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

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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

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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\(^{1-3}\). 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 program 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 abdominal perineal resection, contraindications for epidural anesthesia or early ambulation were excluded from the fast-track rehabilitation program 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\[^{[3]}\].

**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. \(\chi^2\) 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 program 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.
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 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 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                                       |
|                      | Anesthesia General anesthesia                                             | General anesthesia                                       |
|                      | Remifentanil 1 μg/kg per minute                                           | Remifentanil 1 μg/kg per minute                         |
|                      | Propofol 2-4 mg/kg per hour                                                | Propofol 2-4 mg/kg per hour                             |
|                      | Cisatracium 0.15 mg/kg                                                    | Cisatracium 0.15 mg/kg                                  |
|                      | Ondansetron 4 mg                                                          | Ondansetron 4 mg                                        |
|                      | Bupivacaine 0.25% 20 mL (incision)                                        |                                                        |
|                      | Epidual catheter T10-T12 Test: 3 mL 2% lidocaine with epinephrine           |                                                        |
|                      | Surgical management Minimal invasive incision                             | Median laparotomy approach                              |
|                      | Surgical drains Infiltation of surgical wounds with Bupivacaine           | No infiltration of surgical wounds with local anesthetic drugs |
|                      | Early post-operative care Use of epidural catheter (0.125% Bupivacaine with 2.5 μg/mL Fentanyl) | Analgesia by bolus administration of diclofenac or morphine |
|                      | First oral drink 2 h after surgery                                        | No oral application scheme                              |
|                      | IV infusion of Ringers lactate 1.5 L/d                                    | IV infusion of Ringers lactate 2.5 L/d                  |
|                      | Mobilization in the evening (> 2 h out of bed)                            | No mobilization scheme                                  |
| Postoperative care   | Day 1 after surgery Oral intake > 2 L (including 4 units CHL liquids)     | Diet increased on daily basis                           |
|                      | Semi-solid food intake                                                    | IV fluid administration (2.5 L/d) till adequate oral fluid intake |
|                      | Stop IV fluid administration                                              | Mobilization according to attending surgeon            |
|                      | Remove urine catheter                                                     |                                                        |
|                      | Expand mobilization (> 6 h out of bed)                                    |                                                        |
|                      | Day 2 after surgery Remove epidural add Diclofenac 3 × 50 mg/d            | Continue as on day 1 till discharge criteria fulfilled  |
|                      | Normal diet                                                               |                                                        |
|                      | Expand mobilization (> 8 h)                                               |                                                        |
|                      | Plan discharge                                                            |                                                        |
|                      | Day 3 after surgery 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    | 2.1 ± 2.0                               | 3.2 ± 2.5                         | -       |
| Mean (range)         | 2 (1-6)                                 | 3 (1-8)                           | -       |
| Hospital stay time (d)| 5.1 ± 3.1                               | 7.6 ± 4.8                         | -       |

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 care group.
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 laparoscopic-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 track 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.

**REFERENCES**

1. Basle L, Thorbøl JE, Løssø K, Kehlet H. Colonic surgery with accelerated rehabilitation or conventional care. *Dis Colon Rectum* 2004; 47: 271-277; discussion 277-278
2. Bradshaw BG, Liu SS, Thirifby RC. Standardized perioperative care protocols and reduced length of stay after colon surgery. *J Am Coll Surg* 1998; 186: 501-506
3. Delaney CP, Zutshi M, Senagore AJ, Remzi FH, Hammel J, Fazio VW. Prospective, randomized, controlled trial between a pathway of controlled rehabilitation with early ambulation and diet and traditional postoperative care after laparotomy and intestinal resection. *Dis Colon Rectum* 2003; 46: 851-859
4. DiFronzo LA, Yamin N, Patel K, O’Connell TX. Benefits of early feeding and early hospital discharge in elderly patients undergoing open colon resection. *J Am Coll Surg* 2003; 197: 747-752
5. Anderson AD, McNaul CE, MacFie J, Tring I, Barker P, Mitchell CJ. Randomized clinical trial of multimodal optimization and standard perioperative surgical care. *Br J Surg* 2003; 90: 1497-1504
6. Gritt M, Anderson AD, Reddy BS, Hayward-Sampson P, Tring IC, MacFie J. Randomized clinical trial of multimodal optimization of surgical care in patients undergoing major colonic resection. *Br J Surg* 2005; 92: 1354-1362
7. Khoo CK, Vickery CJ, Forsyth N, Vinall NS, Eyre-Brook IA. A prospective randomized controlled trial of multimodal perioperative management protocol in patients undergoing elective colorectal resection for cancer. *Ann Surg 2007; 245: 867-872
8. Kehlet H, Wilmore DW. Multimodal strategies to improve surgical outcome. *Ann J Surg 2002; 183: 630-641
9. Wind J, Polle SW, Fung Kon Jin PH, Dejong CH, von Meyenfeldt MF, Ubbink DT, Gouma DJ, Bemelman WA. Systematic review of enhanced recovery programmes in colonic surgery. *Br J Surg* 2006; 93: 800-809
10. Fearon KC, Ljungqvist O, Von Meyenfeldt M, Revhaug A, Dejong CH, Lassen K, Nygren J, Haasell J, Soop M, Andersen J, Kehlet H. Enhanced recovery after surgery: a consensus review of clinical care for patients undergoing colorectal resection. *Clin Nutr 2005; 24: 466-477
11. Kehlet H. Fast-track colorectal surgery: status and perspectives. *Recent Results Cancer Res 2005; 165: 8-13
12. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg 2004; 240: 205-213
13. Wilmore DW, Kehlet H. Management of patients in fast track surgery. *BMJ 2001; 322: 473-476
14. Ljungqvist O, Søreide E. Preoperative fasting. *Br J Surg* 2003; 90: 400-406
15. Reissman P, Teoh TA, Cohen SM, Weiss EG, Nogueras JJ,
Wexner SD. Is early oral feeding safe after elective colorectal surgery? A prospective randomized trial. *Ann Surg* 1995; 222: 73-77

16 Lewis SJ, Egger M, Sylvester PA, Thomas S. Early enteral feeding versus "nil by mouth" after gastrointestinal surgery: systematic review and meta-analysis of controlled trials. *BMJ* 2001; 323: 773-776

17 Feo CV, Romaniini B, Sortini D, Ragazzi R, Zamboni P, Pansini GC, Liboni A. Early oral feeding after colorectal resection: a randomized controlled study. *ANZ J Surg* 2004; 74: 298-301

18 Wu CL, Cohen SR, Richman JM, Rowlingson AJ, Courpas GE, Cheung K, Lin EE, Liu SS. Efficacy of postoperative patient-controlled and continuous infusion epidural analgesia versus intravenous patient-controlled analgesia with opioids: a meta-analysis. *Anesthesiology* 2005; 103: 1079-1088; quiz 1109-1110

19 Carli F, Mayo N, Klubien K, Schricker T, Trudel J, Belliveau P. Epidural analgesia enhances functional exercise capacity and health-related quality of life after colonic surgery: results of a randomized trial. *Anesthesiology* 2002; 97: 540-549

20 Clemente A, Carli F. The physiological effects of thoracic epidural anesthesia and analgesia on the cardiovascular, respiratory and gastrointestinal systems. *Minerva Anestesiol* 2008; 74: 549-563

21 Steinberg RB, Liu SS, Wu CL, Mackey DC, Grass JA, Ahlén K, Jeppsson L. Comparison of ropivacaine-fentanyl patient-controlled epidural analgesia with morphine intravenous patient-controlled analgesia for perioperative analgesia and recovery after open colon surgery. *J Clin Anesth* 2002; 14: 571-577

22 Taqi A, Hong X, Mistraletti G, Stein B, Charlebois P, Carli F. Thoracic epidural analgesia facilitates the restoration of bowel function and dietary intake in patients undergoing laparoscopic colon resection using a traditional, nonaccelerated, perioperative care program. *Surg Endosc* 2007; 21: 247-252

23 Marret E, Remy C, Bonnet F. Meta-analysis of epidural analgesia versus parenteral opioid analgesia after colorectal surgery. *Br J Surg* 2007; 94: 665-673

24 Augestad KM, Delaney CP. Postoperative ileus: impact of pharmacological treatment, laparoscopic surgery and enhanced recovery pathways. *World J Gastroenterol* 2010; 16: 2067-2074

25 Andersen HK, Lewis SJ, Thomas S. Early enteral nutrition within 24h of colorectal surgery versus later commencement of feeding for postoperative complications. *Cochrane Database Syst Rev* 2006; CD004080

26 Gatt M, MacFie J. Randomized clinical trial of the impact of early enteral feeding on postoperative ileus and recovery (Br J Surg 2007; 94: 555-561). *Br J Surg* 2007; 94: 1044-1045

27 Kim HJ, Lee IK, Lee YS, Kang WK, Park JK, Oh ST, Kim JC, Kim YH. A comparative study on the short-term clinicopathologic outcomes of laparoscopic surgery versus conventional open surgery for transverse colon cancer. *Surg Endosc* 2009; 23: 1812-1817

28 Steele SR, Brown TA, Rush RM, Martin MJ. Laparoscopic vs open colectomy for colon cancer: results from a large nationwide population-based analysis. *J Gastrointest Surg* 2008; 12: 583-591

S- Editor Tian LI L- Editor Wang XL E- Editor Zheng XM