Laparoscopic Colon Resections With Discharge Less Than 24 Hours

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ABSTRACT

Background and Objectives: A short hospital stay is one of the main advantages of laparoscopic surgery. Previous studies have shown that after a multimodal fast-track process, the hospital length of stay can be shortened to between 2 and 5 days. The objective of this review is to show that the hospital length of stay can, in some cases, be reduced to <24 hours.

Methods: This study retrospectively reviews a surgeon's experience with laparoscopic surgery over a 12-month period. Seven patients were discharged home within 24 hours after minimally invasive laparoscopic surgical treatment, following a modified fast-track protocol that was adopted for perioperative care.

Results: Of the 7 patients, 4 received laparoscopic right hemicolectomy for malignant disease and 3 underwent sigmoid colectomies for recurrent diverticulitis. The mean hospital stay was 21 hours, 47 minutes; the mean volume of intraoperative fluid (lactated Ringer) was 1850 mL; the mean surgical blood loss was only 74.3 mL; the mean duration of surgery was 118 minutes; and the patients were ambulated and fed a liquid diet after recovery from anesthesia. The reviewed patients had functional gastrointestinal tracts and were agreeable to the timing of discharge. On the follow-up visit, they showed no adverse consequences such as bleeding, infection, or anastomotic leak.

Conclusion: Laparoscopic colon surgery that incorporated multimodal perioperative care allowed patients to be discharged within the first 24 hours. Careful postoperative outpatient follow-up is important in monitoring complications such as anastomotic leak, which may not present until postoperative day 5.

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INTRODUCTION

Because the health care industry is facing a cost crisis, it is incumbent upon every health care professional to provide optimal-quality, safe, and patient-centered care. A modified approach to the fast-track procedure was adopted to enable a reduction in length of stay (LOS) that simultaneously provided an overall desirable outcome.

Currently, the mean hospital LOS after a colectomy is 7 to 10 days in the United States and >10 days in the United Kingdom, France, Germany, Italy, and Spain.[1–3] However, a trend is emerging toward a significantly shorter LOS after laparoscopic colectomies using a fast-track procedure for perioperative care, leading to better postoperative outcomes such as a shorter length of incision, minimal blood loss during surgery, a decrease in the overall mortality rate, a decreased wound infection rate, less pain, earlier ambulation, earlier bowel movements, earlier alimentation, and shorter hospital stays.[4,5] These results apply not only to young patients but also to the elderly population commonly affected by comorbidities related to cardiovascular and pulmonary diseases.[6]

More than a decade ago, Kehlet and Wilmore[7] developed a multimodal rehabilitation method of mitigating postoperative complications.[8] This has improved patient outcomes while significantly reducing the hospital LOS. Their method targets the harmful effects that the surgical stress response has on organ function. Therefore, by reducing this stress response, the associated complications were also reduced.[9] The essential elements of the multimodal rehabilitation, or fast-tracking, procedure are as follows: epidural anesthesia, enforced early mobilization, early enteral nutrition on the day of surgery, restricted intravenous (IV) fluids, and aggressive postoperative nausea and vomiting prophylaxis.[7,10] This multimodal procedure results in an average 2- to 5-day LOS.[1]

Although the 2- to 5-day LOS afforded by fast tracking pushes the boundaries of conventional colectomy proce-

dures, there is reason to believe that these boundaries can be safely pushed even further. Discharging elderly patients as early as 48 hours after either laparoscopic or open surgery has shown no increased risk of complications.[11]

This retrospective review was conducted to observe the postoperative outcomes in 7 patients, treated by a surgeon with 20 years' experience in laparoscopic colon surgery, who were discharged within 24 hours after surgery by use of a modified fast-track perioperative procedure in a closely monitored environment allowing immediate access to skilled care on short notice.

METHODS

Fifty-five patients were admitted for colonic resections over a period of 12 months, of whom 7 were the subject of this retrospective study. The following data were collected from the medical records of the 7 patients: age, sex, body mass index, American Society of Anesthesiologists (ASA) Physical Status Classification System score, minimal pain score, indications for resection, procedure performed, length of resection, operating time, intraoperative fluid administration, intraoperative blood loss, postoperative diagnosis, pathologic findings, stage of cancer, lymph nodes removed, time to ambulation, time to bowel function, LOS, complications, and death. The protocol adopted for the perioperative care is shown in **Table 1**.

Table 1.
Protocol for Fast-Track Perioperative Plan of Care

Preoperative

    Patient counseling: perioperative care, surgery, and LOS

    Bowel preparation: 1 gallon of polyethylene glycol electrolyte solution 1 day before operation

    IV antibiotics <1 hour before operation

Intraoperative

    Laparoscopic surgery

    No use of abdominal drains

    No use of nasogastric tubes

    No use of epidural anesthesia

Postoperative

    Immediate postoperative liquid diet

    Early ambulation

    Prompt removal of bladder catheter

    Pain management: 10 mg of ketorolac by mouth

    Follow-up at 1 week advised

Preoperative

The bowel preparation involved use of 1 gallon of polyethylene glycol electrolyte solution 1 day before surgery in all patients. IV antibiotics were administered in all patients 30 minutes before surgery; in 5 patients, 1 g of ertapenem sodium intravenous piggy bag (IVPB) was used, and in 2 patients, 500 mg of metronidazole IVPB and 400 mg of ciprofloxacin IVPB were used.

Intraoperative

The laparoscopic technique was applied in all the presented patients in this review. There was no use of any abdominal drains, nasogastric tubes, prokinetic agents, opioid antagonists, or epidural anesthesia. The patients were placed in a supine position, and general endotracheal anesthesia was introduced. The abdomen was prepared and draped in a routine sterile fashion, perioperative antibiotics were given, and a sequential compression device for deep venous thrombosis and pulmonary embolus prophylaxis was applied. Access to the peritoneal cavity was made initially through the transumbilical incision with the use of a Veress needle. Once the pneumoperitoneum was established with the insufflation of carbon dioxide up to 15 mm Hg, the trocars were placed in the standard locations. Intra-abdominal visualization was obtained with a 5-mm, 30° telescope.

For the right hemicolectomy, the initial 12-mm trocar was always placed in the umbilical area, a 5-mm trocar was placed in the suprapubic area, and the second 5-mm trocar was placed cephalad to the 12-mm trocar. Standard, straight instrumentation was used to grasp the tissue when the mobilization of the intestines was performed with an ultrasonic shear scalpel. The dissection was carried out methodically, starting with the creation of a "window" through the mesentery of the proximal transverse colon laterally to the second portion of the duodenum. Further dissection was carried out on the medial aspect of the ascending colon toward the ileocolic blood vessels that underwent skeletonization and were divided close to the mesenteric root by the application of the harmonic scalpel between the hemoclips placed individually on the artery and vein. The hepatic flexure was taken down with the harmonic scalpel, and the same was performed with attachments to the lateral pelvic wall; then, the entire right colon and the terminal ileum were mobilized medially by dividing the retroperitoneal attachments along the line of Toldt and by cutting the hepatocolic ligament. The 2 epigastric incisions (i.e., the umbilical and supraumbilical incisions) were connected, and the fascia was transected

between them to form mini-laparotomy incisions to perform the extraperitoneal part of the procedure. A small Alexis wound retractor (Applied Medical, Rancho Santa Margarita, USA) was used to protect the incision. The bowel was pulled toward the incision. With a completely mobilized right colon, the extracorporeal part of the procedure was performed. The appropriate segment of the bowel containing pathologic changes was identified, excised, and sent for pathologic examination. The integrity of the intestine was reconstructed by a side-to-side staple anastomosis. This was created by use of 1 load of a linear cutter to form a common channel and 1 load of a linear stapler to close the common opening. The anastomotic sites were checked for any potential leaks. The fascia of the incision was closed with running No. 1 polydioxanone suture. The subcuticular tissue was closed with No. 3–0 polyglactin 910 suture, and the dermis was closed with No. 4–0 poliglecaprone 25 suture. Cyanoacrylate was used as a dressing.

In the case of a sigmoid colectomy, a 12-mm trocar was placed in the suprapubic area. Later, the site was converted during the operation into a mini-laparotomy for specimen extraction and the extracorporeal part of the procedure. Four trocars were used for the operation. The colon mobilization was always initiated on the medial aspect of the sigmoid colon, and then the sigmoid blood vessels were transected with the use of an ultrasonic scalpel device between hemoclips. This same energy source was used to mobilize the sigmoid colon all the way to the splenic flexure and, if necessary, to take down the flexure to decrease tension on the anastomotic site. The distal sigmoid colon was transected with the use of an endo-stapler. The afferent part of the transected bowel was exteriorized through the small Pfannenstiel incision and transected at the marked level to remove the inflamed or grossly pathologic part of the specimen with diverticular disease. The anvil of the end-to-end anastomotic stapler was secured with a purse-string suture, and finally, the bowel was returned to the peritoneal cavity. Once the incision was closed, a laparoscopically assisted anastomosis was created. The main shaft of the end-to-end anastomotic stapler was placed through the rectum, and end-to-end anastomosis was finally completed. Insufflation of air was used to test the anastomosis for a leak.

Ureteral infrared stents were used to help visualize the ureter intraoperatively in 2 patients during the sigmoid resection. A colonic splenic flexure takedown was necessary in 2 other patients to decrease the tension on the anastomotic sites.

Postoperative

The patients was advised to adopt a liquid diet after surgery, early ambulation was initiated within 24 hours after surgery, the Foley catheter was removed the morning after surgery, and IV fluids were strategically restricted. Most of the patients had active bowel sounds and started passing flatus within the 24-hour period after surgery. Postoperative pain management was achieved with 10 mg of ketorolac by mouth in most of the patients. Laxatives, opioid antagonists, and prokinetic agents were not used during the postoperative period. All of the patients in the review were discharged home, by their choice, within 24 hours after their admission to the surgical ward. A follow-up visit was provided 1 week after discharge or earlier if necessary.

RESULTS

Of the 7 patients in the study, 4 were women and 3 were men. The indication for colon resection was cancer in 4 patients and diverticulitis in 3. The age range of the patients under review was 30 to 84 years, with the younger population in the diverticulitis group (mean age, 43 years) and the elderly population in the colonic carcinoma group (mean age, 79 years). The mean body mass index of the patients was 25.8 kg/m^2 (range, 19.9–33.9 kg/m^2). The ASA score was 1 (healthy) in 1 patient, 2 (mild systemic disease) in 4 patients, and 3 (severe systemic disease) in 2 patients. The details are provided in **Table 2**.

The review includes 4 patients with colonic carcinoma, of which 2 were cecal, 1 was sigmoid, and 1 was ascending colon. The mean number of lymph nodes dissected was 20 (range, 17–28); 2 patients had positive results for metastatic cancer. The pathologic tumor stage of the regional lymph nodes in the discussed patients ranged from T1N0 to T3N1. The details of cancer staging and lymph nodes removed in the colonic carcinoma patients are provided in **Table 3**.

The mean volume of intraoperative fluid (lactated Ringer) was 1850 mL (range, 1100–2550 mL). The mean surgical blood loss was 74.3 mL (range, 20–150 mL). The mean duration of surgery was 118 minutes (range, 65–158 minutes). The details are given in **Table 4**.

The mean hospital stay was 21 hours, 47 minutes (range, 18 hours, 31 minutes to 23 hours, 56 minutes). On a scale of 0 to 10, the mean maximal pain score reported during the hospital stay was 1.9 (range, 1–3). The time to ambulation was within 24 hours after surgery (range, 12–18 hours). The patients were placed on a full liquid diet immediately after surgery. All the patients showed active bowel sounds and had flatus before discharge. There

Table 2.
Demographic Details of Studied Patients

Case No.	Age, yr	Sex	BMI[a], kg/m^2	ASA Score	Preoperative Diagnosis
1	84	F	19.9	3	Cecal mass
2	69	M	33.9	3	Carcinoma of sigmoid colon
3	80	F	32.2	2	Carcinoma of ascending colon
4	81	F	24.2	2	Invasive cecal carcinoma
5	45	F	20.2	1	Recurrent diverticulitis of sigmoid colon
6	53	M	23	2	Diverticulitis and history of diverticular abscess
7	30	M	27	2	Recurrent diverticulitis

[a]BMI = body mass index; F = female; M = male.

Table 3.
Details of Patients With Colonic Carcinoma

Case No.	Site of Operation	Pathologic Report	Tumor Staging	No. of Lymph Nodes Removed, Positive/Total
1	Cecum	Right colon resection: moderately differentiated invasive adenocarcinoma of the cecum arising in the tubulovillous adenoma. The tumor extends deeply into but not entirely through the muscularis propria. Free margins.	T2N1	2/18
2	Sigmoid colon	Sigmoid colon, segmental resection: moderately differentiated colonic adenocarcinoma invades just through the muscularis propria, with a micrometastasis to 1 of the 17 mesenteric lymph nodes. The margins of resection are uninvolved.	T3N1	1/17
3	Ascending colon	Right colonic adenocarcinoma: high-grade carcinoma with poorly differentiated sessile fungating tumor; tumor invades the submucosa and the muscularis propria but does not break though the structure and does not involve pericolonic adipose tissue.	T2N0	0/18
4	Terminal ileum, cecum, ascending colon	Sessile tubular adenocarcinoma of the colon, conventional type, moderately differentiated. Four other separate small tubular adenomatous colonic polyps were identified in the specimen. Twenty-eight regional mesenteric lymph nodes were examined and found to be tumor free.	T1N0	0/28

were no postoperative complications or deaths among the studied group. By use of the modified enhanced protocol, successful outcomes were observed. The short LOS was exceedingly satisfactory for the operated patients. The details are given in **Table 5**.

DISCUSSION

The presented cases support the application of the multimodal approach. This retrospective study found that laparoscopic colectomies can be performed with an LOS of <24 hours at no additional risk to the patient other than what is associated with standard and modified fast-track procedures. The mean LOS in our study was 21 hours, 47 minutes (range, 18 hours, 31 minutes to 23 hours, 56 minutes).

The described approach benefits patients in at least 2 ways. First, a multimodal approach has shown that restoring natural bodily functions as soon as possible mitigates

Table 4.
Intraoperative Details of Patients

Case No.	IV Abx[a]	Procedure	Length of Resection	LR[a], mL	EBL[a], mL	OT[a], min
1	Metronidazole, 500 mg IVPB Ciprofloxacin, 400 mg IVPB	Laparoscopic right partial colectomy	Right colon, 12 cm length of ascending colon and cecum with no appendix and with 7 cm of terminal ileum	1300	20	65
2	Ertapenem, 1 g IVPB	Laparoscopic sigmoid colectomy	Sigmoid colon, 14 cm	2200	100	158
3	Metronidazole, 500 mg IVPB Ciprofloxacin, 400 mg IVPB	Laparoscopic right hemicolectomy	Terminal ileum, 5 cm; resected colon measures 17 cm	1100	20	90
4	Ertapenem, 1 g IVPB	Laparoscopic right hemicolectomy including terminal ileum, cecum, and ascending colon	Colonic portion of specimen measures 15 cm; terminal ileum, 6 cm	1700	20	86
5	Ertapenem, 1 g IVPB	(1) Laparoscopic sigmoid colectomy with primary anastomosis (2) Cystoscopy for preprocedure bilateral stent placement	Sigmoid colon, 14.5 cm in length × 3.5 cm in average diameter	2100	50	145
6	Ertapenem, 1 g IVPB	(1) Laparoscopic sigmoid colectomy with primary end-to-end stapled anastomosis (2) Laparoscopic splenic flexure takedown	Sigmoid colon, 20 cm, surrounded by moderate amount of pericolic fat	2550	150	143
7	Ertapenem, 1 g IVPB	(1) Laparoscopic sigmoid colectomy with mobilization of splenic flexure (2) Cystoscopy for preprocedure bilateral stent placement	Sigmoid colon, 20 cm; length of colon circumference, 5 cm; and wall thickness, 0.8 cm, with attached mesentery that extends 6 cm from wall	2000	50	135

[a]EBL = estimated blood loss; IV Abx = intravenous antibiotics; LR = lactated Ringer; OT = operating time.

morbidity. At least 3 of the essential elements of fast tracking were used: enforced early mobilization, early feeding, and restricted IV fluids. The mean surgical blood loss was 58.57 mL (range, 20–150 mL), and the mean duration of surgery was 118 minutes (range, 65–158 minutes) as compared with the published literature results of 51 mL and 142 minutes, respectively.[12] The mean maximal pain score during the stay in our study was 1.9 (range, 1–3) compared with 4.3 in published studies.[12] Second,

with each day of reduced LOS, perioperative cost is reduced and the available resources of a hospital are increased. Although a laparoscopy is more expensive than an open colectomy, the laparoscopic method is preferable because of favorable outcomes and patient satisfaction, and generally, a shorter LOS mitigates the total cost. Indisputable among the aforementioned benefits of laparoscopic surgery are cosmesis and minimal intra-abdominal adhesion. The laparoscopic surgery was successful with

Table 5.
Postoperative Details of All Patients

Case No.	LOS	Pain Score During Stay	Time to Ambulation, h	Time to Bowel Function, h	Complications
1	21 h, 58 min	1 of 10	<18	<18	None
2	23 h, 17 min	3 of 10	<18	<18	None
3	20 h, 4 min	2 of 10	<14	<14	None
4	22 h, 55 min	2 of 10	<14	<12	None
5	18 h, 31 min	2 of 10	<15	<15	None
6	21 h, 54 min	1 of 10	<15	<18	None
7	23 h, 56 min	2 of 10	<12	<21	None

short postoperative stays even among the patients with conditions of a higher degree of complexity, such as diverticulitis, and extended colectomy, even with the takedown of the splenic flexure.

CONCLUSION

The LOS for laparoscopic colectomies can be reduced to <24 hours. This result was observed for right as well as left colectomies and even with splenic flexure takedown when necessary. The benefit of the multimodal approach and laparoscopic technique may be synergistic, allowing a quick return of gastrointestinal function. Advanced age, tumor stage, and ASA score were markers represented in the successfully treated groups. The high acuity values, along with early discharge, can decrease the risks related to prolonged hospitalization, bringing hope for a fast recovery in a carefully monitored environment even to the fragile elderly patient population.

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