Annals of COLOPROCTOLOGY

Original Article
Ann Coloproctol 2023;39(5):395-401
pISSN: 2287-9714 • eISSN: 2287-9722
https://doi.org/10.3393/ac.2022.00073.0010

Outcomes following anastomotic leak from rectal resections, including bowel function and quality of life

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Purpose: Anastomotic leak (AL) is an uncommon but potentially devastating complication after rectal resection. We aim to provide an updated assessment of bowel function and quality of life after AL, as well as associated short- and long-term outcomes.
Methods: A retrospective audit of all rectal resections performed at a colorectal unit and associated private hospitals over the past 10 years was performed. Relevant demographic, operative, and histopathological data were collected. A prospective survey was performed regarding patients' quality of life and fecal continence. These patients were matched with nonAL patients who completed the same survey.
Results: One hundred patients (out of 1,394 resections) were included. AL was contained in 66.0%, not contained in 10.0%, and only anastomotic stricture in 24.0%. Management was antibiotics only in 39.0%, percutaneous drainage in 9.0%, operative abdominal drainage in 19.0%, transrectal drainage in 6.0%, combination of percutaneous drainage and transrectal drainage in 2.0%, and combination abdominal/transrectal drainage in 1.0%. The 1-year stoma rate was 15.0%. Overall, mean Fecal Incontinence Severity Instrument scores were higher for AL patients than their matched counterparts (8.06 ± 10.5 vs. 2.92 ± 4.92, P = 0.002). Patients with an AL had a mean EuroQol visual analogue scale (EQ-VAS) of 76.23 ± 19.85; this was lower than the matched mean EQ-VAS for non-AL patients of 81.64 ± 18.07, although not statistically significant (P = 0.180).
Conclusion: The majority of AL patients in this study were managed with antibiotics only. AL was associated with higher fecal incontinence scores in the long-term; however, this did not equate to lower quality of life scores.

Keywords: Anastomotic leak; Fecal incontinence; Quality of life; Rectal neoplasms

INTRODUCTION

Anastomotic leak is an uncommon but potentially devastating complication after total mesorectal excision (TME) of rectal cancer, occurring in 2% to 19% of patients [1]. The risk factors for anastomotic leak are well-known [2–4], and there has been much interest in the literature in regards to anastomotic leak prediction and associated outcomes [5–7].

Patients that have an anastomotic leak after colorectal surgery have a greater hospital length of stay, morbidity, mortality, permanent stoma rate, and even poorer oncological outcomes [8, 9]. However, we do not yet know the ideal management of these patients

Received: January 16, 2022; Revised: March 26, 2022; Accepted: March 26, 2022
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[10], particularly in regards to achieving optimal bowel function and quality of life outcomes afterward. Current management strategies include reoperation, radiological guided drainage, or intravenous antibiotics alone. However, most studies on this topic were published more than 5 years ago [11–15]. Poor bowel function can occur after colorectal surgery; and from limited data, this may worsen after anastomotic leak [11–13] and negatively impact upon quality of life.

In our study, we hope to provide an updated assessment of bowel function and quality of life after anastomotic leak from rectal resections. Associated short- and long-term outcomes are also described.

METHODS

Ethics statement

This study was approved by the South Western Sydney Local Health District Ethics Committee (No. ETH00454).

Study design

A retrospective audit of all rectal resection patients performed at a colorectal unit in Sydney, Australia over the past 10 years, as well as associated private hospitals, was performed. Rectal resection patients were identified, and then medical records were examined to identify those with an "anastomotic leak."

We have defined anastomotic leak in our paper to include the following criteria: a leak in the bowel anastomosis that is identified at reoperation; the presence of extraluminal gas or perianastomotic collection on postoperative imaging; or evidence of anastomotic stenosis on routine endoscopic examination, clinical examination, or radiological examination.

Additional inclusion criteria included adult population, benign or malignant colorectal disease, emergency or elective surgery, and laparoscopic or open/conversion procedures. Patients with inflammatory bowel disease and/or pouch formation were excluded, as were redo resections.

A prospective telephone survey of identified anastomotic leak patients was then performed, regarding the patients' quality of life and fecal continence. Patients who still had a stoma at the time of the survey were assessed for quality of life, but not fecal incontinence. Anastomotic leak patients without a current stoma, who completed the telephone survey, were then matched with patients who did not have an anastomotic leak by age, sex, height of anastomosis, whether neoadjuvant radiotherapy was given, presence of initial defunctioning ileostomy, and timeframe. These patients also did not have a current stoma. The matched patients subsequently underwent the same telephone survey.

Primary outcomes

The primary outcomes were long-term bowel function and quality of life after anastomotic leak. Secondary outcomes included short-term outcomes such as 30-day mortality, morbidity, reoperation, and hospital length of stay; long-term outcomes including stoma reversal, colorectal cancer recurrence, and survival.

Data collection

The following demographic data were collected: patient age, sex, body mass index, comorbidities, preoperative blood tests, nature of bowel pathology, whether neoadjuvant therapy was given, TNM stage if cancer, previous pelvic radiotherapy, and previous laparotomy. Indications for neoadjuvant radiotherapy were for locally advanced rectal cancers (T3–T4 and/or nodal disease) that were below the peritoneal reflection. Operation demographics including type of operation and whether defunctioning stoma was performed were collected. Postoperatively, the date of anastomotic leak detection, mode of diagnosis, whether the leak was contained (and if so, size of leak), and the intervention performed were recorded. The American Joint Committee on Cancer (AJCC) pathological staging was recorded. Short-term postoperative outcomes including 30-day mortality, 30-day morbidity, 30-day reoperation, and hospital length of stay were recorded. Long-term postoperative outcomes including stoma reversal, colorectal cancer disease-free survival (DFS) and overall survival (OS) rates were recorded. In addition, we evaluated postoperative patient functional outcome by means of a detailed questionnaire based on the Fecal Incontinence Severity Index (FISI), ranging from 0 to 61 [16]. Postoperative quality of life was assessed using the validated EuroQol visual analogue scale (EQ-VAS) score, ranging from 0 to 100 [17].

Operative technique

The standard operative approach included TME for rectal dissection. Operations performed laparoscopically, open, robotically, or with conversion were all included. Conversion procedure refers to laparoscopic procedures that were then converted to laparotomy. The construction of a defunctioning loop ileostomy was left to the surgeon's discretion. An end-to-end anastomosis was performed using a circular stapler. The height of the anastomosis was considered ultra-low if 5 cm or less from the anal verge, low if between 5 and 10 cm from the anal verge, and high if 10 to 15 cm from the anal verge.

Statistical analysis

Statistical analysis was performed using IBM SPSS ver. 26.0 (IBM Corp). Categorical independent variables were summarized with

https://doi.org/10.3393/ac.2022.00073.0010

frequencies (percentages), and continuous independent variables were summarized using mean ± standard deviation. Univariate categorical variable analysis was performed using Pearson chi-square test if cell count > 5 and Fisher exact test if cell count ≤ 5. Continuous variables were analyzed using Kruskal-Wallis H-test for nonparametric data. EQ-VAS scores and FISI scores were compared between anastomotic leak and nonanastomotic leak groups using the paired samples t-test. The significance level was set at a P-value of < 0.05.

RESULTS

Demographics

There were 100 patients (out of 1,394) identified who met the study criteria for anastomotic leak from October 2010 to October 2020 (Table 1). Sixty-five participants were male, with a mean age of 63 ± 12.5 years. Seventy-one patients had operations for colorectal cancer (rectal cancer in 55 patients, distal sigmoid cancer in 16 patients), with the remaining being for benign conditions such as unresectable polyps and diverticular disease. In patients with rectal cancer, 28 patients (50.9%) had received neoadjuvant radiotherapy. Pretreatment AJCC rectal cancer staging was stage I in 12 patients (21.8%), stage II in 14 patients (25.5%), stage III in 28 patients (50.9%), and stage IV in 1 patient (1.8%). In terms of operations performed, 50.0% of patients underwent ultra-low anterior resection, 25.0% low anterior resection, and 25.0% high anterior resection. In terms of operative approach, 76.0% underwent laparoscopic surgery, 7.0% open, 13.0% conversion, and 4.0% robotic surgery. Eight patients received emergency operations. At the initial operation, 48 patients had a defunctioning ileostomy formed (Table 2).

Table 1. The demographics of patients (n = 100)

Characteristic	Value
Age (yr)	63 ± 12.5
Male sex	65 (65.0)
Body mass index (kg/m^2)	30 ± 7.5
Preoperative albumin	39.4 ± 4.9
Smoker	12 (12.0)
Cardiovascular disease	14 (14.0)
Diabetes mellitus	24 (24.0)
Renal failure	4 (4.0)
Lung disease	10 (10.0)
Liver disease	7 (7.0)
Immunosuppression	7 (7.0)
Neoadjuvant radiotherapy for cancer (n = 71)	28 (38.9)
Short-course radiotherapy	1 (1.4)
Long-course chemoradiotherapy	27 (37.5)

Values are presented as mean ± standard deviation or number (%).

Anastomotic leak diagnosis and management

The mode of diagnosis of leak was radiological in 74.0%, clinical in 6.0%, operative in 2.0%, and stricture on postoperative colonoscopy in 18.0%. Anastomotic leak was contained in 66.0%, not contained in 10.0%, and stricture only in 24.0%. In those with a contained leak, the mean radiological maximal diameter was 50.4 ± 27.8 mm. The mean time between diagnosis of leak and initial operation was 62 days. In those without stricture, the mean time between diagnosis of leak and initial operation was 18 days; in those with stricture only, the mean time of diagnosis was 200 days from initial operation (Table 3).

Management of anastomotic leak was antibiotics only in 39.0%, percutaneous radiologically guided drainage in 9.0%, operative abdominal drainage in 19.0%, transrectal drainage in 6.0%, anastomotic dilatation in 24.0%, combination of percutaneous drainage and transrectal drainage in 2.0%, and combination of abdominal and transrectal drainage in 1.0%. Management of anastomot-

Table 2. The demographics of operation and pathology (n = 100)

Variable	No. of patients (%)
Malignant pathology	72 (72.0)
Inflammatory pathology	28 (28.0)
Emergency operation	8 (8.0)
Height of anastomosis	
High	25 (25.0)
Low	25 (25.0)
Ultra-low	50 (50.0)
Operative approach	
Open	7 (7.0)
Laparoscopic	76 (76.0)
Robotic	4 (4.0)
Conversion	13 (13.0)
Presence of defunctioning ileostomy at the initial operation	48 (48.0)
Pathological AJCC stage for rectal cancer (n = 55)	
0 (Complete pathological response)	4 (7.3)
I	20 (36.4)
II	15 (27.3)
III	15 (27.3)
IV	1 (1.8)
Pathological AJCC stage for sigmoid cancer (n = 16)	
I	1 (6.3)
II	8 (50.0)
III	6 (37.5)
IV	1 (6.3)

AJCC, American Joint Committee on Cancer.

Table 3. Anastomotic leak management and outcomes (n = 100)

Variable	Value
Duration from initial operation to diagnosis of leak (day)	
Contained or free perforation	18.3 ± 28.0
Stricture only	200.7 ± 142.9
Mode of diagnosis of leak	
Clinical	6 (6.0)
Radiological	74 (74.0)
Operative	2 (2.0)
Stricture at colonoscopy	18 (18.0)
Degree of leak	
Contained	66 (66.0)
Not contained	10 (10.0)
Stricture only	24 (24.0)
Maximal diameter of contained leak (mm)	50.4 ± 27.8
Intervention performed for leak	
Intravenous antibiotics only	39 (39.0)
Percutaneous drainage	9 (9.0)
Operative abdominal drainage	19 (19.0)
Transrectal drainage	6 (6.0)
Anastomotic dilatation	24 (24.0)
Other combined approaches	3 (3.0)
Reoperation within 30 days	32 (32.0)
Readmission within 30 days	27 (27.0)
Hospital length of stay (day)	17.1 ± 14.9
Stoma reversed (n = 69)	59 (85.5)
Time interval from initial operation (day)	232.1 ± 121.8

Values are presented as mean ± standard deviation or number (%).

ic leak was significantly dependent (P < 0.001) upon the degree of leak, with the majority of patients with an uncontained perforation being managed by operative abdominal drainage (90.0%); patients with contained perforation were mainly managed with intravenous antibiotics only (60.0%) followed by percutaneous drainage (15.0%), operative abdominal drainage (15.0%), and transrectal drainage (10.0%). Three patients with anastomotic stricture only eventually required operative resection of the stricture with anastomosis (the remaining 21 patients all had anastomotic dilatation). Height of the anastomosis also significantly affected leak management (P = 0.040), with a high anastomosis more likely requiring abdominal operative drainage (40.0%) compared to low (22.2%) and ultra-low joins (8.7%); transrectal drainage was used mostly in ultra-low joins (10.9%).

Of the 20 patients who underwent operative abdominal drainage, 13 patients (65.0%) had laparoscopic washout and defunctioning ileostomy performed, 6 patients (30.0%) had a take-down of the anastomosis and end colostomy performed, and 1 patient (10.0%) had a redo of the colorectal anastomosis and defunctioning ileostomy performed.

Additional short-term outcomes

The hospital length of stay was 17.1 ± 14.9 days. Thirty-day mortality in our study was 0%; however, 30-day morbidity (aside from anastomotic leak) was 39.0%. The 3 most commonly associated 30-day morbidity was surgical site infection (25.6%), prolonged postoperative ileus (17.9%), urinary tract infection (12.8%), and high ileostomy output (12.8%). Thirty-day reoperation rate was 32.0% (abdominal procedure, 88.0%; transanal drainage, 9.0%; combined abdominal and transanal procedure, 3.0%), with 30-day readmission to hospital rate being 27.0%.

Stoma rates

At the initial operation, 48 patients had a defunctioning loop ileostomy performed. Forty patients (83.0%) had an ileostomy performed if undergoing an ultra-low anterior resection, compared to 10.4% for low anterior resections and 6.3% for high anterior resections (P < 0.001). There was no association between the degree of leak (contained vs. not contained vs. stricture) and whether an initial defunctioning ileostomy was performed. Initial defunctioning ileostomy did not impact 30-day readmission or reoperation rates. Time from initial operation to stoma reversal was on average 232.1 ± 121.8 days. The stoma rate at 1 year was 15%, with no difference between public and private patients.

Oncological outcomes

Pathological AJCC staging (p) for all rectal cancer patients (n = 55) was complete pathological response in 4 patients (7.3%), stage I in 20 (36.4%), stage II in 15 (27.3%), stage III in 15 (27.3%), and stage IV in 1 (1.8%). In rectal cancer patients, 41.8% received adjuvant chemotherapy. For those rectal cancer patients who underwent neoadjuvant radiotherapy (n = 28), pathological staging (yp) was complete pathological response in 4 patients (14.3%), stage I in 7 (25.0%), stage II in 8 (28.6%), stage III in 8 (28.6%), and stage IV in 1 (3.6%). Pathological AJCC staging (p) for sigmoid cancer patients (n = 16) was stage I in 1 patient (6.3%), stage II in 8 (50.0%), stage III in 6 (37.5%), and stage IV in 1 (6.3%). In the patients with sigmoid cancer, 37.5% received adjuvant chemotherapy. Across the cancer study population, 1-year DFS and OS rates were both 91.5%, 3-year DFS and OS rates were both 83.1%, and 5-year DFS and OS rates were both 80.3%. Kaplan-Meier curve for DFS of the telephone survey participants is shown in Fig. 1.

Quality of life and fecal incontinence scores

Seventy-one patients participated in the quality of life and fecal incontinence telephone survey; however, 10 of these patients still

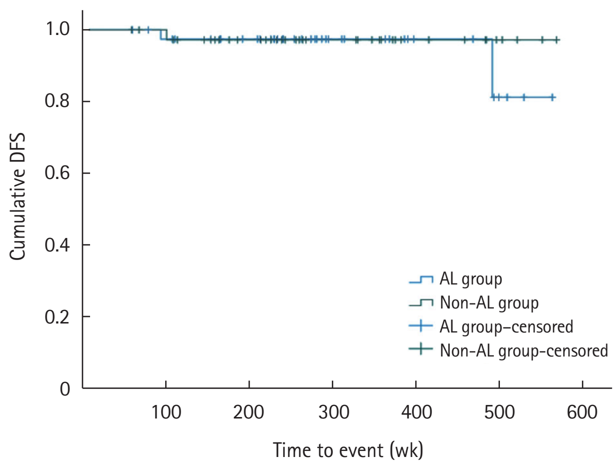

Fig. 1. Kaplan-Meier curve for disease-free survival (DFS). AL, anastomotic leak.

had a stoma at the time of data collection, so fecal incontinence scores were unable to be obtained. Comparative demographic and outcome data for the remaining 61 patients are summarized in Table 4. Patients with anastomotic leak had a mean EQ-VAS of 76.23 ± 19.9; this was lower than the matched mean EQ-VAS for nonanastomotic leak patients of 81.64 ± 18.1, although this was not statistically significant (P = 0.180).

Mean EQ-VAS for anastomotic leak patients without a stoma at the time of data collection was 77.30 ± 19.5, whereas the mean EQ-VAS for anastomotic leak patients with a stoma at the time of data collection was lower at 65.56 ± 25.6, although this did not reach statistical significance (P = 0.140).

Overall FISI scores were higher for patients with an anastomotic leak than their matched counterparts (8.06 ± 10.5 vs. 2.92 ± 4.9, P = 0.002); as were incontinence scores for solid feces (1.26 ± 3.8 vs. 0, P = 0.020) and liquid feces (2.96 ± 5.1 vs. 0.60 ± 2.1, P = 0.003). There was no difference between incontinence to mucous (0.70 ± 2.7 vs. 0.60 ± 0.4, P = 0.360) and flatus scores between the 2 groups (2.82 ± 4.8 vs. 2.05 ± 4.14, P = 0.380).

There was no trend in EQ-VAS and FISI scores in anastomotic leak patients over time, except for liquid feces incontinence which was higher in patients who had surgery within 1 to 2 years prior, compared to those within 3 to 5 and > 5 years postsurgery (31.07 vs. 23.64 vs. 20.50, H(3) = 7.31, P = 0.030).

When examining the degree of anastomotic leak (contained, not contained, or anastomotic stricture) with the overall FISI score and EQ-VAS score, there was no difference seen (P = 0.780 and P = 0.940, respectively). Neither was there an association between intervention performed for leak and overall FISI score (P = 0.08) and EQ-VAS score (P = 0.90), whether an initial defunctioning ileostomy was performed and overall FISI score (P = 0.680) and EQ-VAS score (P = 0.830), and height of anastomosis and overall FISI score (P = 0.720) and EQ-VAS score (P = 0.140).

Table 4. The baseline data and outcomes of AL and non-AL patients

Variable	AL group (n = 61)	Non-AL group (n = 61)	P-value
Male sex	43 (70.5)	41 (67.2)	0.700
Age (yr)	62.4 ± 12.3	64.1 ± 8.6	0.700
Height of anastomosis			0.900
High	12 (19.7)	14 (23.0)	
Low	18 (29.5)	17 (27.9)	
Ultra-low	31 (50.8)	30 (49.2)	
Neoadjuvant radiotherapy	14 (23.0)	14 (23.0)	> 0.999
Defunctioning ileostomy	24 (39.3)	23 (37.7)	0.900
Timeframe from initial operation			> 0.999
1–2 yr	9 (14.8)	9 (14.8)	
3–5 yr	25 (41.0)	25 (41.0)	
> 5 yr	27 (44.3)	27 (44.3)	
Disease-free survival[a]			
At 1 yr	39 (97.5)	38 (100)	0.400
At 3 yr	35 (97.2)	32 (97.0)	0.960
At 5 yr	15 (93.8)	16 (100)	0.300
FISI score			
Overall	8.06 ± 10.5	2.92 ± 4.9	0.002*
Solid stool	1.26 ± 3.8	0	0.020*
Liquid stool	2.96 ± 5.1	0.60 ± 2.1	0.003*
Mucous	0.70 ± 2.7	0.60 ± 0.4	0.360
Flatus	2.82 ± 4.8	2.05 ± 4.1	0.380
EQ-VAS score	76.23 ± 19.9	81.64 ± 18.1	0.180

Values are presented as number (%) or mean ± standard deviation.
AL, anastomotic leak; FISI, Fecal Incontinence Severity Index; EQ-VAS, EuroQol visual analogue scale.
[a]Disease-free survival calculated from cancer patients only.
*P < 0.05 (statistically significant).

DISCUSSION

The majority of patients in our study were managed with intravenous antibiotics only, with the management modality significantly dependent upon the degree of leak and height of the anastomosis. Additionally, anastomotic leak patients had higher FISI scores than the matched cohort, although EQ-VAS scores were not significantly different.

There have been several studies published within the past 10 years that examine the impact of anastomotic leak on bowel function and quality of life. However, this is the largest cohort of anastomotic leak patients examining bowel function and quality of life that we have found in the literature. Several studies have found that anastomotic leak has a negative impact on quality of life. Marinatou et al. [14] found that anastomotic leak patients had the lower overall quality of life scores at 6 and 12 months after surgery than patients who did not have an anastomotic leak. Similarly, Ashburn et al. [13] found that anastomotic leak patients had lower quality of life scores at 1 year and the most recent follow-up. They also found that anastomotic leak patients had worse control of solid stool and higher use of incontinence pad, although no difference between incontinence to liquid stool or gas was found. Mongin et al. [18], however, found that anastomotic leak did not lead to lower quality of life scores (physical component summary nor the mental component summary) using the 36-Item Short Form Survey (SF-36) quality of life scoring system. Anastomotic leak was not associated with impaired bowel function in their study. In contrast, Riss et al. [19] found that both fecal incontinence and quality of life scores were not significantly different between leak and nonleak patients. Hain et al. [20] examined low anterior resection syndrome (LARS) scores in leak and non-leak patients and found that there was a significantly higher LARS score in "symptomatic" leak patients but not "asymptomatic" patients. Killeen et al. [15] found asymptomatic leak patients had worse fecal incontinence quality of life, Cleveland Clinic Fecal Incontinence Score, and Memorial Sloan Kettering Cancer Center Bowel Function Index scores.

More recently, Kverneng Hultberg et al. [21] using a nonvalidated questionnaire, found an increased risk of aid use for fecal incontinence after leakage (odds ratio, 2.27; 95% confidence interval, 1.20–4.30) although there was no difference in frequency of fecal incontinence. The degree of anastomotic leak has also been found to be associated with worse incontinence [22], although this was not replicated in our study.

This variation in the literature, including our own study, can be explained by the variety of validated and nonvalidated fecal incontinence and quality of life scores used. Also, the majority of previous studies had small sample populations making extrapolation of data difficult. There are multiple factors that can impact bowel function after rectal cancer surgery, including neoadjuvant radiotherapy (particularly long-course chemoradiotherapy) [23], tumor location, operative method, anastomotic type, and temporary ileostomy [24]. This has been accounted for in our case-matched telephone survey.

There are several limitations to our study. Firstly, the majority of data was collected retrospectively (except for the telephone survey). Secondly, not all patients were able to be interviewed, with a survey completion rate of 71.0%. Thirdly, the survey only collected data at 1 particular time point, rather than at several time points after surgery. This made analysis of trends in FISI scores and EQ-VAS scores difficult compared to interventions performed.

Overall, our study demonstrates that the majority of anastomotic leak patients are managed with antibiotics only. The intervention performed for anastomotic leak was not a significant predictor of fecal incontinence and quality of life. Anastomotic leak was associated with higher fecal incontinence scores in the long-term; however, this did not necessarily equate to lower quality of life scores.

ARTICLE INFORMATION

Conflict of interest

No potential conflict of interest relevant to this article was reported.

Funding

None.

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Ann Coloproctol 2023;39(5):395-401

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