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RESEARCH ARTICLE

Stoma Creation Tendency and Short-Term Surgical Outcomes in Low Anterior Resection for Rectal Cancer: Analysis from the TSCRS Colorectal Cancer Database (TSCRS-CCD)

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ABSTRACT

Aim: Anastomotic leakage (AL) is a major complication following low anterior resection (LAR), leading to significant morbidity. Although diverting stomas have been shown to reduce both the incidence and severity of AL, data on stoma creation practices and their impact on short-term surgical outcomes in the Turkish population remain limited. This study evaluates trends in ostomy creation and their impact on postoperative outcomes among patients with rectal cancer undergoing LAR.

Method: We retrospectively analyzed prospectively collected data from the Turkish Society of Colon and Rectal Surgery's Colorectal Cancer Database (2018-2024) for patients who underwent curative-intent LAR for rectal cancer located ≤12 cm from the anal verge. Patients with synchronous tumors, inflammatory bowel disease, hereditary colorectal cancer, or those undergoing emergency surgery were excluded. Patients were stratified into stoma and no-stoma groups. The primary outcome was AL, and secondary outcomes included 30-day readmission, reoperation, and mortality rates.

Results: Of 313 patients (37.1% women; median age: 62), 260 (83%) underwent stoma creation. Patients without a stoma had lower tumor stages (T1-T2: 43.4% vs. 18.1%; p<0.001) and a lower incidence of lymph node metastasis (50.9% vs. 67.3%; p=0.023). Additionally, tumors and anastomoses were located higher in patients without an ostomy (9 vs. 7 cm, p<0.001; 4 vs. 3 cm, p<0.001, respectively). Patients with an ostomy were more likely to undergo neoadjuvant treatment (56.5% vs. 88.5%, p<0.001). Partial mesorectal excision was more common in the no-stoma group (35.8% vs. 8.8%, p<0.001). AL occurred at a significantly higher rate in the no-stoma group (11.3% vs. 4.2%; p=0.038), leading to a higher reoperation rate (15.1% vs 4.2%; p=0.003), although other complications did not differ significantly.

Conclusion: This study demonstrates that diverting stoma formation in patients undergoing LAR for rectal cancer was associated with reduced AL and the need for reoperation. These findings highlight the importance of individualized consideration of diverting stoma creation in patients undergoing LAR for rectal cancer.

Keywords: Rectal cancer, low anterior resection, stoma, ostomy, anastomotic leakage

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Introduction

Rectal cancer management frequently involves a multimodal approach; however, surgery—specifically, total mesorectal excision (TME)—remains the cornerstone of curative treatment. In patients without invasion of the anal sphincter complex, low anterior resection (LAR) with colorectal or coloanal anastomosis is the preferred surgical strategy. Despite advances in surgical techniques and perioperative care, postoperative complications remain common, and anastomotic leakage (AL) represents one of the most severe and clinically significant adverse outcomes.[1,2] AL is associated with increased morbidity, prolonged hospitalization, need for reintervention, impaired functional recovery, and mortality.[3,4] Reported rates of AL range from 5% to 21%, particularly in low pelvic anastomoses.[5]

To mitigate the risk of clinically significant AL, many surgeons construct a temporary diverting stoma—most commonly a loop ileostomy—to divert the fecal stream and protect the anastomosis and potential AL-related complications.[6] Numerous studies have demonstrated that diverting stomas reduce the incidence and severity of AL, the need for reoperation, and hospital readmission.[7] However, controversy persists regarding which patients benefit most from diversion and whether routine stoma creation is justified in all low rectal resections.

Despite global evidence supporting selective use of diverting stomas, current decision-making patterns among colorectal surgeons in Türkiye remain unclear. National data on the frequency of stoma formation, associated outcomes, and surgeon preferences are lacking. This knowledge gap limits the development of standardized guidelines and may contribute to variability in clinical practice and patient outcomes.

Therefore, this study assesses the rate of diverting stoma formation during LAR for rectal cancer in Türkiye and evaluates its association with AL and postoperative outcomes. We hypothesized that diverting stomas are underutilized among Turkish colorectal surgeons and that a lower diversion rate is associated with a higher incidence of AL.

Materials and Methods

Patient Selection

This retrospective cohort study utilized prospectively collected data from the Turkish Society of Colon and Rectal Surgery's Colorectal Cancer Database (TSCRS-CCD) covering 2018-2024. The Ege University Ethics Committee of Medical Research approved the study protocol (approval no.: 25-3T/58, dated: 06.03.2025). Patients who underwent curative-intent LAR for rectal adenocarcinoma located ≤12 cm from the anal verge in the middle and lower rectum were included. Patients with upper rectum or colon tumors, rectal tumors with synchronous tumors, inflammatory bowel disease, hereditary colorectal cancer syndromes, or those undergoing emergency surgery and metastatic colorectal cancers were excluded. Patients were stratified into two groups based on whether a diverting stoma was created intraoperatively (stoma group vs. no-stoma group). Demographic characteristics, tumor- and treatment-related variables, surgical details, and short-term postoperative outcomes were compared between the two groups. The primary outcome was AL, and secondary outcomes included 30-day readmission, reoperation, and mortality rates. Furthermore, factors affecting AL were evaluated to identify independent risk factors.

Turkish Society of Colon and Rectal Surgery's Colorectal Cancer Database

To qualify as a contributing center capable of uploading data to TSCRS-CCD, institutions must perform at least 50 colorectal cases annually and have at least one board-certified colorectal surgeon. Centers that repeatedly failed to enter complete patient data, specifically those that submitted incomplete data for more than 10% of patients in multiple quarterly periods, were excluded from the database. The database comprises detailed information on patient demographics [including age, sex, body mass index (BMI), comorbidities, American Society of Anesthesiologists (ASA) score, and smoking status]; clinical and familial cancer history; preoperative findings such as presenting symptoms, tumor localization, serum tumor markers [carcinoembryonic antigen (CEA), carbohydrate antigen 19-9 (CA 19-9)], and clinical staging Tumor, Node, Metastasis (TNM); and neoadjuvant therapy details, including type, duration, and time interval to surgery. Operative variables include the urgency of the procedure (elective or emergency), surgical technique (open, laparoscopic, robotic), type and extent of resection, anastomotic configuration and method, intraoperative findings, blood loss and transfusion requirement, operative duration, and creation of a diverting stoma. Postoperative outcomes assessed within 30 days include both surgical and non-surgical complications (e.g., surgical site infections, intra-abdominal abscesses, AL, ileus, urinary retention, pulmonary embolism), need for reoperation, length of hospital stay, mortality, and hospital readmission. AL was recorded as a binary variable (present/absent) as per the database structure; no standardized grading system, such as the International Study Group of Rectal Cancer classification, was available to further subclassify leakage severity. Pathological variables encompass histologic tumor type and grade, number of retrieved and metastatic lymph nodes, pathological TNM stage, lymphovascular and perineural invasion, tumor budding, surgical margin status, tumor perforation, and response to neoadjuvant therapy. All data were recorded in a secure, web-based system by authorized personnel, using standardized definitions outlined in the CCD dictionary.

Variables Examined

Demographic data, including age, sex, BMI, comorbidities, ASA score, and smoking history, were recorded. Clinical parameters included presenting symptoms, tumor location, serum tumor markers (CEA, CA 19-9), family history, and clinical TNM staging based on imaging studies [magnetic resonance imaging (MRI), positron emission tomography-computed tomography]. Details regarding neoadjuvant treatment (type, duration, chemotherapy before and/or after radiation, and interval to surgery) were also documented. Operative data encompassed urgency of surgery (elective/emergency), surgical approach (open, laparoscopic, robotic), type of resection, tumor resection margins, creation and type of stoma, operative time, estimated blood loss, intraoperative transfusions, and intraoperative complications. Anastomotic details, including configuration, technique (hand-sewn or stapled), level from the anal verge, and construction site (intra- or extracorporeal), were noted. Postoperative outcomes within 30 days included surgical complications (AL, surgical site infection, bleeding, intra-abdominal abscess, ileus, evisceration, urinary and pancreatic fistulas), non-surgical complications (e.g., venous thromboembolism, myocardial infarction, pneumonia), need for reoperation, length of hospital stay, readmissions, and mortality. AL following LAR is defined as a loss of anastomotic integrity that results in the release of intestinal contents, gas, or contrast material into the pelvic or peritoneal cavity, detected clinically or radiologically. Pathological findings included tumor type, differentiation grade, total and metastatic lymph node counts, pathological TNM stage, lymphovascular and perineural invasion, tumor budding, tumor perforation, distal and radial resection margins, mesorectal excision quality, inflammatory bowel disease, multiorgan involvement, and response to neoadjuvant therapy.

Statistical Analysis

The Shapiro-Wilk test was utilized to assess the normality of continuous variables. Continuous variables were summarized as medians with interquartile ranges (IQRs), and comparisons were made using the Mann-Whitney U test because most continuous variables were non-normally distributed. For the normal distribution of other continuous parameters, Student's t-test was used. Categorical variables were represented as frequencies and percentages, with group comparisons conducted using either the chi-square test or Fisher's exact test, as appropriate. A two-tailed p-value of <0.05 was considered statistically significant. A multivariable logistic regression model was constructed to identify independent predictors of AL. Although variables with a p-value <0.20 in the univariate analysis were initially considered, "MRI utilization" and "previous abdominal surgery" were excluded from the final model to prevent quasi-complete separation and mathematical instability due to zero-cell counts in the cross-tabulations. Consequently, the final multivariable model included only three clinically relevant variables: age, sex, and presence of a diverting stoma. Statistical analyses were conducted using Jamovi software [version 2.6; The Jamovi Project (2005), Sydney, Australia].

Results

A total of 313 patients who underwent LAR for rectal cancer were included in this study. The median age of the cohort was 62 years (IQR, 16), and 37.1% were women. A diverting stoma was created in 260 patients (83%), whereas 53 patients (17%) underwent surgery without a stoma. The baseline demographic characteristics were comparable between groups regarding age, sex, BMI, ASA score, smoking status, and previous abdominal surgery (Table 1). Constipation as a presenting symptom was more frequent among patients with a stoma (33.1% vs. 17%, p=0.020). Patients with a stoma also had more advanced clinical T stage and MRI T stages (p<0.001) and were more likely to present with positive nodal status (p=0.023) and stage III disease at diagnosis (p=0.016). Consistent with these findings, neoadjuvant treatment was more frequently observed in the stoma group than in the non-stoma group (88.5% vs. 56.5%, p<0.001).

Operative variables were similar between the two groups in terms of approach (open, laparoscopic, or robotic), anastomotic technique, and intraoperative blood loss (Table 1). However, TME was performed more frequently in the stoma group (91.2% vs. 64.2%, p<0.001). The median operative time was 200 minutes (IQR, 92.5), and the median length of hospital stay was 7 days (IQR, 3). The overall conversion rate was 9.7%.

Postoperative short-term outcomes are summarized in Table 2. The overall rate of AL was 5.4% (17/313); AL occurred significantly more often in patients without a diverting stoma than in those with a stoma (11.3% vs. 4.2%, p=0.038). Similarly, the 30-day reoperation rate was higher in the non-stoma group (15.1% vs. 4.2%, p=0.003). Other postoperative complications, including surgical site infection (11.8%), postoperative ileus (8.9%), and urinary complications (4.8%), did not differ significantly between the two groups. The 30-day readmission rate was 8.6%, and the 30-day mortality rate was 0.3%, both of which were comparable between groups.

The comparison of patients with and without AL is presented in Table 3. No significant differences were observed in demographic factors, ASA classification, tumor stage, or neoadjuvant treatment rates between the two groups. However, AL was more common in patients without a diverting stoma (35.3% vs. 15.9%, p=0.038). Logistic regression analysis revealed that the omission of a diverting stoma was the variable most closely associated with an increased risk of AL [odds ratio (OR): 0.34; 95% confidence interval (CI): 0.11-0.99; p=0.05].

Table 1. Demographics, tumor characteristics, and surgical details (no stoma vs. stoma)

	All (n=313)	No stoma (n=53)	Stoma (n=260)	p-value
Age, year (IQR)	62 (16)	60 (14)	62.5 (16)	0.61
Female sex, n (%)	116 (37.1%)	20 (37.7%)	96 (36.9%)	0.91
BMI, kg/m^2 (IQR)	25.5 (4.2)	26 (3.8)	25.4 (4.3)	0.86
Symptoms, n (%)				
Bleeding	205 (65.5%)	32 (60.4%)	173 (66.5%)	0.39
Constipation	95 (30.4%)	9 (17%)	86 (33.1%)	**0.020**
Abdominal pain	93 (29.7%)	16 (30.2%)	77 (29.6%)	0.93
Anemia	18 (5.8%)	1 (1.9%)	17 (6.5%)	0.32
Screening	22 (7%)	7 (13.2%)	15 (5.8%)	0.05
Incidental	10 (3.2%)	4 (7.5%)	6 (2.3%)	0.07
ASA score, n (%)				
I	82 (26.2%)	15 (28.3%)	67 (25.8%)	0.46
II	190 (60.7%)	34 (64.2%)	156 (60%)	
III	41 (13.1%)	4 (7.5%)	37 (14.2%)	
Previous abdominal surgery, n (%)	60 (19.2%)	7 (13.2%)	53 (20.4%)	0.22
Non-smoker, n (%)	202 (64.5%)	37 (69.8%)	165 (63.5%)	0.65
CRC family history, n (%)	43 (13.8%)	10 (19.2%)	33 (12.7%)	0.21
Preoperative CEA level, (IQR)	3 (3)	2 (4)	3 (3)	0.50
Preoperative CA19-9 level, (IQR)	9 (16)	10 (15)	9 (16)	0.63
cT stage				
T1	16 (5.1%)	7 (13.2%)	9 (3.5%)	**<0.001**
T2	54 (17.3%)	16 (30.2%)	38 (14.6%)	
T3	209 (66.8%)	27 (50.9%)	182 (70%)	
T4	34 (10.9%)	3 (5.7%)	31 (11.9%)	
Positive nodal status, n (%)	202 (64.5%)	27 (50.9%)	175 (67.3%)	**0.023**
Stage at the time of diagnosis, n (%)				
I	37 (14.4%)	11 (29.7%)	26 (11.8%)	**0.016**
II	56 (21.8%)	7 (18.9%)	49 (22.3%)	
III	164 (63.8%)	19 (51.4%)	145 (65.9%)	
MRI utilization, n (%)	265 (84.7%)	46 (86.8%)	219 (84.2%)	0.63
MRI T stage, n (%)				
T1	9 (3.4%)	5 (10.9%)	4 (1.8%)	**<0.001**
T2	43 (16.2%)	16 (34.8%)	27 (12.3%)	
T3	179 (67.5%)	22 (47.8%)	157 (71.7%)	
T4	34 (12.8%)	3 (6.5%)	31 (14.2%)	
MRI-positive nodal status, n (%)	187 (70.6%)	25 (54.3%)	162 (74%)	**0.008**
Tumor distance to anal verge, cm (IQR)	7 (4)	9 (3)	7 (3)	**<0.001**
Neoadjuvant treatment, n (%)	261 (83.1%)	30 (56.5%)	231 (88.5%)	**<0.001**
Time to surgery, weeks (IQR)	10 (4)	8 (6)	10 (4)	0.12
Surgical approach, n (%)				
Open	129 (41.2%)	19 (35.8%)	110 (42.3%)	0.75
Hand assisted	1 (0.3%)	0 (0%)	1 (0.4%)	
Laparoscopic	169 (54%)	32 (60.4%)	137 (52.7%)	
Robotic assisted	14 (4.5%)	2 (3.8%)	12 (4.6%)	
Conversion, n (%)	18 (9.7%)	3 (8.8%)	15 (10%)	1.00
Total mesorectal excision, n (%)	271 (86.6%)	34 (64.2%)	237 (91.2%)	**<0.001**

Table 1. Continued

	All (n=313)	No stoma (n=53)	Stoma (n=260)	p-value
Stapler anastomosis, n (%)	278 (88.8%)	45 (84.9%)	233 (89.6%)	0.32
Intracorporeal anastomosis, n (%)	114 (36.4%)	21 (67.7%)	93 (67.4%)	0.97
Anastomosis distance to anal verge, cm (IQR)	3 (2)	4 (3)	3 (2)	**<0.001**
Intraoperative complication, n (%)	11 (3.5%)	1 (1.9%)	10 (3.8%)	0.69
Operative time, min (IQR)	200 (92.5)	200 (90)	200 (98)	0.61
EBL, mL (IQR)	100 (95)	85 (100)	100 (90)	0.35
Intraoperative blood transfusion	9 (2.9%)	0 (0%)	9 (3.5%)	0.36

Note: Stage at diagnosis data were available for 257 of 313 patients (82.1%). Data were missing for 56 patients (17.9%), including 16 patients in the non-stoma group and 40 patients in the stoma group. Percentages for stage at diagnosis were calculated based on patients with available staging data.

p-values shown in bold indicate statistically significant differences, defined as $p<0.05$.

IQR: Interquartile range, BMI: Body mass index, ASA: American Society of Anesthesiologists, CRC: Colorectal cancer, CEA: Carcinoembryonic antigen, CA19-9: Carbohydrate antigen 19-9, MRI: Magnetic resonance imaging, EBL: Estimated blood loss, TNM: Tumor, Node, Metastasis

Table 2. Postoperative short-term surgical outcomes (no stoma vs. stoma)

	All (n=313)	No stoma (n=53)	Stoma (n=260)	p-value
Surgical site infection, n (%)	37 (11.8%)	8 (15.1%)	20 (11.2%)	0.48
Deep surgical site infection, n (%)	7 (2.2%)	0 (0%)	7 (2.7%)	0.60
Evisceration, n (%)	3 (1%)	0 (0%)	3 (1.2%)	1.00
Postoperative ileus, n (%)	28 (8.9%)	4 (7.5%)	24 (9.2%)	1.00
Anastomotic leakage, n (%)	17 (5.4%)	6 (11.3%)	11 (4.2%)	**0.038**
Urinary leakage, n (%)	3 (1%)	0 (0%)	3 (1.2%)	1.00
Urinary retention, n (%)	10 (3.2%)	2 (3.8%)	8 (3.1%)	0.67
Urinary incontinence, n (%)	2 (0.6%)	0 (0%)	2 (0.8%)	1.00
Postoperative bleeding, n (%)	3 (1%)	2 (3.8%)	1 (0.4%)	0.07
Mechanical bowel obstruction, n (%)	5 (1.6%)	2 (3.8%)	3 (1.2%)	0.20
Non-surgical complications, n (%)	11 (3.5%)	4 (7.5%)	7 (2.7%)	0.09
LOS, day (IQR)	7 (3)	7 (3)	7 (3)	0.41
Reoperation (30-day), n (%)	19 (6.1%)	8 (15.1%)	11 (4.2%)	**0.003**
Readmission (30-day), n (%)	27 (8.6%)	4 (7.5%)	23 (8.8%)	1.00
Mortality (30-day), n (%)	1 (0.3%)	1 (1.9%)	0 (0%)	0.16

p-values shown in bold indicate statistically significant differences, defined as $p<0.05$.

LOS: Length of stay, IQR: Interquartile range

Age and sex demonstrated trends toward increased risk but did not reach statistical significance ($p=0.078$ and $p=0.100$, respectively) (Table 4).

Discussion

This study demonstrated that the absence of a diverting stoma in patients undergoing LAR for rectal cancer was associated with a significantly higher rate of AL and reoperation. The rate of diverting stoma creation during LAR procedures among Turkish surgeons was higher than that reported in the international literature.[8] This may primarily be attributed to the tendency of Turkish surgeons to perform a prophylactic stoma during surgery to prevent potential postoperative complications.

The rate of diverting stoma formation in our study was markedly high at 83%, whereas large series from Asia have generally reported lower rates ranging between 32.3% and 42.1%.[9] In contrast, data from Europe indicate intermediate diversion rates; for example, a meta-analysis of nine randomized controlled trials reported a diversion rate of 51.7%.[6] The lower diversion rates reported in Asian cohorts may partly reflect the earlier timeframes in which many of these studies were conducted compared with more recent European series. Over the past decade, there has been a noticeable global

Table 3. Demographics, tumor characteristics, and surgical details (anastomotic leak vs. no leak)

	All (n=313)	Anastomotic leak (n=17)	No leak (n=296)	p-value
Age, years (IQR)	62 (16)	57 (21)	62.5 (15.3)	0.13
Female sex, n (%)	116 (37.1%)	3 (17.6%)	113 (38.2%)	0.08
BMI, kg/m² (IQR)	25.5 (4.2)	25.3 (4.2)	25.6 (4)	0.38
Symptoms, n (%)				
Bleeding	205 (65.5%)	10 (58.8%)	195 (65.9%)	0.55
Constipation	95 (30.4%)	3 (17.6%)	92 (31.1%)	0.29
Abdominal pain	93 (29.7%)	5 (29.4%)	88 (29.7%)	0.97
Anemia	18 (5.8%)	1 (5.9%)	17 (5.7%)	1.00
Screening	22 (7%)	0 (0%)	22 (7.4%)	0.61
Incidental	10 (3.2%)	1 (5.9%)	9 (3%)	0.43
ASA score, n (%)				
I	82 (26.2%)	7 (41.2%)	75 (25.3%)	0.31
II	190 (60.7%)	8 (47.1%)	182 (61.5%)	
III	41 (13.1%)	2 (11.8%)	39 (13.2%)	
Abdominal surgical history, n (%)	60 (19.2%)	0 (0%)	60 (20.3%)	0.05
Non-smoker, n (%)	202 (64.5%)	13 (76.5%)	189 (63.9%)	0.56
CRC family history, n (%)	43 (13.8%)	1 (5.9%)	42 (14.2%)	0.48
Preoperative CEA level (IQR)	3 (3)	2 (3)	3 (3)	0.34
Preoperative CA19-9 level (IQR)	9 (16)	7 (11.8)	9 (16.5)	0.41
cT stage				
T1	16 (5.1%)	0 (0%)	16 (5.4%)	0.27
T2	54 (17.3%)	5 (29.4%)	49 (16.6%)	
T3	209 (66.8%)	12 (70.6%)	197 (66.6%)	
T4	34 (10.9%)	0 (0%)	34 (11.5%)	
Positive nodal status, n (%)	202 (64.5%)	12 (70.6%)	190 (64.2%)	0.59
Stage at the time of diagnosis, n (%)				
I	37 (14.4%)	2 (15.4%)	35 (14.3%)	0.92
II	56 (21.8%)	2 (15.4%)	54 (22.1%)	
III	164 (63.8%)	9 (69.2%)	155 (63.5%)	
MRI utilization, n (%)	265 (84.7%)	17 (100%)	248 (83.8%)	0.08
MRI T stage, n (%)				
T1	9 (3.4%)	0 (0%)	9 (3.6%)	0.71
T2	43 (16.2%)	4 (23.5%)	39 (15.7%)	
T3	179 (67.5%)	12 (70.6%)	167 (67.3%)	
T4	34 (12.8%)	1 (5.9%)	33 (13.3%)	
MRI-positive nodal status, n (%)	187 (70.6%)	13 (76.5%)	174 (70.2%)	0.58
Tumor distance to anal verge, cm (IQR)	7 (4)	7 (3)	7 (4)	0.93
Neoadjuvant treatment, n (%)	261 (83.1%)	15 (88.2%)	246 (83.1%)	0.74
Time to surgery, weeks (IQR)	10 (4)	8 (3.5)	10 (4)	0.30
Surgical approach, n (%)				
Open	129 (41.2%)	9 (52.9%)	120 (40.5%)	0.41
Hand assisted	1 (0.3%)	0 (0%)	1 (0.3%)	
Laparoscopic	169 (54%)	7 (41.2%)	162 (54.7%)	
Robotic assisted	14 (4.5%)	1 (5.9%)	13 (4.4%)	

Table 3. Continued

	All (n=313)	Anastomotic leak (n=17)	No leak (n=296)	p-value
Conversion, n (%)	18 (9.7%)	0 (0%)	18 (10.2%)	1.00
Total mesorectal excision, n (%)	271 (86.6%)	15 (88.2%)	256 (88.5%)	1.00
Stapler anastomosis, n (%)	278 (88.8%)	15 (88.2%)	263 (88.9%)	1.00
Intracorporeal anastomosis, n (%)	114 (36.4%)	8 (47.1%)	106 (35.8%)	0.50
Anastomosis distance to anal verge, cm (IQR)	3 (2)	3 (1)	3 (2)	0.54
Intraoperative complication, n (%)	11 (3.5%)	1 (5.9%)	10 (3.4%)	0.46
Operative time, min (IQR)	200 (92.5)	200 (70)	200 (95)	0.90
EBL, mL (IQR)	100 (95)	75 (150)	100 (91)	0.67
Intraoperative blood transfusion	9 (2.9%)	0 (0%)	9 (3%)	1.00
No diverting stoma, n (%)	53 (16.9%)	6 (35.3%)	47 (15.9%)	**0.038**

p-values shown in bold indicate statistically significant differences, defined as $p<0.05$.

IQR: Interquartile range, BMI: Body mass index, ASA: American Society of Anesthesiologists, CRC: Colorectal cancer, CEA: Carcinoembryonic antigen, CA19-9: Carbohydrate antigen 19-9, MRI: Magnetic resonance imaging, EBL: Estimated blood loss

Table 4. Anastomotic leakage predictors

	Ref	Odds ratio (95% CI)	p-value
Age at diagnosis	-	1.03 (0.99-1.08)	0.078
Sex	Female	0.34 (0.09-1.23)	0.100
Stoma	Performed	0.34 (0.11-0.99)	0.050

CI: Confidence interval

trend toward increased utilization of diversion stomas, driven by growing awareness of AL-related morbidity and its impact on postoperative outcomes. By comparison, the notably higher rate observed in our cohort may also reflect the proactive attitude of Turkish surgeons toward preventing the clinical consequences of AL, in line with contemporary literature emphasizing its significant impact on postoperative morbidity and mortality; this highlights how national practice patterns regarding diversion stoma creation during LAR may influence postoperative outcomes. To our knowledge, this is the first and largest database-based study conducted in Türkiye to investigate these patterns and their clinical consequences.

In the 132-patient series reported by Lefebure et al.[10], the rate of defunctioning stoma was 31.8%, and although the incidence of AL was similar between patients with and without a stoma (7.1% vs. 11%), both mortality and the development of a permanent stoma were observed exclusively in the non-diverted group. In an analysis of 1,791 patients using the National Surgical Quality Improvement Program database, protective stoma formation was found to provide no additional benefit in low pelvic anastomoses and was even associated with an increased risk of renal complications; however, in coloanal anastomoses, the absence of a stoma was significantly associated with higher rates of sepsis, septic shock, and reoperation.[11] In our cohort, diverting stoma creation was associated with lower observed rates of AL and reoperation; however, these findings should be interpreted in the context of substantial baseline differences between groups.

In a large multicenter meta-analysis, the rate of clinical AL was 18.3% in patients without diversion compared with 6.3% in those with diversion, and reoperation rates were 16.3% and 5.6%, respectively; however, no significant difference in mortality was observed.[12] Taken together, our national data indicate that diversion not only limits the clinical consequences of AL but may also reduce its overall incidence, thereby contributing important complementary evidence to the international literature. Postoperative complications other than AL—such as surgical site infection or urinary problems—did not differ significantly with stoma creation, consistent with findings reported in the existing literature.[11]

In our cohort, diverting stoma creation was associated with a lower observed rate of AL, consistent with the findings of Park et al.[13], who reported a significantly lower risk of leakage in patients undergoing diversion (hazard ratio=0.65; $p<0.05$). However, given the limited number of leakage events and the potential for residual confounding, this association should be interpreted with caution.[13] In a large meta-analysis (n=9,675), neoadjuvant therapy was not identified as an independent risk factor for AL (OR=1.16; 95% CI: 0.99-1.36; p=0.07), indicating that treatment modality alone does not significantly compromise anastomotic integrity.[14] Our findings are consistent with these results, indicating that neoadjuvant therapy did not independently increase the risk of leakage in our cohort.

In our cohort, diverting stoma creation was associated with the administration of neoadjuvant therapy and a lower anastomotic level. Neoadjuvant treatment was more frequent in the stoma group than in the non-stoma group (88.5% vs. 56.5%, $p<0.001$), while the median anastomotic distance from the anal verge was lower in the stoma group (3 vs. 4 cm, $p<0.001$). Similarly, in a large multicenter study, the most frequently cited criteria influencing surgeons' decision-making were neoadjuvant chemoradiotherapy (88%) and the anastomotic level (96%).[15] This alignment indicates that, both nationally and internationally, these two parameters remain the key considerations for protective stoma formation. Notably, although patients without a diverting stoma had earlier-stage tumors and relatively higher anastomotic levels, they exhibited higher rates of AL and reoperation. This finding suggests that the decision to omit diversion should not be based solely on these apparently favorable characteristics. However, the contribution of unmeasured technical and surgeon-related factors cannot be excluded.

Study Limitations

The main strength of our study is the use of a large national colorectal database, which enabled analysis of a substantially broader cohort than previously reported Turkish series and provided robust comparisons between diverted and non-diverted groups. Multivariate analysis further demonstrated that the absence of a stoma was associated with an increased risk of AL, underscoring the clinical relevance of our findings. However, the retrospective design may have introduced selection bias, as the decision to create a stoma depended on surgeon preference. Another important limitation is the potential for confounding by indication. Since the decision to create a diverting stoma was surgeon dependent and guided by intraoperative risk assessment, patients perceived as at greater risk of AL were more likely to undergo stoma formation. Therefore, despite the observed association between diversion and lower leakage rates, this finding should be interpreted with caution, as substantial baseline differences between the groups and potential confounding by indication may have contributed to it. It should also be recognized that diverting stomas are not without morbidity. Although they may mitigate the clinical consequences of AL, stoma formation can be associated with stoma-related complications such as dehydration, electrolyte imbalance, skin irritation, prolapse, parastomal hernia, and the need for an additional reversal procedure. Long-term outcomes such as permanent stoma rates and functional results were not assessed, which limits the scope of our conclusions. AL was recorded in the database only as a dichotomous variable (yes/no), without grading according to a standardized classification system. Therefore, although we were able to evaluate the association between diverting stoma formation and leakage, we could not assess whether diversion affected the clinical severity of leakage, which may be a more relevant outcome in this context. Finally, the low absolute number of AL events (n=17) represents a statistical limitation. Including multiple predictor variables in the logistic regression model with this number of events resulted in a low events-per-variable ratio, which may increase the risk of overfitting and limit the predictive power of the multivariable analysis. Nevertheless, this study provides national, database-based evidence from Türkiye showing an association between diverting stoma formation during LAR and lower observed rates of AL and reoperation. These findings bridge an important gap in the literature by reflecting real-world surgical practice and decision-making trends in a large, multicenter cohort. It provides valuable data to support the development of standardized surgical strategies and guideline recommendations in the management of rectal cancer.

Conclusion

In this observational cohort, diverting stoma formation during LAR for rectal cancer was associated with lower rates of AL and reoperation. However, given the retrospective design and potential selection bias, these findings should be interpreted as associated with lower observed rates of AL. Despite having earlier-stage tumors and relatively higher tumor and anastomosis levels, patients without a stoma exhibited a higher incidence of AL with increased reoperation rates. These findings highlight the importance of individualized consideration of diverting stoma creation in patients undergoing LAR for rectal cancer.

Ethics

Ethics Committee Approval: The Ege University Ethics Committee of Medical Research approved the study protocol (dated: 06.03.2025, approval no.: 25-3T/58).

Informed Consent: This retrospective cohort study utilized prospectively collected data

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Footnotes

Authorship Contributions

Concept: K.E., O.B. Design: K.E., O.B. Data Collection or Processing: B.E.B., K.E., Analysis or Interpretation: K.E., Literature Search: B.E.B., K.E., Writing: B.E.B., K.E., O.B.

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