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Management of Anastomotic Leak: Lessons Learned from a Large Colon and Rectal Surgery Training Program

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Abstract

Background Anastomotic leak is a dreaded surgical complication that can lead to significant morbidity and mortality. Despite its prevalence, there is no consensus on the management of anastomotic leak. This study aimed to review the management of anastomotic leak in the Division of Colon and Rectal Surgery at two institutions.

Methods This is a retrospective review of all anastomotic leaks occurring after surgery in the Division of Colon and Rectal Surgery at two teaching institutions during 1997–2008.

Results Altogether, 103 leaks occurred in 1,707 anastomoses (6 %), with a median time to diagnosis of 20 days (2–1,400 days). The 90-day mortality rate was 3 %. The majority of cases were managed nonoperatively (73 %), and the majority of leaks were from an extraperitoneal anastomosis (67 %). Success (i.e., radiographic demonstration of a healed leak, restored gastrointestinal continuity) occurred in 54 % of operatively managed leaks and 57 % of nonoperatively managed leaks (56 % overall). Operative management differed by leak location. In 91 % of patients with intraperitoneal leaks, the anastomosis was resected. In 76 % of patients with extraperitoneal leaks, diversion and drainage alone was performed without manipulating the anastomosis. Nonoperative management was successful for 57 % of extraperitoneal leaks and 58 % of intraperitoneal leaks. There was no significant difference in the success rates based on type of management (operative/nonoperative) for either extraperitoneal or intraperitoneal leaks.

Conclusions Anastomotic leak continues to result in patient morbidity and mortality. Its diverse presentation requires tailoring management to the patient. Nonoperative and operative treatments are viable options for intraperitoneal and extraperitoneal leaks based on patient presentation.

Introduction

Anastomotic leak continues to be a dreaded surgical complication, leading to significant patient morbidity and mortality. Leak rates described in the literature are significant, ranging from 3 to 21 % [1–11], with mortality rates of 3–22 % [1, 2, 4, 9, 10]. Despite the prevalence of this complication, there is no consensus on the management of anastomotic leaks [12–14]. Although operative intervention has traditionally been preferred [9, 12], selected patients with anastomotic leak have been managed nonoperatively with or without percutaneous intervention [2, 10, 13]. Disparities in treatment may result from the varying definitions of anastomotic leak. As one systematic review noted, there are more than two dozen definitions of leak [14]. For the clinician attempting to care for a patient, these varying definitions of anastomotic leak may lead to

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some confusion as to the best treatment. The presence or absence of a diverting stoma may change the treatment algorithm as well. This study evaluated the incidence and management of anastomotic leak within the Division of Colon and Rectal Surgery at two teaching institutions.

Methods

After institutional review board (IRB) approval, we carried out a retrospective chart review of all patients who had undergone bowel resection and anastomosis in the Division of Colon and Rectal Surgery at Stroger Hospital of Cook County and Advocate Lutheran General Hospital from January 1997 to July 2008. Surgeons at these two centers include seven board-certified colon and rectal surgeons who participate in a colon and rectal surgery residency training program that currently trains three residents per year. Only patients undergoing anastomosis were included. Patients undergoing abdominoperineal resection, creation of stoma as sole procedure, or closure of an enterotomy were excluded. Because of IRB regulations, all patients with anastomotic leak during the 11-year period had to be included, even for outliers who did not seek closure of their diverting stoma for many years.

Hospital records were reviewed for patient demographics, indication for surgery, type of surgery, incidence of anastomotic leak, time to identification of leak, methods for management of leak, and outcomes. The aim of this study was to review the management of all types of anastomotic leak, so the definition of leak was intentionally broad. Anastomotic leak was defined as identification at reoperation, radiographic findings of extravasation from an anastomosis on computed tomography (CT) or contrast enema, intra-abdominal abscess at the site of the anastomosis noted on a CT scan, and enterocutaneous or rectovaginal fistula originating from the anastomosis. Patients were categorized according to (1) the location of the anastomosis as intraperitoneal or extraperitoneal and (2) according to the management of the leak as operative or nonoperative. Extraperitoneal anastomosis was defined as an anastomosis below the level of the peritoneal reflection based on the initial operative report.

Primary endpoints were overall survival and success of treatment. Success of treatment was defined as evidence of healing of the anastomotic leak by radiographic studies (sinogram through a drain or contrast enema) or reversal of the stoma with restoration of gastrointestinal continuity. Failure of treatment was defined as evidence of persistent leak at the anastomosis or persistent stoma. Those patients who had persistent leaks and who underwent further

Table 1 Patient and surgical characteristics

Characteristic	No. (% of leaks)
Sex	
Male	49 (47.5)
Female	54 (52.5)
Prior radiation	
Yes	42 (41.0)
No	61 (59.0)
Indication (diagnosis)	
Rectal cancer	43 (41.7)
Colon cancer	16 (15.5)
Stoma takedown	16 (15.5)
Inflammatory bowel disease	15 (14.6)
Colon/rectal polyps	6 (5.8)
Diverticulitis	3 (2.9)
Anastomotic leaks	2 (1.9)
Ischemic stricture	1 (1.0)
Obstruction	1 (1.0)
Procedure	
Intraperitoneal	
Right hemicolectomy	14 (13.6)
Stoma takedown	10 (9.7)
Subtotal colectomy	3 (2.9)
Small bowel resection	3 (2.9)
Ileocecectomy	2 (1.9)
Redo ileosigmoid anastomosis	1 (1.0)
Transverse colectomy	1 (1.0)
Left hemicolectomy	1 (1.0)
Extraperitoneal	
Low anterior resection	51 (49.5)
Total proctocolectomy or proctectomy + IPAA	7 (6.8)
Stoma takedown	6 (5.8)
Total abdominal colectomy + ileorectal anastomosis	3 (2.9)
Ileocolonic interposition/anal anastomosis	1 (1.0)
Method	
Open	73 (70.9)
Laparoscopic	23 (22.3)
Laparoscopic converted to open	4 (3.9)
Robotic	3 (2.9)
Stoma	
Yes	34 (33.0)
No	69 (67.0)
Level of extraperitoneal anastomosis ($n = 68$)	
Coloanal	25 (36.8)
Ileoanal	7 (10.3)
Upper rectal	8 (11.8)
Mid-rectal	12 (17.6)
Low rectal	11 (16.2)
Unspecified	5 (7.4)

IPAA ileal pouch anal anastomosis

surgical procedures to repair the leaking anastomosis (i.e., local or transanal repair) after the initial management of the leak were included in the failure group, as were the patients who were lost to follow-up prior to demonstration of healing of leak.

SPSS software (SPSS, Chicago, IL, USA) was used for all statistical analyses. The χ^2 test was used for univariate analysis, with statistical significance defined as $p < 0.05$.

Results

There were 103 leaks identified in 1,707 bowel anastomoses for an overall leak rate of 6 %. The median age of the patients was 57 years (range 19–91 years). Table 1. The most common diagnosis resulting in leak was rectal cancer (41.7 %), and the most common procedure resulting in leak was low anterior resection (49.5 %). At the time of the anastomotic leak diagnosis, 34 of 103 patients already had a diverting stoma (33 %). All 34 patients had an extraperitoneal leak. In seven patients (6.8 %) the anastomotic leak had been asymptomatic initially but was diagnosed with contrast enema obtained as part of a workup for stoma takedown. In addition to the patients who underwent prior pelvic irradiation, one patient had preoperative chemotherapy and five were receiving postoperative chemotherapy at the time of the leak diagnosis.

Leaks were diagnosed at a median time of 20 days postoperatively (range 2–1400 days). In 68 patients (66 %) the leak was diagnosed after discharge from the hospital. In all, 77 % (58/75) of leaks undergoing nonoperative management were diagnosed after hospital discharge. Of those undergoing operative management, 36 % (10/28) were diagnosed after discharge. The median time to diagnosis of nonoperative leaks was 27 days (range 3–1,400 days), and the median time to diagnosis of operative leaks was 6 days (range 2–660 days). There was a significant association between time to the leak diagnosis and the type of management (Mann–Whitney U-test, $p = 0.001$). There were three deaths resulting from the anastomotic leak (90-day mortality 3 %).

Leaks were classified based on the site of the anastomosis as extraperitoneal or intraperitoneal. There were 68 extraperitoneal (66 %) and 35 intraperitoneal (34 %) leaks. The management schema is depicted in Fig. 1. In all, 73 % of patients (75/103) with anastomotic leak were managed nonoperatively, and 27 % (28/103) were managed operatively. The success rate was 54 % for operative management and 57 % for nonoperative management ($p = 0.73$), with an overall success rate of 56 %.

Operative management is displayed in Table 2. Operative management was performed in 17 extraperitoneal leaks. In 13 of 17 (76 %) patients the leaks were managed with diverting ileostomy and drainage without manipulating the anastomosis. Two of these patients had undergone diversion at the original operation and this time underwent drainage alone. All of the patients undergoing resection of the anastomosis (i.e., Hartmann's procedure) were considered treatment failures as none of them underwent reversal of their colostomy. This is in contrast to a 54 % success rate among those who underwent diverting ileostomy with drainage of the anastomosis. Operative management of intraperitoneal leaks differed from extraperitoneal leaks in that the anastomosis was resected in the majority of cases with ($n = 7/11$) or without ($n = 3/11$) proximal diversion. The one patient undergoing drainage and diversion without manipulation of the anastomosis for an intraperitoneal leak was a treatment failure. A total of 91 % of the intraperitoneal leaks were resected, compared to 17 % of the extraperitoneal leaks ($p = 0.0001$).

Nonoperative management (Tables 3, 4) was performed for 51 extraperitoneal leaks in patients with ($n = 31$) and

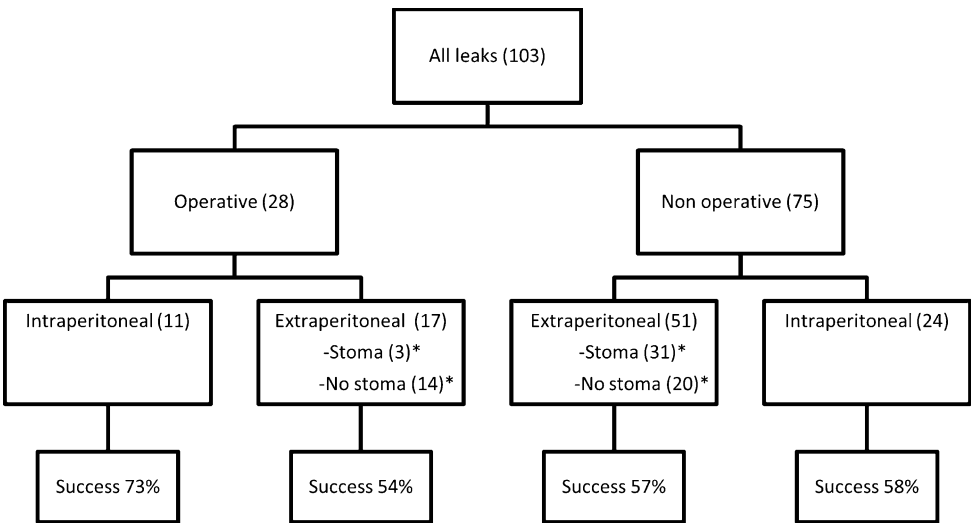

Fig. 1 Management schema for 103 anastomotic leaks found in 1707 anastomoses. (*Asterisk*) Stoma or no stoma refers to the original operation

Table 2 Operative management of anastomotic leak

Procedure	*N*	*N* (% success)
Extraperitoneal surgery		
Diverting ileostomy and drain	13	7 (54)
Hartmann's procedure	3	0
Transanal drainage (had prior diverting ileostomy)	1	0
Total	17	7 (41)
Intraperitoneal surgery		
Resection with anastomosis	3	2 (67)
Resection with anastomosis, proximal diversion	3	3 (100)
Resection and diversion	4	3 (75)
Divert and drain	1	0
Total	11	8 (73)

Table 3 Nonoperative management of anastomotic leak

Treatment	*N*	*N* (% success)
Extraperitoneal		
Antibiotics alone	17	8 (47)
Percutaneous drainage	32	20 (63)
Other	2	1 (50)
Total	51	57 (29)
Intraperitoneal		
Antibiotics alone	15	8 (53)
Percutaneous drainage	8	6 (75)
Fibrin glue	1	0
Total	24	14 (58)

without ($n = 20$) a protective stoma. Nonoperative management consisted primarily of antibiotic treatment alone or with percutaneous drainage. Treatment success, defined as ultimate restoration of gastrointestinal continuity or radiographic evidence of a healed leak, was seen for 48 % of extraperitoneal leaks with a stoma compared to 70 % without a stoma when managed nonoperatively. ($p = 0.13$)

A total of 24 intraperitoneal leaks were treated nonoperatively. They consisted of contained abscesses and enterocutaneous fistulas. Treatment consisted primarily of antibiotics with or without percutaneous drainage. The success rate was 58 %.

The overall success rate for the entire cohort was 56 %. Treatment was successful for 53 % of the extraperitoneal leaks and 63 % of the intraperitoneal leaks ($p = 0.34$)

The choice of management (operative vs. nonoperative) was not significantly different between extraperitoneal and intraperitoneal leaks ($p = 0.49$). There was no significant difference in the success rates for operative versus nonoperative management of extraperitoneal or intraperitoneal leaks (Table 5).

Table 4 Nonoperative management of extraperitoneal leaks with or without a stoma

Treatment	*N*	*N* (% success)
Stoma present		
Antibiotics alone	10	3 (30)
Percutaneous drainage	19	11 (58)
Other[a]	2	1 (50)
Total	31	15 (48)
No stoma		
Antibiotics alone	7	5 (71)
Percutaneous drainage	13	9 (69)
Total	20	14 (70)

[a] One case of endoscopic drainage (failure) and one case of fibrin glue (success)

Table 5 Ultimate success by management type

Management type	Operative success	Nonoperative success	*p*
Extraperitoneal	41 % (7/17)	57 % (29/51)	0.26*
Intraperitoneal	73 % (8/11)	58 % (14/24)	0.48*

* Nonsignificant

Discussion

Anastomotic leaks continue to be a prevalent and devastating complication of colon and rectal surgery. The lack of a standard definition for anastomotic leak results in a lack of standards for management. Phitayakorn et al. [15] made progress in this area by creating treatment algorithms for the management of anastomotic leaks based on their location and the presence or absence of a stoma. They concluded that further research was necessary for standardizing management. In the current study, the definition of anastomotic leak was intentionally kept quite broad as the study was designed as a retrospective review of the management of all anastomotic leaks. The leak rate (6 %), and mortality rate of 3 % in this study compare favorably with recent published data, however, even though the lack of a universal classification and standardized nomenclature made such a comparison difficult [1–11].

The management of anastomotic leak has typically been surgical, with resection of the leaking anastomosis and creation of a diverting stoma. Today, however, based on the patient's presentation and the timing of the leak, there

has been a gradual shift in management. Over the past few decades, with the prevalent use of CT scanning, more mildly symptomatic or asymptomatic leaks are being identified, and nonoperative management using antibiotics and percutaneous drainage is becoming more prevalent, as seen in this study [9, 10, 13]. The majority of patients do not require surgery for management of the leak, as evidenced by the 73 % of patients in this study who underwent nonoperative management. Given that this study is a retrospective review and subject to selection bias, generalizations cannot be readily made regarding the selection of patients for nonoperative management. The utilization of imaging modalities such as CT scans were done at the discretion of the treating surgeon. However, patients undergoing nonoperative management were diagnosed at a later postoperative date than those who required surgical intervention (27 vs. 6 days), which implies that the leak had a more indolent course in the nonoperative patients. Symptoms such as prolonged ileus, mild to moderate abdominal or pelvic pain, fever, leukocytosis, or evidence of enterocutaneous or rectovaginal fistula prompt physicians to obtain radiographic studies such as a contrast enema or CT scan. Intra-abdominal abscesses and small, contained leaks in such patients may be managed successfully with antibiotics with or without percutaneous drainage [10, 12, 13]. Reasons for failure of nonoperative management cited in the literature include large, loculated or multiple abscesses, fistulas, and high Acute Physiology and Chronic Health Evaluation (APACHE) II scores [16]. Nonoperative management has become a viable alternative to surgery for most healthy patients with few symptoms. Fever, tachycardia, leukocytosis, and/or feculent discharge from drains are no longer absolute indications for reoperation. Surgical management is reserved for septic patients with generalized peritonitis.

In this study, there was a higher percentage of patients with intraperitoneal leaks that required surgical intervention than those with extraperitoneal leaks (31 vs. 25 %) although the difference was not statistically significant ($p = 0.49$). At surgery, resection of the anastomosis, exteriorization of the proximal end as a stoma, and either closure of the distal stump (Hartmann's procedure) or construction of a mucous fistula has been the standard of care, resulting in a permanent stoma in up to 56–68 % of patients [12, 17, 18]. Most intraperitoneal leaks undergo resection of the anastomosis, including in this study, with minimal dissection around the extraperitoneal leak being advocated [13, 16, 19]. In one study, 12 of 13 (92 %) patients treated with diversion and drainage demonstrated healing of the leak. The remaining patient developed a stricture that required operative revision [13]. Another study demonstrated that patients were less likely to have the anastomosis taken down during reoperation for leak if the anastomosis was in the rectum [20]. Novel procedures to preserve the leaking anastomosis have also been described, including laparoscopic diverting ileostomy combined with an endoscopically placed polyurethane vacuum sponge at the site of the leak [21] or endoluminal stenting combined with diverting stoma [22]. In the present study, 13 patients underwent diversion and drainage of an extraperitoneal leak without manipulation of the anastomosis. Of the 13 patients, 7 healed without problems. One additional patient had successful transanal repair of the anastomosis and was able to have the stoma reversed. In contrast, all patients with an extraperitoneal leak who underwent Hartmann's procedure ($n = 3$) kept the stoma to the end of the study. It is important to note that almost all patients (25/28) who underwent reoperation required creation of a diverting stoma as part of the treatment, regardless of the location of the leak.

The use of a protecting stoma should theoretically attenuate the severity of an anastomotic leak [2, 5, 23] and allow wider use of nonoperative therapies. In one multicenter trial that randomized patients to a defunctioning stoma group or a no-stoma group at the time of low anterior resection for rectal cancer, there was no difference in the number of symptomatic leaks in patients in either group, although the rate of reoperation for leak was significantly lower in patients with diversion (9 vs. 25 %) [23]. In this study only 3 of 34 patients (9 %) with a diverting stoma required operative intervention for their leak. However, the absence of a stoma should not dictate the management of anastomotic leak as nonoperative management may be successful in these patients as well. In another study, 18 of 33 nondiverted leaks were managed successfully with nonoperative treatment [10]. In the current study, success rates of nonoperative management were similar for extraperitoneal leaks with or without a diverting stoma (48 vs. 70 %, $p = 0.13$). This demonstrates that the absence of fecal diversion should not affect the choice of management of anastomotic leak (operative vs. nonoperative). Rather, treatment should be based on the patient's overall clinical status.

The time to diagnosis of the leak varied widely in this study, with a median being 20 days. Conventional teaching dictates that leaks occur during the first week postoperatively. Few leaks should be diagnosed after 30 days. However, Hyman et al. [10] showed that leaks may occur later than previously thought, with a mean diagnosis made at 12 days (four patients were diagnosed after 30 days). In their study, leaks that were diagnosed clinically occurred earlier than those diagnosed radiographically (7 vs. 16 days). Those managed operatively were also diagnosed earlier than those managed nonoperatively (9 vs. 15 days). This later diagnosis of leaks managed nonoperatively was also demonstrated in the current study, with leaks requiring

operative treatment diagnosed earlier than those managed nonoperatively. The cause of these delayed leaks is not entirely clear. Byrn et al. [9] postulated that smoldering inflammatory processes or ischemia around the anastomosis is the cause of late anastomotic leaks. With leaks being diagnosed late, many patients are being diagnosed after discharge. "Fast-track" protocols are becoming common following colorectal surgery, leading to 26–42 % of patients being diagnosed as outpatients [9, 10, 24]. As fast track protocols were not in place at the authors' institutions for much of the study time period, the impact of such protocols cannot be evaluated in the current study. Byrn et al. [9] suggested that outpatient leaks may result in worse outcomes owing to delay in diagnosis and treatment. In contrast, a study by Telem et al. [24] did not demonstrate worse outcomes in these patients. In the current study, 66 % of patients were diagnosed after discharge. The highly inclusive definition of anastomotic leak as well as including those patients with a prior diverting stoma and those diagnosed solely radiographically likely contributed to the late diagnosis of leak in this study.

The major limitations to this study are its retrospective nature and an inherent surgeon's bias in treatment strategy of anastomotic leak, with obviously septic patients undergoing operative management and more stable patients undergoing nonoperative management. This makes comparisons between the two strategies difficult to interpret. The broad definition of leak also contributes to this bias. However, several important points can be made. For patients requiring surgery, diversion and drainage alone without manipulation of the leaking pelvic anastomosis was successful (i.e., resulted in healing of the leaking anastomosis) in more than 50 % of patients, supporting the notion that sepsis can be controlled without resecting the anastomosis. Intraperitoneal leaks, which are more easily accessible, are likely best treated by resection and reanastomosis or exteriorization as an end-loop stoma. Nonoperative management can be performed successfully in both diverted (at the initial operation) and nondiverted patients. Finally, with the development of "fast track" protocols and the prevalent use of CT scanning, more patients will likely be diagnosed with anastomotic leak after discharge from the hospital.

Conclusions

Anastomotic leak in colon and rectal surgery continues to be an ongoing source of patient morbidity and mortality. Diverse presentation of leak mandates that clinicians tailor the management of this condition to the individual patient. Nonoperative management can be safely and successfully employed in most patients with this potentially devastating complication. Patients with overt sepsis requiring surgical intervention almost always require a diverting stoma as part of their treatment, which might well become permanent.

Conflict of interest None

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