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RESEARCH ARTICLE

Risk Factors in Anastomotic Leaks After Low Anterior Resection for Rectal Cancer and the Effects of Diverting Stoma on Clinical Results

Rektum Kanserinde Low Anterior Rezeksiyon Sonrası Gelişen Anastomoz Kaçağında Risk Faktörleri ve Diversiyon Stomanın Klinik Sonuçlara Etkisi

Ebubekir Gündeş[1], Durmuş Ali Çetin[2], Ulaş Aday[3], Hüseyin Çiyiltepe[4], Emre Bozdağ[5], Orhan Uzun[5], Kamuran Cumhur Değer[5], Mustafa Duman[5]

[1]University of Health Sciences, Gazi Yaşargil Training and Research Hospital, Clinic of Gastroenterological Surgery, Diyarbakır, Turkey
[2]Şanlıurfa Training and Research Hospital, Clinic of Gastroenterological Surgery, Şanlıurfa, Turkey
[3]Elazığ Training and Research Hospital, Clinic of Gastroenterological Surgery, Elazığ, Turkey
[4]İstanbul Fatih Sultan Mehmet Training and Research Hospital, Clinic of Gastroenterological Surgery, İstanbul, Turkey
[5]İstanbul Kartal Koşuyolu Yüksek İhtisas Training and Research Hospital, Clinic of Gastroenterological Surgery, İstanbul, Turkey

ABSTRACT

Aim: The aim of this study was to determine the risk factors which might render patients who underwent rectal cancer surgery prone to anastomotic leaks (AL) and to investigate whether diverting stoma (DS) alleviated the severity of AL.

Method: Patients who underwent elective curative surgery because of rectal cancer in our clinic between January 2010 and December 2016 were included in the study. The definition and grading of AL were determined using the criteria put forward by the International Study Group of Rectal Cancer. Relationships among variables related to the clinical, surgical, and pathological results of patients with AL were investigated through univariate and multivariate analyses. Patients observed to have AL were classified as those with and without DS for subgroup analysis.

Results: Of 110 patients who underwent low anterior resection, AL was detected in 19 patients (17.2%). Sixty-three patients (57.3%) had DS during the first surgery [DS (+)], while 47 patients (42.7%) did not [DS (-)]. The results of the univariate analysis revealed significant associations between AL and male sex, chronic artery disease (CAD), preoperative chemoradiation (CRT), preoperative hemoglobin <10 g/dL, and operation time >300 (minute). There was no significant relationship between AL and DS [p=0.653; odds ratio (OR)=0.797; 95% confidence interval (CI)=0.295-2.149]. The results of the multivariate analysis, however, showed CAD (p=0.024; OR=4.201; 95% CI=0.069-0.824) and preoperative CRT (p=0.030; OR=3.66; 95% CI=0.017-1.804) as independent prognostic factors. In subgroup analysis of patients with AL, the DS (-) group had significantly longer mean hospital stay (p=0.049), higher Clavien-Dindo morbidity score (p=0.028), and more severe AL (p=0.002). Relaparotomy was performed in 7 patients (77.7%) in the DS (-) group but none of the patients in the DS (+) group (p=0.001).

Conclusion: CAD and preoperative CRT were associated with increased risk of AL after rectal cancer surgery. Although diversion ostomy procedures do not decrease AL and postoperative mortality rates, we believe that DS alleviates the severity of AL. Therefore, they enable leaks to be treated palliatively and reduce the need for emergency reoperations.

Keywords: Low anterior resection, anastomotic leak, rectal cancer

ÖZ

Amaç: Bu çalışmanın amacı, rektum kanseri nedeniyle opere edilen hastaları anastomoz kaçağına (AK) yatkın hale getirebilecek risk faktörlerini tespit etmek ve diversiyon stomanın (DS), gelişen AK şiddetini azaltıp azaltmadığını incelemektir.

Yöntem: Kliniğimizde Ocak 2010-Aralık 2016 tarihleri arasında rektum kanseri nedeniyle elektif küratif cerrahi uygulanmış hastalar çalışmaya dahil edildi. AK tanımı ve şiddeti, International Study Group of Rectal Cancer tarafından belirlenen kriterler kullanılarak belirlendi. Klinik AK saptanan hastalarda klinik, cerrahi ve patolojik sonuçlarla ile ilişkili değişkenler arasındaki ilişkiler tek değişkenli ve çok değişkenli analizle incelendi. Subgrup analizde AK tespit edilen hastalar ise DS açılan ve açılmayan şeklinde iki gruba ayrılarak incelendi.

Address for Correspondence/Yazışma Adresi: Ebubekir Gündeş MD
University of Health Sciences, Gazi Yaşargil Training and Research Hospital, Clinic of Gastroenterological Surgery, Diyarbakır, Turkey
Phone: +90 505 860 67 40 **E-mail:** ebubekir82@hotmail.com **ORCID ID:** orcid.org/0000-0001-7944-8681
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Bulgular: Low anterior rezeksiyon yapılan 110 hastanın 19'unda (%17,2) AK meydana geldi. İlk cerrahi sırasında 63 (%57,3) hastaya DS açılırken [DS (+)] 47 (%42,7) hastaya ise DS açılmamıştır [DS (-)]. Tek değişkenli analizde; erkek cinsiyet, koroner arter hastalığı (KAH), preoperatif kemoradyoterapi (KRT), preoperatif hemoglobin <10 g/dL ve operasyon süresi (dakika) >300 olması AK ile anlamlı derecede ilişkiliydi. Bunun yanında DS'nin AK ilişkisi saptanmadı [p=653; odds oranı (OR)=0,797; %95 güven aralığı (GA)=0,295-2,149]. Çok değişkenli analizde, KAH (p=0,024; OR=4,201; %95 CI=0,069-0,824) ve preoperatif KRT (p=0,030; OR=3,66; %95 GA=0,017-1,804) bağımsız prognostik faktörler olarak belirlendi. AK saptanan hastalarda yapılan subgrup analizde ise; ortalama hastanede kalış süresi (p=0,049), Clavien-Dindo'ya göre morbidite skoru (p=0,028) ve anastomoz kaçağı şiddet derecesi (p=0,002) DS (-) grupta anlamlı derede yüksek saptandı. DS (-) grubundaki yedi hastaya (%77,7) relaparotomi yaparken DS (+) hiçbir hastaya relaparatomi yapılmamıştır (p=0,001).

Sonuç: KAH ve preoperatif KRT, rektum kanseri cerrahisinden sonra artmış anastomoz kaçak riski ile ilişkilendirildi. Diversiyon ostomileri anastomoz kaçak oranlarını ve postoperatif mortaliteyi azaltmamakla ancak anastomoz kaçaklarının şiddetini azatlığı kanısındayız. Böylece kaçakların palyatif yöntemlerle tedavi edilmelerine olanak sağladığını ve acil reoperasyon ihtiyacını azalttığını düşünmekteyiz.

Anahtar Kelimeler: Aşağı anterior rezeksiyon, anastomoz kaçağı, rektum kanseri

Introduction

On one hand, life expectancy of patients has been increased by way of total mesorectal excision (TME) and sphincter-protective procedures that were initiated for rectal cancer treatment. On the other hand, anastomotic leaks (AL) still prove to be significant problems in rectal surgery procedures, especially in distal rectal tumors. The clinical leak rate reported for rectal cancer after low anterior resections (LAR) goes as high as 21%.[1,2,3]

AL still continue to pose major problems for surgeons today even though there is an ample amount of studies on AL.[4] There are, however, very few studies on the ways in which the presence of loop ileostomy in patients with AL affects the progress of complications. The aim of this study, therefore, was to analyze the risk factors for AL after LAR and to investigate whether diverting stoma alleviated the severity of the developed AL.

Materials and Methods

Patients

Patients who underwent elective curative surgery because of rectal cancer in Kartal Koşuyolu Yüksek İhtisas Training and Research Hospital, Clinic of Gastroenterological Surgery between January 2010 and December 2016 were included in the study. The exclusion criteria were determined to be patients with palliative resection, distant organ metastasis, subtotal colectomy, total proctocolectomy, abdominoperineal resection, Hartmann procedure or pull-through procedures, and those with insufficient medical file information. A hundred forty patients underwent surgery within this period having been diagnosed with rectal cancer. A hundred ten patients who met the inclusion criteria out of the mentioned 140 were included in the study.

Preoperative Evaluation

During treatment planning all cases in the series received general physical examination, rectal touché; their full blood count, blood biochemistry, carcinoembryonic antigen level results were obtained and they also received colonoscopy, tumor biopsy, thoracoabdominopelvic computerized tomography (CT) while pelvic magnetic resonance examination and/or endorectal ultrasonography were performed for necessary cases. All the patients were diagnosed with rectal adenocarcinoma verified by colonoscopic biopsy. Thoracoabdominal CT results were obtained for all patients for preoperative staging. The treatment of the cases was planned in a multidisciplinary manner evaluating the localization and stage of the tumor, patient's age and comorbid conditions together. TME was performed for tumors located in the lower and mid rectum. The mesorectum was divided 5 cm beneath the distal border of the tumor in tumors with upper rectal localization. "En bloc" resection was performed for cases where the tumor was involved with surrounding structures. All the anastomoses had extraperitoneal localizations while pelvic and anastomotic area drainage was maintained in all patients.

Anastomotic Leaks and Categorization

Clinical AL was defined as pus, gas, or stool leak from the drain, incision, or vagina (rectovaginal fistula). Radiological AL, on the other hand, was defined as the extravasation of the contrast material administered rectally and the presence of pelvic abscess neighboring the anastomosis. The severity of AL was divided into 3 groups according to the International Study Group of Rectal Cancer.[1] According to this categorization, group A was composed of patients with no change in patient management, group B was made up of patients who necessitated active therapeutic intervention but could be managed without relaparotomy, and group C covered patients necessitating relaparotomy.

The patients covered by our study were divided into two groups as those with AL (AL +) and those without (AL -). Moreover, patients with AL were also divided into two groups as those with protective ileostomy opening [diverting stoma (DS) (+)] and those without [DS (-)] in the light of the results of the subgroup analysis.

Data

The preoperative data on the age, sex, body mass index, left ventricular ejection fraction, respiratory function tests, comorbidities, American Society of Anesthesiologists classification, history of smoking, neoadjuvant treatment and preoperative laboratory results, pathological characteristics, and duration of hospitalization of the patients in the study were obtained from their respective file records and electronic archives. Surgical method, level of anastomosis from the anal verge, use of defunctioning stoma, duration of surgery (minutes), and blood transfusions utilized in the surgery were recorded. Mortality seen within the first 30 days of postoperative follow-up was defined as surgical mortality, while the surgical complications observed within the same period were defined as morbidity. Postoperative complications were graded according to the Clavien-Dindo classification.[2]

Research Questions

1. Primary question: What are the risk factors affecting AL after LAR?

2. Secondary question: Does protective ileostomy alleviate the severity of AL in rectal cancer surgery?

Statistical Analysis

SPSS (Statistical Package for Social Sciences, Inc., Chicago, IL, ABD) for Windows 22.0 was utilized for the statistical analyses of the data collected. The mean and standard deviation values were calculated for the data collected from the patients covered by the study. The distribution of data was checked by the Kolmogorov-Simirnov test. Student's t-test was used to analyze comparisons of two groups with normal distribution. Categorical groups were compared by the chi-square test. Univariate logistic regression analysis was performed initially for each variable in order to determine the variables to be introduced into the model during the building of the multivariate logistic regression model for anastomotic leak risk factors following rectal cancer surgery. In cases where the probability value of the Wald test statistics was smaller than the level of significance ($p<0.25$), related variables were included in the multivariate model. The odds ratio (OR) and 95% confidence interval (95% CI) were calculated, while statistical significance was set at $p<0.05$.

Results

A total of 110 patients with rectal adenocarcinoma received sphincter protective LAR at our clinic between January 2010 and December 2016. Sixty two (56.4%) of the patients were male, while 48 (43.6%) were female and their mean age was 64.5±11 years. While 63 (57.3%) patients had DS opening during surgery, 47 (42.7%) did not. The mean anastomotic height from the anal verge was 5.91±2.37 cm. AL was seen in 19 (17.3%) patients (Figure 1). Male sex, chronic artery disease (CAD), preoperative chemoradiation, preoperative hemoglobin <10 g/dL, and operation time (min) >300 were determined to have statistically significant relationships with the dependent variable as revealed by the results of the significance test performed for the coefficients of the factors included in each univariate model by means of Table 1. These variables were ascertained to be candidates to be

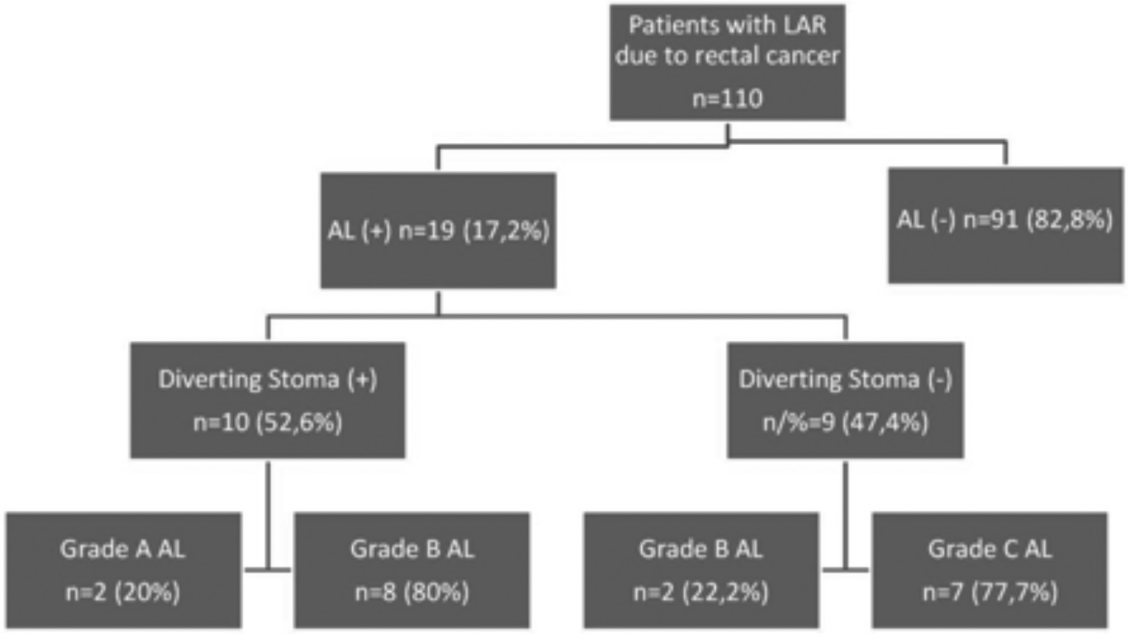

Figure 1. Flow chart showing diverting stoma and anastomotic leak rates in patients with low anterior resections
AL: Anastomotic leaks, LAR: Low anterior resections

Table 1. Univariate Logistic Regression Model analysis of anastomotic leakage in patients with rectal cancer

Variable	Total	AL (-)	AL (+)	Odds ratio	95% CI	p
Clinical and demographic characteristics						
Age (≥65)	59	49 (53.8%)	10 (52.6%)	1.050	0.390-2.827	0.923
Male sex	62	49 (53.8%)	13 (68.4%)	1.857	0.649-5.315	0.249
HT	57	45 (49.5%)	12 (63.2%)	0.571	0.206-1.580	0.280
CAD	19	12 (13.2%)	7 (36.8%)	3.84	0.086-0.792	0.018
DM	22	17 (18.7%)	5 (26.3%)	0.643	0.240-2.030	0.452
COPD	27	24 (26.4%)	3 (15.8%)	1.910	0.511-7.140	0.336
AF	6	4 (4.4%)	2 (10.5%)	0.391	0.066-2.306	0.300
CRF	5	4 (4.4%)	1 (5.3%)	1.208	0.127-11.456	0.869
ASA skore ≥3	67	55 (60.4%)	12 (63.2%)	0.891	0.321-2.478	0.825
BMI (kg/m^2) (≥25)	85	70 (76.9%)	15 (78.9%)	0.889	0.266-2.969	0.848
Preoperative chemoradiation	46	34 (37.4%)	12 (63.2%)	2.87	0.125-0.969	0.043
Smoker	25	22 (24.2%)	3 (15.8%)	1.700	0.453-6.386	**0.432**
LVEF <55	15	11 (12.1%)	4 (21.1%)	0.516	0.145-1.837	0.307
CEA	27	20 (24.4%)	7 (36.8%)	0.553	0.192-1.596	0.273
Albumin <3.5 g/dL	15	14 (15.4%)	1 (5.3%)	3.273	0.404-26.530	0.267
Hemoglobin <10 g/dL	14	10 (11%)	4 (21.1%)	0.463	0.128-1.671	**0.240**
Intraoperative features						
Laparoscopic surgery	28	25(27.5%)	3 (15.8%)	2.020	0.542-7.534	0.295
Diverting ileostomy	63	53 (58.2%)	10 (52.6%)	0.797	0.295-2.149	0.653
Peroperative transfusion of PRBCs	8	6 (6.6%)	2 (10.5%)	0.600	0.112-3.229	0.552
Operation time (min) >300	34	25 (27.5%)	9 (47.4%)	0.421	0.153-1.157	**0.094**
Anastomosis ≤7 cm from anal verge	76	62 (68.1%)	14 (73.7%)	0.764	0.251-2.322	0.635
Pathological features						
Lymphovascular invasion	28	24 (26.4%)	4 (21.1%)	1.343	0.406-4.448	0.629
Primary node status	52	43 (47.3%)	9 (47.4%)	0.995	0.370-2.679	0.993
Tumor stage ≥3	75	61 (67%)	14 (73.7%)	0.726	0.239-2.205	0.572

HT: Hypertension, CAD: Chronic arter disease, DM: Diabetes mellitus, COPD: Chronic obstructive pulmonary disease, AF: Atrial fibrillation, CRF: Chronic renal failure, ASA: American Society of Anesthesiologists, BMI: Body mass index, LVEF: Left ventricul ejection fraction, CEA: Carcinoembryonic antigen, CI: Confidence internal, AL: Anastomotic leaks, PRBCs: Packed red blood cells

introduced to the multivariate model. CAD and preoperative chemoradiation were determined to be independent risk factors within the scope of the multivariate analysis of the risk factors related to AL and logistic regression analysis (Table 2). The other variables determined to have significance by the univariate analysis, however, did not reveal any significance in the multivariate analysis.

In the Anastomotic Leak Group

When all the cases were investigated it was seen that the AL rate was 17.2% (19/110). There was no statistically significant difference between the group with DS opening and the one without as revealed by the results of univariate analysis (p=0.653, OR 0.797, 95% CI 0.295-2.149). The fistula grade (p=0.002), morbidity that emerged within the postoperative 30 days according to Clavien-Dindo (p=0.028), and the duration of hospitalization (p=0.049) were found to be significantly higher in the group without DS opening in the first surgical procedure than the group with DS opening. Table 3 summarizes the clinical and demographic

Table 2. Multiple Logistic Regression Model analysis of anastomotic leakage in patients with rectal cancer

Variable	OR	95% CI	p
Male sex	2.954	0.803-10.863	0.103
Chronic arter disease	**4.201**	**0.069-0.824**	**0.024***
Preoperative chemoradiation	**3.66**	**0.017-1.804**	**0.030***
Preoperative hemoglobin <10 g/dL	0.111	0.060-1.337	0.111
Operation time (min) >300	0.389	0.191-1.906	0.603

OR: Odds ratio, CI: Confidence interval, *: Independent risk factor for anastomotic leakage

characteristics of patients with AL. When the treatment management of the patients with AL was investigated, it was observed that although there was no need for relaparotomy in the DS (+) group in the first operation, 7 cases necessitated relaparatomy in the DS (-) group (p=0.001). While 6 out of 7 of these cases received the Hartmann procedure, one case had ileostomy opening. Mortality related to multi-organ failure was seen in a patient with grade C fistula in the DS (-) group. No mortality cases were seen in the DS (+) group. It was observed that 9 (90%) out of 10 patients in the DS (+) group in the first operation had their ileostomy closure procedures without any problems within the scope of long-term follow-up. It was seen that one case's ileostomy could not be closed up upon multiple metastases in the liver because of anastomotic narrowness during the follow-ups. It was also seen that none of the patients' ostomies were closed up during the ostomy follow-up of patients with grade C fistulas who had relaparatomy and ostomy openings. There was a statistically significant difference with regards to ostomy closures between the patients who had ileostomy in the first operation and the patients who had relaparatomy and ostomy openings (p=0.001).

Discussion

The rate of clinical leaks after LAR performed for rectal cancer has been reported to vary between 3% and 21%. Recently, the number of patients with possible anastomotic leak risks has been on the rise with the increasing number of sphincter protective procedures.[3,4,5] We determined that the rate of AL at our clinic was 17.2%. AL is the most feared septic complication and leads to an increased risk of morbidity, mortality, and prolonged hospitalization. Postoperative mortality is seen between 6 to 22% because of septicemia and peritonitis observed after AL.[6,7,8,9] Mortality was seen in only one case (5.2%) in patients with AL within the scope of our study. The longer the period of time between

Table 3. Characteristics of patients with anastomotic leak

Variable		DS (+) (n=10)	DS (-) (n=9)	p
Age (yrs)		61.3±13.9	66.89±13.23	0.682
Sex	M	6 (60%)	7 (77.8%)	0.405
	F	4 (40%)	2 (22.2%)	
Comorbidities (n/%)	HT	6/10 (60%)	6/9 (66.7%)	0.764
	CAD	3/10 (30%)	5/9 (44.4%)	0.515
	DM	4/10 (40%)	1/9 (11.1%)	0.153
	COPD	3/10 (30%)	0/9	0.073
	CRF	1/10 (10%)	0/9	0.330
	AF	0/10	2/9 (22.2%)	0.115
Smoker (n/%)		2/10 (20%)	1/9 (%11)	0.596
BMI (kg/m^2)		29.49±4.7	28.2±3.9	0.527
ASA	1+2	4 (40%)	3 (33.3%)	0.764
	3+4	6 (60%)	6 (66.7%)	
Neoadjuvant therapy	Yes	8 (80%)	4 (44.4%)	0.109
	No	2 (20%)	5 (55.6%)	
Level of anastomosis	>4 cm	5 (50%)	1 (11.1%)	0.069
	≤4 cm	5 (50%)	8 (88.9%)	
Anastomotic leak grade	A	2 (20%)	0 (%)	**0.002***
	B	8 (80%)	2 (22.2%)	
	C	0 (%)	7 (77.8%)	
Hospital stay (d)		13.2±4.94	28.11±11.39	**0.049***
Clavian-Dindo classification	I	3 (30%)	0 (%)	**0.028***
	II	5 (50%)	1 (11.1%)	
	III	2 (20%)	3 (33.3%)	
	IV	0 (%)	4 (44.4%)	
	V	0 (%)	1 (11.1%)	

HT: Hypertension, CAD: Chronic arter disease, DM: Diabetes mellitus, COPD: Chronic obstructive pulmonary disease, CRF: Chronic renal failure, AF: Atrial fibrillation, BMI: Body mass index, ASA: American Society of Anesthesiologists, F: Female, M: Male, DS: Diverting stoma

AL development and diagnosis the higher are the rates of mortality and morbidity. Therefore, patients with AL should be diagnosed early and treatment should be initiated without any delays. Although TME has been widely accepted in the treatment of rectal cancer, an increased risk of AL has been seen following this operation. Decreased blood flow into the remnant anorectal area and pelvic infection related to fluid accumulation because of the formation of a large pelvic cavity after TME have been considered to be possible

factors for this increase. Moreover, some risk factors have also been reported to be the causes of leaks. These factors include emergency surgery, malnutrition, corticosteroid administration, male sex, obesity, smoking and alcohol abuse, cardiovascular disease, perioperative blood transfusion, old age, and preoperative chemoradiotherapy.[4,5,6,10] The International Study Group of Rectal Cancer has classified ALs into three groups as grade A, B, and C. Grade A refers to asymptomatic radiological leak that does not necessitate treatment, grade B refers to leaks that call for percutaneous or transanal drainage and antibiotics treatment, and grade C refers to leaks with septic presentation that necessitate relaparatomy and render oncological results deteriorate.[1] In our study, 2 of the patients with AL were evaluated to be grade A, while 10 were grade B and 7 were grade C. Grade C fistulas were not seen in any of the patients with diversion stoma openings. The efficient treatment of AL is mandatory when the patient is diagnosed. Surgical decision is the most important stage and when the cases that underwent surgery are investigated it is observed that early decision to perform surgery proves to be the most significant factor that decreases the risk of mortality.[11] Especially the leaks that develop under the protection of diverting stoma are mostly asymptomatic and medical supportive treatment is generally sufficient. In patients with extraperitoneal anastomoses with no peritonitis symptoms, special drains located on the fistula line following the endoscopic debridement of the area and their aspiration with negative pressure enables AL to recover and may reduce the need for a second surgical intervention.[12] Exploration is mandatory in patients with widespread peritonitis. Proximal fecal diversion is enabled in cases without stoma but the Hartmann procedure becomes necessary in cases where the anastomosis is separated in full-thickness.[13] There are studies in literature that have reported that protective stoma did not prevent AL but helped recuperate patients clinically from the significant complications of the leak in an easier manner.[14,15,16,17,18] Hüser et al.[17] stated in their study that opening up protective stoma in anastomoses done up to 7 cm from the anal verge reduced the risk of serious anastomotic leak complications which could be life-threatening. Diversion stoma for AL in rectal cancer surgery proves to be the most controversial issue. Lopez-Kostner et al.[14] found in their 1998 study conducted with 260 LAR patients that the AL rate for the AL stoma group was 154/9 (5.8%) while it was 106/13 (12.2%) in the group without stoma. The authors reported no statistically significant difference between the two groups. In our study we found out that this rate was 63/10 (15.87%) in the stoma group while it was 47/9 (19.1%) in the group without stoma. There was no statistically significant difference between the two with regards to AL. Poon et al.[15] analyzed the cases of 148 patients with LAR in their 1999 study and performed stoma in 61 (41%) patients (with cardiac problems, on steroids, challenging pelvic dissection, hemorrhaging more than 1 lt, suspicious blood circulation, + air test, deficient dognat, bowel obstruction, preoperative irradiation) while the procedure was not performed in patients without any risks. While the authors observed AL only in 2 (3.3%) patients with stoma (at risk), these patients were followed-up conservatively. The authors ascertained AL in 11 (12.6%) patients without stoma (not at risk). The follow-up of these patients included conservative treatment for 4 patients, while the remaining 7 received laparotomy out of which 6 had loop ileostomy and 1 received the Hartmann procedure. Within the framework of our study none of the AL patients in the stoma group needed relaparatomy but we found that 7 out of 9 AL patients without stoma received relaparatomy. Rullier et al.[7] reported that 6 (30%) out of 20 AL patients with stoma necessitated relaparatomy while 7 (58%) out of 12 AL patients without stoma needed relaparatomy when they investigated the AL cases with regards to reoperation. Anderin et al.[18] stated in their 2015 study that diversion ostomy procedures reduced the rate of relaparatomy supporting the study by Rullier et al.[7] In spite of the above mentioned benefits of protective stoma opening, there are some disadvantages to the procedure as well. Matthiessen et al.[19] argued in their randomized multicenter study that this procedure, which is also known as temporary stoma, became literally permanent in some patients. Nevertheless, other studies documented that patients with protective stoma openings stayed in the hospital longer and witnessed a decrease in their quality of life during the process of adapting to the stoma.[20,21] In addition, various studies have also reported that stoma related complications superimposed additional load to patient morbidity and mortality alongside with necessitating second hospitalization for the closure of the protective stoma and calling for additional costs for treatment.[22] Dinc et al.[23] analyzed the cases of 68 patients with ileostomy because of colorectal surgery in their 2014 study. The authors found the rate of AL in such patients with ileostomy closure as 2.9%. In another metaanalysis published in 2014, the authors underlined that protective stoma related morbidity and stoma closure complications were insignificant when compared to the necessary reoperations performed for AL in the absence of protective stoma.[24] The limitations of this study include the limitations of a retrospective analysis. The fact that the study was conducted with a limited number of patients and the possible differences among surgeons regarding DS opening indications could be listed among the other limitations of the study.

CAD and preoperative CRT were seen to be related to an increased risk of anastomotic leak after rectal cancer surgery. Pelvic septic complications following rectal surgery

prove to be the most significant cause of early morbidity and mortality. Although diversion ostomy procedures reduce the rates of AL and postoperative mortality, we believe that they alleviate the severity of AL. Thus, we are of the opinion that they render the palliative treatment of the leaks possible and reduce the need for emergency reoperations.

Ethics

Ethics Committee Approval: Retrospective study.

Informed Consent: Retrospective study.

Peer-review: Internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: E.G., Concept: D.A.Ç., Design: E.G., U.A., Data Collection or Processing: E.B., H.Ç., Analysis or Interpretation: K.C.D., Literature Search: O.U., Writing: E.G., M.D.

Conflict of Interest: No conflict of interest was declared by the authors.

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