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Original Research Article

Therapeutic Potential of a Modified Gui-Zhi (*Cinnamomi ramulus*) and Shao-Yao (*Paeoniae radix Alba*) Decoction for Postcolonoscopy Pain: A Herbal Acupoint Application Study

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Abstract

Background and Objectives: *Gui-Zhi* (*Cinnamomi ramulus*) and *Shao-Yao* (*Paeoniae radix Alba*) are traditional Chinese medicinal herbs with well-documented analgesic and antispasmodic properties. This study explores the efficacy of a modified herbal decoction comprising these two herbs applied via acupoint therapy to alleviate postcolonoscopy pain (PCP).
Materials and Methods: In this randomized cohort trial, 60 patients undergoing colonoscopy were divided into a control group (standard care) and a treatment group (standard care combined with acupoint application of the modified *Gui-Zhi* and *Shao-Yao* decoction). The visual analog scale (VAS) and Modified Gloucester Comfort Scale (MGCS) were used to evaluate pain and discomfort at 1-, 6-, and 24-h postprocedure, respectively.
Results: The treatment group demonstrated significantly lower VAS scores at all time points compared to the control group ($p < .05$), with rapid improvement in comfort levels. Enhanced borborygmus at 6-h postprocedure further suggested restoration of gastrointestinal motility. No significant changes in blood pressure or heart rate were observed.
Conclusion: The acupoint application of a modified decoction containing *Gui-Zhi* and *Shao-Yao* offers a promising plant-based therapeutic approach to PCP management, aligning with pharmacognosy principles. Its efficacy and safety merit further investigation in clinical herbal medicine.

Keywords

Gui-Zhi, Shao-Yao, *Cinnamomi ramulus*, *Paeoniae radix Alba*, herbal medicine, acupoint application, postcolonoscopy pain, natural products

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Introduction

Colonoscopy is an indispensable tool in the diagnosis and treatment of gastrointestinal diseases because of its high specificity and sensitivity, and it is also widely regarded as the gold standard for detecting colorectal cancer and precancerous lesions (Gimeno-García & Quintero, 2023; Jacobsson et al., 2024). With the increasing frequency of colonoscopy procedures, procedure-related adverse events have garnered considerable attention in recent decades (Rognstad et al., 2024).

Among these, minor adverse events, such as postcolonoscopy pain (PCP), abdominal distension, and discomfort, are particularly common, with incidence rising in parallel with the number of colonoscopies performed (Cankurtaran & Atalay, 2023). Minor adverse events significantly impact patients' comfort and compliance. PCP is one of the most frequently reported symptoms (Kim et al., 2019; Makker et al., 2021). Studies have shown that nearly half of patients undergoing colonoscopy may experience pain or new gastrointestinal symptoms postprocedure, and over 10% require analgesic intervention (Allen et al., 2015; Collatuzzo et al., 2022). Factors such as sex and procedural duration are known

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to influence the development of PCP (Lee et al., 2006). Moreover, the psychological distress and physical discomfort associated with PCP often deter patients from completing subsequent recommended evaluations. While conventional analgesics are commonly used for PCP management, their application is frequently limited by adverse effects, contraindications, and patient intolerance (Ball et al., 2015; De Oliveira et al., 2014). This highlights the urgent need for safe, effective, and well-tolerated therapeutic alternatives.

Traditional Chinese Medicine (TCM) has emerged as a promising avenue in this context due to its holistic approach, long-standing clinical history, and favorable safety profile (Dune, 2006; Waits et al., 2018). Various TCM-based strategies, including oral decoctions, acupuncture, and topical applications, have demonstrated efficacy in managing different types of pain (Zhu et al., 2024). For example, acupuncture and acupressure are clinically associated with improved outcomes in cancer-related pain (He et al., 2020). In patients undergoing selective painless colonoscopy, wrist–ankle acupuncture can reduce both the induction and total dosage of propofol, as well as the incidence of adverse reactions, without affecting patient satisfaction (He, Liu et al., 2022).

Among external TCM therapies, acupoint application therapy (AAT) has gained attention as a noninvasive technique that integrates meridian theory with topical use of herbal preparations (Hsu et al., 2022; Xie et al., 2023). Growing clinical validation affirmed the potential of noninvasive TCM in pain management for various diseases. A narrative review showed that in cancer pain management, TCM acupoint therapies can offer safer, noninvasive adjuvant analgesia, which works through neuroendocrine modulation, anti-inflammatory effects, immune regulation, and improved microcirculation (Shi et al., 2025). A randomized controlled trial suggested that acupressure intervention applied to specific points was a useful nonpharmacological treatment for postpartum pain and comfort for the study group (Çayır & Abiç, 2024). Notably, AAT offers analgesic efficacy comparable to traditional acupuncture while providing a safer and more accessible option (Zhang et al., 2015). It has also been widely used in clinical practice and is believed to modulate physiological function, relieve pain, and enhance local tissue perfusion.

In this study, we employed a modified herbal decoction derived from the classical formula Gui-Zhi-Jia-Shao-Yao-Tang (桂枝加芍药汤), which originates from the ancient medical text Shang Han Lun. The core herbal ingredients, Gui-Zhi (*Cinnamomi ramulus*) and Shao-Yao (*Paeoniae radix Alba*), are well-known medicinal plants with established phytochemical profiles and therapeutic properties. Gui-Zhi contains bioactive compounds, such as cinnamaldehyde and eugenol, which exhibit smooth muscle relaxant and anti-inflammatory effects, while Shao-Yao is rich in paeoniflorin, a monoterpene glycoside shown to exert antinociceptive and gastrointestinal regulatory effects. These herbs were selected for their potential synergistic action in alleviating PCP.

Despite the increasing recognition of AAT in various pain syndromes, its application in PCP has not been systematically evaluated. Therefore, this study aims to assess the effectiveness of Chinese herbal AAT using a modified Gui-Zhi and Shao-Yao decoction for relieving PCP and to explore its role as a plant-based, natural therapeutic modality in integrative gastroenterological care.

Materials and Methods

Study Population

This randomized controlled trial was conducted at Gaoming District Traditional Chinese Medicine Hospital (Foshan City, China) between April 2, 2024 and December 20, 2024. Eligible participants were adult patients undergoing colonoscopy during the study period. Inclusion criteria were as follows: (a) definitive diagnosis and immediate treatment initiated at our hospital; (b) aged between 18 and 85 years; and (c) undergoing pain-free colonoscopy accompanied by abdominal distension and pain. Exclusion criteria included (a) pregnancy or lactation; (b) presence of dermatoses, scar tissue, or open wounds at application sites; (c) cognitive impairment, behavioral abnormalities, or psychiatric illness; (d) long-term use of analgesics; and (e) severe infections, organ failure, or other critical medical conditions. A total of 60 patients met the eligibility criteria and were enrolled in the study. The clinical trial registration number was ITMCTR2025000436.

Randomization and Blinding

Participants were randomly assigned in a 1:1 ratio to either the control group or the AAT treatment group using a computer-generated random number table. Both groups received standard postcolonoscopy care, with the AAT group additionally receiving herbal AAT.

To maintain study rigor, an independent assessor, blinded to group assignment, was responsible for outcome evaluation. Although complete participant and physician blinding was not feasible due to the nature of the intervention, both the statisticians and data collectors remained blinded. Unblinding was permitted only for statistical analysis at the conclusion of the study or in the event of a serious adverse reaction, under the supervision of the research team. Data from unblinded participants were excluded from the final analysis.

Colonoscopy Procedure

All participants were instructed to follow a low-fiber diet for 3 days before colonoscopy and to ingest polyethylene glycol the day before the procedure for bowel cleansing. Sedation was achieved using midazolam under an anesthesiologist's supervision. Colonoscopy was performed using a Fujifilm 7000 colonoscope, with the time to reach the cecum and total

procedure duration recorded. Bowel preparation quality was assessed intraoperatively using the Newcastle–Ottawa Scale (Stang, 2010), and patients with a score of >7 were excluded from analysis.

Acupoint Application Therapy

In the AAT group, patients received acupoint application therapy in addition to standard care. The herbal preparation was based on the classic formula Gui-Zhi-Jia-Shao-Yao-Tang from the Shang Han Lun, modified to enhance its gastrointestinal therapeutic profile. The final formula consisted of:

- Gui-Zhi (*C. ramulus*, 15 g),
- Shao-Yao (*Paeoniae radix Alba*, 30 g),
- Gan-Cao (Glycyrrhizae Radix et rhizoma, 10 g),
- Cang-Zhu (Atractylodis rhizoma, 12 g),
- Hou-Po (*Magnoliae officinalis* Cortex, 12 g),
- Chen-Pi (Citri reticulatae pericarpium, 12 g), and
- Yan-Hu-Suo (*Corydalis* rhizoma, 12 g).

Each of these botanicals has been documented to have pharmacological activity relevant to gastrointestinal modulation and pain relief. The decoction was freshly prepared and applied to specific acupoints for 60 min: Shenque (CV8), bilateral Tianshu (ST25), Zhongwan (CV12), and Guanyuan (CV4). These acupoints are associated with the stomach, intestine, and overall gastrointestinal function according to TCM theory.

Standard care was explaining possible adverse reactions after colonoscopy, teaching specific essentials of coping with adverse reactions, which can eliminate patients' tension and fear, as well as reduce their psychological pressure.

Pain and Comfort Evaluation

The primary outcome was pain relief after colonoscopy. Pain was assessed at 1-, 6-, and 24-h postprocedure using the visual analog scale (VAS) (He, Renne et al., 2022), a validated emoji-based rating scale ranging from 0 (no pain) to 10 (worst pain imaginable).

Comfort level was evaluated using the Modified Gloucester Comfort Scale (MGCS), assessed at baseline (before colonoscopy), 1-, and 6-h postprocedure. The MGCS uses a 5-point scale, where 1 indicates no discomfort and 5 represents severe discomfort (Ismail et al., 2022).

Data Collection

Demographic and clinical data included age, gender, body mass index (BMI), smoking and alcohol use, prior history of colorectal surgery, and whether the procedure was collected at the patient's first colonoscopy.

Physiological indicators, such as abdominal circumference and borborygmus frequency, were recorded at baseline, 1, and 6 h after colonoscopy. Cardiovascular parameters, including systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR), were recorded at three time points, that is, preprocedure, intraprocedure, and postprocedure.

Statistical Analysis

Continuous variables were expressed as mean ± standard error (SE). Between-group comparisons of continuous variables were performed using Student's *t*-test, while categorical variables were analyzed using the χ^2 test. A p value < .05 was considered statistically significant. All statistical analyses were performed using SPSS 24.0 (IBM, Armonk, NY, USA) and GraphPad Prism 8 (GraphPad Software, San Diego, CA, USA).

Results

Characteristics of Participants

A total of 60 patients were enrolled and evenly randomized into two groups: the control group ($n = 30$) and the AAT treatment group ($n = 30$). Baseline demographic and clinical characteristics are summarized in Table 1. The mean age of all participants was 54.77 years, with females accounting for 46.7% of the study population. The proportions of smokers were 43.3% in the control group and 40.0% in the AAT group; corresponding proportions for alcohol consumption were 46.7% and 36.7%, respectively.

The incidence of prior colorectal surgery was comparable between the groups (46.7% in control vs. 43.3% in AAT), as was the percentage of patients undergoing their first colonoscopy (46.7% vs. 56.7%). No significant differences were found in mean BMI (22.28 vs. 22.01 kg/m²), time to reach the cecum (17.10 vs. 16.13 min), or total procedure duration (30.30 vs. 30.70 min). All comparisons yielded p values > .05, indicating successful baseline matching between the groups.

VAS and MGCS Scores at Different Time Points

To evaluate the analgesic efficacy of plant-based AAT using Gui-Zhi and Shao-Yao, VAS pain scores were compared between the two groups at 1, 6, and 24 h after colonoscopy (Table 2). The AAT group exhibited significantly lower VAS scores at all assessed time points:

- At 1-h postprocedure, the AAT group reported a mean score of 7.10 as compared to 7.47 in the control group ($p = .0461$).
- At 6 h, scores were 0.07 versus 1.50 ($p = .0010$).
- At 24 h, the AAT group experienced virtually no pain (0.00 vs. 0.33, $p = .0039$).

These findings are further illustrated in Figure 1, which highlights the more rapid pain reduction trajectory in the AAT group.

Table 1. Characteristics of Participants in Control Group and Acupoint Application Therapy (AAT) Treatment Group.

Variables	Total (n = 60)	Control (n = 30)	AAT (n = 30)	Statistical Analysis	p
Age, years, mean ± SE	54.77 ± 1.723	59.50 ± 1.918	50.03 ± 2.620	t = 2.916	.005
Gender, n (%)				χ^2 = 0.623	.430
Female	28 (46.7)	13 (43.3)	15 (50.0)		
Male	32 (53.3)	17 (56.7)	15 (50.0)		
Smoking, n (%)	25 (41.7)	13 (43.3)	12 (40.0)	χ^2 = 0.054	.816
Drinking, n (%)	25 (41.7)	14 (46.7)	11 (36.7)	χ^2 = 0.002	.967
Colorectal surgery history, n (%)	27 (45.0)	14 (46.7)	13 (43.3)	χ^2 = 0.181	.670
First colonoscopy, n (%)	31 (51.7)	14 (46.7)	17 (56.7)	χ^2 = 0.134	.715
BMI, kg/m^2, mean ± SE	22.15 ± 0.253	22.28 ± 0.372	22.01 ± 0.348	t = 0.521	.605
Duration of reaching the cecum, min, mean ± SE	16.62 ± 0.513	17.10 ± 0.603	16.13 ± 0.830	t = 0.942	.350
Duration of colonoscopy, min, mean ± SE	30.50 ± 0.667	30.30 ± 0.807	30.70 ± 1.077	t = 0.297	.767

Notes: BMI: Body mass index; SE: Standard error.

Table 2. Visual Analog Scale (VAS) Scores of Patients in Control Group and Acupoint Application Therapy (AAT) Treatment Group.

VAS Scores	Control (n = 30)	AAT (n = 30)	p
1 h after colonoscopy	30	30	
Pain score, mean (SE)	7.47 (0.11)	7.10 (0.14)	.0461
Pain score, median (min−max)	7 (6−9)	7 (6−9)	
6 h after colonoscopy	10	2	
Pain score, mean (SE)	1.50 (0.41)	0.07 (0.05)	.0010
Pain score, median (min−max)	0 (0−6)	0 (0−1)	
24 h after colonoscopy	8	0	
Pain score, mean (SE)	0.33 (0.11)	0.00 (0.00)	.0039
Pain score, median (min−max)	0 (0−2)	0 (0)	

Notes: SE: Standard error.

Consistently, comfort levels assessed via the MGCS also favored the AAT group. MGCS scores showed a markedly steeper decline from baseline to 6-h postcolonoscopy, reflecting improved procedural tolerance. These results underscore the potential of topical herbal interventions incorporating *C. ramulus* and *Paeoniae radix Alba* to modulate pain perception and enhance patient comfort.

Observation of Secondary Indicators

To explore additional physiological effects of AAT, we analyzed changes in abdominal circumference and borborygmus frequency (Table 3). While abdominal girth measurements did not differ significantly between groups at any time point, a notable difference was observed in intestinal motility, that is, at 6-h postprocedure, patients in the AAT group exhibited a significantly higher frequency of borborygmus (4.80 vs. 4.13 times/min, p = .030), suggesting earlier restoration of gut function.

Cardiovascular parameters, including SBP, DBP, and HR, were monitored throughout the peri-procedural period (Table 4). No statistically significant differences were detected between groups in any of these indicators (all p > .05), confirming the short-term hemodynamic safety of AAT.

Discussion

In this study, we investigated the therapeutic potential of AAT using a modified herbal decoction in alleviating PCP. The results showed that patients who received AAT experienced significantly lower VAS scores at 1, 6, and 24 h after colonoscopy as compared to those receiving standard care alone. In addition, the AAT group demonstrated a more rapid reduction in MGCS scores, supporting its pain-relieving effects in the context of PCP.

To our knowledge, this is the first study to specifically assess the efficacy of AAT for PCP following colonoscopy.

As a noninvasive and safe traditional therapy, AAT has been increasingly applied to a wide range of clinical conditions. For example, Wang et al. (2024a) demonstrated that graphene-based warm uterus acupoint paste improved pain symptoms in primary dysmenorrhea rats by modulating inflammatory and immune-related biomarkers. In allergic rhinitis, AAT has shown superior short- and long-term efficacy as compared to placebos, Western medicine, and even oral TCM or acupuncture (Mengxia et al., 2022). Our study extends this evidence base by introducing AAT as a novel adjunct in managing PCP, highlighting its potential role in integrative postendoscopic care.

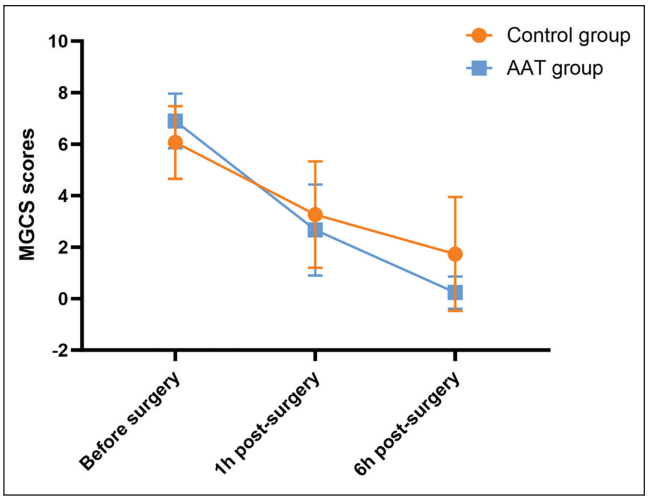


Figure 1. Visual Analog Scale (VAS) Scores in Control Group and Acupoint Application Therapy (AAT) Treatment Group at 1, 6, and 24 h After Colonoscopy, Respectively.

Importantly, the formulation used in this study is based on Gui-Zhi-Jia-Shao-Yao-Tang, a classic TCM prescription. Its core botanical components, Gui-Zhi (*C. ramulus*) and Shao-Yao (*Paeoniae radix Alba*), are time-honored medicinal herbs with well-characterized phytochemicals. *C. ramulus* contains cinnamaldehyde and eugenol, which have analgesic, anti-inflammatory, and smooth muscle relaxant effects. *Paeoniae radix Alba* contains paeoniflorin and albiflorin, which modulate cytokines and inhibit visceral hypersensitivity through multiple signaling pathways. Previous studies have shown that this modified herbal decoction can regulate gastrointestinal motility and function (Nobe et al., 2002; Saitoh et al., 1999). These findings suggest that the plant-derived compounds within the formula may exert therapeutic effects on PCP via neuromodulatory and gut-regulatory mechanisms.

Although the mechanisms underlying the analgesic effects of AAT remain incompletely understood, several possibilities exist. Acupoint therapies, including manual and electroacupuncture, have been widely applied for functional gastrointestinal disorders, such as constipation, reflux disease, and

Table 3. Abdomen Circumference and Borborygmus of PATIENTS in Different Time Points.

	Abdomen Circumference (cm), Mean (SE)			Borborygmus (times/min), Mean (SE)		
Variables	**Control (*n* = 30)**	**AAT (*n* = 30)**	***p***	**Control (*n* = 30)**	**AAT (*n* = 30)**	***p***
Before colonoscopy	86.23 ± 0.45	86.57 ± 0.56	.646	2.07 ± 0.13	1.93 ± 0.12	.441
1 h after colonoscopy	83.50 ± 0.52	82.93 ± 0.51	.440	3.10 ± 0.18	3.17 ± 0.16	.784
6 h after colonoscopy	81.63 ± 0.60	80.70 ± 0.42	.206	4.13 ± 0.25	4.80 ± 0.16	.030

Notes: AAT: acupoint application therapy; SE: Standard error.

Table 4. Blood Pressure and Heart Rate at Different Time Points.

Variables	**Control (*n* = 30)**	**AAT (*n* = 30)**	**Statistical Analysis**	***p***
SBP, mmHg				
Preprocedure	139.5 (3.278)	134.2 (2.501)	$t = 1.277$	.207
During procedure	131.3 (2.840)	128.6 (2.264)	$t = 0.743$	.460
Postprocedure	124.7 (2.502)	121.8 (1.928)	$t = 0.918$	.362
DBP, mmHg				
Preprocedure	84.0 (1.895)	81.8 (1.826)	$t = 0.849$	.400
During procedure	79.4 (1.775)	76.8 (1.559)	$t = 1.101$	.276
Postprocedure	75.1 (1.541)	73.7 (1.282)	$t = 0.715$	.477
HR, bpm				
Preprocedure	80.8 (1.625)	80.3 (1.619)	$t = 0.189$	.851
During procedure	77.2 (1.542)	76.9 (1.356)	$t = 0.130$	.897
Postprocedure	73.9 (1.343)	73.0 (1.116)	$t = 0.496$	.622

Note: AAT: Acupoint application treatment; DBP: Diastolic blood pressure; HR: Heart rate; SBP: Systolic blood pressure.

irritable bowel syndrome (Li et al., 2023). While most prior studies have used needling methods, AAT offers a noninvasive alternative. Mechanistically, acupuncture is known to activate central pain modulation pathways, involving opioids, serotonin, norepinephrine, and the endocannabinoid system, and to reduce peripheral inflammation through suppression of cyclooxygenase-2 and prostaglandin E2 expression. Similar mechanisms may also apply to AAT.

Clinically, AAT has demonstrated efficacy in alleviating diverse types of pain, including labor pain (Smith et al., 2020), musculoskeletal injuries (Zhao et al., 2018), postoperative pain (Ogul & Yildiz, 2023), and menstrual cramps (Cha & Sok, 2016). Wang et al. (2024b) further showed that AAT can regulate immune function through inhibition of the TLR4/MyD88/NF-κB p6-5 signaling pathway, thereby relieving dysmenorrhea symptoms in rats. In our study, the selected acupoints, primarily from the large intestine, stomach, and spleen meridians, may have contributed to the observed pain relief in PCP, consistent with traditional acupuncture protocols but delivered in a more patient-friendly form.

Moreover, AAT may interact with gut microbiota to exert systemic benefits. Previous studies have reported that acupoint therapy may influence microbial diversity and inflammatory responses, while probiotic supplementation has also shown benefits in reducing postcolonoscopy gastrointestinal symptoms (Muzellina et al., 2024). Thus, microbiota modulation could represent another mechanism by which plant-based AAT alleviates PCP.

Regarding borborygmus, we observed that at 6-h postprocedure, patients in the AAT group exhibited a significantly higher frequency of borborygmus, suggesting earlier restoration of gut function. A previous study exploring the effect on the recovery of gastrointestinal function after cesarean section was treated with transcutaneous electrical acupoint stimulation and found that the observation group was superior to the control group in restoring the time of borborygmus (Mu et al., 2019). These findings indicated that recovery time and frequency of borborygmus may indicate the recovery status of gastrointestinal function. Nevertheless, the specific mechanisms by which AAT treatment influences borborygmus in patients undergoing PCP are unclear. Another randomized clinical trial reported that abdominal massage can be considered an effective intervention for relieving bloating and facilitating flatulence after colonoscopy. Therefore, our findings suggested that AAT could be a promising tool for reducing labor costs through treatment methods to enhance gastrointestinal comfort after PCP surgery.

We also evaluated potential demographic confounders. Although prior research has identified female sex and colonoscopy duration as risk factors for PCP, no significant differences were observed between groups in our study. However, patients in the control group were older on average. Literature suggests older individuals may have better tolerance to procedural discomfort (Ristikankare et al., 2001), yet our findings still indicated superior outcomes in the younger AAT group, supporting the robustness of the intervention. Furthermore, blood pressure and HR remained stable across both groups during all time points, indicating that AAT did not compromise hemodynamic stability. Although application therapies may lower blood pressure in some settings (Cohen et al., 2022; Koenig et al., 2014; Wei et al., 2022), our results did not reveal such effects, possibly due to the short-term observation window.

AAT with a modified herbal decoction of *Gui-Zhi* (*C. ramulus*) and *Shao-Yao* (*Paeoniae radix Alba*) may offer a plant-based, noninvasive alternative to conventional analgesics that often have side effects, such as gastrointestinal irritation, sedation, or dependency, with a rapid pain reduction. By mitigating PCP, AAT could improve patient willingness to undergo repeat colonoscopies, which is critical for colorectal disease screening adherence. However, this study has limitations. First, the sample size was relatively small, and participants were recruited from a single institution, which may limit generalizability. Second, pain is inherently subjective and influenced by individual variability. Therefore, larger multicenter trials are needed to confirm these preliminary findings and clarify the mechanistic basis of Chinese herbal AAT in PCP management. Optimizing herbal decoction doses, application duration, and acupoint selection should be further investigated in future research. Also, for long-term outcomes, whether AAT can reduce opioid use or hospital readmissions postcolonoscopy is an interesting scope.

This study demonstrated that AAT using a modified herbal decoction of *Gui-Zhi* (*C. ramulus*) and *Shao-Yao* (*Paeoniae radix Alba*) can significantly relieve PCP. Compared to standard analgesics, this plant-based, noninvasive therapy offers a safe and well-tolerated alternative that aligns with the principles of natural product pharmacology. By integrating traditional herbal medicine with modern clinical practice, AAT represents a promising adjunctive strategy for improving patient comfort and adherence during gastrointestinal procedures. These findings support the continued investigation of plant-derived topical therapies within the framework of evidence-based pharmacognosy.

Abbreviations

AAT: Acupoint application therapy; BMI: Body mass index; DBP: Diastolic blood pressure; HR: Heart rate; MGCS: Modified Gloucester Comfort Scale; PCP: Postcolonoscopy pain; SBP: Systolic blood pressure; SE: Standard error; TCM: Traditional Chinese medicine; VAS: Visual analog scale.

Authors' Contributions

Shengjie Chen and Wei Xu designed the study and performed the experiments; Xinxin Zhou collected the data; Jiaohui Yang analyzed the data; and Shengjie Chen and Wei Xu prepared the manuscript. All authors read and approved the final manuscript.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Approval

This study was approved by the Ethics Committee of Gaoming District Traditional Chinese Medicine Hospital (No. [2023] no. 6).

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Informed Consent

All participants provided written informed consent.

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