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# Outcomes of Discharge after Elective Laparoscopic Colorectal Surgery with Transversus Abdominis Plane Blocks and Enhanced Recovery Pathway

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- BACKGROUND:** Enhanced recovery pathways (ERP) have been well shown to permit early recovery and discharge. The addition of a transversus abdominis plane (TAP) block to a standard pathway may improve these outcomes. We evaluated the addition of a TAP block to an established ERP.
- STUDY DESIGN:** One hundred consecutive patients underwent elective laparoscopic colectomy by a single surgeon. A laparoscopic-guided TAP block was administered at the end of the procedure. Patients followed an established ERP that included overnight intravenous patient-controlled analgesia pump, diet and oral analgesia on postoperative day 1, and standardized discharge criteria.
- RESULTS:** The mean age was 60.5 years (range 15 to 92 years), 62 patients were female, and mean body mass index was 28.4 kg/m<sup>2</sup> (range 18 to 46 kg/m<sup>2</sup>). Median hospital stay was 2 days and mean length of stay was 2.9 days. Patients were grouped and analyzed by the day of discharge. Sixty-two percent of patients were discharged within 48 hours (27 on day 1; 35 on day 2). There was no mortality. Only 1 patient discharged within 48 hours of surgery developed a complication. Two patients were readmitted, both of whom were discharged more than 48 hours after surgery.
- CONCLUSIONS:** Transversus abdominis plane blocks with an ERP contribute to a short length of stay after laparoscopic colectomy, without increasing complication or readmission rates. (J Am Coll Surg 2013;217:503–506. © 2013 by the American College of Surgeons)
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Implementation of enhanced recovery pathways (ERP) in colorectal surgery has been well demonstrated to enhance postoperative recovery.<sup>1</sup> Studies have shown a shorter median hospital stay and earlier return of bowel function<sup>2</sup> along with direct cost savings with the use of ERP.<sup>3</sup> In 2 different series of 1,000 consecutive laparoscopic procedures, we reported lengths of stay of 3.7 and 4 days.<sup>4</sup> The addition of a transversus abdominis plane block (TAP) to our standard ERP has further decreased length of stay without significantly increasing readmissions or postoperative complications.

An important component of ERPs is the optimization of pain control with multimodal analgesia. Most pathways include opioid-sparing regimens, which include

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a combination of nonsteroidal anti-inflammatory drugs (NSAIDs), acetaminophen, cyclooxygenase-2 (COX-2) inhibitors, and local anesthetics.<sup>5,6</sup> Another nonopioid modality used in our ERPs is laparoscopic-guided TAP blocks, which provide regional analgesia by blocking the neurovascular plane between the internal oblique and transversus abdominis muscles of the anterior abdominal wall.<sup>7</sup> A prospective randomized controlled trial by McDonnell and colleagues<sup>8</sup> showed the analgesic efficacy of TAP blocks in the first 24 hours after abdominal surgery. A preliminary study of our first 35 patients using laparoscopic-guided TAP blocks in colorectal surgery demonstrated a mean length of stay of 2.0 days along with a decrease in total narcotic use.<sup>9</sup> In this consecutive series of 100 patients, we further evaluated surgeon-administered TAP blocks in the setting of an established ERP in laparoscopic colorectal surgery, to assess the technique over a longer time period.

## METHODS

A total of 100 consecutive patients underwent elective colorectal surgery by an experienced laparoscopic colorectal surgeon during a 12-month period. A TAP block

**Abbreviations and Acronyms**

ERP = enhanced recovery pathway  
 POD = postoperative day  
 TAP = transversus abdominis plane

was performed at the conclusion of the laparoscopic procedure by the surgeon. Using a blunt-tipped Braun Stimuplex A needle with 0.5 mg/kg solution of 0.5% Marcaine (Hospira), the TAP block was administered midway between the iliac crest and costal margin in the midaxillary line. A double “pop” method, as described by O’Donnell and associates,<sup>10</sup> was used, with the needle passing first through the skin and then continuing until 2 distinct “pops” were felt. The blunt tipped needle allows for a loss of resistance or “pop” as the needle passes through each fascial layer. The first “pop” indicated the needle was passing through the external oblique and internal oblique. With the second “pop,” the needle was between the internal oblique and transversus abdominis. If injecting in the correct plane, a smooth raised area, the injectate covered by transversus abdominis, was visualized internally by the laparoscope. The laparoscope allowed for visualization of the needle tip to ensure that it did not penetrate the peritoneum. Furthermore, a preperitoneal injection would be seen as a blister of fluid instead of a gentle bulge. This procedure was performed at a second injection site 2 cm inferior to the first injection to spread the injectate along the abdominal wall to

ensure adequate anesthesia. The TAP block was then performed on the opposite side for a bilateral block. During each of the 4 injections, approximately two-thirds of the solution was injected before withdrawing the needle 1 cm and injecting the remaining solution. At the conclusion of the procedure, the needle was removed and the patient was extubated.

Outcomes were recorded prospectively in an institutional review board-approved database. Patients were managed by using previously published standardized postoperative care protocols and discharge criteria, which are outlined in Table 1. Patients were started on intravenous patient controlled analgesia systems until the morning after surgery. Intravenous acetaminophen and additional nonsteroidal analgesia were also used. No epidurals were used during or after surgery. Orogastric tubes were placed after induction of anesthesia but were removed before extubation. As per the standardized ERP, patients were given noncarbonated clear liquids and encouraged to walk on the evening of surgery. On postoperative day (POD) 1, patients were advanced to a soft diet and patient controlled analgesia systems were discontinued as oral analgesia was initiated. Nonsteroidal analgesia and acetaminophen were continued. Foley catheters were removed on POD 1.

Patients were discharged when the following criteria were met: passed flatus or stool, tolerated at least 3 meals (clear liquids on evening of surgery, soft diet for breakfast and lunch on POD 1), pain controlled with oral analgesia,

**Table 1.** Standardized Enhanced Recovery Pathways: Perioperative Care Protocols for Laparoscopic Colorectal Surgical Patients

Preoperative	Postoperative	Discharge criteria
Voltaren 100 mg oral evening before surgery	Clear liquids as tolerated after surgery	Passage of flatus or stool
Oral bowel preparation evening before surgery for left-sided cases, proctectomies, those requiring diverting ostomy or intraoperative colonoscopy	Ambulate 5 times daily	Tolerated 3 meals: clear liquids evening after surgery and soft diet on POD 1 for breakfast and lunch (at least 2 meals)
Gabapentin 300 mg oral tid starting day before surgery	Incentive spirometry hourly during waking hours	No nausea or vomiting
Heparin prophylaxis	Intravenous (IV) PCA systems until morning after surgery along with IV or oral acetaminophen/toradol	Pain controlled with oral analgesia
Compression stockings	POD 1- PCA discontinued and oral analgesia started; oral acetaminophen and IV toradol continued; IV narcotics for breakthrough pain failing oral analgesia	Stable vital signs
Antibiotic prophylaxis at induction of anesthesia	POD 1- Foley catheter removed	Ambulate independently
Orogastric tubes after induction of anesthesia (removed before extubation)	Gabapentin continued until discharge	Adequate home support

PCA, patient-controlled analgesia; POD, postoperative day.

**Table 2.** Demographic Data of 100 Consecutive Patients by Postoperative Day of Discharge

Demographic	All	POD 1	POD 2	POD 3	POD 4+
n	100	27	35	19	19
Mean age, y	60.5	57.9	58.4	66.1	62.7
Mean BMI, kg/m <sup>2</sup>	28.4	28.5	27.5	27.7	30.5
Male:female, n	38:62	12:15	12:23	5:14	9:10
Cancer/polyp, n	65	21	22	11	11
Inflammatory, n	31	4	13	6	8
Other, n	4	2	0	2	0
Right/ileocolic, n	35	15	9	5	6
Left/sigmoid, n	15	2	9	2	2
LAR/proctectomy ± IPAA, n	34	5	13	8	8
Total, n	4	0	2	2	0
Other, n	12	5	2	2	3

BMI, body mass index; IPAA, ileal pouch anal anastomosis; LAR, low anterior resection; POD, postoperative day.

with stable vital signs. Patients received a phone call within 48 hours of discharge to answer any postoperative questions.

The outcomes were recorded prospectively in an institutional review board-approved database. Results were presented as mean and standard deviation for parametric variables and median and range for nonparametric continuous variables. For matched groups, the paired *t*-test was used to compare the significance of difference between means of parametric data. The significance level for all analyses was  $p < 0.05$ .

## RESULTS

A total of 100 patients were evaluated during a 12-month period (Table 2). In this consecutive study, 2 patients were excluded: 1 for planned postoperative intubation for severe COPD, and a second for a planned early reoperation for high ostomy output from radiation enteritis. The mean age was 60.5 years (range 15 to 92 years) and 62 patients were female. Sixty-five patients had a preoperative diagnosis of colorectal cancer or polyp.

**Table 3.** Clinical Outcomes for 100 Consecutive Patients Undergoing Laparoscopic Colorectal Procedures with Transversus Abdominis Plane Blocks by Postoperative Day

Outcome	All	POD 1	POD 2	POD 3	POD 4+
n	100	27	35	19	19
Mean hospital stay, d	2.9	1.0	2.0	3.0	7.0
Median stay, d	2	1	2	3	5
Patients with complications, n	8	0	1	1	6
Ileus/SBO, n	3	0	0	0	3
Anastomotic/gastrointestinal bleed, n	4	0	1	0	3
UTI, n	1	0	0	1	0
Readmissions, n	2	0	0	1	1

POD, postoperative day; SBO, small bowel obstruction; UTI, urinary tract infection.

The mean body mass index was 28.4 kg/m<sup>2</sup> (range 18 to 46 kg/m<sup>2</sup>). Thirty-one patients had inflammatory pathology, such as diverticulitis, ulcerative colitis, or Crohn's disease. Four patients had other pathology, including volvulus, recurrent obstruction, or adhesions. Operations performed included right colectomy/ileocolic resection (n = 35), left/sigmoid colectomy (n = 15), low pelvic resection/proctectomy ± ileal pouch anal anastomosis (n = 34), total colectomy (n = 4), and others (n = 12), including lysis of adhesions, ileostomy, and colostomy.

Patients were grouped and analyzed by POD of discharge (Table 2). Sixty-two patients were discharged within 48 hours of surgery (27 on POD 1; 35 on POD 2), and 19 more patients were discharged on POD 3. The remaining patients were discharged on or after POD 4.

In this consecutive series, there was no operative mortality. The overall median hospital stay was 2 days and the mean length of stay was 2.9 days (Table 3). Eight patients had complications: 1 patient on POD 2, another on POD 3, and the remaining 6 occurred after POD 4. Complications included ileus or small bowel obstruction (3 patients); anastomotic or gastrointestinal bleed (4 patients), and urinary tract infection (1 patient). There were 2 readmissions in this patient population; both patients were discharged after POD 3.

## DISCUSSION

With rising health care costs, many strategies have been used to control expenditures without affecting clinical outcomes. In colorectal surgery, ERPs have been used as a method of decreasing length of stay while improving postoperative outcomes. Furthermore, studies suggest that laparoscopy in conjunction with ERP has resulted in shorter length of stay.<sup>11</sup> In this study, we have added TAP blocks to an established ERP in laparoscopic colorectal surgery.

As a continuation of a series of studies evaluating TAP blocks with an ERP, this study examined the outcomes after laparoscopic colectomy in cases discharged within 48 hours by a single experienced surgeon. During the first 48 hours after elective surgery, this study had no readmissions and 1 complication, an early staple-line anastomotic bleed. As illustrated in Table 3, most of the complications occurred in patients discharged after POD 4. Similar to previous studies, our study showed that earlier discharge does not increase readmissions or complications.<sup>12</sup>

## CONCLUSIONS

This study demonstrated that the addition of a TAP block to an established ERP can reproducibly reduce length of stay to less than 3 days. In conjunction with a well established ERP, TAP blocks are a safe and cost effective adjunct for patients undergoing laparoscopic colorectal surgery. A prospective randomized controlled trial is currently being performed to further evaluate the benefits of TAP blocks to ERP in colorectal surgery.

## Author Contributions

Study conception and design: Favuzza, Delaney

Acquisition of data: Favuzza, Delaney

Analysis and interpretation of data: Favuzza, Delaney

Drafting of manuscript: Favuzza, Delaney

Critical revision: Favuzza, Delaney

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