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Intra-abdominal drains after colorectal resection do not reduce major complications but are associated with higher postoperative ileus

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ABSTRACT

Introduction: Prophylactic intra-abdominal drains are still frequently used after colorectal resections despite inconsistent evidence regarding clinical benefit. This study evaluated the association between drain use and short-term postoperative outcomes after colorectal surgery.

Materials and Methods: A retrospective observational cohort study was performed at Erzurum City Hospital including adult patients who underwent colorectal resection between January 2020 and October 2025. Patients were categorized as drain or no-drain based on intraoperative drain placement. Primary outcomes included overall postoperative complications, major morbidity (Clavien–Dindo ≥III), anastomotic leakage, surgical site infection, postoperative ileus, reoperation, readmission, in-hospital mortality, and length of stay. Group comparisons were conducted using appropriate univariable tests. Multivariable logistic regression was used to assess independent associations between drain use and key outcomes adjusting for procedure type, tumor localization, and operative approach.

Results: A total of 432 patients were analyzed; 248 (57.4%) received drains and 184 (42.6%) did not. Operative time was longer in the drain group (p=0.039). Rates of overall complications, major morbidity, anastomotic leakage, surgical site infection, reoperation, readmission, and in-hospital mortality were comparable between groups. Postoperative ileus was significantly more frequent in the drain group (14.9% vs 7.6%, p=0.020). In multivariable analysis, drain use remained independently associated with postoperative ileus (OR 2.17, 95% CI 1.11–4.25; p=0.024). Drain use was not independently associated with overall complications (OR 0.67, 95% CI 0.43–1.05; p=0.080) and showed a non-significant trend toward lower major morbidity (OR 0.51, 95% CI 0.25–1.03; p=0.061).

Conclusions: In this single-center cohort, routine intra-abdominal drain placement after colorectal resection was not associated with improved major postoperative outcomes and was independently associated with a higher risk of postoperative ileus. Drain use should be individualized rather than routine.

Keywords: Colorectal surgery, intra-abdominal drain, prophylactic drainage, postoperative ileus, anastomotic leak

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Introduction

Colorectal surgery remains a cornerstone in the management of benign and malignant colorectal diseases; however, postoperative morbidity continues to represent a major clinical challenge. Among postoperative complications, anastomotic leakage (AL) is one of the most feared events, as it is associated with increased morbidity, prolonged hospitalization, reintervention, and mortality.[1,2] Reported AL rates after colorectal resection vary widely, ranging from 3% to 20%, depending on patient characteristics, tumor location, and surgical technique.[3]

To mitigate postoperative complications and to facilitate early detection of AL, intra-abdominal drains have traditionally been placed at the end of colorectal resections. The theoretical rationale for drain use includes evacuation of intra-abdominal fluid collections, reduction of local contamination, and early identification of bleeding or anastomotic failure through changes in drain output.[4] Despite these theoretical benefits, the routine use of prophylactic drains has been increasingly questioned over the last two decades.

Several randomized controlled trials and meta-analyses have failed to demonstrate a clear benefit of routine drain placement in reducing AL, surgical site infection, reoperation, or mortality after colorectal surgery.[5–7] On the contrary, some studies have suggested that drains may act as foreign bodies, potentially increasing local inflammation, impairing tissue healing, or contributing to delayed gastrointestinal recovery.[8] Consequently, current clinical practice varies widely, with drain use largely guided by individual surgeon preference rather than high-level evidence.

Given the persistent controversy and the lack of consensus regarding optimal drain use after colorectal surgery, further real-world data are needed. The present study aimed to evaluate the association between intra-abdominal drain use and short-term postoperative outcomes in a large single-center cohort of patients undergoing colorectal resection, with particular emphasis on postoperative morbidity, ileus, and in-hospital mortality.

Materials and Methods

This retrospective observational cohort study was conducted at Erzurum City Hospital to evaluate short-term postoperative outcomes after colorectal surgery, with a specific focus on the clinical impact of intra-abdominal drain use. All eligible adult patients who underwent an index colorectal resection between January 2020 and October 2025 were identified through the institutional electronic medical record system and operative registries. Demographic characteristics, perioperative variables, including tumor localization and receipt of neoadjuvant therapy for rectal cancer when applicable, and postoperative outcomes were extracted from standardized hospital records and transferred to a dedicated study database for analysis.

The study protocol was reviewed and approved by the Erzurum City Hospital Ethics Committee (Date: 11/11/2025, No: 169) and was conducted in accordance with the Declaration of Helsinki and applicable national regulations for retrospective clinical research. Given the retrospective design and the use of routinely collected clinical data, informed consent was handled in line with institutional policy and the Ethics Committee decision.

Patients were included if they underwent an index colorectal resection with available perioperative documentation and complete outcome data for the prespecified endpoints. Patients were excluded when key exposure or outcome data were missing, when the index procedure did not represent a colorectal resection, or when record incompleteness precluded reliable outcome assessment. The exposure of interest was intraoperative placement of an intra-abdominal drain at the completion of the index operation. Drain placement was performed at the discretion of the operating surgeon based on intraoperative findings and perceived risk, and patients were categorized into two groups: those who received an intra-abdominal drain and those who did not. For patients in whom a drain was placed, the timing of drain removal was recorded when available.

Perioperative characteristics were captured from operative notes and anesthesia records, including procedure type, tumor localization, surgical approach, and preoperative neoadjuvant therapy status for rectal cancer patients when available. Surgical approach was categorized according to the documented operative course (e.g., laparoscopic completed, conversion to open), consistent with intraoperative decision-making. Postoperative management followed routine institutional protocols and was individualized to patient-specific clinical needs. Outcomes were ascertained from inpatient progress notes, radiology reports, laboratory data, and discharge summaries. The primary outcomes included postoperative morbidity

and recovery metrics, namely overall complications, severe complications (defined as Clavien–Dindo grade III or higher), anastomotic leakage, surgical site infection, postoperative ileus, need for reoperation, readmission, in-hospital mortality, and length of hospital stay.

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 29.0 (IBM Corp., Armonk, NY, USA). Continuous variables were evaluated for distributional characteristics and summarized as mean with standard deviation or median with interquartile range, as appropriate. Categorical variables were presented as frequencies and percentages. Between-group comparisons (drain versus no drain) were performed using the Mann–Whitney U test for non-normally distributed continuous variables and the chi-square test or Fisher's exact test for categorical variables, as appropriate. To assess the independent association between drain use and postoperative outcomes while accounting for baseline differences between groups, multivariable logistic regression models were constructed with drain use as the primary explanatory variable and clinically relevant covariates entered for adjustment (including procedure type, tumor localization, surgical approach, and neoadjuvant therapy status when available in the dataset). Adjusted effect estimates were reported as odds ratios with 95% confidence intervals, and a two-sided p value of <0.05 was considered statistically significant.

Results

A total of 432 patients who underwent colorectal resection between January 2020 and October 2025 were included in the final analysis. Of these, 248 patients (57.4%) received an intra-abdominal drain at the end of the index operation, while 184 patients (42.6%) did not. Baseline demographic and perioperative characteristics by drain use are summarized in Table 1.

The distribution of operative characteristics differed between groups, consistent with surgeon-selected drain placement in cases perceived to have higher technical complexity or risk. In particular, the spectrum of procedures and their relative frequencies varied between the drain and no-drain cohorts, as illustrated in Figure 1, which depicts the distribution of procedure categories across groups. This imbalance supports the presence of clinical selection (confounding by indication) and underlines the need for adjusted analyses when interpreting crude outcome comparisons. Operative time was also significantly longer in the drain group (p=0.039, Table 1), further indicating a higher operative burden in patients who received drains.

Postoperative outcomes are detailed in Table 2 and visually summarized in Figure 2, which compares key endpoints between the drain and no-drain groups. Overall postoperative complications occurred at comparable rates across cohorts and did not differ significantly. Similarly, the incidence of major morbidity, defined as Clavien–Dindo grade ≥ III, was numerically lower in the drain cohort but did not reach conventional statistical significance on unadjusted comparison. Importantly, the rates of clinically critical endpoints—anastomotic leak, surgical site infection, reoperation, readmission, and in-hospital mortality—were also similar between groups (Table 2; Figure 2), suggesting that routine drain placement did not translate into measurable reductions in these major adverse outcomes in this cohort.

In contrast, postoperative ileus was significantly more common among patients who received an intra-abdominal drain (14.9% vs. 7.6%, p=0.020; Table 2). This difference is also apparent in Figure 2, where ileus demonstrates the most pronounced separation between the two cohorts. Given that ileus is highly sensitive to operative complexity and tissue handling, this signal could reflect either a drain-associated effect or residual confounding related to case-mix differences; therefore, multivariable adjustment was performed to better estimate the independent association.

Length of hospital stay was examined as a recovery marker. Although the group comparison did not demonstrate a statistically significant difference in length of stay, the distributional pattern is informative. As shown in Figure 3, the drain group exhibited greater dispersion, with a wider upper range consistent with a subset of patients experiencing a prolonged postoperative course. This finding aligns with the clinical expectation that drains are preferentially used in more complex operations and/or in patients with a higher anticipated complication risk, even when median LOS does not materially differ.

Among patients who received drains, the timing of drain removal demonstrated a clinically interpretable pattern. Figure 4 presents the distribution of drain removal days, showing that removal clustered within the early postoperative period, with a tapering tail toward later removal. This pattern suggests that, in routine practice, drains

Table 1. Baseline characteristics by drain use

Variable	No drain (n=184)	Drain (n=248)	p	test
Age, years	63.5 [59.0–72.0]	64.0 [58.0–71.0]	0.958	MW
BMI, kg/m²	26.7 [24.1–29.9]	27.0 [24.3–29.9]	0.789	MW
Operative time, min	156.0 [134.0–182.0]	165.0 [138.8–187.0]	0.039	MW
Estimated blood loss, mL	147.5 [100.5–207.0]	158.0 [101.2–212.8]	0.456	MW
Sex			0.075	Chi2
Female	90 (48.9%)	100 (40.3%)		
Male	94 (51.1%)	148 (59.7%)		
ASA class			0.521	Chi2
ASA 1	20 (10.9%)	22 (8.9%)		
ASA 2	72 (39.1%)	86 (34.7%)		
ASA 3	78 (42.4%)	114 (46.0%)		
ASA 4	14 (7.6%)	26 (10.5%)		
Current smoker	56 (30.4%)	90 (36.3%)	0.203	Chi2
Diabetes	44 (23.9%)	58 (23.4%)	0.899	Chi2
Cardiovascular disease	55 (29.9%)	86 (34.7%)	0.294	Chi2
Indication			0.602	Chi2
Cancer	142 (77.2%)	181 (73.0%)		
Diverticulitis	28 (15.2%)	49 (19.8%)		
IBD	4 (2.2%)	7 (2.8%)		
Other	10 (5.4%)	11 (4.4%)		
Tumor location			0.016	Chi2
Left	83 (45.1%)	92 (37.1%)		
Rectum	41 (22.3%)	87 (35.1%)		
Right	60 (32.6%)	69 (27.8%)		
Procedure type			0.047	Chi2
APR	7 (3.8%)	19 (7.7%)		
LAR	34 (18.5%)	68 (27.4%)		
LHC	31 (16.8%)	28 (11.3%)		
RHC	60 (32.6%)	69 (27.8%)		
Sigmoid	52 (28.3%)	64 (25.8%)		
Approach			0.015	Chi2
Laparoscopic	170 (92.4%)	210 (84.7%)		
Converted	14 (7.6%)	38 (15.3%)		
Intraoperative complication	12 (6.5%)	7 (2.8%)	0.064	Chi2

Values are reported as median [IQR] or n (%). p-values reflect univariable comparisons; test abbreviations: MW= Mann–Whitney U; t= Student's t-test; Chi2= Chi-square; Fisher= Fisher's exact; BMI: Body-Mass Index; ASA: American Society of Anesthesiologists; IBD: Inflamatorry Bowel Disasster; APR: Abdominal Perineal Resection; LAR: Low Anterior Resection; LHC: Left Hemicolectomy; RHC: Right Hemicolectomy.

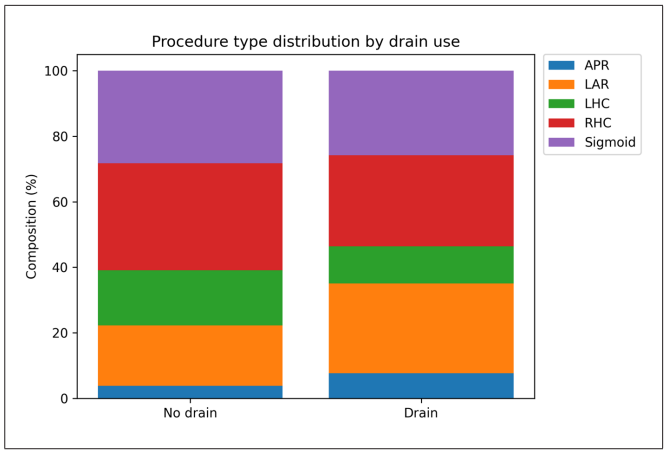

Figure 1. Procedure type distribution by drain use.
APR: Abdominal Perineal Resection, LAR: Low Anterior Resection, LHC: Left Hemicolectomy, RHC:Right Hemicolectomy.

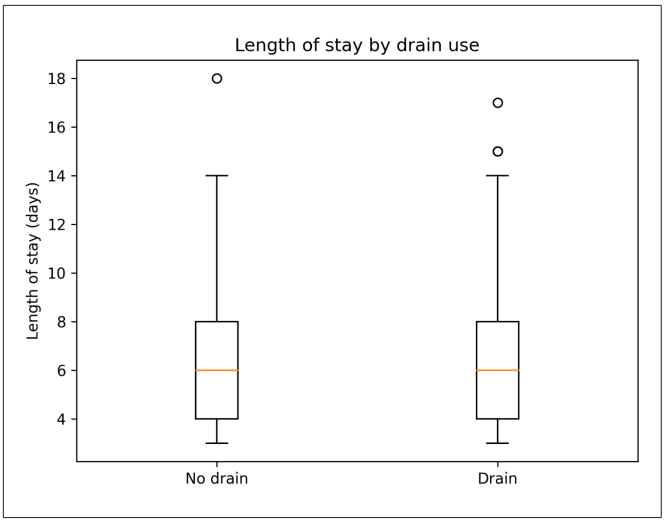

Figure 3. Length of stay by drain use.

were commonly discontinued once early recovery milestones were achieved and/or output characteristics were reassuring, while delayed removal likely reflected prolonged output, slower recovery, or clinician concern in higher-risk cases.

To account for baseline imbalances (procedure type, tumor localization, operative approach) highlighted in Figure 1 and reflected in Table 1, multivariable logistic regression models were performed (Table 3). After adjustment, intra-abdominal drain use remained independently associated with an increased risk of postoperative ileus (OR 2.17, 95% CI 1.11–4.25; p=0.024), consistent with the unadjusted signal seen in Figure 2. Drain use was not independently associated with overall postoperative complications (OR 0.67, 95% CI 0.43–1.05; p=0.080) and showed a non-significant trend toward lower odds of major complications (Clavien–Dindo≥III: OR 0.51, 95% CI 0.25–1.03; p=0.061) (Table 3). No independent association was identified between drain use and other major endpoints, including anastomotic leakage, reoperation, readmission, or in-hospital mortality.

Discussion

In this retrospective cohort study including 432 patients undergoing colorectal resection, routine intra-abdominal drain use was not associated with a reduction in overall postoperative complications, major morbidity, anastomotic leakage, surgical site infection, reoperation, readmission, or in-hospital mortality. However, drain placement was independently associated with a significantly

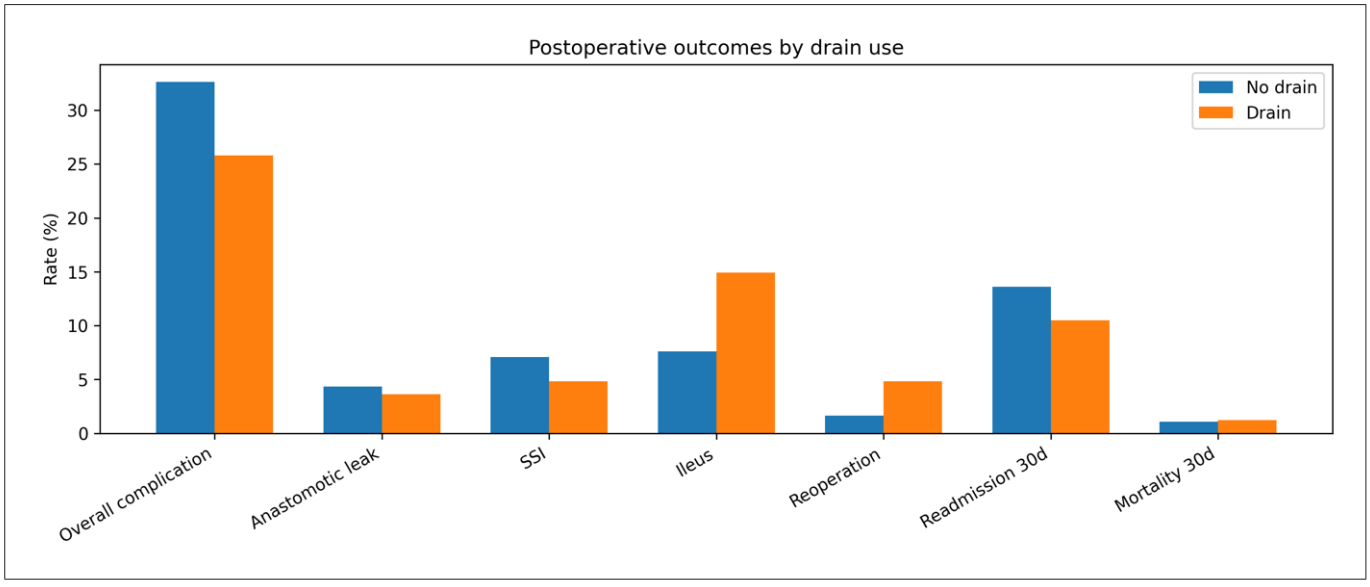

Figure 2. Postoperative outcomes by drain use.

Table 2. Postoperative outcomes by drain use

Outcome	No drain (n=184)	Drain (n=248)	p	test
Overall complication	60 (32.6%)	64 (25.8%)	0.122	Chi2
Anastomotic leak	8 (4.3%)	9 (3.6%)	0.704	Chi2
Surgical site infection	13 (7.1%)	12 (4.8%)	0.327	Chi2
Ileus	14 (7.6%)	37 (14.9%)	0.020	Chi2
Reoperation	3 (1.6%)	12 (4.8%)	0.072	Chi2
Readmission (30d)	25 (13.6%)	26 (10.5%)	0.323	Chi2
Mortality (30d)	2 (1.1%)	3 (1.2%)	1.000	Fisher
Clavien–Dindo grade (0–V), median [IQR]	0.0 [0.0–2.0]	0.0 [0.0–1.0]	0.079	MW
Clavien–Dindo ≥III	21 (11.4%)	16 (6.5%)	0.068	Chi2
Length of stay, days, median [IQR]	6.0 [4.0–8.0]	6.0 [4.0–8.0]	0.655	MW

Values are n (%), unless otherwise indicated. LOS is median [IQR].

Table 3. Multivariable logistic regression: Effect of drain use

Outcome	Effect for drain_used	Estimate	p
Overall complication	Adjusted OR (95% CI)	0.67 (0.43–1.05)	0.080
Ileus	Adjusted OR (95% CI)	2.17 (1.11–4.25)	0.024
Clavien–Dindo ≥III	Adjusted OR (95% CI)	0.51 (0.25–1.03)	0.061

Adjusted ORs correspond to the coefficient for drain_used in each model (as specified in the Regression sheet of the analysis workbook).

higher risk of postoperative ileus. These findings provide important insight into the ongoing debate regarding the clinical value of prophylactic drains in colorectal surgery.

Our results are consistent with previous randomized trials and meta-analyses demonstrating no protective effect of routine drainage on anastomotic integrity or major postoperative outcomes.[5–7] A landmark Cochrane review reported insufficient evidence to support routine prophylactic drainage after colorectal anastomosis, with no significant differences observed in AL, mortality, or wound infection rates between drained and non-drained patients.[5] Subsequent meta-analyses have reinforced these conclusions, highlighting the limited clinical benefit of routine drain placement.[6,7]

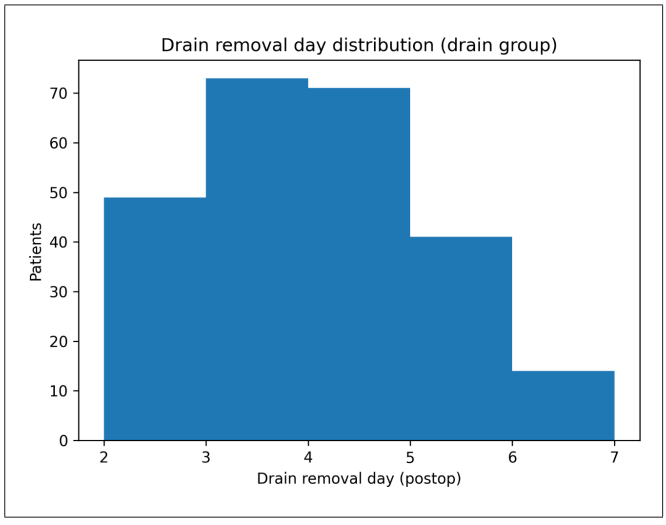

Figure 4. Drain removal day distribution.

The observed association between drain use and increased postoperative ileus in our cohort is noteworthy. Postoperative ileus is a multifactorial condition influenced by surgical stress, bowel manipulation, inflammatory response, and postoperative pain management.[9] Drains may contribute to ileus through local irritation, increased inflammatory response, or patient discomfort that limits early mobilization. Importantly, although drain placement often reflects greater surgical complexity, the association with ileus persisted after adjustment for procedure type, tumor localization, and surgical approach, suggesting an independent relationship rather than pure confounding by indication.

Interestingly, we observed a non-significant trend toward lower rates of major complications (Clavien–Dindo ≥ III) in the drain group after multivariable adjustment. Similar findings have been reported in selected high-risk cohorts, leading some authors to advocate selective rather than routine drain use, particularly in technically demanding cases.[8,10] Nevertheless, the absence of a significant reduction in AL or mortality in our study argues against routine drain placement as a standard strategy.

This study has several limitations. Its retrospective design introduces potential selection bias, as drain placement was determined by surgeon judgment rather than randomization. Additionally, drain management protocols, including duration and removal criteria, were not standardized. Given the higher proportion of rectal cancer patients in the drain group, the potential influence of neoadjuvant therapy on postoperative bowel motility cannot be fully excluded. Although our multivariable model adjusted for tumor location and operative approach, the absence of detailed neoadjuvant treatment data represents a potential residual confounder. Despite these limitations, the study reflects real-world practice in a high-volume tertiary center and provides clinically relevant evidence supporting a more selective approach to drain use after colorectal surgery.

Conclusion

In conclusion, our findings suggest that routine intra-abdominal drain placement after colorectal resection does not improve major postoperative outcomes and may increase the risk of postoperative ileus. Drain use should therefore be individualized, reserved for selected cases based on intraoperative findings rather than applied universally.

Disclosures

Ethics Committee Approval: The study protocol was reviewed and approved by the Erzurum City Hospital Ethics Committee (Date:11/11/2025, No:169)

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Conflict of Interest: The authors declare that they have no conflicts of interest.

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