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Fast-track Rehabilitation Accelerates Recovery After Laparoscopic Colorectal Surgery

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ABSTRACT

Background: Fast-track (FT) rehabilitation protocols have been shown to be successful in reducing both hospital stay and postoperative complications, as well as enhancing overall postoperative patient recovery. We are reporting the outcomes of our first group of patients undergoing colorectal surgery following the FT protocol.

Patients and Methods: We performed a prospective study of patients, between January 1, 2007 and January 31, 2010, who underwent laparoscopic colorectal resections in accordance with the guidelines of FT rehabilitation protocol. Recovery parameters including time to removal of naso-gastric tube and urinary catheter, time to bowel function and to resume diet, and length of hospital stay were evaluated. Postoperative outcomes, that is, postoperative complications and mortality, reoperations, and readmissions were also studied.

Results: A total of 71 patients, 30 women and 41 men, underwent FT rehabilitation for laparoscopic colorectal surgery. The mean age of the patients was 60 ± 16 years. The most common surgical procedures were right hemicolectomy 30% and anterior resection 27%. Liquid and regular diet were initiated on postoperative day 1.2 ± 0.4 and 2.1 ± 0.4, respectively. Overall postoperative morbidity was 8.5%. The mean length of stay was 4.4 ± 1.7 days, with only 3 readmissions. Forty-five patients fulfilled the FT care plan and were discharged on postoperative day 3. No reoperations or mortality were observed.

Conclusions: FT rehabilitation results in favorable postoperative outcomes. Our data provides evidence and suggests that FT protocols should be implemented as a reliable method of preparation and recovery for laparoscopic colorectal surgery.

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INTRODUCTION

The primary goal of all surgery recovery programs is to reduce hospital stay and to quickly restore the overall well-being of the patient with a reduced complication rate. Many advances have been developed to reach this goal, including all 3 parameters: preoperative, intraoperative, and postoperative measures. The advancement of minimally invasive surgical techniques, such as laparoscopic surgery, has been shown to accelerate patient recovery, reduce postoperative pain and fatigue, and decrease the length of hospital stay. According to the COLOR (Colon Cancer Laparoscopic Open Resection) trial, laparoscopic colon resection results in earlier recovery of bowel function, decreased need for analgesia, and shorter hospital stay as compared to open colectomy.[1] Additional advantages associated with laparoscopic colon surgery include improved pulmonary function and overall quality of life postoperation.[2–4]

In 1995, Bardram et al[5] introduced the notion of "fast-track" (FT) rehabilitation as an approach to further pronounce the advantages of minimally invasive surgery, by reducing the physiologic adjustment induced by traditional surgical methods. The mainstay of FT protocols include avoidance of nasogastric (NG) tube and preoperative bowel cleansing, appropriate analgesia, early oral feeding and ambulation, as well as well-controlled fluid balance. Using a FT rehabilitation care plan for laparoscopic colon resection, length of hospital stay could have been reduced to 2 to 3 days.[5–7] When compared with non-FT laparoscopic right hemicolectomy, patients who underwent FT protocol resumed normal gastrointestinal function earlier and observed a decrease in postoperative morbidity,[7] providing evidence that FT rehabilitation directly enhances the overall recovery of patients. A recent meta-analysis showed a reduction in overall complications, but major complications were not reduced with FT rehabilitation. Length of stay was reduced significantly. Thus, enhanced recovery seems safe, but the quality of

trials and lack of sufficient outcome parameters do not justify its implementation as the standard of care for laparoscopic colorectal surgery.[8]

FT rehabilitation programs have become popular in many surgical procedures.[9] It has been in play for over 10 years now, yet there still is no agreement on a precise, standardized protocol for laparoscopic colorectal surgery. The aim of this study is to provide data supporting the use of FT rehabilitation care plans in laparoscopic colorectal surgery, to present our protocol, and to share our experience with it.

METHODS

After obtaining the institutional review board approval, we performed, between the years 2007 and 2010, a prospective study including patients who underwent laparoscopic colorectal resection in accordance with the guidelines of our FT rehabilitation protocol. This is a single general surgeon series (AM), with an extensive experience in laparoscopic surgery.

Prior to patient enrollment in the study, each participant had a thorough discussion of the nature of the surgery as well as details of the pre-, peri-, and postoperative parts of the FT care plan. Exclusion criteria included emergent surgery or patients who underwent combined surgery requiring resection of multiple organs that may limit the use of our FT care plan. Conversions to open surgery were excluded as well. Of note, all cases that required a substantial incision, >7.5 cm, for specimen extraction, were defined as conversion.

The FT rehabilitation plan allows for early return to routine activity and early resumption of gastrointestinal activity, which resulted in fast recovery and earlier discharge from the hospital. **Table 1** illustrates details of our FT surgery care plan. Elements reflective of the FT care plan being measured include time to removal of NG tube and urinary catheter, time to fluid and food intake, time to bowel function, need for pain control, and length of hospital stay.

Data collected included patients' characteristics, indication for surgery, and type of surgical procedures. Recovery parameters and variables pertaining to the FT rehabilitation plan (ie, first bowel movement, time to fluid and diet resumption, and time to patient discharge) were recorded.

Early postoperative morbidity (ie, postoperative ileus [defined as lack of flatus or bowel movement within 5 postoperative days or vomiting requiring reinsertion of NG tube], wound infection, intra-abdominal abscess or leak, urinary tract infection, cardiopulmonary complications, and hemorrhage) were also studied.

Table 1.
Fast-Track Care Perioperative Plan

Day	Protocol
Preoperative	Detailed discussion of nature of surgery and rehabilitation plan with both the patient and staff
	No bowel preparation
Intraoperative	Prophylactic antibiotics
	Induction of anesthesia (no epidural catheter)
	Insertion of:
	Urinary catheter
	Nasogastric tube (removed intra-operatively at extubation)
	Fluid maintenance; 1 L crystalloids
Surgery	Pain control by oral nonsteroidal anti-inflammatory drugs and/or oral hydrocodone
	Ambulation enforced for stable candidates
POD 1	Patient reassessed and care plan discussed again
	Oral fluid intake
	Fluid maintenance discontinued
POD 2	Regular diet
	Removal of urinary catheter
POD 3	Evaluation of patient status
	Discharge for stable candidates

Abbreviation: POD, postoperative day.

Preoperative Preparation

Patients were informed extensively about our FT surgery care plan and our goal of early discharge. The department, including all staff and nurses, were educated about FT rehabilitation care plan to ensure quality control. Our preoperative regimen did not include mechanical bowel preparation. Rectal surgery candidates were, however, offered 2 enemas (C.B. Fleet Inc, Lynchburg, Virginia) preoperatively, to allow safe colorectal anastomosis. Patients started nothing-by-mouth restrictions at midnight the day before surgery. Intravenous antibiotic prophylaxis (ceftriaxone 1 g and metronidazole 500 mg) was given 30

minutes prior to surgery and continued for 24 hours afterward (ie, 2 extra doses of metronidazole 500 mg).

Intra-operative Details

All patients underwent colorectal surgery using the same laparoscopic technique. Pneumoperitoneum was achieved by Veress needle, and port placement varied consistently depending on the segment of colon to be resected. After induction of anesthesia, a urinary catheter and an NG tube were inserted in all patients. The NG tube was removed intraoperatively at extubation. No epidural catheter was placed for analgesic or anesthetic treatment. Fluid maintenance was limited to 1 L of crystalloids, except for patients who experienced hypotensive episodes where extra fluid boluses (300 cc) were administered. Patient position was determined based on the resected segment.

Postoperative

After standard recovery at the postanesthesia unit, all patients were transferred to a regular nursing floor. Analgesia was maintained by use of oral nonsteroidal anti-inflammatory medications (ie, ibuprofen, celecoxib) and oral hydrocodone if necessary; no patient-controlled analgesia pumps were used. For nausea, patients were offered odansetron. No use of laxatives or prokinetics were allowed. Ambulation was enforced on the day of surgery. On postoperative day (POD) 1, the patient was reassessed and the care plan was discussed again. In addition, oral fluid intake was initiated. On POD 2, regular hospital meals were encouraged, and the urinary catheter was removed. Fluid maintenance (100 cc/hour saline) was discontinued if patients tolerated a liquid meal. On POD 3, evaluation of patient status was performed and discharge was approved for stable and mobile candidates who tolerated a liquid diet. Flatus nor defecation were criteria for discharge.

Statistical Analysis

Categorical variables were summarized as frequency (percentage), and quantitative variables as mean ±SD, and median (minimum; 25%; median; 75%; maximum).

RESULTS

Over a 4-year time span, 88 patients underwent elective colon or rectal surgery by the 2 surgeons. Seventy-one patients agreed and underwent FT rehabilitation care plans for laparoscopic colorectal surgery. Forty-one patients were male and 30 were female, with mean age of 60 ± 16 years **(Table 2).** Operative data varied consistently in reference to indication for surgery and surgical procedure. Indication for surgery was colorectal cancer in 45 patients (64%), diverticular disease in 9 patients (12.5%), malignant colonic polyps in 9 patients (12.5%), and inflammatory bowel disease in 8 patients (11%) (Table 2). The surgical procedures were right hemicolectomy in 21 patients (30%), left hemicolectomy or sigmoidectomy in 12 patients (17%), anterior resection in 19 patients (27%), total colectomy in 4 patients (5.5%), subtotal colectomy in 3 patients (4%), Hartmann reversal in 8 patients (11%), and abdominoperineal resection in 4 patients (5.5%) (Table 2). Intraoperative course was uneventful in the entire cohort. Significant hemodynamic changes were uncommon, and no extra fluid boluses were required.

All patients had the NG tube removed immediately after surgery. Urinary catheter removal occurred on POD 1.7 ± 0.9. Almost all patients were encouraged to and succeeded in handling oral fluid intake on POD 1. Oral food intake resumed afterward on POD 2.1 ± 0.4. The mean length of stay was 4.4 ± 1.7 days. Forty-five patients fulfilled the FT care plan criteria and were discharged on

Table 2.
Patients, Indication for Surgery, and Type of Operations

Variable	
Age, years	60 ± 16
Sex, male/female	41/30
ASA score	2 ± 0.6
Indication for surgery, patients	
Colorectal carcinoma	45 (64)
Malignant polyp	9 (12.5)
Diverticular disease	9 (12.5)
Inflammatory bowel disease	8 (11)
Type of procedure	
Right colectomy	21 (30)
Left colectomy	6 (8.5)
Sigmoidectomy	6 (8.5)
Anterior resection	19 (27)
Total colectomy	4 (5.5)
Subtotal colectomy	3 (4)
Closure of Hartmann	8 (11)
Abdominoperineal resection	4 (5.5)

Abbreviation: ASA, American Society of Anesthesiology score.
Values are mean ± SD, n, or n (%).

POD 3. Failure to follow the FT care plan and early discharge was in general related to postoperative complications or administrative repositioning limitations.

Becuase neither flatus nor defecation were criteria for discharge, it was not possible to calculate an accurate incidence rate. However, of the 35 patients who experienced flatus or defecation prior to discharge, it occurred on POD 2 ± 0.4 and POD 3 ± 0.8, respectively. Of note, in terms of pain control, all 35 patients were satisfied with the protocol oral analgesics. Recovery parameters are presented in **Table 3.**

There were 6 patients with complications: 1 patient experienced superficial surgical site infection (1.5%), 1 intra-abdominal abscess (1.5%), 2 had postoperative ileus (2.8%) that required reinsertion of NG tube, and 1 has a gastrointestinal hemorrhage (1.5%) that was treated with blood transfusion. A sixth patient experienced a transient arrhythmia. The patient with the wound infection was treated with antibiotics and local wound care, while the intra-abdominal abscess required ultrasound-guided drainage. Both later patients recovered uneventfully. There were no anastomotic leaks detected, and no early reoperations were required. Mortality rate was zero during the 30-day period following surgery. Three patients (4%) were readmitted for diarrhea, fever without definitive etiology, and acute cholecystitis. Postoperative outcomes are listed in **Table 4.**

Table 3.
Recovery Parameters

Recovery Parameter	Postoperative Day
Nasogastric tube removal	0
Urinary catheter removal	1.7 ± 0.9
First fluid intake	1.2 ± 0.4
First diet intake	2.1 ± 0.4
First flatus*	2 ± 0.4
First bowel movement*	3 ± 0.8

*Data were available for 35 patients.

Table 4.
Postoperative Outcomes

Outcome	Patients, n (%)
Postoperative complication	6 (8.5)
Intra-abdominal abscess	1 (1.4)
Paralytic ileus	2 (2.8)
Gastrointestinal bleeding	1 (1.4)
Wound infection	1 (1.4)
Cardiac arrhythmia	1 (1.4)
Anastomotic leak	0
Reoperations	0
Readmissions	3 (4)
Mortality	0

DISCUSSION

All published results of FT rehabilitation care plans have shown comparable outcomes.[5,10–14] Specifically, rapid patient recovery, decreased postoperative fatigue and ileus, and patient discharge within 2 to 5 days following surgery have been reported.[5,11–14] The most significant impact of the FT rehabilitation care plans is the reduction of postoperative morbidity from >20% to 9.1% when compared with traditional care plans.[5,11–15]

Our study shows comparable results with current literature, providing further evidence that FT rehabilitation is an applicable method for recovery programs to be used in laparoscopic colorectal surgery. Our protocol for operative management included no mechanical bowel preparation, avoidance of NG tube, appropriate anesthesia and pain control, early ambulation, and oral intake of fluids and solid foods. In addition, we made an effort to tightly control fluids intraoperatively to reduce sequelae of fluid overload.

Our discharge criteria did not include a requirement for presence of flatus nor defecation. We wanted to illustrate that mandatory return of bowel function prior to discharge does not play any significant role in either treatment and/or postoperative complications in FT rehabilitation. Our results provide significant evidence that patients do not experience greater morbidity when discharged prior to return of normal bowel function. Approximately 50% of our patients were discharged prior to flatus passage or defecation, which agrees well with previous reports,[16] and yet no increased report of complications. For sheer completeness, we presented data of patients that experienced bowel function prior to discharge.

Mechanical bowel preparation has not only been shown to be unnecessary, but rather increases the risk of anastomotic dehiscence and spillage, consequently leading to higher infectious complications rate.[17] Spillage occurs 3× more frequently for liquid bowel content than for semi-solid contents and very rarely in solid bowel content. Moreover, in 1 study, patients receiving mechanical bowel preparation had increased incidence of bowel content

spillage when compared with patients who did not: 17% versus 12%, respectively.[18]

In our study, we supported the notion of early removal of the NG tube. A survey showed that 66% and 41% of European and United States surgeons, respectively, leave the NG tube in situ after surgery. However, there is no evidence supporting its use because it may be associated with increased complications as well as patient discomfort.[19] We have reason to believe that early removal of the NG tube induces early feeding, which has multiple advantages. Early feeding has been shown to maintain absorptive integrity of the bowel, to increase collagen content in the anastomosis, to allow positive nitrogen balance with reduction of insulin resistance, to favor wound healing, and to reduce risk of sepsis.[20]

Fluid maintenance is strictly followed in our protocol. To prevent any symptoms of fluid overload, we allowed no more than 1 L of crystalloids intraoperatively. Further fluids were administered as needed, based on the patients' hemodynamic status. Those were rarely required. Tight fluid control may prevent cardiopulmonary complications such as atelectasis, dyspnea, and oxygenation defects within the lungs due to fluid accumulation. Fluid overload has been associated with cardiopulmonary complications, decreased muscular oxygen tension, and a delay in recovery of gastrointestinal function.[21] Our fluid maintenance protocol was feasible, and easily followed by the anesthesia and the departmental staff.

Anesthesia and pain control has a significant impact on postoperative complications and patient overall recovery. Our protocol excluded the use of epidural catheters due to increased risk of urinary retention, ultimately postponing discharge from the hospital. This decreased risk of urinary retention allows for early removal of the urinary catheter, which is critical for early ambulation. Ambulation, in turn, is key for accelerating the recovery period for patients because it induces a stimulant for return of normal gastrointestinal function.[22] In addition, early ambulation is directly correlated to a decrease in risk of pulmonary and thromboembolic complications as well as preservation of muscle mass and function.

CONCLUSIONS

In this prospective cohort study, despite the lack of a control group, we believe that our results illustrate reliable evidence that the FT rehabilitation care plan for laparoscopic colorectal surgery results in short hospital stay as well as low morbidity and mortality rates. Herein, we have shown comparable outcomes related to our FT protocol as compared to traditional laparoscopic colorectal resection outcomes. A standard protocol for FT rehabilitation has yet to be developed; however, we believe our protocol has shown to be successful in accelerating patient recovery, and, importantly, it is easily applicable and accessible to the average surgeon. Despite the amount of research needed to perfect the management of FT rehabilitation, there exists strong clinical evidence that it indeed accelerates patient recovery with decreased incidence of morbidities and mortality.

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