

ORIGINAL ARTICLE

Right-sided colectomies are associated with slower bowel functional recovery compared to left-sided colectomies: a retrospective analysis within a fully implemented ERAS program

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ABSTRACT

Background: Recent studies have indicated variations in functional bowel recovery associated with right-sided and left-sided colectomies. The current evidence is inadequate to differentiate postoperative enhanced recovery after surgery (ERAS) guidelines based on the side of resection. This study aimed to compare bowel functional recovery between right-sided and left-sided colectomies within a fully implemented ERAS program.

Methods: Patients scheduled for elective colectomies due to benign and malignant conditions were managed according to ERAS protocols and registered into a prospective database between January 2017 and May 2020. The study compared demographic and surgical characteristics, functional recovery, and complications between right-sided and left-sided resections.

Results: This study compared 223 patients who underwent right-sided colectomy with 161 patients who underwent left-sided resections, focusing on baseline demographic and surgical characteristics. Left-sided colectomies exhibited significantly higher BMI, intraoperative blood loss, and duration of surgery. Both groups first experienced Flatus at a median of one postoperative day ($p < 0.001$). The median time to stool passage was two postoperative days for the right group and one postoperative day for the left group ($p < 0.001$). Of the patients studied, 37 (17%) developed postoperative ileus (POI) following right-sided colectomy, while 22 (14%) experienced POI after left-sided colectomy ($p = 0.5$). Compliance with the ERAS protocol was significantly greater in patients undergoing right-sided colectomy (70% right vs. 66% left, $p < 0.001$).

Conclusion: Right-sided colectomies are associated with slower bowel functional recovery and an increased incidence of POI. However, the cause of this finding remains undetermined and requires further investigation.

Keywords: ERAS, colorectal surgery, right hemicolectomy, left hemicolectomy, ERAS compliance, bowel functional recovery, clinical outcome, postoperative ileus, anastomotic leakage.

Introduction

Over the past 20 years, elective colorectal surgery has experienced two significant advancements: the introduction of the laparoscopic minimally invasive approach and the implementation of enhanced recovery after surgery (ERAS) programs. ERAS comprises a set of evidence-based guidelines aimed at minimizing surgical stress response and organ dysfunction while promoting rapid recovery [1]. ERAS programs are safe and cost-

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effective, associated with rapid postoperative recovery, reduced complication rate, and shortened length of hospital stay in patients undergoing colorectal surgery [2-5]. Adherence to the ERAS protocol correlates with improved oncological outcomes, leading to reduced complications and better prognosis [6]. The same ERAS protocol is currently implemented for right- and left-sided colectomies [1]. It is widely believed that recovery following right colectomy is more challenging and prolonged compared to left-sided resections. Multiple studies have documented the trend of slower recovery, which can be partially attributed to a higher incidence of postoperative ileus (POI) following right-sided resections [7,8]. POI occurs in 10%-17% of cases and is among the most prevalent complications following abdominal surgery [9,10]. Recent studies have identified right-sided colonic resection as a risk factor for the development of POI [7,10,11]. The mechanisms underlying the slower functional recovery and a higher rate of POI in the right compared to left-sided colectomies remain inadequately understood and yet undefined.

This study aimed to compare bowel functional recovery and clinical outcomes between right- and left-sided colectomies within a fully implemented ERAS program. Understanding the difference between right and left-sided colonic resections is essential for optimizing ERAS protocols and enhancing postoperative care for patients undergoing colorectal surgery. This study also aimed to identify the risk factors associated with POI within a fully implemented ERAS program.

Subjects and Methods

This retrospective single-center study was conducted at the General Surgery Department of the Martini General Hospital in Groningen, the Netherlands. Patient data were retrieved from a prospective ERAS database and analyzed anonymously to eliminate the need for patient-informed consent. The institutional medical ethics committee approved the study on March 3, 2020 (MEC-2020-027). The ERAS protocol implemented at Martini Hospital adhered to the published ERAS guidelines of 2013 and 2018 [1,12]. There was institutional consensus regarding a protocol deviation concerning oral bowel preparation. Patients undergoing right colectomy fully adhered to this protocol item due to variations in intestinal content consistency, while those undergoing left colectomy received oral bowel preparation. The study population included all patients who underwent elective colectomy managed according to the ERAS protocol between January 2017 and May 2020. Patients were categorized into groups based on the type of colectomy performed. Patients who underwent right hemicolectomy or ileocecal resection were classified into the right-sided colectomy group, whereas those who underwent left hemicolectomy or sigmoid resection were placed in the left-sided colectomy group. Patients who underwent transverse colectomy were categorized as either right or left hemicolectomy, depending on the

resection's proximity to the hepatic or splenic flexure. All surgical procedures were performed or supervised by board-certified surgeons. Six board-certified surgeons participated in the colonic resections included in the study. The standard surgical approach was laparoscopy, barring any contraindications. The technique used for anastomosis varied and included hand-sewing, stapling, or a combination of both methods.

The outcome measures included compliance with the ERAS protocol, assessed as a binary variable (yes/no) for each of the 24 items implemented. Functional recovery was evaluated by measuring the time to the first passage of flatus, the first passage of stool, and tolerance of solid food, all expressed in POD. POI was defined as the need for nasogastric tube insertion, indicated by persistent nausea, vomiting, and abdominal distension. This definition aligns with the systematic review by Vather et al. [9]. A post hoc analysis was conducted, including only patients who underwent elective laparoscopic surgeries, given the established association between open surgery and delayed functional recovery [10,13].

Clinical outcomes included postoperative complications, adverse events and length of hospital stay. Complications and adverse events were graded on a five-point severity scale using the Clavien-Dindo classification system [14]. The length of stay was calculated from the day of surgery to the day of hospital discharge.

Data analysis was performed using RStudio version 1.2.5042. Continuous variables were expressed as mean $\pm$ standard deviation or median (interquartile range), based on their distribution, and were analyzed using Student's *t*-test or the Mann-Whitney U test, respectively. Categorical variables were reported as absolute frequencies and percentages, with comparisons made using Chi-square or Fisher's exact test. All statistical tests were two-sided, with a *p*-value of less than 0.05 considered significant.

A listwise deletion approach was applied to retain only patients with complete sets of variables for the predefined risk factors and confounders of POI, resulting in the exclusion of 48 patients from the analysis. A backward stepwise elimination method was applied to the full model using an automated R function, with McFadden's pseudo-*R*-squared value of 0.231.

Results

Demographic and surgical characteristics

A total of 384 patients who underwent elective colonic resections from January 2017 to May 2020 were included in our ERAS database. Of the patients studied, 58% (*n* = 223) underwent right-sided colectomy, whereas 42% (*n* = 161) underwent left-sided resection. Patients necessitating a right-sided colectomy exhibited a higher likelihood of being older and female than those requiring a left-sided colectomy (Table 1). Patient demographic characteristics were

Table 1. Patient demographic and surgical characteristics stratified by the side of colectomy.

Characteristic	Total No.	Total N = 384	Right-sided colectomy No.	Right-sided colectomy N = 223	Left-sided colectomy No.	Left-sided colectomy N = 161	p-value
Patient characteristics							
Age		70 (63-75)		71 (65-77)		69 (60-73)	$p < 0.001^a$
Male gender		188 (49)		94 (42)		94 (58)	0.002
BMI kg/m ²	379	27 (24-30)	218	26 (24-29)	161	28 (25-30)	0.001^a
Smoking	382	53 (14)	221	30 (14)	161	23 (14)	0.96
Alcohol usage	383	147 (38)	222	80 (36)	161	67 (42)	0.32
ASA score							0.2
1-2		309 (80)		174 (78)		135 (84)	
3-4		75 (20)		49 (22)		26 (16)	
WHO performance score ≥ 2	378	6 (2)	219	4 (2)	159	2 (1)	$>.999^b$
Preoperatively malnourished		31 (8)		20 (9)		11 (7)	0.57
Comorbidities							
Diabetes mellitus	383	67 (17)	223	37 (17)	160	30 (19)	0.68
Severe heart disease		38 (10)		21 (9)		17 (11)	0.84
Severe pulmonary disease	383	28 (7)	222	13 (6)	161	15 (9)	0.28
Underlying disease							$p < 0.001^b$
Malignancy		310 (81)		189 (85)		121 (75)	
Diverticular disease		30 (8)		0 (0)		30 (19)	
Inflammatory bowel disease		12 (3)		11 (5)		1 (1)	
Functional disorder		4 (1)		0 (0)		4 (2)	
Other benign conditions including polyp(s)		28 (7)		23 (10)		5 (3)	
Distant metastasis	364	17 (5)	211	8 (4)	153	9 (6)	0.5
Surgical characteristics							
Surgical access							0.07
Laparoscopy		299 (78)		183 (82)		116 (72)	
Conversion in laparotomy		26 (7)		12 (5)		14 (9)	
Laparotomy		59 (15)		28 (13)		31 (19)	
Intraoperative blood loss (ml)	370	0 (0-100)	212	0 (0-50)	158	0 (0-200)	$p < 0.001^a$
Length of operation (min)	384	142 (105-177)	223	125 (97-157)	161	169 (130-209)	$p < 0.001^a$
New stoma		5 (1)		1 (0)		4 (2)	0.17 ^b
Systemic opioids given							0.88
No		16 (4)		10 (4)		6 (4)	
Yes, short-acting		73 (19)		41 (18)		32 (20)	
Yes, long-acting		295 (77)		172 (77)		123 (76)	
Regional anesthesia (thoracic TEA)	383	9 (2)	223	4 (2)	160	5 (3)	0.5 ^b
IV fluids > 3L at POD 0		2 (1)		2 (1)		0 (0)	0.51 ^b

Data are presented as frequency (%), median (interquartile range), or mean $\pm$ SD, unless otherwise indicated. ASA American Society of Anesthesiologists, WHO World Health Organization, POD postoperative day, TEA Thoracic epidural anesthesia. (a) Mann-Whitney U test, (b) Fisher exact test.
* significance p value (< 0.005).

comparable, except for body mass index (BMI), which was significantly higher in patients undergoing left-sided colectomy ($p = 0.001$). Patients undergoing right-sided colectomy exhibited a higher prevalence

of malignancy and benign conditions, such as polyps, than those requiring left-sided colectomy (85% vs. 75%, 10% vs. 3%, respectively). Furthermore, diverticular diseases were observed solely in patients

164 who had a left-sided colectomy, representing 19% of
165 the surgical indications in this cohort ($p < 0.001$).

166 The laparoscopic approach is increasingly preferred for
167 right colectomies, with a utilization rate of 82% compared
168 to 72% for left colectomies and a conversion rate of 5%
169 versus 9%, respectively ($p = 0.07$). Left-sided colectomies
170 required longer operative time (median of 169 vs. 125
171 minutes, $p < 0.001$) and caused more intraoperative
172 blood loss than in the right-sided colectomies (median of
173 0 for both, IQR 0-200 left vs. 0-50 right, $p < 0.001$), as
174 depicted in (Table 1).

175 **ERAS compliance**

176 Compliance with the ERAS-protocol was significantly
177 greater in patients undergoing right-sided colectomy,
178 with rates of 70% compared to 66% ($p < 0.001$).
179 Compliance with the components of the three phases of
180 ERAS is similar in both groups. The preoperative phase
181 demonstrated a compliance rate of nearly 100% in the
182 right-sided group, in contrast to 84% in the left-sided
183 group ($p < 0.001$). Figure 1 presents a comprehensive

overview of the individual components of the ERAS
protocol for right and left colectomies.

186 **Functional recovery**

187 The first passage of flatus happened in both groups after
188 a median of one postoperative day (IQR 1-2 and 1-1 for
189 right and left colectomy groups, respectively, $p < 0.001$).
190 The first passage of stool occurred on POD 2 (IQR
191 1-3) after right-sided colectomy and POD 1 (IQR 1-2)
192 after left-sided colectomy ($p < 0.001$). The occurrence
193 of POI was comparable in both groups. In a study of
194 patients undergoing colectomy, 37 patients (17%) who
195 had a right-sided procedure experienced POI, compared
196 to 22 individuals (14%) who underwent a left-sided
197 colectomy ($p = 0.5$). However, in a post hoc analysis of
198 only laparoscopic surgeries (Table 3), the POI rate was
199 significantly higher following right-sided resections,
200 affecting 27 patients (15%), compared to 8 patients (7%)
201 after left-sided colectomies ($p = 0.04$), as displayed in
202 (Table 2).

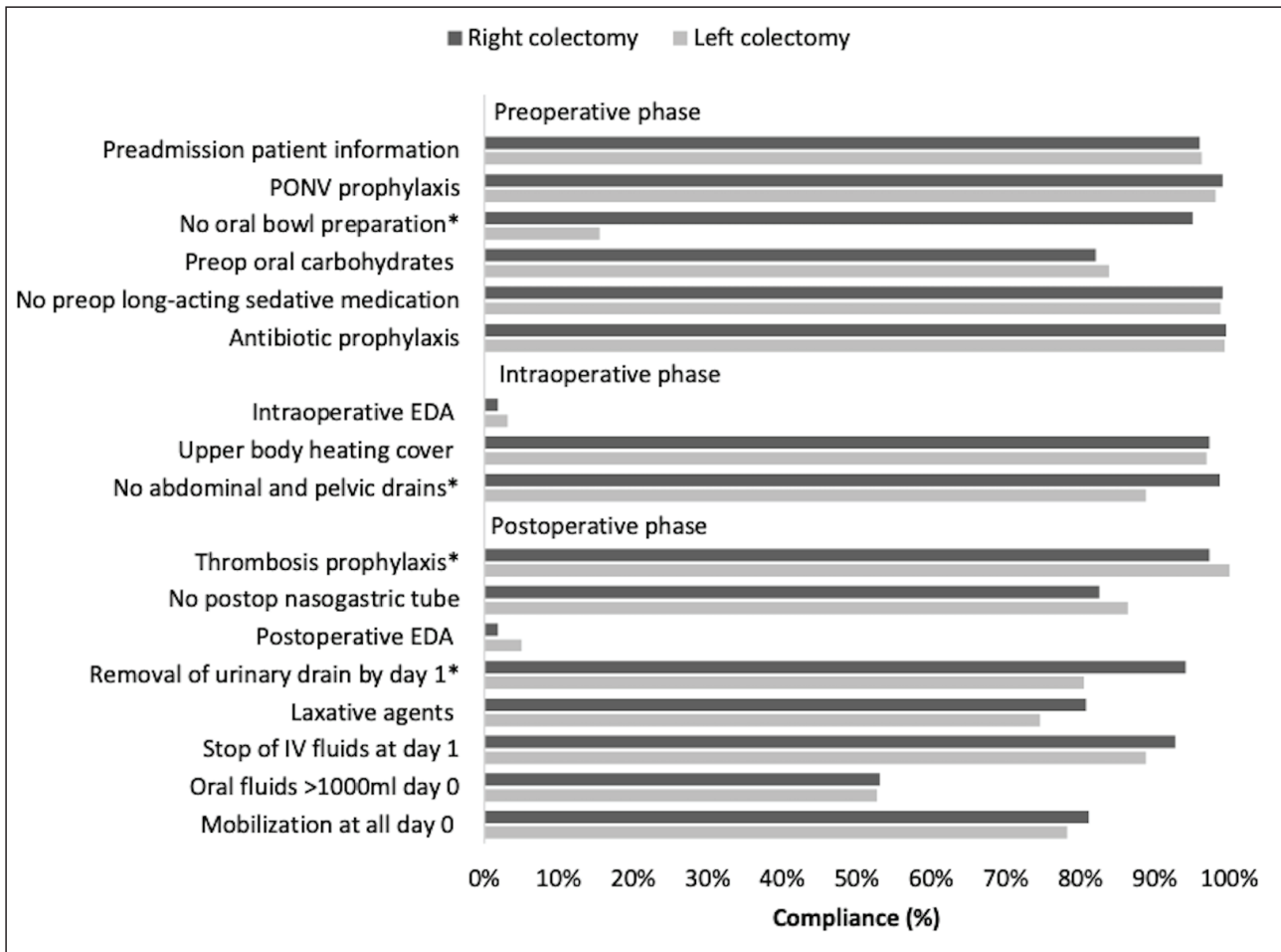


Figure 1. Detailed elements of the ERAS protocol for right and left-sided colectomies. *indicates statistical significance ($p < 0.05$). PONV postoperative nausea and vomiting. EDA epidural anesthesia.

Table 2. Functional recovery of patients undergoing right-sided versus left-sided colectomy.

	Total		Right-sided colectomy		Left-sided colectomy		p-value
	No.	N = 384	No.	N = 223	No.	N = 161	
Time to first passage of flatus (POD)	333	1 (1-2)	200	1 (1-2)	133	1 (1-1)	$p < 0.001^a$
Time to first passage of stool (POD)	311	2 (1-3)	171	2 (1-3)	140	1 (1-2)	$p < 0.001^a$
Time to tolerating solid food (POD)	377	0 (0-1)	218	0 (0-1)	159	0 (0-1)	0.48
POI	382	59 (15)	221	37 (17)	161	22 (14)	0.5

Data are presented as frequency (%), median (interquartile range), unless otherwise indicated. POD postoperative day, POI postoperative ileus. (a) Mann-Whitney U test.

* significance p value (< 0.005)

Table 3. Functional recovery of patients undergoing laparoscopic right versus left-sided colectomy (post hoc analysis).

	Total		Right colectomy		Left colectomy		p-value
	No.	N = 384	No.	N = 223	No.	N = 161	
Time to first passage of flatus (POD)	261	1 (1-2)	164	1 (1-2)	97	1 (1-1)	$p < 0.001^a$
Time to first passage of stool (POD)	237	2 (1-3)	139	2 (1-3)	98	1 (1-2)	$p < 0.001^a$
POI	298	35 (12)	182	27 (15)	116	8 (7)	0.04^b

Data are presented as frequency (%), median (interquartile range), unless otherwise indicated. POD postoperative day, POI postoperative ileus. (a) Mann-Whitney U test, (b) Fisher exact test.

* significance p value (< 0.005).

Table 3 presents the functional recovery outcomes of patients undergoing laparoscopic right versus left-sided colectomy. The median time to the first passage of the flatus was significantly shorter for patients undergoing left-sided colectomy compared to right-sided colectomy (1 [IQR: 1–1] vs. 1 [IQR: 1–2], $p < 0.001$). Similarly, the median time to first passage of stool was significantly reduced in the left colectomy group (1 [IQR: 1-2]) compared to the right colectomy group (2 [IQR: 1-3], $p < 0.001$). The incidence of POI was significantly lower in the left colectomy group (7%) compared to the right colectomy group (15%), with a p -value of 0.04. The findings indicate improved functional recovery outcomes, characterized by decreased gastrointestinal recovery times and lower POI, in patients who underwent laparoscopic left-sided colectomy.

Clinical outcomes

Ninety-eight patients who underwent a right-sided colectomy (44%) and 59 patients who underwent a left colectomy (37%) experienced complications or adverse events during their primary stay ($p = 0.18$). Anastomotic leakage was the most common indication for reoperations during the primary stay in both groups (42% and 36% for right and left groups, respectively). The median postoperative length of stay during the primary stay was 4 days (IQR 2-6) in the right and 3 days (IQR 2-6) in the left-sided colectomy group ($p = 0.5$) (Table 4).

Risk factors for developing POI

Table 5 shows that six variables were identified as independent risk factors for developing POI. ASA ≥ 3 was

associated with a lower risk of developing POI (OR 0.27, CI 0.08-0.76, $p = 0.02$). The WHO performance score of ≥ 2 (OR 16.33, CI 1.61-168.91, $p = 0.01$), laparotomy (OR 3.19, CI 1.29-7.65, $p = 0.01$), conversion (OR 3.99, CI 1.24-11.69, $p = 0.02$), anastomotic leakage (OR 58.22, CI 13.08-421.14, $p < 0.001$), and the absence of oral bowel preparation (OR 3.93, CI 1.73-10.01, $p = 0.002$) were identified as factors associated with an increased risk of developing POI.

Discussion

This study demonstrates a delayed functional recovery following right-sided colectomies and a significantly higher incidence of POI in laparoscopic right-sided resections. The institutionally determined deviation from the standard ERAS protocol for oral bowel preparation resulted in a notably higher overall compliance rate among patients undergoing right-sided colectomies. Consequently, a more conservative early postoperative feeding strategy is advised, and greater emphasis should be placed on optimizing the adjustable risk factors associated with POI in patients undergoing right-sided colectomies. The observed delay in functional recovery following right-sided colectomies in this study aligns with recent literature reports [7,8]. The study found that the rate of POI following right-sided and left-sided colectomies was 15%. The observed rate coincides with findings from other studies [10,15] and a systematic review conducted by Wolthuis et al. [16], which indicated a prevalence of POI in the general literature at closer to 10%. However, it is noteworthy that this latter study of Wolthuis et al. [16] had significant limitations, including the use of various definitions of ileus and reliance

Table 4. Clinical outcomes of patients undergoing right-sided versus left-sided colectomy.

	Total		Right-sided colectomy		Left-sided colectomy		p-value
	No.	N = 384	No.	N = 223	No.	N = 161	
Complications during primary stay		157 (41)		98 (44)		59 (37)	0.18
Reoperation(s)	157	30 (19)	98	19 (19)	59	11 (19)	>.999
Admitted to the IC	157	14 (9)	98	10 (10)	59	4 (7)	0.66
Indications for reoperations	30		19		11		0.3 ^b
Anastomotic leakage		12 (40)		8 (42)		4 (36)	
Wound rupture		7 (23)		5 (26)		0 (0)	
Hemorrhage		2 (7)		2 (11)		2 (18)	
Mechanical bowel obstruction		5 (17)		1 (5)		4 (36)	
Any other cause		4 (13)		3 (16)		1 (9)	
Length of hospital stay during primary admission, nights	383	4 (2-6)	222	4 (2-6)	161	3 (2-6)	0.5 ^a
Readmission(s)		32 (8)		16 (7)		16 (10)	0.44

Data are presented as frequency (%), median (interquartile range), unless otherwise indicated. IC intensive care postoperative day, WHO world health organization. (a) Mann-Whitney U test, (b) Fisher exact test.

* significant *p* value (< 0.005).

on low-quality data series. Furthermore, the rate of postoperative complications observed in this study was

POI in the right-sided group than in the left-sided group (*p* = 0.04).

relatively higher following right-sided colectomies (17 vs. 14%). Although this finding did not reach statistical significance, it is consistent with two other studies conducted within an ERAS program [7,8].

This study utilized nasogastric tube placement as an objective endpoint to define prolonged POI, aligning with the clinical indications outlined in the definition proposed by Vather et al. [9]. This practical approach was also proposed in a systematic review by Wolthuis et al. [16] encouraging the adoption of nasogastric tube reinsertion as a standardized definition for POI. Nonetheless, this definition of POI is limited by its subjectivity; for instance, a nasogastric tube can be inserted quickly following only one episode of vomiting.

Our cohort exhibited differences between the two patient groups regarding risk factors for delayed bowel recovery. Factors such as a higher BMI [17], prolonged operative time [10,18], and increased intraoperative blood loss [19] are associated with unfavorable outcomes in left-sided colectomies. Several studies [10] indicate reduced POI rates following a laparoscopic approach compared to open procedures. In this cohort, open/converted operations were more prevalent in the left compared to the right-sided colectomy groups (*p* = 0.07). The increased frequency of open/converted operations in the left-sided group is believed to have contributed to a corresponding increase in the POI rate for that group, resulting in comparable POI rates between right and left-sided colectomies in this study. The assumption was further validated by a post hoc analysis of laparoscopic surgeries, which revealed a significantly higher rate of

Regarding clinical outcomes, the advantages of faster functional recovery following left-sided colectomies did not result in a reduced length of hospital stay. The higher complication rate cannot be verified, as complications were not elevated following left-sided colectomies, consistent with findings from a previous study [20]. However, it can be attributed to the relatively higher rates of conversion and laparotomies in the left-sided group, as conversion to open surgery was associated with prolonged hospital stay [21].

The present study identified six independent risk factors for the development of POI. The WHO performance score is associated with an increased risk of POI, likely due to reduced physiologic reserve [19]. Nonetheless, this patient cohort exhibited a relatively high level of fitness and preoperative optimization, as only six patients (2%) had WHO scores of ≥ 2, while 75 patients (20%) had ASA scores of III-IV. The inverse association between ASA score III-IV and POI may be attributed to this reason, which contrasts with findings from other studies [10,22]. Furthermore, open and converted operations have been demonstrated to elevate the risk of POI, which aligns with other studies [10,13]. This finding can be due to several factors, including the increased bowel manipulation linked to open or converted surgeries, the timing of feeding, and the greater quantity of opioids typically required in these procedures [10,13]. This study found a strong positive correlation between anastomotic leakage and POI, consistent with several studies [23,24]. Peters et al. [24] have indicated that inflammation may serve as a

346 **Table 5.** Risk factors for developing POI.

Factor	Univariate OR (95% CI)	p value	Multivariate OR (95% CI)	p value
Patient-related factors				
Male gender	1.31 (0.72-2.38)	0.38		
Age > 70 years	1.87 (1.03-3.47)	0.04	1.93 (0.94-4.04)	0.08
BMI > 25 kg/m ²	0.74 (0.40-1.40)	0.35		
Diabetes mellitus	1.32 (0.61-2.67)	0.46		
Severe heart disease	1.24 (0.44-2.99)	0.65		
Severe pulmonary disease	1.31 (0.36-3.72)	0.64		
WHO performance score ≥2	5.64 (0.66-47.89)	0.09	16.33 (1.61-168.91)	0.01
ASA ≥ 3	0.65 (0.26-1.43)	0.32	0.27 (0.08-0.76)	0.02
Presence of metastasis	1.28 (0.29-4.14)	0.71		
Preoperatively malnourished	1.93 (0.67-4.87)	0.19		
Underlying disease				
Functional and other benign conditions including polyps	Reference			
Malignancy	0.57 (0.24-1.51)	0.23		
Diverticular disease	0.98 (0.28-3.40)	0.97		
Inflammatory bowel disease	0.34 (0.02-2.30)	0.35		
Surgery-related factors				
Side of colectomy				
Left colectomy	Reference			
Right colectomy	1.55 (0.85-2.92)	0.17		
Surgical approach				
Laparoscopy	Reference			
Laparotomy	2.98 (1.42-6.08)	0.003	3.19 (1.29-7.65)	0.01
Conversion in laparotomy	2.90 (1.06-7.25)	0.03	3.99 (1.24-11.69)	0.02
New stoma	3.75 (0.48-23.16)	0.16	6.31 (0.67-49.25)	0.08
Intraoperative blood loss > 500 ml	1.1 (0.17-4.32)	0.91		
Duration of surgery > 180 min	0.9 (0.43-1.76)	0.77		
Urinary retention	0.78 (0.04-4.49)	0.82		
Anastomotic leakage	33.57 (8.49-223.4)	p < 0.001	58.22 (13.08-421.14)	p < 0.001
ERAS-related factors				
Epidural anesthesia	4.65 (1.12 -18.18)	0.03	4.73 (0.90-24.35)	0.06
Oral carbohydrates treatment	1.12 (0.52-2.70)	0.79		
No oral bowel preparation	2.37 (1.23-4.90)	0.01	3.93 (1.73-10.01)	0.002
Systemic opioids given	0.91 (0.23-6.05)	0.91		

347 * significant p value (< 0.005).

348 common contributing factor to the development of POI
349 and anastomotic leakage. Subsequent clinical studies
350 demonstrated that chewing gum and early postoperative
351 enteral nutrition, intended to reduce inflammation
352 and POI, significantly decreased the occurrence of
353 anastomotic leakage [25]. The initiating event is unclear
354 due to the unknown pathophysiology of anastomotic
355 leakage. Consequently, the presence of POI should
356 prompt surgeons to conduct additional investigations to
357 assess for potential anastomotic leakage [23].

The mean overall compliance rate with the ERAS-
357 protocol in this study was 67.3%, consistent with existing
358 literature [2,26]. The compliance rate was significantly
359 higher in the right-sided colectomy group, with the most
360 significant differences observed in the preoperative phase
361 (Figure 1). This is mainly due to the deviation from the
362 preoperative ERAS-item “no oral bowel preparation,”
363 which was institutionally decided, disfavoring left-sided
364 colectomies. The multivariate analysis reveals that the
365 absence of oral bowel preparation is linked to an increased
366 risk of POI, raising concerns regarding this aspect of the
367

ERAS protocol. The institutional decision regarding this deviation led to an interaction effect analysis, revealing that the protective effect of oral bowel preparation was independent of the side of colectomy. The necessity of mechanical bowel preparation (MBP) has been increasingly scrutinized in recent years. A meta-analysis of 36 studies indicated that MBP does not significantly affect the incidence of postoperative complications compared to no bowel preparation [27]. Conversely, a large retrospective study including 32,359 patients by Koller et al. [28] demonstrated that the combination of MBP and oral antibiotics was associated with a decreased risk of POI and anastomotic leakage. This finding agrees with findings from a prior study [29]. Nevertheless, the aforementioned findings were reported in retrospective studies; therefore, the combination requires validation through high-quality evidence.

The present study has several limitations. Factors associated with POI, including increased BMI [16], longer operative time [19,17], intraoperative blood loss [19], and open/converted operations, were all more pronounced in left-sided colectomies, resulting in unmatched groups. Additionally, a significant limitation of retrospective studies is the unavailability of potentially relevant variables from the database, such as prior abdominal surgery [19] and the amount of opioids given [30]. However, the present study included a wide range of potential risk factors for POI based on a large number of literature studies. Furthermore, despite the relatively small sample size, the findings were consistent with prior research.

This study's findings suggest several recommendations for clinical practice. First, it is advisable to cautiously encourage early oral nutrition in patients who are undergoing right-sided colectomies. Half-sized portions of oral nutrition should be provided until bowel recovery appears appropriate. Attention must be directed towards the adjustable risk factors for POI, including the laparoscopic approach and the maintenance of fluid balance, particularly in the context of right-sided resections. Third, a high index of suspicion for additional complications, such as anastomotic leakage, should be maintained in patients diagnosed with POI. Finally, the role of oral bowel preparation in preventing POI requires reevaluation, especially considering evidence from randomized controlled trials and additional primary studies.

Conclusion

This study indicates that the recovery of bowel function is slower after right-sided colon resections compared to left colectomies. Patients who undergo right-sided colectomy experience an extended period before bowel retraining, as well as a higher incidence of POI, particularly in the laparoscopic surgery subgroup. The study confirms the recent trend of delayed gastrointestinal recovery following right colonic resection and suggests that early oral nutrition should be cautiously introduced in

this patient population. The physiological mechanisms underlying these side differences remain undetermined and require further investigation.

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List of Abbreviations

ASA	American Society of Anesthesiologists	432
BMI	Body mass index	433
EDA	Epidural anesthesia	434
ERAS	Enhanced recovery after surgery	435
POD	Postoperative day	436
POI	Postoperative ileus	437
PONV	Postoperative nausea and vomiting	438
TEA	Thoracic epidural anesthesia	439
WHO	World Health Organization	440

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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None.

Consent to participate

Written informed consent was obtained from all the participants.

Ethical approval

Ethical approval for the current study was obtained from the institutional medical ethical committee approved the study on the 3rd of March 2020 (nr. 2020-027).

Author details

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