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Original Article

Perioperative fast-track rehabilitation protocol contributes to recovery after laparoscopic resection of colorectal cancer

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Abstract: Aim: The present study aimed to evaluate the effect of perioperative fast-track (FT) rehabilitation protocols on patients with laparoscopic colorectal resection of colorectal cancer (CC). Methods: The clinical information was collected from 174 cases of CC patients who were admitted to our hospital between August 2015 and May 2016. Patients were divided into two groups according to the rehabilitation protocol, the FT rehabilitation protocol and the conventional protocol. The general clinical data, the timing of exhaust, hospital stays and costs were recorded by relevant carers. The complications, the variations in intensity of pain and patients' satisfaction were compared between the two groups. Results: The first time for flatus was much shorter in FT treated group than that of control group. FT treated patients spent less postoperative hospital stays (50.8 ± 0.54 vs. 6.75 ± 0.92 days) and hospital costs (49350.77 ± 1893.48 yuan vs. 57824.92 ± 2134.07 yuan) than the control patients. Less postoperative complications and lower VAS score were found in FT treated group ($P < 0.05$). Conclusion: The application of FT in patients with laparoscopic radical resection of colorectal cancer benefit to early rehabilitation with fewer complications.

Keywords: Laparoscopic inspection, catheter tube, nasogastric tube, analgesia, visual analogue scale (VAS)

Introduction

Recently, fast-track (FT) rehabilitation protocols have been used after surgery, and have been proved to benefit patients significantly. The protocol involves several approaches, such as preoperative patient education, improved anesthesia, early postoperative nutrition and early ambulation. Therefore, the primary goals of this protocol are to avoid the application of nasogastric tube and bowel cleansing, to eat and ambulate earlier. Studies reported that the use of FT rehabilitation protocol significantly reduced patients' hospital stay to 2-3 days [1, 2]. Studies also reported that the FT programs significantly reduced the postoperative complications for patients who underwent colorectal resection [3, 4].

Minimally invasive surgery, such as laparoscopic surgery, is also been widely used for patients with colorectal cancer (CC) due to its similar function as FT methods. By using of laparoscopic surgery, the tissue trauma and postoperative pain are attenuated, and accelerated rehabilitation is found for CC patients after surgery [1, 4]. Up to now, researchers believe that combining of laparoscopic surgery and FT rehabilitation protocol may result in a faster recovery and high satisfaction received from patients. However, no conformed conclusions on this issue have been drawn [5-7]. A meta-analysis based on 2 randomized controlled trials and 3 case-control trials showed no additional benefits for FT protocol in combined with laparoscopic colorectal surgery [8]. However, the results were disapproved by other meta-analysis [9, 10]. Therefore, whether FT rehabilitation protocol plays an important role in fast recovery during perioperative period of laparoscopic colorectal surgery for CC patients still needs more clinical studies to verify.

Our study aimed to examine the effectiveness and feasibility of FT rehabilitation protocol in caring CC patients during perioperative period,

Table 1. Basic information of the patients in two groups

Index	FT group (n = 87)	Control group (n = 87)	X^2/t/Z	*P*
Gender (M/F)	54/33	49/38	0.595	0.441
Age (year)	54.2 ± 13.2	51.6 ± 12.5	1.333	0.184
Tumor sites				
Left-side CC (n, %)	28 (32.18)	33 (37.93)	0.632	0.729
Right-side CC (n, %)	34 (39.08)	31 (35.63)		
Rectosigmoid carcinoma (n)	25 (28.74)	23 (26.44)		
Tumor staging				
I (n, %)	20 (22.99)	18 (20.69)	0.130	0.897
II (n, %)	41 (47.13)	46 (52.87)		
III (n, %)	26 (29.89)	23 (26.44)		

FT group: patients treated with Fast-track rehabilitation protocols.

the results will contribute to establish a useful nursing management in caring CC patients.

Materials and methods

The clinical information was collected from 174 cases of CC patients who were admitted to our hospital between August 2015 and May 2016. Inclusion criteria were (1) patients with CC and (2) no previous surgery within 3 months. Patients were excluded for the following reasons: (1) age less than 18 years old and more than 70 years old; (2) with history of drug abuse or psychosis; (3) with American Society of Anesthesiologists (ASA) IV and V; (4) need monitoring in ICU; (5) complicated with intestinal obstruction, perforation, bleeding and acute abdomen; (6) have risk of malnutrition (NRS ≥ 3). Patients were randomly divided into 2 groups, the FT treatment group (n = 87) and control group (n = 87), according to the application of FT rehabilitation protocol.

The written informed consent was obtained from all of the patients. The study protocol was approved by the medical ethics committee of our hospital.

Both groups were treated by the same surgical research team. Before surgery, patients in the FT treatment group were informed the FT surgery procedure including the conditions that may occur and solutions. Preoperative fasting until 6 hours before surgery was not allowed, but patients were advised to drink 800 ml of carbohydrate (12.5%) containing liquid at night before surgery day and drank another 400 ml 2-3 hours before surgery. Nasogastric tube was used if necessary, but was removed once patients awareness from anesthesia after surgery. Bladder catheters were placed before surgery, and removed immediately when patients waked from anesthesia after surgery. Patients in the control group were informed the information related to surgery to reduce anxiety. They were not allowed to eat anything 12 hours before surgery and drinking anything 4 hours before surgery. After induction of general anesthesia, both nasogastric tube and bladder catheters were placed before surgery.

Epidural orgeneralanesthesia was performed on the FT treatment group during surgery. Patients in this group were encouraged to ambulate after wake up as soon as possible, and allowed to drink water and take 500 ml glucose liquid (10%). They received 40 mg parecoxib Q12 h intravenously for 3 days for analgesia. In order to prevent deep venous thrombosis, patients were mobilized to do ankle joint movement, which we called patients controlled analgesia (PCA). In the control group, both water and semi-liquid diet were not allowed at the first day after surgery. On the second postoperative day, patients were allowed to take some semi-liquid diet (nutrition and rice soup), and were invited to walk.

Both protocols have the same discharge criteria: (1) stablevital signs; (2) tolerance of full diet with regular exhausts; (3) analgesia; (4) capable of performing basic self-care functions; (5) satisfied family support.

The general clinical data (age, gender, tumor sites and pathological staging) of the two groups was recorded and compared. The tumor location was confirmed according to the results of contrast-enhanced CT scanning. Pathological staging was stratified through intraoperative pathologic results.

The relevant carers recorded the following indicators, such as the time of removal of nasogastric tube and urinary catheter; the first time for ambulation (≥ 10 min), eating semi-liquid diet (≥ 20 ml) and exhaust (non-sleeping exhaust), as well as the hospital stays and costs.

Table 2. Postoperative indicators between the FT group and control group (data were expressed as mean ± SD)

Index	FT treatment group (n = 87)	Control group (n = 87)	t	*P*
Timing of NT tube (h)	24.48 ± 7.50**	46.56 ± 10.44	16.021	< 0.001
Timing of urinary catheter (h)	21.96 ± 9.54**	40.65 ± 12.68	10.986	< 0.001
First time for eatingsemi-liquid diet (h)	18.30 ± 3.64**	43.84 ± 3.72	45.771	< 0.001
First time for exhaust (h)	56.04 ± 5.76**	70.47 ± 4.85	17.875	< 0.001
First time for ambulation (h)	35.36 ± 6.28**	61.85 ± 6.74	26.821	< 0.001
Hospital days (d)	5.08 ± 0.54**	6.75 ± 0.92	14.602	< 0.001
Costs (yuan)	49350.77 ± 1893.48**	57824.92 ± 2134.07	27.705	< 0.001

**$P < 0.01$ indicates significant difference compared to the control group. *$P < 0.05$ indicates significant difference compared to the control group.

The variations in pain intensity at postoperative 6 h, 12 h, 24 h, 48 h and 72 h were assessed by visual analogue scale (VAS) which was performed by the nurses. Satisfaction survey about pain was performed based on two sections of Houston Pain Management Outcome Instrument (HPMOI), they are the patients' satisfaction related to pain control education (5 items) and the satisfaction related to methods of control/relief pain (5 items). The score range is from 0 to 10 for each item. A higher score indicates higher satisfaction.

The postoperative complications such as urinary tract infection, pulmonary infection, nausea and vomiting, venous thrombosis, anastomotic fistula, wound infection, intraperitoneal abscess, ileus, conventional infection etc. were recorded.

Data were analyzed by SPSS 20.0. Count data was expressed as N (%), and was compared using χ^2 test or Fisher's exact test. The normal distributed quantitative data was expressed by mean ± standard deviation, and t text was used for comparison; the abnormal distributed quantitative data was compared by rank sum test. $P < 0.05$ was used to indicate a statistically significant difference.

Results

Basic characteristics of patients

The basic clinical data of the two groups were listed in **Table 1**. A total of 54 male and 33 female with an average age of 54.2 ± 13.2 years were included in FT treatment group; for control group, the gender ratio was 49:38, with an average age of 51.6 ± 12.5 years old. There were no significant differences between the two groups for age and gender. Contrast-enhanced CT scanning showed that the left-side CC was in 28 patients, right CC-side was in 34 patients, sigmoid CC was occurred in 25 patients for FT treatment group. However, for control group, the number of patients with left-side, right-side and sigmoid CC was 33, 31 and 23 respectively. There were no significant differences for tumor location between the two groups. A total of 20 and 18 cases in treatment group and control group were staged as I. The number was 41 and 26 staged as II, and 26 and 23 patients staged as III. No significant differences were found for tumor staging between the two groups.

Postoperative indicators between the two groups

Table 2 showed the postoperative indicators between the FT group and control group. As a result, the timing of removal of nasogastric tube (24.48 ± 7.50 vs. 46.56 ± 10.44) and urinary catheter (21.96 ± 9.54 vs. 40.65 ± 12.68) were much lower in TF treatment group compared to that of the control group ($P < 0.05$). As well, the first time for eating semi-liquid diet, ambulation and exhaust were significantly shorter than that of control group ($P < 0.05$). The average postoperative hospital stays were 50.8 ± 0.54 and 6.75 ± 0.92 days respectively for treatment group and control group respectively, and the difference between them were significant ($P < 0.05$). The hospital costs were much lower in treatment group (49350.77 ± 1893.48 yuan) than that of control group (57824.92 ± 2134.07 yuan, $P < 0.05$).

Postoperative complications between the two groups

Postoperative complications were found in 16 cases and 28 cases respectively for treatment

Table 3. Postoperative complications between the two groups

Postoperative complications (n, %)	TF treatment group (n = 87)	Control group (n = 87)	X^2	*p*
Urinary tract infection	3 (3.44)	5 (5.75)	0.524	0.469
Pulmonary infection	5 (5.75)	9 (10.34)	1.243	0.265
Nausea and vomiting	2 (2.30)	4 (4.60)	0.690	0.406
Venous thrombosis	1 (1.15)	3 (3.44)	1.024	0.312
Anastomotic fistula	4 (4.60)	7 (8.05)	0.873	0.350
Wound infection	3 (3.44)	6 (6.90)	1.055	0.304
Intraperitoneal abscess	2 (2.30)	5 (5.75)	1.340	0.247
Ileus	2 (2.30)	3 (3.44)	0.206	0.650
Conventional infection	9 (10.34)	19 (21.84)	4.256	0.039
Total	16 (18.39)	28 (32.18)	4.380	0.036

Table 4. Visual analogue scale (VAS) scores between the two groups

Time	TF treatment group (n = 87)	Control group (n = 87)	t	*P*
Postoperative 6 h	2.02 ± 0.38**	2.87 ± 0.72	8.405	< 0.001
Postoperative 12 h	3.04 ± 0.69**	3.68 ± 0.81	6.775	< 0.001
Postoperative 24 h	2.57 ± 0.71**	4.62 ± 0.74	19.256	< 0.001
Postoperative 48 h	1.96 ± 0.70**	2.26 ± 0.58	3.264	0.001
Postoperative 72 h	1.81 ± 0.63	1.79 ± 0.75	1.019	0.309

**P < 0.01 indicates signifcant difference compared to the control group.

Table 5. Satisfaction related to pain control education and the satisfaction related to methods of control/relief pain

Groups	Satisfaction related to pain control education	Satisfaction related to methods of control/relief pain
TF treated group (n = 87)	43.53 ± 4.86	44.72 ± 2.52**
Control group (n = 87)	43.29 ± 5.03	42.96 ± 3.17
t	0.320	4.054
p	0.749	< 0.001

**P < 0.01 indicates signifcant difference compared to the control group.

group and control group (**Table 3**). Significant difference was found between them (*P* = 0.036). More cases with infection were found in control group (n = 19) than that of treatment group (n = 9) (*P* < 0.05). However, there were no significant differences between the two groups for the other complications, such as urinary tract infection, pulmonary infection, nausea and vomiting, venous thrombosis, anastomotic fistula, wound infection, intraperitoneal abscess and ileus.

Visual analogue scale (VAS) scores between the two groups

Surgery related pain measured by the VAS score was listed in **Table 4**. Significant differences were found between the treatment group and control group in all the time points (*P* < 0.05), except that at 72 h. The VAS score was remarkably lower in FT treated patients than in non-FT treated patients within postoperative 48 h, but that was not significantly difference on postoperative 72 h (1.81 ± 0.63 vs. 1.79 ± 0.75).

Satisfaction related to pain control education and the satisfaction related to methods of control/relief pain

The scores of satisfaction related to pain control education for treatment group and control group were 43.53 ± 4.86 and 43.29 ± 5.03 respectively (**Table 5**), and no significant different was found between them. However, the scores of satisfaction related to the methods of control/relief pain in treatment group (44.72 ± 2.52) was much higher than that of control group (42.96 ± 3.17) (*P* = 0.002).

Discussion

Postoperative recovery after colonic resection related to several factors such as the pain degree, surgical trauma, organ dysfunction, use of gastrointestinal tubes, as well as the restriction of oral intake [11]. The main purpose of FT strategy is to reduce the trauma and sur-

gical stress response; therefore, nursing intervention during perioperative period is of great importance for fast rehabilitation. In comparison with the traditional nursing strategy, our study showed that the perioperative FT nursing strategy significantly shortened the time of exhaust, reduced the postoperative complications, VAS score, as well as hospital stays and costs. Besides, we gained much more satisfaction from patients who were treated with FT strategy. Our results indicated that the FT rehabilitation protocol was beneficial and effective on CC patients during perioperative period.

Bowel preparation

The FT strategy is different from traditional strategy in many aspects, such as bowel preparation and preoperative fasting. Improper bowel preparation is related to interference of bowel function. In the traditional surgical care schedule, antibiotic and mechanical bowel preparation is considered to be necessary for bowel resection in China [12]. Bowel preparation has been reported to reduce the risk of perioperative infection by reducing faecal flora [13]. However, recent studies reported that there was no significant difference for the infection rate between patients having bowel preparation and those not having bowel preparation [14]. Some researchers even oppose to apply mechanical bowel preparation, because it increases the leak rate and infectious morbidity [15]. Therefore, none bowel preparation is advocated in FT strategy.

Catheter and nasogastric tubes

Urinary catheters are inserted preoperatively to monitor patients' urine volume and to avoid the immediate postoperative toilet use for patients. Nevertheless, the application of urinary catheters for gastrointestinal decompression is unnecessary due to the following reasons: As we know, the rectum is located at the lower segment of the digestive tract, and is insensitive to impassability. Besides, as gastrointestinal decompression equipment, urinary catheter can reduce the tension from lower oesophageal sphincter, induce the reflux of digestive juices, and finally lead to pulmonary complications [16]. Preoperative urinary catheters might increase the patients' discomfort and fear, which might harmful to anesthesia. Previous studies have been reported that the early mobilization and early catheter removal are associated with reduced complications and length of hospital stay [17]. Patel *et al*. [18] suggested that the immediate discontinuation of urinary catheters after laparoscopic colon resection is beneficial for fast rehabilitation.

In order to avoid the risk of aspiration, ileus and wound dehiscence, the nasogastric tubes were used as a routine after surgery in traditional nursing strategy. However, clinical practice has shown that the use of nasogastric tubes would increase the risk of aspiration [19] and dehiscence [20]. Nevertheless, FT protocol routine advocates an immediate removal of nasogastric tubes as soon as the completion of surgery. In our study, fewer cases showed nasogastric tubes related complications (such as nausea, vomiting, wound dehiscence and ileus) than that of the traditional nursing treated patients, suggesting that the FT protocol is effective in decreasing nasogastric tube related complications.

Fasting minimization

For traditional nursing scheme, patients are fasted to reduce the aspiration risk. Patients in our control group underwent 12 h preoperative fasting and were forbidden to drink water at least 6 h preoperatively. Patients were permitted to take liquid diet at the second postoperative day. However, patients underwent FT protocol were encouraged to use carbohydrate rich oral supplements.

Usually, the stomach begins to work 5 min after eating. Different food characters are associated with the different times of flatus. Liquid food is easier to be digested than the solid food. Based on these physiological characteristics, 6 h fasting for solid food and 2 h fasting for liquid food prior to surgery in our study did not result in adverse reaction in FT treated group. Early liquid diet might contribute to the recovery of gastrointestinal function. Besides, glucose liquid significantly alleviated the patients' starvation, thus decreased the resistance to insulin. Our study indicated the feasibility of FT protocol routine.

Analgesia

Analgesia can reduce the stress response caused by pain. Previous studies have shown

that both the preoperative counseling and education were associated with the perioperative analgesia [21, 22]. In FT protocol scheme in our study, patients were educated about the surgical process, as well, an assessment of fitness to undergo the surgery for each patient were informed. All these methods might relieve patients' pain during surgery and promote rehabilitation.

In conclusion, the results of our study indicate that the application of FT in patients with laparoscopic radical resection of colorectal cancer benefit to early rehabilitation with fewer complications.

Disclosure of conflict of interest

None.

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