Original Article

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

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Received March 7, 2017; Accepted May 24, 2017; Epub July 15, 2017; Published July 30, 2017

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,
The rehabilitation protocol contributes to fast recovery.

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 rea-
sons: (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 mon-
itoring 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 applica-
tion 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 sur-
gical research team. Before surgery, patients
in the FT treatment group were informed
the FT surgery procedure including the condi-
tions 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 liq-
uid at night before surgery day and drank an-
other 400 ml 2-3 hours 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 gro-
up, 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 crite-
ria: (1) stable vital signs; (2) tolerance of full diet
with regular exhausts; (3) analgesia; (4) capa-
ble 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. Pathologi-
cal staging was stratified through intraopera-
tive pathologic results.

The relevant carers recorded the following indi-
cators, such as the time of removal of nasogas-
tric 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>
<thead>
<tr>
<th>Index</th>
<th>FT group (n = 87)</th>
<th>Control group (n = 87)</th>
<th>χ²/z/t/Z</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (M/F)</td>
<td>54/33</td>
<td>49/38</td>
<td>0.595</td>
<td>0.441</td>
</tr>
<tr>
<td>Age (year)</td>
<td>54.2 ± 13.2</td>
<td>51.6 ± 12.5</td>
<td>1.333</td>
<td>0.184</td>
</tr>
<tr>
<td>Tumor sites</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left-side CC (n, %)</td>
<td>28 (32.18)</td>
<td>33 (37.93)</td>
<td>0.632</td>
<td>0.729</td>
</tr>
<tr>
<td>Right-side CC (n, %)</td>
<td>34 (39.08)</td>
<td>31 (35.63)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rectosigmoid carcinoma (n)</td>
<td>25 (28.74)</td>
<td>23 (26.44)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tumor staging</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I (n, %)</td>
<td>20 (22.99)</td>
<td>18 (20.69)</td>
<td>0.130</td>
<td>0.897</td>
</tr>
<tr>
<td>II (n, %)</td>
<td>41 (47.13)</td>
<td>46 (52.87)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III (n, %)</td>
<td>26 (29.89)</td>
<td>23 (26.44)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FT group: patients treated with Fast-track rehabilitation protocols.
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 χ² 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).
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**Table 3. Postoperative complications between the two groups**

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

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

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

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

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

<table>
<thead>
<tr>
<th>Groups</th>
<th>Satisfaction related to pain control education</th>
<th>Satisfaction related to methods of control/relief pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>TF treated group (n = 87)</td>
<td>43.53 ± 4.86</td>
<td>44.72 ± 2.52**</td>
</tr>
<tr>
<td>Control group (n = 87)</td>
<td>43.29 ± 5.03</td>
<td>42.96 ± 3.17</td>
</tr>
<tr>
<td>$t$</td>
<td>0.320</td>
<td>4.054</td>
</tr>
<tr>
<td>$p$</td>
<td>0.749</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

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

Significant difference was found between them ($P = 0.036$). More cases with infection were found in control group (n = 9) 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 different 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-
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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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References

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