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BRIEF ARTICLE

Fast-track rehabilitation program *vs* conventional care after colorectal resection: A randomized clinical trial

Gang Wang, Zhi-Wei Jiang, Jing Xu, Jian-Feng Gong, Yang Bao, Li-Fei Xie, Jie-Shou Li

Gang Wang, Zhi-Wei Jiang, Jian-Feng Gong, Yang Bao, Li-Fei Xie, Jie-Shou Li, Research Institute of General Surgery, Jinling Hospital, School of Medicine, Nanjing University, Nanjing 210002, Jiangsu Province, China
Jing Xu, Department of Medical Oncology, Jinling Hospital, School of Medicine, Nanjing University, Nanjing 210002, Jiangsu Province, China
Author contributions: Wang G, Jiang ZW and Li JS designed the research; Wang G, Jiang ZW, Xu J, Gong JF, Bao Y and Xie LF performed the research; Wang G analyzed the data; Wang G and Xu J wrote the paper.
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Correspondence to: Zhi-Wei Jiang, MD, Research Institute of General Surgery, Jinling Hospital, School of Medicine, Nanjing University, 305 Zhongshan East Road, Nanjing 210002, Jiangsu Province, China. surgery34@163.com
Telephone: +86-25-80860137 Fax: +86-25-84803956
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Abstract

AIM: To compare the fast-track rehabilitation program and conventional care for patients after resection of colorectal cancer.

METHODS: One hundred and six consecutive patients who underwent fast-track rehabilitation program were encouraged to have early oral feeding and movement for early discharge, while 104 consecutive patients underwent conventional care after resection of colorectal cancer. Their gastrointestinal functions, postoperative complications and hospital stay time were recorded.

RESULTS: The restoration time of gastrointestinal functions in the patients was significantly faster after fast-track rehabilitation program than after conventional care (2.1 d *vs* 3.2 d, $P < 0.01$). The percentage of patients who developed complications was significantly lower 30 d after fast-track rehabilitation program than after conventional care (13.2% *vs* 26.9%, $P < 0.05$). Also, the percentage of patients who had general complications was significantly lower 30 d after fast-track rehabilitation program than after conventional care (6.6% *vs* 15.4%, $P < 0.05$). The postoperative hospital stay time of the patients was shorter after fast-track rehabilitation program than after conventional care (5 d *vs* 7 d, $P < 0.01$). No significant difference was observed in the readmission rate 30 d after fast-track rehabilitation program and conventional care (3.8% *vs* 8.7%).

CONCLUSION: The fast-track rehabilitation program can significantly decrease the complications and shorten the time of postoperative hospital stay of patients after resection colorectal cancer.

Key words: Perioperative care; Fast track; Rehabilitation; Colorectal cancer resection

Peer reviewer: Luca Stocchi, MD, Desk A 30, Department of Colorectal Surgery, Digestive Disease Institute, Cleveland Clinic, 9500 Euclid Avenue, Cleveland, OH 44195, United States

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INTRODUCTION

The concept of fast track rehabilitation program has been recently introduced with the intent to improve the management, stress, complications, shorten hospital stay time and reduce cost of patients after resection of colorectal cancer[1-7]. Fast track rehabilitation program is basically a

multidisciplinary perioperative care strategy for patients after resection of colorectal cancer, including preoperative education, effective anesthesia, postoperative analgesia techniques, early oral nutrition and ambulation[8-11]. However, the previous researches were mainly focused on the postoperative complications after conventional care rather than on the general complications after fast-track rehabilitation program. This study was to compare the complications, restoration of gastrointestinal functions, and hospital stay time of postoperative colorectal cancer patients after fast -track rehabilitation program and conventional care.

MATERIALS AND METHODS

Patients and procedures

Two hundred and thirty patients who underwent resection colorectal cancer in the Research Institute of General Surgery, Jinling Hospital (Nanjing, China) in July 2007 to August 2009 were enrolled in this study. Of the 230 patients, 115 who underwent resection of colorectal neoplastic disease served as a fast-track rehabilitation grogram group, and 115 who underwent resection of colorectal cancer served as a conventional care group. Nine patients with non-selective admission, preoperative distant metastasis, stoma, emergency situations, scheduled total colectomy or abdominoperineal resection, contraindications for epidural anesthesia or early ambulation were excluded from the fast-track rehabilitation grogram group, and 11 from the conventional care group. Finally, 106 patients in the fast-track rehabilitation program group and 104 patients in the conventional care group were analyzed in this study.

The contents of fast-track rehabilitation program include preoperative education of patients with no bowel preparation and fasting but with carbohydrate containing liquids 2 h before surgery, analgesia with routine oral non-steroidal anti-inflammatory medications and minimization of opioid pain management, avoidance of perioperative fluid overload, no routine use of nasogastric tubes, early removal of bladder catheters, early feeding and enforced ambulation on the day of surgery. In the fast track rehabilitation program group, minimal-access surgery or transverse curved incision used included right-sided hemicolectomy through a right horizontal incision above the umbilicus, sigmoid resection through a curved incision in the left iliac fossa and low anterior rectal resection through a mini-laparotomy in the subumbilicus which was extended toward the curvature if necessary. Principles of the perioperative care are shown in Table 1.

Discharge criteria for patients in both groups were the same, including tolerance to fluids and solid diet, adequate oral analgesia, passage of flatus or stool, and no surgical complication, basic self-care ability, and acceptance of discharge.

Clinical outcome

The intestinal function was defined as passage of flatus, morbidity requiring treatment during the first 30 postoperative days, postoperative hospital stay time, and readmission rate. No patient was lost during the follow-up. General complications were defined as those occurred in the cardiovascular, pulmonary, thromboembolic, urinary systems, while surgical complications were defined as wound complication, anastomotic leak, and bowel obstruction requiring reoperation as previously described[12].

Statistical analysis

Statistical analysis, based on an intention-to-treat analysis, was performed with the SPSS version 16.0 (Chicago, IL, USA). Mann-Whitney test was used to compare the continuous variables. χ^2 test and Fisher's exact test were used to compare the discrete variables. P <0.05 was considered statistically significant.

RESULTS

Of the 230 enrolled patients (115 in the fast track rehabilitation grogram group and 115 in the conventional care group), 210 were analyzed (106 in the fast track rehabilitation program group and 104 in the conventional care group). The relevant characteristics of patients and the types of surgery are shown in Table 2. No significant difference was observed in age, ASA status, types of surgery and tumor stages between the two groups.

The intestinal function of patients in the fast track rehabilitation program group and conventional care group became normal 2 d (range, 1-6 d) and 3 d (range, 1-8 d), respectively, after resection of colorectal cancer ($P < 0.01$). The median postoperative hospital stay time was 5 d (range, 2-41 d) and 7 d (range, 3-55 d), respectively, for the patients in the fast track rehabilitation program group and conventional care group ($P < 0.01$). The postoperative rehabilitation was also faster in patients of the fast track rehabilitation program group than in those of conventional care group. On the day of surgery, 11 patients (35%) in the fast track rehabilitation program group and no patient in the conventional care group were able to walk. On postoperative day 1, 56 patients (53%) in the fast track rehabilitation program group and 24 patients (23%) in the conventional care program group were able to walk. On postoperative day 2, 90 patients (85%) in the fast track rehabilitation program group and 61 patients (59%) in the conventional care group were able to walk ($P < 0.01$) (Table 3).

The urethral catheter in 81 patients (81%) of the fast track rehabilitation program group and in 21 patients (20%) of the conventional care group was removed on day 1 after resection of colorectal cancer ($P < 0.05$), and in 97 patients (92%) of the fast track rehabilitation program group and in 47 patients (45%) of the conventional care group on day 2 after resection of colorectal cancer ($P < 0.05$). Urinary retention occurred in 5 patients (5%) of the fast track rehabilitation program group and in 16 patients (15%) of the conventional care group. Urethral catheter was inserted again in 4 patients of the fast track rehabilitation program group and in 12 patients of the conventional care group.

Table 1 Principles of fast track rehabilitation program and conventional care

	Fast track rehabilitation program	Conventional care
Preoperative	Patients and their relatives were informed about the surgical procedure and postoperative course	Patient were educated in the standard manner
Day before surgery		
Bowel preparation	No bowel preparation was performed	Two oral sachets of fleet® bowel preparation
Carbohydrate load	4 units (preOp®)	No
Diet	Last meal 6 h before operation	Last meal at midnight
Day of surgery		
Pre-operative fasting	No, 2 units (preOp®) 2 h before surgery	Yes
Nasogastric tubes	No unless nausea and vomit	Routine placement
Pre-anesthetic medication	No	Oral diazepam 10 mg
Anesthesia	General anesthesia Remifentanil 1 μg/kg per minute Propofol 2-4 mg/kg per hour Cisatracium 0.15 mg/kg Ondansetron 4 mg Bupivacaine 0.25% 20 mL (incision) Epidural catheter T10-T12 Test: 3 mL 2% lidocaine with epinephrine Bupivacaine 0.5% (6 + 6) mL	General anesthesia Remifentanil 1 μg/kg per minute Propofol 2-4 mg/kg per hour Cisatracium 0.15 mg/kg Ondansetron 4 mg
Surgical management	Minimal invasive incision Infiltration of surgical wounds with Bupivacaine	Median laparotomy approach No infiltration of surgical wounds with local anesthetic drugs
Surgical drains	No, unless required in circumstances and discarded in early time (usually on postoperative day 1)	Routine placement usually discarded the day before discharge
Early post-operative care	Use of epidural catheter (0.125% Bupivacaine with 2.5 μg/mL Fentanyl) First oral drink 2 h after surgery IV infusion of Ringers lactate 1.5 L/d Mobilization in the evening (> 2 h out of bed)	Analgesia by bolus administration of diclofenac or morphine No oral application scheme IV infusion of Ringers lactate 2.5 L/d No mobilization scheme
Postoperative care		
Day 1 after surgery	Oral intake > 2 L (including 4 units CHL liquids) Semi-solid food intake Stop IV fluid administration Remove urine catheter Expand mobilization (> 6 h out of bed)	Diet increased on daily basis IV fluid administration (2.5 L/d) till adequate oral fluid intake Mobilization according to attending surgeon
Day 2 after surgery	Remove epidural add Diclofenac 3 × 50 mg/d Normal diet Expand mobilization (> 8 h) Plan discharge	Continue as on day 1 till discharge criteria fulfilled
Day 3 after surgery	Continue as on day 2 till discharge criteria fulfilled	Continue as on day 2 till discharge criteria fulfilled

Table 2 Characteristics of patients and their diagnosis

	Fast track rehabilitation group (*n* = 106)	Conventional care group (*n* = 104)	*P* value
Median age (range, yr)	57 (38-69)	55 (40-67)	0.462
Male/female	65/41	60/44	0.393
Colon/rectum	73/33	63/41	0.110
ASA score			0.384
Ⅰ	27	32	-
Ⅱ	60	56	-
Ⅲ	19	16	-
Operation			0.721
Right hemicolectomy	30	24	
Left hemicolectomy	18	26	
Sigmoid colectomy	28	32	
Anterior resection	30	22	
TNM stage			0.741
Ⅰ	19	17	
Ⅱ	56	61	
Ⅲ	31	26	

Table 3 Postoperative rehabilitation and hospital stay time of two groups *n* (%)

	Fast track rehabilitation group (*n* = 106)	Conventional care group (*n* = 104)	*P* value
Walk on surgery day	11 (35)	0 (0)	0.001
Walk on D 1	56 (53)	24 (23)	0.000
Walk on D 2	90 (85)	61 (59)	0.001
Days until flatus			0.001
mean ± SD	2.1 ± 2.0	3.2 ± 2.5	-
Median (range)	2 (1-6)	3 (1-8)	-
Hospital stay time (d)			0.001
mean ± SD	5.1 ± 3.1	7.6 ± 4.8	-
Median (range)	5 (2-41)	7 (3-55)	-

The nasogastric tube was maintained for 1-4 d in 3 patients (3%) of the fast track rehabilitation program group and for 1-11 d in 84 patients (81%) of the conventional

Table 4 General and surgical complications of two groups

	Fast track rehabilitation group (n = 106)	Conventional care group (n = 104)	P value
Overall complications	20	39	0.015
Patients with complications	14	28	0.016
General complications	10	23	0.042
Patients with general complications	7	16	0.048
Cardiac	2	5	-
Pulmonary	3	8	-
Thromboembolic	1	3	-
Urinary tract	2	5	-
Other	2	2	-
Overall surgical complications	10	16	0.221
Patients with surgical complications	7	12	0.230
Wound infection	4	7	-
Anastomotic leakage	4	2	-
Bowel obstruction	2	5	-
Death	2	1	0.572

care group ($P < 0.01$). The nasogastric tube was reinserted in 4 patients (4%) of the fast track rehabilitation program group and in 12 patients (11%) of the conventional care group due to nausea and vomit ($P < 0.05$).

No significant difference was observed in re-admission rate between the two groups within 30 d after resection of colorectal cancer. Four patients (4%) in the fast track rehabilitation program group were readmitted due to wound infection, and 9 patients (9%) in the conventional care group were readmitted due to bowel obstruction, vomit and wound infection.

The incidence of complications was 19% in patients of the fast track rehabilitation program group and 38% in those of the conventional care group ($P < 0.05$) during the first 30 postoperative days. One or more complications occurred in 14 patients (13%) of the fast track rehabilitation program group and in 28 patients (27%) of the conventional care group ($P < 0.05$). The overall incidence of general complications was lower in patients of the fast track rehabilitation program group than in those of the conventional care group ($P < 0.05$). The incidence of complications in the cardiac and pulmonary system was also significantly lower in patients of the fast track rehabilitation program group than in those of the conventional care group ($P < 0.05$). A significant difference was observed in surgical complications between the two groups. Two patients died in the fast track rehabilitation program group due to cardiovascular failure and multiple organ failure, respectively. One patient died in the conventional care group due to cardiovascular failure. The types of complications are listed in Table 4.

DISCUSSION

The results of the present study indicate that fast-track rehabilitation program can significantly accelerate the restoration of gastrointestinal function and reduce the postoperative complications as well as hospital stay time of patients after resection of colorectal cancer. The results of this study show that preoperative education of patients, epidural anesthesia or regional anesthesia[13], early ambulation and early postoperative oral nutrition are the important predictors for the rehabilitation of patients after resection of colorectal cancer.

Preoperative education of patients is regarded as one of the crucial factors for fast-track rehabilitation. It is necessary to explain the detailed treatment plan, different stages of fast-track rehabilitation program and relevant measures for recovery for the patients in order to make them better understand the importance of fast-track rehabilitation program. Better cooperation of patients can bring better outcomes of fast track rehabilitation program. Generally, since the gastric emptying time of solid meal and fluid is 6 and 2 h, respectively[14], the patients should be encouraged to have liquid meal 2 h before operation instead of fasting. It has been shown that preoperative oral carbohydrate is safe and can efficiently reduce complications[15-17].

The role of epidural anesthesia or regional anesthesia in fast-track rehabilitation program should be stressed. Postoperative epidural analgesia can avoid stress-induced neurological, endocrinological and homeostatic changes or the blocking of sympathetic nerve-related surgical stress response, reduce complications such nausea, vomiting and enteroparalysis after operation, early ambulation, improve the intestinal function and shorten the hospital stay time of patients after resection of colorectal cancer[18-24]. In this study, epidural analgesia significantly shortened the bedridden time and potentially reduced the cardiopulmonary and thromboembolic complications. The rate of cardiopulmonary and thromboembolic complications was much lower in patients of the fast track rehabilitation program group than in those of the conventional care group ($P < 0.05$).

Early postoperative oral nutrition also plays an essential part in fast-track rehabilitation program. Food intake can stimulate gastrointestinal peristalsis, and early feeding during the first 24 h after surgery promotes the recovery of ileus. It has been illustrated that early postoperative oral nutrition attenuates catabolism and potentially decreases infectious complications[25,26]. Consistent with this, early postoperative oral nutrition has been suggested as a routine procedure of abdominal surgery[26]. Enforced postoperative mobilization of patients can reduce protein loss due to long-term bedridden, pulmonary infection and venous thrombosis. In this study, complete analgesia, control of nausea and vomiting, early postoperative oral nutrition and early ambulation efficiently reduced the postoperative complication of ileus and improved the recovery of intestinal function.

In this study, the early removal of gastric tube and urethral catheter decreased not only the infectious complications in cardiopulmonary and urinary systems but also the symptoms of patients. The shortened fasting

time, preoperative carbohydrate load and intraoperative fluid restriction effectively protected against homeostasis in patients after resection of colorectal cancer. The outcome of fast-track rehabilitation program was better than that of conventional care.

Fast track rehabilitation program can improve the symptoms of patients after resection of colorectal cancer better than conventional care, thus benefiting their surgery, anesthesia, pain management, physical therapy and social work. The primary work of fast track rehabilitation program is the preoperative education of patients to make them understand the whole plan and the aim of each stage. Therefore, it is necessary to get the cooperation from nurses, because they need to work professionally and nicely. Although there must be lots of difficulties in fast track rehabilitation program, it is an inevitable stage to test a new set of rules and guidelines.

Recently, laparoscopic surgery, applied in treatment of colorectal and early gastric cancer, can significantly reduce trauma and speed up the rehabilitation of patients after surgery. It was reported that the hospital stay time is shorter and the morbidity and readmission rate are lower after laparoscopic surgery[27,28]. However, these studies only compared open surgery with laparoscopic surgery rather than laparoscopic surgery with fast-track rehabilitation program[27,28]. Therefore, further studies are needed to focus on the potential influence of laparoscopy-assisted surgery with or without fast-track rehabilitation program on the recovery of patients after resection of colorectal cancer. Laparoscopic surgery and fast-track rehabilitation program can effectively promote the recovery of patients after resection of colorectal cancer. We believe that laparoscopic surgery in combination with fast track rehabilitation program is significantly advantageous over other procedures for patients after resection of colorectal cancer.

In conclusion, fast track rehabilitation program plays an important role in the recovery of patients after resection of colorectal cancer, which can accelerate the restoration of their gastrointestinal function, decrease their postoperative complications, and shorten their hospital stay time.

COMMENTS

Background

Fast-track rehabilitation program, first reported by Kehlet *et al*, can reduce the postoperative complications and hospital stay time of patients after resection of colorectal cancer without compromising the surgical outcome. The concept of fast track rehabilitation program has been recently introduced in colorectal surgery. It is basically a multidisciplinary perioperative care strategy for patients after resection of colorectal cancer.

Research frontiers

The previous studies seemed to compare the postoperative complications rather than the general complications of fast tract rehabilitation program and conventional care.

Innovations and breakthroughs

The gastrointestinal function, postoperative complications, and hospital stay time of patients after resection of colorectal cancer were studied during their fast track rehabilitation program. The accelerated restoration of gastrointestinal function and decreased postoperative complications may shorten the hospital stay time of patients after resection of colorectal cancer.

Applications

Surgical care has changed dramatically over the past half century and will continue to improve with the time. Extensive studies on the optimized care will allow us to develop more appropriate perioperative surgical care programs for patients after resection of colorectal cancer.

Terminology

Fast track rehabilitation program, basically a multidisciplinary strategy for patients after resection of colorectal cancer, is to optimize the preoperative, perioperative and postoperative factors for reducing their physiological and psychological stress surgery.

Peer review

This manuscript describes a prospective randomized trial comparing fast track rehabilitation program and conventional care for patients after resection of colorectal cancer. The data are sound support the hypothesis of the authors.

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