Observational Study

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The efficacy of foot acupoint massage combined with medium-frequency electrical stimulation in enhancing gastrointestinal function recovery after colorectal cancer surgery

Lingya Wang, MM[a], Zhouxiu Qin, MM[a], Mengfei Xu, MM[a], Caifang Chen, MM[a,*]

Abstract

Gastrointestinal (GI) dysfunction is a common complication after colorectal cancer surgery, often leading to prolonged hospitalization and reduced quality of life. This study aims to evaluate the impact of combining foot acupoint massage (FAM) and medium-frequency electrical stimulation (MFES) on the recovery of GI function after colorectal tumor surgery. A total of 135 patients were retrospectively categorized into 3 groups according to the nursing interventions recorded in their medical records: the control group (routine care), the FAM group (routine care + FAM), and the FAM/MFES group (routine care + FAM + MFES), with 45 patients in each group. The primary outcomes included postoperative pain (Visual Analog Scale score), time to first flatus, time to first bowel movement, time for bowel sounds to return, time to resume normal diet, abdominal distension score, and the incidence of postoperative ileus. Compared with the other 2 groups, the FAM/MFES group showed superior results in postoperative pain, time to first flatus, time to first bowel movement, time for bowel sounds to return, and time to resume normal diet ($P < .05$). The abdominal distension score was also significantly lower in the FAM/MFES group ($P = .016$). However, there was no significant difference in the incidence of postoperative ileus between the groups ($P = .240$). The combination of FAM and MFES significantly promotes GI function recovery after colorectal surgery, providing a promising adjunctive treatment approach for postoperative care.

Abbreviations: FAM = foot acupoint massage, GI = gastrointestinal, MFES = medium-frequency electrical stimulation, POI = postoperative ileus, VAS = Visual Analog Scale.

Keywords: colorectal tumor, foot acupoint massage, gastrointestinal function, medium-frequency electrical stimulation

1. Introduction

Colorectal cancer is one of the most common malignancies worldwide, and its incidence and mortality continue to rise globally.[1,2] Surgical resection remains the cornerstone of treatment for colorectal cancer; however, postoperative gastrointestinal (GI) dysfunction continues to pose a significant clinical challenge.[3,4] Postoperative GI complications prolong hospitalization and increase the risk of obstruction, distension, and pain, thereby reducing patients' quality of life.[5,6] Therefore, developing effective interventions to facilitate the recovery of GI function and reduce complications has become a critical focus in the postoperative care of colorectal cancer patients.

Although conventional pharmacological and nursing approaches have achieved some success, their effectiveness in fully restoring GI function remains limited. Consequently, non-pharmacological therapies such as foot acupoint massage (FAM) and medium-frequency electrical stimulation (MFES) have garnered increasing clinical attention. FAM is a traditional therapy that regulates physiological functions by stimulating specific points on the feet. Studies have demonstrated that foot massage can enhance GI motility, facilitate the passage of gas and stool, and alleviate postoperative abdominal distension, thereby promoting the recovery of GI function.[7] Additionally, FAM offers multiple benefits, including the enhancement of systemic blood circulation and the reduction of anxiety, which aid patients in better adapting to the postoperative recovery process.[8]

MFES stimulates patients' skin and muscles through low-frequency currents, enhancing blood circulation, boosting the motility of GI smooth muscles, and promoting GI function recovery.[9,10] Numerous studies have supported the application of MFES in postoperative rehabilitation, highlighting its significant

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The authors have no conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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effects in alleviating postoperative pain, accelerating gas and stool passage, and improving intestinal peristalsis. By delivering electrical stimulation to the abdominal area, MFES effectively relieves spasms of GI smooth muscles, reducing the incidence of postoperative intestinal dysfunction.[11] Currently, an increasing number of studies propose combining MFES with other adjunctive therapies to further enhance its therapeutic efficacy.[12] However, few studies have systematically examined the combined effects of FAM and MFES on postoperative GI recovery.

This study aims to evaluate the impact of various nursing interventions on GI function recovery following colorectal tumor surgery through a retrospective analysis. Furthermore, it seeks to explore the clinical effectiveness of combining FAM with MFES in promoting GI function restoration. By comparing the 3 patient groups in terms of postoperative pain relief, duration of GI function recovery, and the incidence of postoperative complications, this research assesses the effects of different nursing protocols on postoperative GI recovery. The findings are intended to provide a novel and effective nursing strategy for clinical application.

2. Materials and methods

2.1. Study design

This clinical study employed a retrospective cohort design to assess the effects of various nursing interventions on GI function recovery following colorectal tumor surgery. A retrospective analysis was conducted using clinical data from 135 patients who had undergone colorectal tumor resection in the Department of General Surgery, Jiading Central Hospital, Shanghai, between October 2023 and October 2024 (Fig. 1).

Patients were categorized retrospectively according to the nursing interventions recorded in their medical charts: the Control group (standard care), the FAM group (standard care plus FAM), and the FAM/MFES group (standard care plus FAM and MFES), with 45 patients in each group. All relevant clinical and nursing data were retrieved from the hospital's electronic medical record system. To protect patient confidentiality, all identifiable information such as names, ID numbers, and contact details was removed or coded before data analysis. All patient information was strictly anonymized to ensure privacy and data security. The study protocol and the waiver of informed consent were reviewed and approved by the Ethics Committee of Jiading Central Hospital, Shanghai (Approval No. JCHEC-2023-CRC-028), in accordance with institutional and national ethical standards for retrospective research. Since this study was based solely on existing medical records and involved no direct patient contact, the requirement for additional informed consent was formally waived by the ethics committee.

2.2. Inclusion and exclusion criteria

2.2.1. Inclusion criteria.

(1) Age: Patients aged > 18 years.
(2) Diagnosis and surgery: Individuals diagnosed with colon or rectal cancer undergoing elective radical surgical procedures.
(3) Consciousness and assessment capability: Patients who were fully conscious postoperatively and capable of undergoing assessments for GI function recovery.
(4) Postoperative stability: Patients who did not require ICU admission or experience major complications.

2.2.2. Exclusion criteria.

(1) Congenital GI disorders: Patients with inherent GI diseases present from birth.

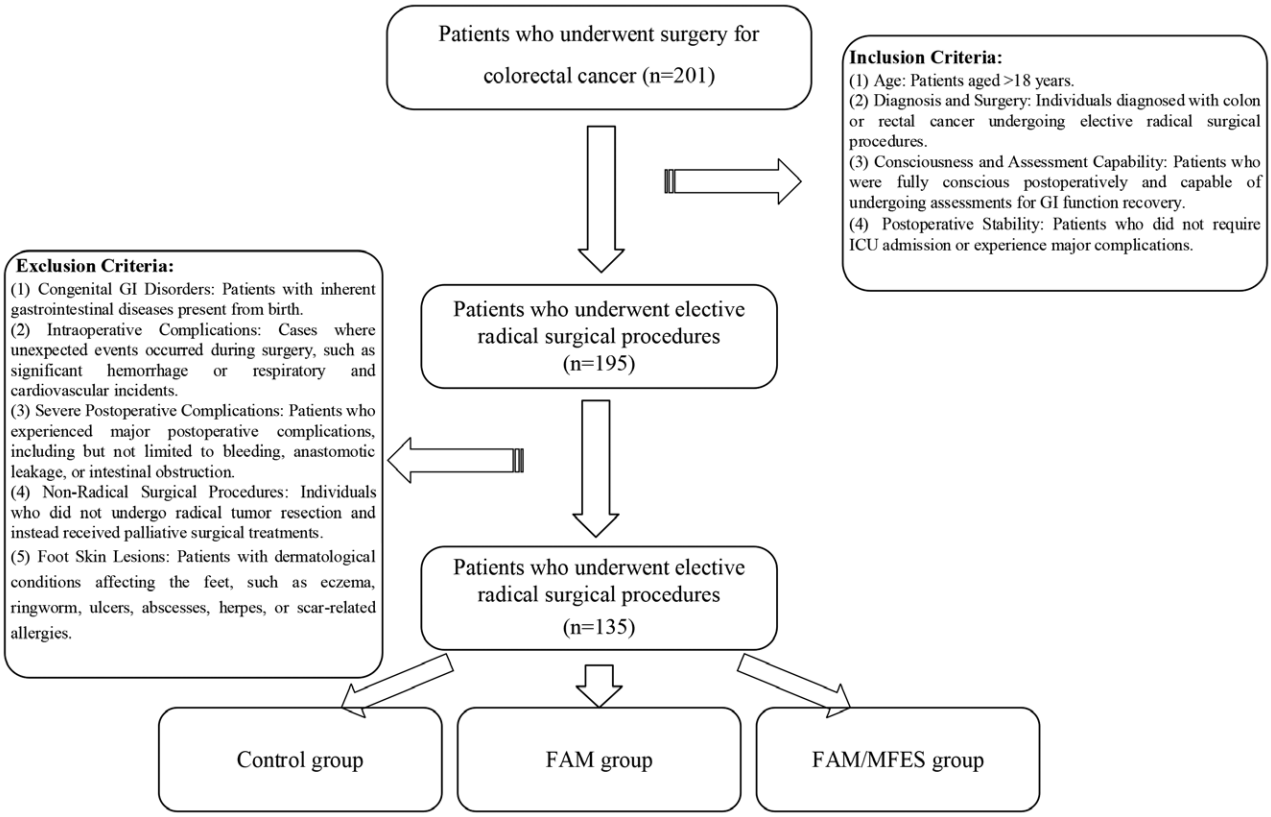

Figure 1. Flowchart of this study. FAM = foot acupoint massage, GI = gastrointestinal, MFES = medium-frequency electrical stimulation.

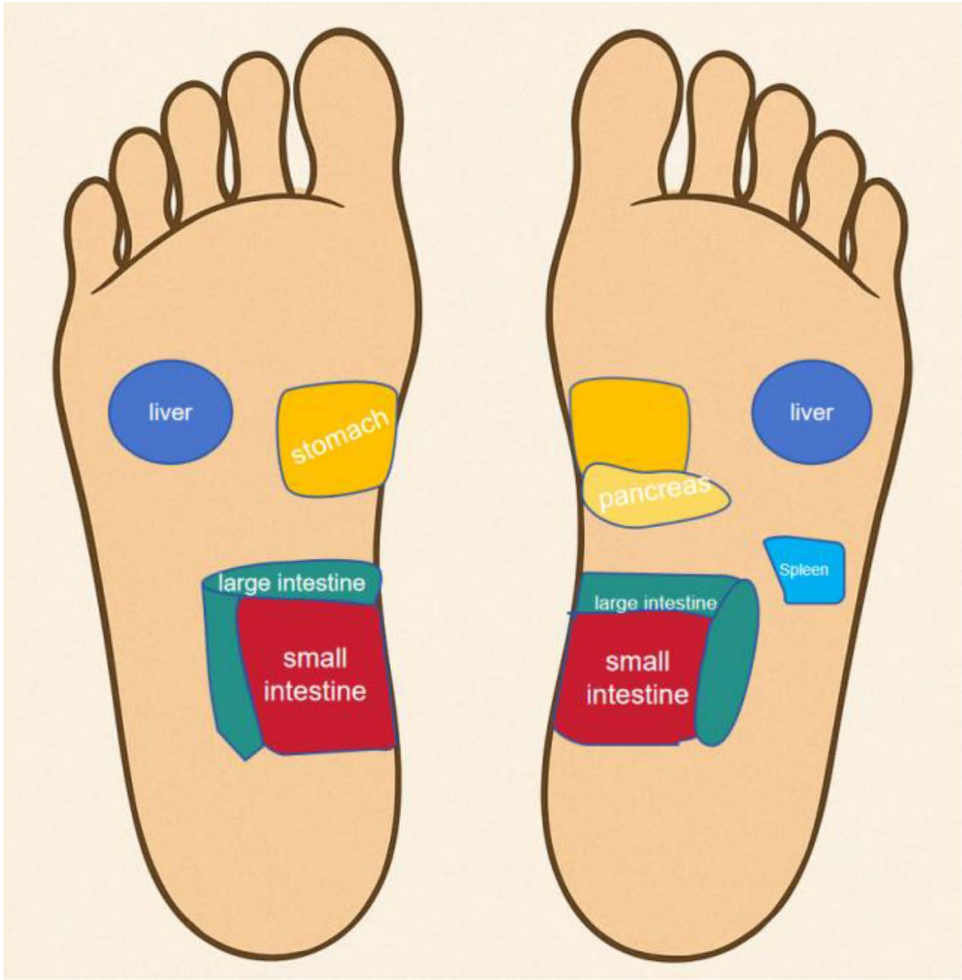

Figure 2. Reflexology map of the foot showing specific zones corresponding to the digestive system.

(2) Intraoperative complications: Cases where unexpected events occurred during surgery, such as significant hemorrhage or respiratory and cardiovascular incidents.
(3) Severe postoperative complications: Patients who experienced major postoperative complications, including but not limited to bleeding, anastomotic leakage, or intestinal obstruction.
(4) Non-radical surgical procedures: Individuals who did not undergo radical tumor resection and instead received palliative surgical treatments.
(5) Foot skin lesions: Patients with dermatological conditions affecting the feet, such as eczema, ringworm, ulcers, abscesses, herpes, or scar-related allergies.

2.3. Nursing protocols

2.3.1. Standard care group (control group). Patients in the Standard Care Group received routine postoperative nursing practices, as per the hospital's established protocols. These included continuous electrocardiographic monitoring, blood oxygen saturation assessment, and observation of vital signs. Postoperatively, patients received standard postoperative bowel management and gradual reintroduction of a normal diet. The prevention of postoperative complications was emphasized, with nutritional support and pain management provided based on individual patient needs. The standard postoperative pain management protocol involved the use of analgesics as needed, including oral or intravenous medications such as nonsteroidal anti-inflammatory drugs and opioids, with dosages adjusted according to the patient's pain level and response. Early mobilization, including bedside activities and gradual ambulation, was encouraged to facilitate recovery, following standard hospital procedures.

2.3.2. FAM group. In addition to standard care, patients in FAM group received supplementary FAM therapy. FAM commenced on the first postoperative day, administered once daily until the patient experienced their first flatus. Each session lasted approximately 20 minutes (about 10 minutes per foot) and was performed by 2 trained nurses who had completed standardized massage training and competency assessment organized by the hospital's nursing department.

During the massage sessions, moderate pressure was applied using thumb pressing and index finger gliding techniques, ensuring mild soreness without discomfort to the patient. These techniques targeted specific reflex zones on the soles of the feet associated with the digestive system (Fig. 2), including areas corresponding to the stomach, pancreas, duodenum, and small intestine. A heated towel was used to warm the feet before each session, enhancing blood circulation and the overall effectiveness of the massage. To ensure the consistency and reproducibility of the intervention, all procedures followed a standardized operation protocol established and supervised by senior nursing staff, and adherence to this protocol was regularly monitored during the study.

2.3.3. FAM/MFES group (FAM + MFES). Patients in the FAM/MFES group received both standard care and FAM, in

addition to MFES. Starting 48 hours post-surgery, MFES was administered to specific foot acupoints using an MFES device. The electrical parameters were set to a carrier frequency of 2500 Hz and a modulation frequency between 80 and 100 Hz. Each MFES session lasted for 30 minutes and was conducted once daily until the patient passed their first flatus. The rationale for starting MFES at 48 hours post-surgery was based on clinical guidelines that suggest this timing allows for sufficient recovery of initial postoperative stability, such as the stabilization of vital signs and the resolution of acute surgical inflammation. Initiating MFES too early might cause discomfort or interfere with the natural healing process. Additionally, starting the intervention after 48 hours helps to ensure that patients are sufficiently stabilized, thus minimizing potential risks associated with early electrical stimulation.

2.4. Observation indicators

The primary observation indicators of this study include:

2.4.1. Primary outcomes.

(1) *Pain Score Visual Analog Scale (VAS)*: The VAS was utilized to assess the pain intensity of patients in all 3 groups at 12, 24, and 48 hours postoperatively. The VAS score ranges from 0 to 10, with higher scores indicating more severe pain.
(2) *Time to first flatus and defecation*: The time to the first passage of flatus and stool post-surgery was recorded for patients in all 3 groups, serving as indicators of GI function recovery.
(3) *Time to bowel sound recovery*: The time required for bowel sounds to return postoperatively was recorded to evaluate the restoration of GI motility. Bowel sounds were auscultated starting 8 hours after surgery and then every 4 hours thereafter (excluding the nighttime period from 22:00 to 06:00 to avoid disturbing rest). The auscultation continued until bowel sounds were detected. The recovery time was defined as the time until bowel sounds were heard 4 to 5 times per minute in the upper and lower quadrants of the abdomen and the umbilical region.
(4) *Time to resume normal diet*: The time taken for patients to return to a normal diet was recorded as a standard measure of postoperative GI function recovery.

2.4.2. Secondary outcomes.

[1] *Abdominal Distension Score*: Abdominal distension was evaluated using a standardized scoring system. Responsible nurses inquired daily about the presence of abdominal distension and recorded the patients' self-reported symptoms. The scores were categorized into 4 levels: Grade 0: No sensation of abdominal distension. Grade 1: Mild abdominal distension with slightly increased abdominal wall tension, not affecting rest or sleep. Grade 2: Moderate abdominal distension with significantly increased abdominal wall tension, affecting rest and sleep. Grade 3: Severe abdominal distension with markedly increased abdominal wall tension, preventing rest and sleep.
[2] *Postoperative ileus (POI)*: POI was diagnosed if a patient had not passed flatus within 72 hours postoperatively.

Additionally, the study also monitored for any complications or adverse events associated with FAM or MFES. Potential adverse reactions, including skin irritation, pain, dizziness, or muscle spasms, were considered. No significant adverse events or complications were observed in any of the patient groups during the study period.

2.5. Data collection

All data were extracted by trained researchers from the hospital's electronic health records system. The collected data included patients' basic information, postoperative recovery status, pain scores, and GI function recovery metrics. Data entry was subjected to double-checking to ensure completeness and accuracy. Missing data were handled according to predefined protocols, which included methods such as data deletion or substitution. Postoperative follow-up data were collected through outpatient revisit records and telephone follow-ups. To account for potential bias introduced by the different timing of interventions, statistical adjustments were made using covariate adjustment methods. Specifically, analysis of covariance was employed to control for the influence of the starting time of the MFES intervention (48 hours post-surgery) on the outcomes. This approach ensured that the observed effects of the intervention were not confounded by variations in the timing of the treatment, allowing for a more accurate evaluation of the intervention's impact on recovery. In addition, detailed perioperative variables – including surgical method (laparoscopic or open resection), anesthesia type (general or combined anesthesia), and postoperative analgesic regimen – were also collected. These variables were assessed as potential confounders and were incorporated as covariates in the statistical analysis to minimize bias.

2.6. Statistical analysis

All data were entered into Excel spreadsheets using a double-entry method and verified by 2 independent researchers to ensure accuracy before being analyzed with SPSS version 25.0 (IBM, Armonk). Statistical analyses were two-tailed, with a significance level set at $P < .05$. Continuous variables were expressed as mean ± standard deviation ($\bar{x} \pm s$) or as median and interquartile range for non-normally distributed data. Baseline comparisons for normally distributed continuous variables were performed using independent samples *t*-tests, while the Mann–Whitney *U* test was used for non-normally distributed data. Categorical variables were analyzed with chi-square tests, and ordinal data were assessed using rank-sum tests. For outcome comparisons, one-way ANOVA was applied for normally distributed data between groups, and the Kruskal–Wallis *H* test was used for non-normal distributions. Within-group comparisons employed paired samples *t*-tests for normally distributed data and Wilcoxon signed-rank tests for data not following a normal distribution. To minimize potential bias, multivariate analyses were performed using analysis of covariance, with surgical method (laparoscopic or open), anesthesia type, and postoperative analgesic regimen included as covariates to control for possible confounding effects.

3. Results

3.1. General data comparison

The 3 groups demonstrated comparable baseline characteristics ($P > .05$; Table 1), including age (62.54–63.15 years), BMI (21.35–22.58 kg/m²), gender distribution (55.56–62.22% male), education level, comorbidities (hypertension 42.22–51.11%, diabetes 44.44–53.33%), Dukes staging, American Society of Anesthesiologists status (2.20–2.31), surgical duration (~160 minutes), and hospitalization period (~8 days). No significant differences were observed in postoperative opioid use (31.11–40.00%) or nausea/vomiting rates (17.78–22.22%), confirming balanced group allocation for subsequent intervention comparisons.

3.2. VAS score comparison

Postoperative pain was evaluated using the VAS at 12, 24, and 48 hours after surgery. At 12 hours postoperatively, VAS scores were similar among the 3 groups, showing no significant differences ($P = .903$). However, at both 24 and 48 hours postoperatively, the FAM/MFES group exhibited significantly lower VAS scores compared to Control Groups A and B, with the differences being statistically significant ($P < .001$; Table 2, Fig. 3). These results indicate that the combination of FAM and MFES effectively reduces postoperative pain, alleviates patient discomfort, and enhances overall postoperative comfort.

3.3. Time to first flatus and defecation

There were statistically significant differences in the time to first flatus and defecation among the 3 groups (Table 3, Fig. 4). The FAM/MFES group had a notably shorter time to first flatus (53.64 ± 26.43 hours) compared to the Standard Care Group (72.43 ± 34.64 hours) and the Foot Massage Group (63.42 ± 29.05 hours; $P = .014$). Similarly, the time to first defecation was significantly earlier in the FAM/MFES group (98.24 ± 35.45 hours) than in the Standard Care Group (134.52 ± 45.63 hours) and the Foot Massage Group (116.64 ± 55.62 hours; $P = .001$). These findings suggest that the combination of foot reflexology and MFES effectively accelerates GI recovery, particularly in reducing the time to first flatus and defecation.

3.4. Time to bowel sound recovery and time to resume normal diet

Significant differences were observed in the time to bowel sound recovery and the time to resume a normal diet among the 3 groups (Table 4). The FAM/MFES group exhibited a significantly shorter time to bowel sound recovery (34.46 ± 22.57 hours) compared to the Standard Care Group (53.25 ± 23.14 hours) and the FAM Group (45.74 ± 21.58 hours; $P < .001$).

Table 1

Baseline characteristics (n [%], mean ± SD).

Variables	Control group (n = 45)	FAM group (n = 45)	FAM/MFES group (n = 45)	F/ χ2	P
Age (yr)	62.54 ± 3.46	63.15 ± 2.29	62.87 ± 3.13	0.466	.628*
BMI (kg/m²)	21.46 ± 2.53	22.58 ± 3.57	21.35 ± 2.42	2.275	.107*
Gender					
Male	25 (55.56)	26 (57.78)	28 (62.22)	0.427	.808**
Female	20 (44.44)	19 (42.22)	17 (37.78)		
Education level					
Primary education	22 (48.89)	25 (55.56)	20 (44.44)	2.105	.716**
Secondary education	20 (44.44)	18 (40.00)	20 (44.44)		
Higher education	3 (6.67)	2 (4.44)	5 (11.12)		
Comorbidities					
Hypertension	19 (42.22)	21 (46.67)	23 (51.11)	0.381	.827**
Diabetes	22 (48.89)	24 (53.33)	20 (44.44)	0.364	.834**
Coronary heart disease	14 (31.11)	13 (28.89)	15 (33.33)	0.19	.909**
Hypokalemia	16 (35.56)	18 (40.00)	11 (24.44)	1.733	.420**
History of abdominal surgery	6 (13.33)	5 (11.12)	3 (6.67)	1	.606**
Dukes' staging					
A	11 (24.44)	10 (22.22)	12 (26.67)	2.442	.874**
B	20 (44.44)	17 (37.78)	21 (46.67)		
C	11 (24.44)	13 (28.89)	10 (22.22)		
D	3 (6.67)	5 (11.12)	2 (4.44)		
ASA physical status	2.23 ± 0.41	2.31 ± 0.38	2.20 ± 0.42	0.561	.573*
Surgical time (min)	158.72 ± 32.14	162.40 ± 30.65	159.08 ± 31.98	0.179	.836*
Length of hospital stay (d)	8.34 ± 2.47	8.11 ± 2.22	8.22 ± 2.09	0.158	.854*
Postoperative opioid use	18 (40.00)	16 (35.56)	14 (31.11)	1.048	.593**
Nausea and vomiting	10 (22.22)	9 (20.00)	8 (17.78)	0.317	.854**

ASA = American Society of Anesthesiologists, BMI = body mass index (kg/m²), FAM = foot acupoint massage, MFES = medium-frequency electrical stimulation.

*One-way ANOVA.

**Chi-square tests.

Table 2

Multi-group controlled study: analysis of inter-group differences in postoperative visual analogue score (VAS), first exhaust/defecation time, bowel sound recovery, and incidence of POI.

Variable	Control group (n = 45)	FAM group (n = 45)	FAM/MFES group (n = 45)	Statistic (F/χ²)	P-value
VAS 12 h	6.07 ± 1.06	6.05 ± 1.12	6.15 ± 1.15	0.102	.903
VAS 24 h	3.85 ± 0.13	3.52 ± 0.21	3.32 ± 0.16	17.21	<.001
VAS 48 h	3.62 ± 1.23	2.97 ± 1.15	2.37 ± 1.12	12.848	<.001
Time to first flatus (h)	72.43 ± 34.64	63.42 ± 29.05	53.64 ± 26.43	4.348	.014
Time to first defecation (h)	134.52 ± 45.63	116.64 ± 55.62	98.24 ± 35.45	6.907	.001
Time to bowel sound recovery (h)	53.25 ± 23.14	45.74 ± 21.58	34.46 ± 22.57	7.993	<.001
Time to resume normal diet (h)	74.43 ± 23.98	65.32 ± 22.46	53.24 ± 21.25	9.966	<.001
POI incidence (n [%])	15 (33.33%)	12 (26.67%)	8 (17.78%)	χ^2=2.854	.24
Abdominal distension score	1.53 ± 0.98	1.32 ± 0.56	1.12 ± 0.25	4.242	.016

FAM = foot acupoint massage, MFES = medium-frequency electrical stimulation, POI = postoperative ileus.

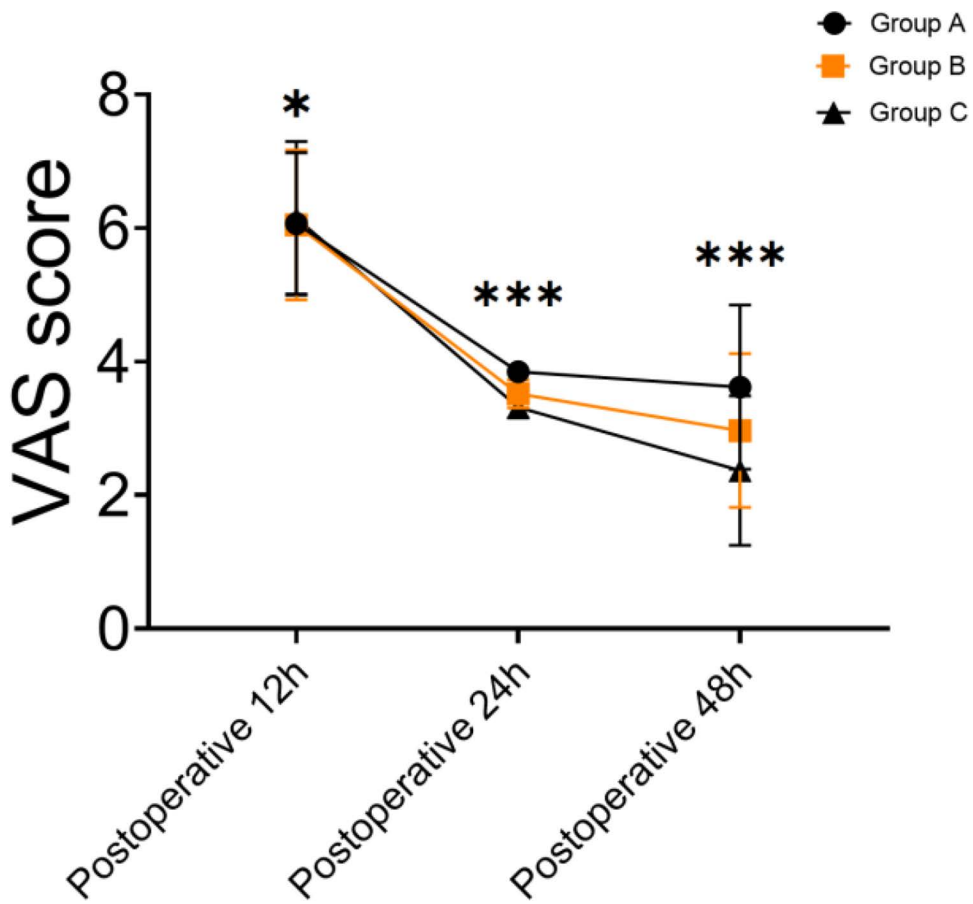

Figure 3. Comparison of postoperative VAS scores (Group A: Control group, Group B: FAM group, and Group C: FAM/MFES group). $P < .05$ was considered statistically significant, indicated by an asterisk *. $P < .01$ is represented by 2 asterisks **, and $P < .001$ is represented by 3 asterisks ***. FAM = foot acupoint massage, MFES = medium-frequency electrical stimulation, VAS = Visual Analog Scale.

Table 3

Comparison of the time to first flatus and defecation among the 3 groups (mean ± SD).

Group	n	Time to first flatus (h)	Time to first defecation (h)
Control group A	45	72.43 ± 34.64	134.52 ± 45.63
Control group B	45	63.42 ± 29.05	116.64 ± 55.62
Observation group	45	53.64 ± 26.43	98.24 ± 35.45
F		4.348	6.907
P		.014	.001

Additionally, the time to resume a normal diet was significantly earlier in the FAM/MFES group (53.24 ± 21.25 hours) than in the Standard Care Group (74.43 ± 23.98 hours) and the FAM Group (65.32 ± 22.46 hours; $P < .001$). These results indicate that the integration of FAM and MFES significantly hastens the recovery of bowel sounds and the initiation of normal eating postoperatively, thereby enhancing overall GI function recovery in patients.

3.5. Abdominal distension score and POI comparison

According to Table 5, there were no statistically significant differences in the incidence of POI among the 3 groups ($P = .240$). However, regarding abdominal distension scores, the FAM/MFES group exhibited significantly lower scores compared to the Standard Care Group and the FAM Group, with the differences being statistically significant ($P = .016$). These findings indicate that the combination of FAM and MFES effectively reduces postoperative abdominal distension.

4. Discussion

Colorectal cancer is a leading cause of cancer-related mortality worldwide, with surgery being the primary treatment modality. However, postoperative complications like GI dysfunction, pain, and infections can significantly impact recovery and quality of life.[13,14] This study demonstrated that combining FAM with MFES effectively relieved postoperative pain and accelerated GI recovery. Specifically, the FAM/MFES group outperformed both the Standard Care Group and the FAM group (standard care plus FAM) in terms of postoperative pain scores, time to first flatus and defecation, time to bowel sound recovery, and time to resume a normal diet. Additionally, the FAM/MFES group exhibited significantly lower abdominal distension scores. Although there were no significant differences among the 3 groups regarding the incidence of POI, the combined use of FAM and MFES clearly facilitated GI function recovery, reduced postoperative discomfort, and enhanced overall patient comfort and recovery quality.

Overall, integrating FAM with MFES appears to be an effective adjunctive nursing strategy for enhancing GI recovery after colorectal surgery. Initially, the significantly lower postoperative pain scores in the FAM/MFES group align with the findings of Huang et al,[15] who reported that foot electrical stimulation effectively alleviated postoperative pain, thereby accelerating recovery. Furthermore, the earlier time to first flatus and defecation observed in the FAM/MFES group is consistent with the

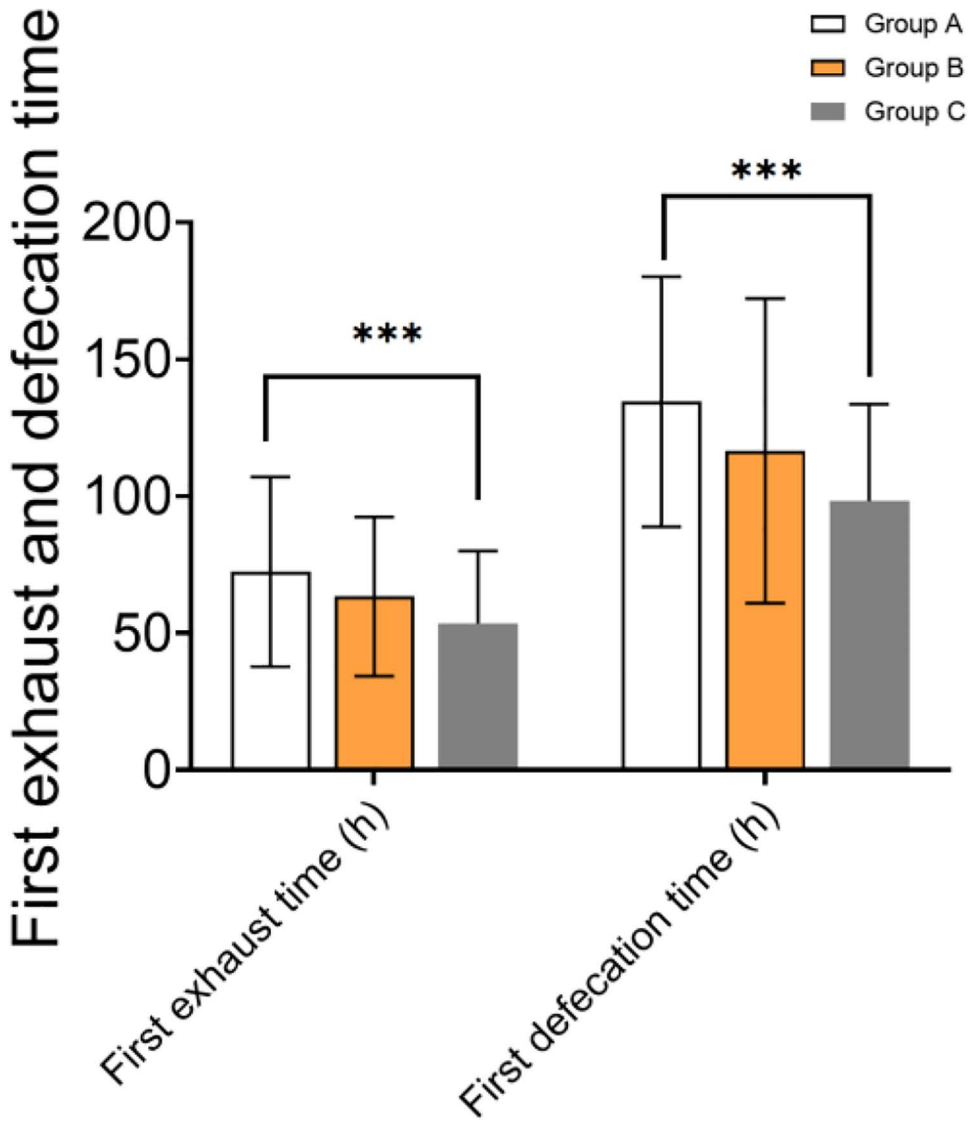

Figure 4. Comparison of the first exhaust and defecation time (Group A: Control group, Group B: FAM group, and Group C: FAM/MFES group). $P < .05$ was considered statistically significant, indicated by an asterisk *. $P < .01$ is represented by 2 asterisks **, and $P < .001$ is represented by 3 asterisks ***. FAM = foot acupoint massage, MFES = medium-frequency electrical stimulation.

Table 4

Comparison of time to bowel sound recovery and time to resume normal diet among the 3 groups (mean ± SD).

Group	n	Time to bowel sound recovery (h)	Time to resume normal diet (h)
Control group A	45	53.25 ± 23.14	74.43 ± 23.98
Control group B	45	45.74 ± 21.58	65.32 ± 22.46
Observation group	45	34.46 ± 22.57	53.24 ± 21.25
F		7.993	9.966
P		<.001	<.001

studies by Zhang et al[16] and Li et al[12] which demonstrated that FAM enhances intestinal peristalsis and reduces the time required for GI function recovery. The marked reduction in abdominal distension scores in the FAM/MFES group further supports the positive impact of combining FAM with MFES on postoperative GI recovery, corroborating the results of multiple studies.[17–19]Although this study did not find a significant impact of foot massage and MFES on the incidence of POI, Gao et al[10] reported that percutaneous electrical stimulation of lower limb acupoints effectively reduces the occurrence of POI, suggesting that the combined application of foot acupoint stimulation and MFES may help mitigate the risk of this complication.

Despite the significant findings, this study has several limitations. Firstly, as a retrospective cohort study, it cannot entirely eliminate selection bias, and causal relationships should be interpreted with caution. Secondly, the sample size was relatively small; therefore, future research should involve multi-center, large-scale prospective randomized controlled trials to validate the results. Thirdly, as a single-center study conducted in Jiading Central Hospital, the generalizability of the findings to other institutions or populations may be limited. In addition, the implementation of the intervention relied on the technical proficiency of nursing staff, which may introduce operational bias due to variability in massage intensity and technique. Individual differences (such as age and comorbidities) may also affect the efficacy of nursing interventions, necessitating further exploration of personalized nursing protocols. Additionally, this study focused only on short-term postoperative recovery and lacked long-term follow-up data, making it difficult to evaluate the

Table 5

Comparison of POI and abdominal distension score among the 3 groups (n [%], mean ± SD).

Group	n	POI	Abdominal distension score
Control group A	45	15 (33.33)	1.53 ± 0.98
Control group B	45	12 (26.67)	1.32 ± 0.56
Observation group	45	8 (17.78)	1.12 ± 0.25
F/χ^2		2.854	4.242
P		.240	.016

POI = postoperative ileus.

sustained effects of the intervention on long-term GI function and quality of life. Future studies should extend the follow-up period to assess long-term prognosis and recurrence outcomes. Future multi-center prospective studies with larger sample sizes are warranted to validate these findings and assess their long-term effects on patient outcomes and quality of life. Further investigation into the mechanisms of nursing interventions will provide more robust scientific evidence for clinical practice.

5. Conclusion

This study evaluated the effects of different nursing protocols on GI function recovery after colorectal tumor surgery. Combining FAM with MFES significantly accelerated postoperative recovery, reduced pain and abdominal distension, and shortened the time to bowel sound recovery, first flatus, and defecation. These findings support the integration of FAM and MFES as effective supplementary measures in postoperative care to enhance GI function restoration. However, the retrospective design and small sample size limit the conclusions. Future research should include larger, multi-center prospective trials and explore individualized nursing strategies and the underlying mechanisms of these interventions to validate and expand upon these results.

Author contributions

Conceptualization: Lingya Wang, Zhouxiu Qin, Mengfei Xu, Caifang Chen.
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