analyzed during the current study are not publicly available because individual privacy could be compromised. However, they are available from the corresponding author on reasonable request.

CONSORT 2010 statement: The authors have read the CONSORT 2010 statement, and the manuscript was prepared and revised according to the CONSORT 2010 statement.

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Figures and Tables

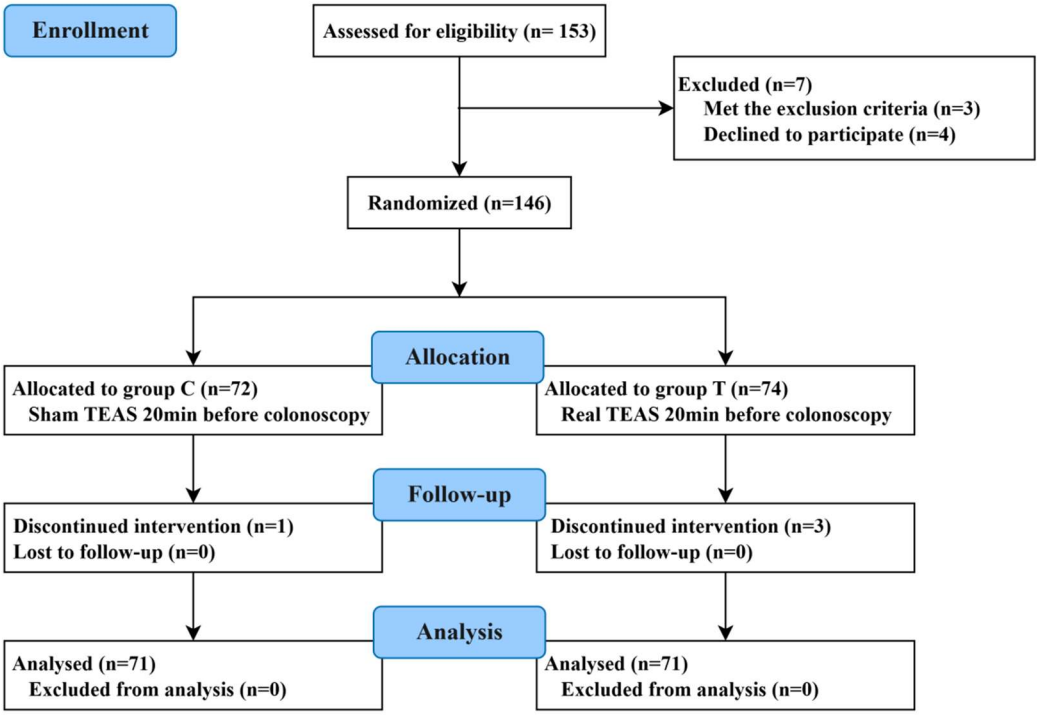

Figure 1 Present study flow chart. After excluding ineligible participants, 146 subjects were randomly assigned to the two groups, and 142 completed the entire colonoscopy. Finally, 71 patients in each group were included in the analysis. TEAS: Transcutaneous electrical acupoint stimulation.

Variables	*n* (%)	Control	TEAS	OR (95% CI)	*P* for interaction
		No. of events/ No. of total			
All patients	142 (100.00)	17/71	7/71	0.35 (0.13 ~ 0.90)	
Age					0.989
<45	50 (35.21)	8/25	0/25	0.00 (0.00 ~ 1.00)	
≥ 45	92 (64.79)	9/46	7/46	0.74 (0.25 ~ 2.18)	
Gender					0.345
Male	73 (51.41)	14/41	4/32	0.28 (0.08 ~ 0.94)	
Female	69 (48.59)	3/30	3/39	0.75 (0.14 ~ 4.01)	
BMI					0.616
<24	64 (45.07)	5/30	3/34	0.48 (0.11 ~ 2.22)	
≥ 24	78 (54.93)	12/41	4/37	0.29 (0.09 ~ 1.01)	
Previous coloscopies					0.590
No	76 (53.52)	11/42	3/34	0.27 (0.07 ~ 1.07)	
Yes	66 (46.48)	6/29	4/37	0.46 (0.12 ~ 1.83)	
Chronic constipation					0.785
No	107 (75.35)	14/56	5/51	0.33 (0.11 ~ 0.98)	
Yes	35 (24.65)	3/15	2/20	0.44 (0.06 ~ 3.07)	
Abdominopelvic surgery					0.916
No	93 (65.49)	10/50	3/43	0.30 (0.08 ~ 1.17)	
Yes	49 (34.51)	7/21	4/28	0.33 (0.08 ~ 1.34)	
Preoperative anxiety VAS score					0.685
<4	102 (71.83)	14/53	5/49	0.32 (0.10 ~ 0.96)	
≥ 4	40 (28.17)	3/18	2/22	0.50 (0.07 ~ 3.38)	
Hypertension					0.989
No	114 (80.28)	10/54	7/60	0.58 (0.20 ~ 1.65)	
Yes	28 (19.72)	7/17	0/11	0.00 (0.00 ~ 1.00)	
Diabetes					0.227
No	136 (95.77)	16/67	6/69	0.30 (0.11 ~ 0.83)	
Yes	6 (4.23)	1/4	1/2	3.00 (0.08 ~ 107.45)	
Cardiovascular disease					1.000
No	131 (92.25)	17/66	7/65	0.35 (0.13 ~ 0.91)	
Yes	11 (7.75)	0/5	0/6	1.00 (0.00 ~ 1.00)	

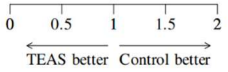

Figure 2 Forest plot of subgroup analysis for the effect of TEAS on colonic spasm. Odds ratios (ORs) with 95% confidence intervals (CIs) are shown for each subgroup. The overall treatment effect is represented by a diamond. *P* for interaction indicates whether the treatment effect differs significantly across subgroups.

Table 1 Baseline characteristics, *n* (%)/median (Q1, Q3)/mean (SD)

	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)	
Body mass index, kg/m^2	23.97 ± 2.68	24.37 ± 2.89	0.322
Number of previous colonoscopies, times	0 (0, 1)	1 (0, 2)	0.272
History of chronic constipation	20 (28.20)	15 (21.10)	0.330
History of abdominopelvic surgery	28 (39.40)	21 (29.60)	0.217
Preoperative anxiety VAS score, points	2 (0, 5)	1 (0, 4)	0.276
Hypertension	11 (15.50)	17 (23.90)	0.206
Diabetes	2 (2.80)	4 (6.10)	0.677
Cardiovascular disease	6 (8.50)	5 (7.00)	0.754

ASA, American Society of Anesthesiologists physical status classification system; VAS, visual analog scale.

Table 2 Comparison of perioperative outcomes, *n* (%)/median (Q1, Q3)/mean (SD)

	TEAS Group *n* = 71	Control Group *n* = 71	*P* value
Colonic spasm	7 (9.80)	17 (23.90)	0.025[a]
Spasm duration, (s)	20.71 ± 11.19	40.88 ± 23.59	0.010[a]
Hypotension	14 (19.70)	25 (35.20)	0.039[a]
Hypoxemia	9 (12.70)	7 (9.90)	0.596
Requirement for norepinephrine	11 (15.50)	21 (29.60)	0.045[a]
Polyp detection rate	33 (46.50)	25 (35.21)	0.172
Colonoscope insertion time[1], (s)	444 (271, 615)	482 (333, 686)	0.285

[a]$P < 0.05$ compared with the control group; [1] the time required from the start of colonoscope insertion until the ileocecal valve was reached.

Table 3 Comparison of postoperative outcomes, *n* (%)/median (Q1, Q3)

	TEAS Group *n* = 71	Control Group *n* = 71	*P* value
Postoperative pain, (points)	2 (0, 3)	1 (0, 2)	0.019[a]
Postoperative nausea and vomiting[1]	3 (4.23)	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], (points)	200 (20, 443)	310 (140, 443)	0.096

[a]$P < 0.05$ compared with the control group; [1] adverse events: such as nausea, vomiting, or dry mouth in the PACU; [2] awakening time: interval from surgery conclusion to return of consciousness.