

Research on the Application of Individualized Exercise Prescriptions Based on the Concept of Enhanced Surgical Rehabilitation in Perioperative Patients with Sigmoid Colon Cancer

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Abstract

Objective: To study the application value of individualized exercise prescriptions based on the concept of enhanced surgical rehabilitation in patients with sigmoid colon cancer during the perioperative period. **Methods:** Three hundred patients with sigmoid colon cancer admitted to our hospital from January 2022 to November 2024 were selected and randomly divided into the study group and the control group by the random number table method, with 150 cases in each group. The control group received conventional treatment, while the study group simultaneously carried out individualized exercise prescription intervention based on the concept of enhanced surgical rehabilitation. The early postoperative recovery, inflammatory status, and perioperative complication rate of the two groups of patients were evaluated and compared. **Results:** The first postoperative exhaust, first bed removal, drainage tube removal, and postoperative hospital stay in the study group were all shorter than those in the control group. The levels of CRP and IL-6 in the study group three days after the operation were lower than those in the control group, and the incidence of perioperative complications in the study group was lower than that in the control group. The differences were statistically significant ($P < 0.05$). **Conclusion:** Individualized exercise prescriptions based on the concept of enhanced surgical rehabilitation can promote postoperative rehabilitation and early postoperative inflammation control in patients with sigmoid colon cancer during the perioperative period, and reduce the risk of complications.

Keywords

The concept of accelerated surgical rehabilitation; Individualized exercise prescription; Sigmoid colon cancer; Inflammatory factors; Complications

Sigmoid colon cancer is a common type of colorectal cancer, mostly seen in people over 50 years old. In recent years, the occurrence of this disease has shown a certain trend of younger age [1]. The occurrence of sigmoid colon cancer is the result of the combined effect of multiple factors and is closely related to factors such as genetics, dietary structure, and lifestyle habits [2]. In recent years, the high incidence and younger age of this disease are related to a high-fat and low-fiber diet and sedentary behavior habits. Patients with this disease lack typical symptoms in the early stage of the lesion. As the disease progresses, symptoms such as abdominal pain and abdominal distension may occur, accompanied by changes in bowel habits. In the advanced stage of the disease, the risk of secondary intestinal obstruction and moderate to severe anemia is relatively high [3]. The clinical treatment for sigmoid colon cancer mainly includes surgical treatment, radiotherapy, and chemotherapy, etc. [4]. Patients with early-stage sigmoid colon cancer

can be treated with surgical methods such as endoscopic mucosal resection in the receptive area. When it progresses to the middle and advanced stages, laparoscopic radical resection and metastatic lesion surgery are generally required. Individualized exercise prescriptions based on the concept of enhanced surgical rehabilitation are a new type of rehabilitation treatment model. Exercise prescriptions are formulated in combination with patients' surgical conditions, physical fitness, comorbidities, etc. By enhancing reserves before surgery and activating functions early after surgery, early postoperative rehabilitation is promoted [5]. In recent years, our hospital has carried out individualized exercise prescription intervention based on the concept of enhanced surgical rehabilitation for some patients with sigmoid colon cancer during the perioperative period. This study is analyzed in combination with the actual situation.

1. Data and Methods

1.1 General information

300 patients with sigmoid colon cancer admitted to our hospital from January 2022 to November 2024 were selected and randomly divided into a study group and a control group by the random number table method, with 150 cases in each group. In the study group, there were 78 males and 72 females, aged 48 to 74 (59.23 ± 5.42) years old. In the control group, there were 80 males and 72 females, aged 49 to 73 (60.11 ± 6.02) years. Inclusion criteria: (1) Meeting the diagnostic criteria of this disease and having no previous history of colorectal cancer; (2) Receive endoscopic or laparoscopic surgical treatment at an appropriate time; (3) All the materials are complete; (4) High compliance with perioperative diagnosis and treatment work; (5) Good mental condition. Exclusion criteria: (1) Previous history of abdominal surgery; (2) The expected survival period is less than 3 months; (4) Accompanied by other types of malignant diseases; (5) Accompanied by severe malnutrition; (6) Motor dysfunction.

1.2 Method

1.2.1 Control group

Conventional treatment was carried out. Intestinal preparation began 3 days before the operation, with a low-residue diet adopted. A liquid diet was provided 1 day before the operation. At the same time, oral laxatives were given for intervention, and enema cleaning treatment was administered. Multimodal analgesia was carried out in the early postoperative period to keep the drainage tube unobstructed. Dietary and activity guidance was provided in combination with the postoperative recovery of the patients.

1.2.2 Research group

Meanwhile, individualized exercise prescription intervention based on the concept of enhanced surgical rehabilitation is carried out as follows:

- (1) Preoperative management: Before the operation, the surgical process, postoperative diet, activities, and catheter indwelling, etc., are explained to the patient through pictures, texts, and videos. The patient's emotional state is evaluated, and psychological counseling and intervention are carried out as needed to relieve the patient's psychological pressure. Preoperative nutritional support was carried out in combination with the patient's nutritional status. Fasting was performed 6 hours before the operation, and about 250 mL of 12.5% glucose solution was given orally 2 hours before the operation.
- (2) Individual assessment and exercise prescription formulation: Conduct individualized assessment of patients from multiple aspects such as cardiopulmonary function, muscle strength level, balance ability, and nutritional status. Based on the assessment results of the patients, formulate plans and intensities for aerobic exercise, resistance exercise, respiratory training, etc., and explain them to the patients and their families to enhance their cooperation.
- (3) Implementation of individualized exercise prescriptions: 3 to 7 days before the operation, guide patients to carry out exercise training, brisk walking for 15 to 30 minutes every day, and at the same time, use elastic bands to conduct resistance exercises for 10 to 20 minutes every day.

The breathing training consists of abdominal breathing combined with pursed lip breathing. Each session lasts for 3 to 5 minutes, three times a day. Improve the cardiopulmonary reserve of patients and enhance the level of core muscle groups. About 12 hours after the operation, if there are no abnormalities, guide the patient to carry out bed activities, mainly ankle pump exercises, straight leg raising, etc., and repeat 10 times per hour. Carry out deep breathing training and effective coughing training simultaneously, once every two hours. After the patient's pain is tolerable, carry out activity training for the shoulder joint, hip joint, etc. Three to five days after the operation, guide the patients

to carry out walking activities for about 10 minutes each time, three times a day. At the same time, use elastic bands and 0.5kg dumbbells to carry out resistance exercises for 10 minutes each time, twice a day. The patient was guided to carry out center of gravity transfer and single-leg standing training to improve balance ability.

1.3 Observe the indicators

1.3.1 Early postoperative recovery

Statistically analyze the first exhaust, first bed removal, drainage tube removal, and postoperative hospital stay in each group after the operation.

1.3.2 Determination of inflammatory factors

At two stages, 1 hour and 3 days after the operation, 5 mL of peripheral venous blood was collected from each case, and the levels of C-reactive protein (CRP) and interleukin-6 (IL-6) were determined by enzyme-linked immunosorbent assay.

1.3.3 Perioperative complication statistics

The perioperative complications of the two groups of patients were statistically analyzed, mainly including digestive tract discomfort, deep vein thrombosis of the lower extremities, pressure injury, and new infections, etc.

1.4 Statistical methods

SPSS 23.0 statistical software was used for processing. Measurement data were expressed as ($\bar{x} \pm s$), and a t-test was used for comparison. Counting data were expressed as percentages, and the χ^2 test was used for comparison. A P value < 0.05 was considered statistically significant.

2. Result

2.1 Comparison of the early postoperative recovery of the two groups of patients (see Table 1)

Table 1. Comparison of the early postoperative recovery of the two groups of patients ($\bar{x} \pm s$)

Group/Number of cases	First exhaust time (h)	Time of first out of bed (h)	Time of drainage tube removal (d)	Postoperative hospital stay (d)
Research group/150	24.19±5.42	24.77±4.12	4.12±0.71	7.62±1.49
Control group/150	30.13±5.09	31.87±5.90	5.05±0.93	9.06±2.34
<i>t</i>	9.784	12.084	9.735	6.357
<i>P</i>	< 0.001	< 0.001	< 0.001	< 0.001

2.2 Comparison of inflammatory factors between the two groups of patients (see Table 2)

Table 2. Comparison of inflammatory factors between the two groups of patients ($\bar{x} \pm s$)

Group/Number of cases	CRP (mg/L)		IL-6 (ng/L)	
	1 hour after the operation	3 days after the operation	1 hour after the operation	3 days after the operation
Research Group/150	54.23±8.12	13.29±2.23 [@]	22.94±2.12	6.32±0.84 [@]
Control group/150	55.69±9.32	18.75±3.49 [@]	22.75±2.04	9.65±1.71 [@]
<i>t</i>	1.447	16.146	0.791	21.407
<i>P</i>	0.149	< 0.001	0.430	< 0.001

Note: Compared with 1 hour after the operation, [@]P < 0.05.

2.3 Comparison of the incidence of perioperative complications between the two groups of patients (see Table 3)

Table 3. Comparison of the incidence of perioperative complications between the two groups of patients (case %)

Group/Number of cases	Gastrointestinal discomfort	Deep vein thrombosis of the lower extremities	Pressure injury	New infection	Total incidence rate
Research group/150	1(0.67)	0(0.00)	0(0.00)	0(0.00)	1(0.67)
Control group/150	4(2.67)	1(0.67)	1(0.67)	1(0.67)	7(4.67)
χ^2					4.623
P					0.032

3. Discussion

Sigmoid colon cancer is a malignant lesion of the digestive system. A history of polyps, chronic intestinal inflammation, smoking, and long-term lack of exercise are all high-risk factors for the occurrence of sigmoid colon cancer [5]. The diagnosis rate of early sigmoid colon cancer in China is relatively low. Most patients seek medical treatment after experiencing significant physical symptoms, and most have already developed to the middle or advanced stage [6]. The clinical diagnosis of sigmoid colon cancer relies on magnetic resonance imaging, computed tomography, colonoscopy, biopsy, etc. After a clinical diagnosis, active surgical and other adjuvant treatments need to be carried out [7].

This study analyzed the application effect of individualized exercise prescriptions based on the concept of enhanced surgical rehabilitation in patients with this disease during the perioperative period. The first postoperative exhaust, first bed removal, drainage tube removal, and postoperative hospital stay in the study group were all shorter than those in the control group. The individualized exercise prescription based on the concept of enhanced surgical rehabilitation can effectively promote the early postoperative recovery of patients. In related rehabilitation treatments, attaching importance to the implementation of preoperative respiratory training can effectively activate the cholinergic pathway of the vagus nerve in the body, and at the same time promote the contraction of intestinal smooth muscle, laying a good foundation for the recovery of gastrointestinal function after surgery. Early postoperative exercise intervention can also stimulate gastrointestinal mechanoreceptors and regulate the secretion level of motilin in the body. Exercise intervention can also upregulate the expression of superoxide dismutase in intestinal tissues, improve intestinal mucosal barrier function, and promote recovery. Relevant studies [8] have found that implementing intervention based on the concept of enhanced recovery after surgery for patients with colon cancer, and providing individualized dietary and exercise guidance in combination with the actual situation of the patients, can effectively promote early postoperative recovery, regulate gastrointestinal function, and improve the sleep quality of patients.

Early postoperative exercise intervention can inhibit the ubiquitin-proteasome system of the body, effectively reduce the venous return flow of the lower extremities, lower the risk of microthrombosis, thereby shortening the time to get out of bed and the length of hospital stay after surgery, and also help prevent the risk of complications. Exercise intervention can induce peritoneal macrophages to polarize towards the M2 phenotype, enhance phagocytic function, promote the absorption of inflammation, accelerate the lymphatic system transport related to inflammatory factors, thereby shortening the postoperative drainage time. Three days after the operation, the levels of CRP and IL-6 in the study group were lower than those in the control group. The individualized exercise prescription based on the concept of enhanced surgical rehabilitation can effectively promote the control of early postoperative inflammation. Early exercise intervention can effectively activate the secretory function of skeletal muscle, trigger the STAT3 phosphorylation pathway in the liver, and regulate the levels of inflammatory factors in the body. It can also promote the expression of oxisome proliferator-activated receptor γ and inhibit the binding efficiency of the CRP promoter region in the lower right corner. Postoperative exercise can induce the release of adrenaline and block the synthesis of MYD88-dependent IL-6, thereby effectively reducing the level of IL-6.

The perioperative complication rate of the study group was lower than that of the control group. In individualized exercise prescriptions, attaching importance to the implementation of various types of exercise training can activate the PGC-1 α pathway and promote the synthesis of mitochondria in skeletal muscle of the body, thereby effectively improving the oxidative phosphorylation ability of skeletal muscle in patients after surgery and alleviating cancer-

related fatigue. Individualized exercise during the perioperative period can also effectively regulate the sensitivity of glucocorticoid receptors, inhibit the excessive secretion process of cortisol in the early postoperative period, regulate the excessive activation of CRH neurons in the hypothalamus, improve the physical and mental health status of patients, and reduce the risk of complications. Individualized exercise prescriptions are all carried out during the day, which can regulate the suprachiasmatic nucleus, adjust the amplitude of the melatonin secretion rhythm, improve the sleep quality of patients at night, and thereby promote the early postoperative recovery of patients. Research related to individualized exercise prescriptions [9] has found that formulating exercise prescriptions based on the individual conditions of patients helps to improve their psychological conditions and promote recovery.

In conclusion, the application of individualized exercise prescriptions based on the concept of enhanced surgical rehabilitation in perioperative patients with sigmoid colon cancer has outstanding value in promoting postoperative recovery, controlling early postoperative inflammatory responses, and reducing the risk of complications, and is worthy of development.

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