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# Construction and Application of a Systematic Nursing Program for Enhanced Recovery after Surgery in the Perioperative Period of Laparoscopic Radical Resection for Gastrointestinal Tumors

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# Construction and Application of a Systematic Nursing Program for Enhanced Recovery after Surgery in the Perioperative Period of Laparoscopic Radical Resection for Gastrointestinal Tumors

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Author Contributions

H.F. and L.H. contributed equally to this work and share first authorship. H.F. and L.H. performed the study, collected and analyzed data, and drafted the manuscript. N.S. and Z.X. participated in data collection and nursing intervention. J.H. designed and supervised the study and revised the manuscript. All authors read and approved the final manuscript.

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## Abstract

To construct a systematic nursing program for enhanced recovery after surgery (ERAS) in the perioperative period of laparoscopic radical resection for gastrointestinal tumors and analyze its effectiveness.

## Methods

Based on the concept of enhanced recovery after surgery (ERAS), a systematic nursing program for enhanced recovery in the perioperative period of patients undergoing laparoscopic radical resection for gastrointestinal tumors was constructed. A total of 100 patients who underwent laparoscopic radical resection for gastrointestinal tumors at the Zengcheng Branch of Nanfang Hospital, Southern Medical University from October 2025 to September 2026 were selected. They were divided into a control group (receiving routine ERAS nursing) and an experimental group (receiving systematic

nursing for enhanced recovery in the perioperative period) according to the admission time, with 50 cases in each group. Gastrointestinal function recovery, quality of recovery, pain, and complications were compared between the two groups.

## Results

The first flatus, defecation, and eating times of the experimental group were earlier than those of the control group ($P < 0.05$). After the intervention, the scores of the 40 - item Quality of Recovery Questionnaire (QoR - 40) in both groups increased, and the score of the experimental group was higher ($P < 0.05$). The Visual Analogue Scale (VAS) scores of the experimental group at different postoperative times were all lower than those of the control group ($P < 0.05$); the incidence of complications was lower than that of the control group ($P < 0.05$).

## Conclusion

The systematic nursing program for enhanced recovery in the perioperative period is scientific and feasible. It can promote the recovery of gastrointestinal function, relieve pain, reduce complications, and is suitable for clinical promotion.

Trial registration: Medical Research Registration and Filing Information System, MR-44-26-006102, registered on 20 January 2026.

## Keywords

Laparoscopy; Radical resection for gastrointestinal tumors; Enhanced recovery nursing; Systematic nursing

Laparoscopic radical resection for gastrointestinal tumors is an important minimally invasive surgical procedure, which has the advantages of small trauma and rapid recovery. However, patients in the perioperative period still face risks of various stress reactions, postoperative pain, and delayed recovery of gastrointestinal function [1-2]. The core concept of enhanced recovery after surgery (ERAS) is to reduce the physiological and psychological trauma and stress reactions of patients in the perioperative period by optimizing the multi - disciplinary collaborative management model during the perioperative period, thereby accelerating the rehabilitation process [3-4]. Systematic nursing is guided by the holistic nursing concept, systematically applies the nursing process to clinical practice, emphasizes the close connection and collaboration of each link, and provides patients with comprehensive, continuous, and high-quality nursing services [5]. At present, the perioperative nursing for laparoscopic radical resection for gastrointestinal tumors is mostly scattered in each link, lacking systematic integration, and it is difficult to give full play to the advantages of ERAS. Moreover, more attention is currently paid to single measures such as postoperative pain control or early mobilization, and the individual differences of patients are not fully integrated, so the overall nursing effect is still not satisfactory [6]. Approved by the Clinical Research Management Committee of Nanfang Hospital, Southern Medical University (Approval No. NFEC-2026-036) and filed with the nursing department and

scientific research department, this study innovatively constructed a systematic nursing program for enhanced recovery in the perioperative period of patients undergoing laparoscopic radical resection for gastrointestinal tumors. The program is based on the recommended measures in the ERAS guidelines and embeds an individual risk assessment module for patients. It realizes the whole - process closed - loop management through a standardized process and a dynamic adjustment mechanism, providing a novel and effective model for patients undergoing laparoscopic radical resection for gastrointestinal tumors.

## 1 Subjects and Methods

### 1.1 Research Subjects

Ethics approval and informed consent:

All methods were performed in accordance with the relevant guidelines and regulations, including the Declaration of Helsinki. All experimental protocols were approved by the Clinical Research Management Committee of Nanfang Hospital, Southern Medical University (Approval No. NFEC-2026-036). Informed consent was obtained from all subjects and/or their legal guardian(s).

This study was registered in the Medical Research Registration and Filing Information System (Registration No. MR-44-26-006102) on 20 January 2026.

**Research Subject Selection** Patients who underwent laparoscopic radical resection of gastrointestinal tumors and were admitted to the Zengcheng Branch of Nanfang Hospital, Southern Medical University from October 2025 to September 2026 were selected as research subjects.

**Sample Size Estimation** The sample size was calculated using the formula for two-independent-sample mean test in Medical Statistics (6th Edition) edited by Li Kang [7]: $N1 = N2 = 2[(t^{\alpha}/2 + t^{\beta})S/\delta]^2$, where:

- N1 and N2 are the number of cases in the two groups
- α is the significance level, with α = 0.05 (two-sided) and $t^{\alpha}/2 = 1.96$
- 1 - β is the power of the test, with β = 0.10 (two-sided) and $t^{\beta} = 1.282$
- S is the sample standard deviation
- δ is the allowable error (the difference between the two means)

Taking the time of first anal exhaust as the primary outcome indicator, according to previous studies [8], with S = 11.25 and δ = 10.49, N1 = N2 = 24 cases were calculated. Considering a 20% dropout rate, at least 30 cases were required in each group. Finally, 100 patients were included in this study, meeting the sample size requirement.

**Inclusion Criteria**

① Diagnosed with gastrointestinal malignant tumors by gastroscopic or enteroscopic biopsy and pathological examination

② Underwent laparoscopic radical resection of gastrointestinal tumors

③ Normal cognitive function

**Exclusion Criteria**

① Simultaneously participated in other clinical trials

② Complicated with infectious diseases

③ Complicated with mental disorders

④ Complicated with serious diseases such as heart, liver, and kidney insufficiency

⑤ Withdrew from the study halfway

**Grouping of Patients**

The 100 patients were divided into a control group (from October 2025 to March 2026) and an experimental group (from April 2026 to September 2026) according to the admission time, with 50 cases in each group. There was no significant difference in the general data between the two groups (P>0.05), indicating comparability (see Table 1).

**Table 1** Comparison of baseline data of the two groups

| Group | *n* | Gender[(subject%)] | | Body Mass Index (x±s, kg/m²) | Years of education (x±s, Year) | Age (x±s, Year) | Hospitalization time (d) |
|---|---|---|---|---|---|---|---|
| | | Male | Female | | | | |
| Experimental group | 50 | 27 (54.00) | 23 (46.00) | 21.69±1.72 | 11.37±3.56 | 50.16±3.76 | 10.23±4.78 |
| Control group | 50 | 26 (52.00) | 24 (48.00) | 21.23±1.67 | 11.75±3.67 | 50.67±3.52 | 10.76±3.65 |

| | | | | | | |
|---|---|---|---|---|---|---|
| $\chi^2$-value/t-value | | 0.040 | 1.357 | 0.526 | 0.700 | 0.623 |
| P-value | | 0.841 | 0.178 | 0.600 | 0.486 | 0.534 |

## 1.2 Nursing Methods

1.2.1 The control group implemented routine Enhanced Recovery After Surgery (ERAS) nursing in reference to the domestic ERAS guidelines. The specific contents included:

(1) Pre - operative nursing: ① Health education: Standardized oral education was used to introduce the surgical process, the concept of ERAS, and the key points of postoperative rehabilitation in detail to patients and their families. ② Nutritional support: Patients were guided to adjust their diet before surgery to ensure adequate nutritional intake.

(2) Intra - operative nursing: ① Anesthesia method: Local anesthesia, spinal anesthesia, or general anesthesia was selected. Anesthetic drugs were administered at standard doses. Vital signs were routinely monitored, and the basic anesthetic depth was maintained to meet the surgical requirements. ② Body temperature maintenance: The operating room temperature was regulated, and heat - preservation equipment was used. ③ Fluid management: The principle of restrictive fluid infusion was followed. The volume and speed of fluid infusion were controlled to maintain fluid balance.

(3) Post - operative nursing: ① Pain management: A multimodal analgesia plan using non - steroidal anti - inflammatory drugs combined with opioids was adopted. ② Activity guidance: Patients were encouraged to get out of bed early to promote the recovery of gastrointestinal function. ③ Diet recovery: According to the gastrointestinal function, the diet was gradually changed from liquid food to a normal diet. ④ Drainage tube management: The drainage tubes were properly fixed, the drainage situation was observed, and the tubes were removed in a timely manner.

（4）Discharge management: Guide patients on home rehabilitation precautions, follow-up visit times, and provide consultation channels.

1.2.2 The experimental group implemented a rapid rehabilitation systematic nursing program

1.2.2.1 Establish a research group

A senior gastroenterological surgical nurse manager served as the group leader. The group members included 1 gastroenterological surgeon (responsible for surgical plan and complication assessment), 1 anesthesiologist (participating inanalgesia and fluid management decision - making), 1 dietitian (conducting individualized nutritional assessment and intervention), 1 rehabilitation therapist (customizing activity plans), 1 psychologist (providing psychological support and counseling), 3 responsible nurses (implementing and providing feedback throughout the process), and 2 evidence - based nurses (conducting literature retrieval), totaling 12 people. The group members discussed through literature - based evidence and clinical experience, clarified the patient - centered personalized goals, and focused on the systematic nursing for rehabilitation in four stages: pre - operation, intra - operation, post - operation, and discharge management.

1.2.2.2 Construction of intervention program

With "Laparoscopy", "gastrointestinal cancer radical surgery", "rapid rehabilitation nursing", "systematic nursing", "nutritional support", "psychological nursing", "pain management" and "early rehabilitation guidance" as the Chinese keywords, and "Laparoscopy", "gastrointestinal cancer radical surgery", "rapid rehabilitation nursing", "systematic nursing", "nutritional support", "psychological nursing", "pain management", "early rehabilitation guidance" as the English keywords, a systematic search was conducted in domestic and foreign databases such as CNKI, Wanfang Database, PubMed, Embase, and Google Scholar. The search time was from the establishment of the database to December 2024. Two nurses with evidence-based practice qualifications independently undertook the literature screening and quality assessment work, and a third member (a senior nursing expert) was responsible for coordinating the differences in opinions between the two. After the preliminary screening through systematic search and the intensive reading of the full - text, a total of 6 high - quality literatures [9-14] were finally determined. The research group conducted hierarchical integration of the included literature based on the JBI evidence evaluation framework. After the first draft of the program was formed, experts from multiple disciplines such as surgery, anesthesia, and nutrition were organized to conduct two rounds of Delphi method.

Table 2 Systematic Nursing Plan for Rapid Recovery

| Intervention Time | Intervention Theme | Specific Intervention Content |
|---|---|---|
| Preoperative preparation | Picture-and-text based health education | On the first day of hospitalization, the responsible nurse, based on the patient's age, educational background, and comprehension ability, uses various forms such as videos, illustrated manuals, and one-on-one explanations to provide a detailed introduction to the surgical process, the concept of ERAS, potential post-operative situations, and |

| | | |
|---|---|---|
| | | corresponding coping methods, aiming to alleviate the patient's fear and anxiety. |
| | Dynamic nutritional support | On the third day after admission, a nutritionist will use the Nutritional Risk Screening 2002 (NRS 2002) [15], the patient's serum albumin level, and recent weight changes to assess the patient's nutritional status and develop a personalized nutrition plan. |
| | Graded psychological nursing | On the third day after admission, the psychologist used the Self-Rating Anxiety Scale (SAS) and the Self-Rating Depression Scale (SDS) to assess the patient's psychological state.<br><br>For patients with SAS scores ranging from 50 to 59 and SDS scores ranging from 53 to 62, medical staff first identify and intervene in the causes of emotional problems, and guide them to perform 10 - 15 minutes of mindfulness meditation, deep breathing, or progressive muscle relaxation training daily.<br><br>For patients with SAS scores ranging from 60 to 69 and SDS scores ranging from 63 to 72, a psychiatrist conducts a formal clinical assessment, and uses cognitive - behavioral therapy to help the patients identify and change negative thinking and behavior patterns. Anti - anxiety or anti - depression medications are used for intervention when necessary.<br><br>For patients with SAS scores of 70 or higher and SDS scores of 73 or higher, the hospital arranges for dedicated nursing. Psychiatrists conduct regular emergency medical assessments to quickly address problems. Nurses communicate closely with psychiatrists, and jointly implement interventions with family members to prevent accidents. At the same time, they guide family members to pay attention to the patient's behavior, provide more family support, and avoid leaving the patient alone. |
| Intraoperative management | Wireless body temperature sensor monitoring | Use wearable wireless body temperature sensors to monitor the patient's body temperature in real time. Adjust the operating room temperature flexibly, use warming blankets, and infuse warmed fluids according to the surgical process and the patient's body temperature changes. |
| Post operative management Graded | pain management | Every 2 hours after the operation, the responsible nurse will use the Visual Analogue Scale (VAS) [17] to evaluate the patient's pain. Targeted pain intervention measures will be given according to the patient's VAS score, pain tolerance, |

| | | |
|---|---|---|
| | | and adverse drug reactions. For mild pain (VAS ≤ 3 points), non-steroidal anti-inflammatory drugs or physical analgesia will be used alone. For moderate pain (4 - 6 points), local nerve block will be combined. For severe pain (≥ 7 points), opioid drugs will be added for a short term and respiratory depression will be monitored. For patients with moderate or severe pain, the rehabilitation therapist will give transcutaneous electrical acupoint stimulation intervention at bilateral Neiguan, Zusanli, and Danzhong acupoints [21]. |
| Discharge management | Return visit | Schedule follow-up appointments based on patients' recovery progress. For those at high risk of complications, inform them via phone or WeChat to have an outpatient review at the clinic one week after the surgery. For those at low risk, the review should be scheduled two weeks after the surgery. |
| | "Internet +" health guidance | Before being discharged from the hospital, distribute rehabilitation manuals and rehabilitation videos to provide "written + video" home-based rehabilitation guidance (including activity intensity, dietary taboos, and identification of abnormal symptoms). |
| | Home-based rehabilitation management supported by information platforms | A WeChat group will be established, and attending physicians, responsible nurses, patients, and their families will be invited to join. The responsible nurses will regularly push popular science knowledge about postoperative wound care in the group. Medical staff will answer patients' questions in real-time through group chats, provide emergency guidance, and coordinate follow-up visits when necessary. For elderly patients or those having difficulty with operations, video guidance or family-member-learning-on-behalf services will be provided. |

#### 1.2.2.3 Implementation of the Plan

The research team synchronizes the patient's dynamic situation through daily bedside handovers. The responsible nurses implement personalized measures according to different procedures and record and provide feedback. Regular meetings are held to evaluate the implementation of the plan. The nursing plan is adjusted and optimized in a timely manner based on patient feedback and actual effects to ensure that the plan fits the patient's real-time status and realizes the closed-loop management of "evaluation-intervention-re-evaluation".

#### 1.2.2.4 Quality Control

Before the intervention, specialized training was conducted for the members of the research group. The training content covered the core theories of ERAS in the peri-operative period of laparoscopic radical resection of gastrointestinal tumors,

the operational specifications of fast - track rehabilitation nursing, the key points of multimodal analgesia management, the early nutritional support plan, the early activity guidance strategies, and the standardized use of assessment tools. The training included the oretical lectures, scenario - simulation drills, and practical demonstrations, with a focus on enhancing skills such as pre - operative guidance on carbohydrate drinking method, refined postoperative pipeline nursing, graded pain management, monitoring of nutritional intake, and safety protection for early activities. After the training, comprehensive evaluations were carried out through theoretical written examinations, practical operation assessments, and case - simulation assessments to ensure that the members could accurately explain the core principles of ERAS, perform nursing procedures in a standardized manner, and skillfully use VAS and NRS 2002 for assessment. Only those who passed the assessment were allowed to participate in the research.

### 1.3 Evaluation Methods

#### 1.3.1 Recovery of Gastrointestinal Function

The responsible nurses recorded the time of first anal exhaust, first defecation, and the time of starting to eat for patients in both groups.

#### 1.3.2 Rehabilitation Quality

Before the intervention and one day before discharge, the responsible nurses used the 40-item quality of recovery scale (QoR - 40) [18] to assess the rehabilitation quality of the research subjects. This scale covers five dimensions: emotional state (9 items), psychological support (7 items), self - care ability (5 items), pain perception (7 items), and physical comfort (12 items). It uses the Likert 5 - level scoring method, with a total score ranging from 0 to 200 points. A higher score indicates better rehabilitation quality.

#### 1.3.3 Pain Level

The responsible nurses will assess the pain levels of patients in both groups using the Visual Analogue Scale (VAS) at 6 hours, 12 hours, and 48 hours after the surgery. The score ranges from 0 to 10, with a higher score indicating a higher level of pain.

#### 1.3.4 Complications

The responsible nurses will record the occurrence of complications such as incision infection, anastomotic fistula, pneumonia, abdominal infection, bleeding, and postoperative intestinal obstruction in both groups according to the patients' medical records, clinical examination reports, nursing records, and doctors' daily ward - round records during hospitalization. The diagnosis criteria for incision infection, pneumonia, and abdominal infection refer to the "Diagnostic Criteria for

Nosocomial Infections". The diagnoses of anastomotic fistula and postoperative intestinal obstruction are made through a comprehensive evaluation of clinical manifestations and imaging examinations.

### 1.4 Statistical Methods

The statistical software SPSS 21.0 was used to process relevant data. Measured data conforming to the normal distribution were expressed as mean ± standard deviation ($x \pm s$). The independent - samples $t$-test was used for comparison between two groups, and the paired $t$-test was used for comparison within the group before and after intervention. Count data were expressed as [$n$(%)], and the $\chi^2$ test was used. A $P$value<0.05 indicated a statistically significant difference.

## 2 Results

### 2.1 Comparison of Gastrointestinal Function Recovery between the Two Groups

The time of first anal exhaust, defecation, and eating in the experimental group was earlier than that in the control group ($P$<0.05). See Table 3.

**Table 3** Comparison of Gastrointestinal function recovery in the two groups （$x \pm s$, h）

| *Group* | *n* | first anal exhaust time | first bowel movement time | Meal time |
|---|---|---|---|---|
| Experimental group | 50 | 14.76±3.65 | 19.89±3.86 | 9.89±2.37 |
| Control group | 50 | 19.86±3.18 | 37.63±6.39 | 13.88±5.76 |
| t-value | | 7.449 | 16.803 | 4.530 |
| P-value | | <0.001 | <0.001 | <0.001 |

### 2.2 Comparison of pain levels between the two groups at 6 h, 12 h, and 48 h after surgery

The VAS scores of the experimental group at 6 h, 12 h, and 48 h after surgery were lower than those of the control group (P<0.05). See Table 4.

**Table 4**Comparison of pain degrees at 6 hours, 12 hours and 48 hours after surgery

between the two groups($x \pm s$, points)

| Group | n | Post-surgery 6h | Post-surgery 12h | Post-surgery 48h |
|---|---|---|---|---|
| Experimental group | 50 | 4.93±0.62 | 3.16±0.37* | 2.23±0.62*b |
| *Control group* | 50 | 5.96±0.75 | 4.23±0.62* | 3.37±0.77*b |
| t-value | | 7.267 | 10.479 | 8.154 |
| P-value | | <0.001 | <0.001 | <0.001 |

Note: Compared with 6h after surgery, *P<0.05; compared with 12h after surgery, P<0.05.

2.3 Comparison of rehabilitation quality between the two groups

After intervention, the total QoR - 40 score and scores of each dimension in both groups were higher than those before intervention, and the scores in the experimental group were higher than those in the control group ($P$<0.05). See Table 5.

**Table 5** Comparison of Rehabilitation Quality between the Two Groups ($x \pm s$, points)

| Scale dimensions | *Group* | sample size | Before intervention | After intervention |
|---|---|---|---|---|
| Emotional state | Experimental group | 50 | 26.78±3.45 | 35.24±5.35[a] |
| | Control group | 50 | 26.07±4.02 | 28.39±3.78[a] |
| | *t*-value | | 0.947 | 7.394 |
| | *P*-value | | 0.345 | <0.001 |
| Psychological support | Experimental group | 50 | 19.84±4.16 | 27.49±7.89[a] |
| | Control group | 50 | 20.02±5.28 | 22.67±7.63[a] |
| | *t-value* | | 0.189 | 3.105 |
| | *P*-value | | 0.850 | 0.002 |

| | | | | |
|---|---|---|---|---|
| Self-care ability | Experimental group | 50 | 14.48±3.22 | 19.61±6.28[a] |
| | Control group | 50 | 13.79±3.89 | 16.17±4.95[a] |
| | *t*-value | | 0.966 | 3.042 |
| | *P*-value | | 0.336 | 0.002 |
| The feeling of pain | Experimental group | 50 | 19.86±4.16 | 27.46±8.97[a] |
| | Control group | 50 | 21.35±5.41 | 22.67±7.16[a] |
| | *t*-value | | 1.543 | 2.951 |
| | *P*-value | | 0.125 | 0.004 |
| Physical comfort level | Experimental group | 50 | 34.89±8.78 | 47.09±13.87[a] |
| | Control group | 50 | 36.34±7.54 | 39.46±10.52[a] |
| | *t*-value | | 0.336 | 3.099 |
| | *P*-value | | 0.737 | 0.002 |
| Total score | Experimental group | 50 | 115.85±20.63 | 156.89±29.75[a] |
| | Control group | 50 | 117.69±21.70 | 129.36±25.17[a] |
| | *t*-value | | 0.435 | 4.995 |
| | *P*-value | | 0.665 | <0.001 |

Note: Compared with the same group of patients before intervention, $P<0.05$.

2.4 Comparison of the incidence of complications between the two groups

In the experimental group, 2 patients had complications, namely 1 case of incision infection and 1 case of bleeding, with an incidence rate of 4%. In the control group, 7 patients had complications, including 2 cases of abdominal infection, 2 cases of incision infection, and 3 cases of bleeding, with an incidence rate of 14%. There was a statistically significant difference in the incidence of complications between

the two groups ($\chi^2$= 5.005, $P$= 0.025).

## 3 Discussion

### 3.1 The systematic fast - track rehabilitation nursing program for patients undergoing laparoscopic radical resection of gastrointestinal tumors during the peri - operative period is scientific, comprehensive, and feasible.

The nursing program in this study is developed based on evidence - based medicine. It deeply integrates the characteristics of laparoscopic surgery with the concept of fast - track rehabilitation. Through measures such as pre - operative picture - text health education, dynamic nutritional support, graded psychological care, intra - operative monitoring with wireless body temperature sensors, post - operative graded pain management, post - operative "Internet +" health guidance for rehabilitation, and home - based rehabilitation management supported by the information platform, it can effectively reduce surgical stress and promote the recovery of patients' physical functions. The comprehensiveness of this program is reflected in its coverage of all stages before, during, and after surgery, involving multiple aspects such as psychological support, pain management, and nutritional support, providing all - around care for patients. The measures of the program are specific and operable. Nurses can master and implement them skillfully after training, and the required resources can be obtained in most medical institutions. The practice in this study shows that this nursing program can shorten the hospital stay and accelerate the rehabilitation process, making it worthy of clinical promotion and application.

### 3.2 A systematic fast - track rehabilitation nursing program can promote the recovery of gastrointestinal function in patients

After gastrointestinal tumor surgery, gastrointestinal dysfunction is one of the common complications. This study showed that the time of the first anal exhaust, defecation, and food intake in the experimental group was earlier than that in the control group. The result trend was consistent with the study by Chen SS et al. [19], indicating that fast - track rehabilitation nursing can promote the recovery of gastrointestinal function. Moreover, the above - mentioned time in this study was shorter than that in previous studies, which might be related to the optimization of the program.

Analysis of the reasons: Preoperative health education was carried out in a picture - and - text combination way according to the educational level of patients. Compared with the unified oral education in conventional nursing, it was more easily understood, which helped to relieve anxiety and fear. This enabled patients to face the surgery and postoperative recovery with a good psychological state, thus promoting the recovery of gastrointestinal function [20]. Preoperative psychological assessment and targeted intervention made patients calm - minded, stabilized their

neuroendocrine system, and better restored gastrointestinal peristalsis. As a result, patients could exhaust, defecate, and resume food intake earlier, accelerating the overall recovery. In addition, the programs at each stage were implemented by professional personnel (e.g., psychological assessment was conducted by psychologists, and postoperative rehabilitation was carried out by rehabilitation therapists). The multi - professional collaboration ensured the professionalism and accuracy of each link, forming a joint force to promote the rapid recovery of patients.

### 3.3 A systematic fast-track rehabilitation nursing program can alleviate the pain of patients and reduce the incidence of complications

This study showed that the Visual Analog Scale (VAS) scores of the experimental group at 6 h, 12 h, and 48 h after surgery were lower than those of the control group, indicating that the systematic fast-track rehabilitation nursing program could relieve pain. The reasons may be as follows: Pain was evaluated every 2 h after surgery. For mild pain, non-steroidal anti - inflammatory drugs or physical analgesia was used alone to inhibit the inflammatory response and reduce the use of opioids; for moderate to severe pain, local nerve block combined with short - term opioid drugs were used, and respiratory depression was monitored to achieve multi - modal analgesia. In addition, patients with moderate to severe pain were treated with trans - acupoint electrical stimulation, which was helpful to relieve postoperative pain[21]. The incidence of complications in the experimental group was lower than that in the control group, suggesting that this program could reduce postoperative complications. The reasons include: Graded psychological nursing alleviates anxiety to facilitate treatment cooperation; dynamic nutritional support enhances the body's resistance; precise pain management avoids activity limitation and stress response; strict infection prevention measures reduce the risk of infection. Multiple measures work together to improve the patient's condition and reduce the occurrence of complications.

### 3.4 The systematic fast - track rehabilitation nursing program can improve the rehabilitation quality of patients

This study shows that the QoR - 40 score of the experimental group is higher than that of the control group, indicating that this program can improve the rehabilitation quality. The reasons are mainly related to the recovery of intestinal function and pain control. The systematic fast - track rehabilitation nursing promotes the recovery of intestinal function and enhances the body's physiological functions. The multimodal analgesia after surgery effectively relieves pain and reduces physical and mental discomfort. The combined effect of the two improves the physical and mental state of patients and enhances the rehabilitation quality.

## 4 Summary

The systematic fast - track rehabilitation nursing program during the peri - operative period for patients undergoing laparoscopic radical resection of gastrointestinal tumors is scientific, comprehensive and feasible. It can promote the recovery of gastrointestinal function, relieve pain and reduce the incidence of complications.

## Data Availability

The datasets generated and/or analysed during the current study are not publicly available due to patient privacy and confidentiality and restrictions imposed by the institutional ethics committee. Raw data cannot be shared. The de-identified summary results are presented in this article.

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