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Predicting delayed discharge in a multimodal Enhanced Recovery Pathway

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ABSTRACT

Background: Despite advances with Enhanced Recovery Pathways(ERP), some patients have unexpected prolonged lengths of stay(LOS). Our goal was to identify the patient and procedural variables associated with delayed discharge despite an established ERP.

Methods: A divisional database was reviewed for minimally invasive colorectal resections with a multimodal ERP(8/1/13–7/31/15). Patients were stratified into ERP success or failure based on length of stay ≥5 days. Logistic regression modeling identified variables predictive of ERP failure.

Results: 274 patients were included- 229 successes and 45 failures. Groups were similar in demographics. Failures had higher rates of preoperative anxiety($p = 0.0352$), chronic pain($p = 0.0040$), prior abdominal surgery($p = 0.0313$), and chemoradiation($p = 0.0301$). Intraoperatively, failures had higher conversion rates(13.3% vs. 1.7%, $p = 0.0002$), transfusions($p = 0.0032$), and longer operative times(219.8 vs. 183.5min,$p = 0.0099$). Total costs for failures were higher than successes($22,127 vs. $13,030,$p = 0.0182$). Variables independently associated with failure were anxiety(OR 2.28, $p = 0.0389$), chronic pain(OR 10.03, $p = 0.0045$), and intraoperative conversion(OR 8.02, $p = 0.0043$).

Conclusions: Identifiable factors are associated with delayed discharge in colorectal surgery. By prospectively preparing for patient factors and changing practice to address procedural factors and ERP adherence, postoperative outcomes could be improved.

1. Introduction

Since their introduction, Enhanced Recovery Pathways (ERP) or fast-track protocols have improved patient outcomes in colorectal surgery.[3–5] These multimodal pathways improve outcomes by standardizing care, which reduces complications and hospital length of stay (LOS).[3–10] In addition to improving clinical outcomes, standardization of health care processes with ERP have been found to decrease cost and healthcare utilization.[11–14] Reducing LOS is a consistent outcome in all ERP, and thus a measure of ERP success in uncomplicated patients. The specific elements in ERPs continue to develop, with multimodal pain management further enhancing recovery.[15] Despite these advances, some patients continue to have unexpected prolonged LOS. This issue warrants attention, as LOS is an increasingly important measure of surgical quality and efficiency.[16,17] Prolonged LOS is associated with increased overall costs and resource consumption, mainly from higher rates of postoperative complications and readmissions.[18–20]

Identifying which factors are associated with prolonged LOS in elective laparoscopic colorectal surgery could help resource allocation, postoperative support, and the informed consent process, as well as reducing costs.[21] A few studies have evaluated characteristics associated with prolonged LOS in surgery, finding impaired functional status, advanced age, major comorbidities, and lower socioeconomic status made patients more susceptible.[19,22,23] These studies are based on large administrative databases, and lack patient-level details or specifics on enhanced recovery protocol use. Studies have also shown deviation and lack of compliance with an ERP can delay discharge following laparoscopic colorectal surgery.[24,25] However, the demographic, procedural, and perioperative variables associated with ERP failure and prolonged LOS have not

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been clearly defined or used to enact process change in minimally invasive colorectal surgery.

The goal of this project was to identify the patient and procedural variables associated with delayed discharge despite following an established ERP. The hypothesis was that preoperative demographic and intraoperative factors associated with longer LOS could be prospectively recognized and addressed to prepare for patients at risk of delayed discharge.

2. Method and materials

After obtaining Institutional Review Board approval, a prospectively-maintained departmental database was retrospectively reviewed to evaluate patients that underwent elective colorectal resection following a standardized multimodal ERP. Patients were stratified into ERP success and ERP based on hospital length of stay. Hospital length of stay was defined as the period from the day of surgery to the day of discharge. The mean length of stay in our division for minimally invasive elective colorectal surgery has been established as 3.5 days (SD 1.5)[1,2]; delayed discharge was defined as mean length of stay greater than or equal to 5 days (mean length of stay + 1 SD). For this analysis, "success" was simply defined as LOS <5 days, while failure LOS >5 days. Using LOS as a measure of success or failure is over simplistic, as failure is multifactorial and can be influenced by many clinical, system, and cultural factors, but is a starting point for this initial analysis. Patients were included in the analysis if the patient was 18 years of age or older, the colorectal resection was performed electively, through an abdominal approach, using a minimally invasive approach, and if complete medical records were available. The minimally invasive approaches used were multiport laparoscopy, single incision laparoscopy, robotic assisted laparoscopy, and hand-assisted laparoscopy. Cases converted intraoperatively were included for intention-to-treat analysis, with the indication for conversion recorded. Patients were excluded if they were less than 18 years of age, underwent an emergent procedure, had a procedure performed though an endoscopic, transanal minimally invasive, or anorectal approach, or had incomplete medical records. In cases of malignant disease, patients that had palliative resections were excluded, as their LOS expectations are different than patients undergoing elective curative resection. Patients that underwent reoperation during the index hospitalization were also excluded, as they had different variables impacting LOS.

The standardized ERP is comprised of pre-operative, intra-operative, and post-operative care parameters (Fig. 1). This includes preoperative patient education, alvimopan- a peripherally acting μ-opioid antagonist that selectively works in the gastrointestinal tract aimed to accelerate the time to upper and lower gastrointestinal recovery following bowel resection cases- from the pre-operative period through the hospital stay, transversus abdominus plane and local wound infiltration with long acting liposomal bupivacaine, limited intraoperative opioids, no routine postoperative nasogastric tubes or drains, pain management with scheduled a multimodal opioid-sparing regimen, early oral analgesia and diet, early ambulation, and defined discharge criteria.

Preoperative demographic, perioperative procedural, and post-operative outcome variables were analyzed. Data fields assessed included age, gender, body mass index (BMI), American Society of Anesthesiologists (ASA) score, individual comorbidities of diabetes mellitus requiring medical management, neuropathy, corticosteroid use within 30 days of operation, chronic opioid or anxiolytic medication use, patient reported anxiety, patient reported chronic pain or fibromyalgia, active smoker within 30 days of operation, regular alcohol use (defined as at least 1 drink more than 4 times per week), previous abdominal operation, preoperative chemo-radiation, the indication for operation, procedure performed, operative approach, operative time, intraoperative conversion, blood loss, intravenous fluids administered, stoma creation, perioperative transfusion, intraoperative and postoperative complications, postoperative day of return of bowel function, hospital length

Preoperative	Perioperative	Postoperative
• Patient counseling • Gabapentin 300mg PO 1-2 hours before surgery • Alvimopan 12mg PO 1-2 hours before surgery	• Post-induction, pre-incision TAP block • Limited opioids • Dexamethasone 8mg at induction • Tylenol 1g IV, Zofran 4mg IV, and Toradol 30mg IV 30 min prior to emergence • Local wound infiltration with EXPAREL	• Ambulate in hallways 4x/ day • Out of bed to chair for meals • Remove Foley at 6am on POD 1 (specify exceptions) • Diet- Clear liquids and Boost Breeze BID • POD 0: Normal Saline at 100cc/h • POD 1: D5 ½ NS + 20meq KCl at 80cc/h • Ofirmev IV 1g q6h scheduled x 24 hours, then Tylenol 650 mg PO q6h • Gabapentin 300mg PO q8h • Toradol 30mg IV q6h x 24 hours, then Celecoxib 400mg PO BID • Lovenox 40mq SQ daily • Zofran 4mg IV q6h prn • Oxycodone 5mg PO q6h prn breakthrough pain 4-6/10 • Oxycodone 10mg PO q6h prn breakthrough pain 6-8/10 • Dilaudid .2mg IV q2h prn breakthrough pain 8-10/10

Fig. 1. Multimodal Enhanced Recovery Pathway Sample.