Operative Management of Anastomotic Leaks after Colorectal Surgery

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Abstract

Anastomotic leak is associated with increased morbidity and mortality after colorectal surgery. Although surgical techniques have improved over time, anastomotic leak is still a reality in colorectal surgery with rates ranging from as low as 1% for low-risk anastomoses, such as enteroenteric or ileocolic, to 19% for high-risk coloanal anastomoses. There are many varied risk factors for anastomotic leak. However, many of the risk factors have not been definitively proven in high-quality studies. Presumably, risk factors are cumulative and every effort should be made to optimize modifiable risk factors in the perioperative period. Treatment of anastomotic leak should start with the determination of patient stability followed by resuscitation and diagnostic imaging or operative exploration. Operative findings will dictate surgical approach with the goal of controlling sepsis and stabilizing the patient. If nonoperative treatment is undertaken, close patient monitoring is necessary to ensure control of sepsis and that intervention is undertaken if the clinical picture changes. Early intervention at each stage is key to decreasing the morbidity of anastomotic leak.

Keywords

- anastomosis
- leak
- sepsis
- drainage
- exploration

Rates and Impact of Anastomotic Leak

Although medical and surgical care of colorectal diseases have continued to evolve and improve, anastomotic leak rates remained relatively stable over time. A recent systematic review revealed an overall leak rate of 1 to 19% in colorectal surgery. Rates of anastomotic leak vary based on the type of anastomosis with enteroenteric having the lowest leak rate (1–2%) and colorectal/coloanal having the highest (5–19%). Ileocolic (1–4%), colocolic (2–3%), ileorectal (3–7%), and ileoanal pouch (4–7%) anastomoses had intermediate leak rates.¹

There is no consensus definition of what constitutes a leak and there is heterogeneity in surgeons' own definitions both from an academic and clinical perspective. Adams and Papanigrigoriadis performed a survey of surgeons and definitions varied from "extravasation of contrast on enema" (94.2%) to "fecal material seen in drains or from the wound" (91.8%). Only

slightly more than half of respondents agreed that "intra-abdominal sepsis requiring a laparotomy," or radiological collections treated with antibiotics or percutaneous drainage constituted a leak.² Bruce et al confirmed that there is no standard anastomotic leak definition in the literature.³

Contributing to the heterogeneity is the varying postoperative time frame when leaks become apparent. Historic teaching has dictated that leaks typically present within 1 week postoperatively. However, a large prospective review of 1,223 patients operated on by two surgeons over a 10-year period revealed a 2.7% leak rate and leaks were diagnosed at a mean of 12.7 days postoperatively. Four patients (12.1%) were diagnosed with a leak after 30 days. Forty-two per cent of leaks were diagnosed after the patient was discharged home.⁴ These late leaks may not be diagnosed at the primary institution, affecting database-driven analysis of leak rates, and may not be clearly defined as leaks and instead treated as simple abscesses.

Complication rates and mortality rates are higher in patients who have an anastomotic leak. Gessler et al evaluated 600 consecutive patients from 2010 to 2012 who underwent colorectal anastomosis for colorectal cancer, diverticulitis, inflammatory bowel disease, or benign polyps. They found a 10% leak rate and leaks were diagnosed at a mean of 8.8 days (range: 2–42) postoperatively. Seventy-three per cent of patients with leaks had an abdominal computed tomography (CT) scan and, of which, 25% were initially negative for leak. Seventy-six per cent of patients with leak required takedown of their anastomosis. The overall complication rate (93.3 vs. 28.5%, $p < 0.001$) and 30-day mortality rate (5 vs. 0.6%, $p = 0.015$) were higher in those patients who had a leak.⁵ In a prospective study of 1,772 patients with cancer, the total leak rate was 5.1%. In those patients diagnosed with a leak, the 5-year overall survival rate was 44.3 versus 64% in patients without a leak. In controlling for patient, surgical, and cancer-specific factors, anastomotic leak had an independent negative association with overall survival (hazard ratio [HR]: 1.6, confidence interval [CI]: 1.2–2.0) and cancer-specific survival (HR: 1.8, CI: 1.2–2.6).⁶

Risk Factors for Anastomotic Leak

Multitudes of risk factors for anastomotic leak have been described in the literature. In fact, a PubMed search using the terms “colorectal surgery,” “anastomotic leak,” and “risk factors” returns almost 500 articles. However, most of the studies are low quality, many studies have shown conflicting results, and few factors have been shown to be definitively associated with anastomotic leak. Potential modifiable risk factors, however, should be minimized perioperatively as the effect of possible risk factors is likely cumulative.

Technical Risk Factors

The location of the anastomosis, defined as intraperitoneal versus extraperitoneal, has been shown to be directly related to the risk of leak. One of the largest prospective studies to examine this issue included almost 1,600 patients who underwent 1,639 anastomoses. The risk of anastomotic leak following extraperitoneal anastomosis was 6.6% compared with 1.5% following intraperitoneal anastomoses. More distal anastomoses had higher leak rates; ultralow or coloanal anastomoses had the highest leak rate (8%).⁷

The visual appearance of the anastomosis intraoperatively can serve as a guide to identify anastomoses at high risk for leaking. Sujatha-Bhaskar et al evaluated 106 stapled colorectal anastomoses intraoperatively and graded them as grade 1: circumferentially normal appearing mucosa, grade 2: ischemia or congestion of <30% of the colon or rectal mucosa, or grade 3: ischemia or congestion of >30% of the colon or rectal mucosa or ischemia/congestion of both sides of the staple line. Any anastomoses (4/106) that were graded 3 were taken down and redone. Of the remaining cohort, 92 of 106 anastomoses were graded as 1 and 10 of 106 were graded as 2. The anastomotic leak rate for the cohort was 12.2% with a leak rate of 9.4% for grade 1 anastomoses and 40% for grade 2 anastomoses. Multivariate logistic regression

showed an increased risk of anastomotic leak with grade 2 anastomosis (odds ratio [OR]: 4.09, 95% CI: 1.21–13.63, $p = 0.023$). The authors concluded that revision of grades 2 and 3 anastomoses should be considered intraoperatively.⁸

A retrospective review of 382 patients undergoing colorectal resection evaluated the impact of the number of staple fires required for rectal division on leak rates. In this study, one stapler load was used to divide the rectum in 58.4% of cases, two in 33.5% of cases, and three or more in 8.1% of cases. Male gender, history of neoadjuvant therapy, diagnosis of rectal cancer, laparoscopy, and operative duration more than 200 minutes were the most prevalent reasons for multiple stapler firings. The overall leak rate was 4.7%. The only factor associated with increased risk of anastomotic leak was three or more stapler loads used to divide the rectum.⁹

Murray et al evaluated the association between laparoscopic and open approaches on leak rate in 23,568 patients undergoing elective colorectal resections identified in the ACS-NSQIP (American College of Surgeons National Surgical Quality Improvement Program) database. The overall leak rate was 3.4%; 2.8% in the laparoscopic group and 4.5% in the open group. This significant difference persisted when controlling for patient, disease, and procedure-related variables using propensity-score matching (OR: 0.73, 95% CI: 0.58–0.91) and multivariate analysis (OR: 0.69, 95% CI: 0.58–0.82).¹⁰ Two randomized trials, however, did not show a difference in leak rates between laparoscopic and open operations, although surgeons were likely earlier in their laparoscopic learning curve in those series.^{11,12}

Not surprisingly, ischemia of the anastomosis has been associated with anastomotic leak.¹³ Techniques such as fully mobilizing the proximal bowel (i.e., takedown of the splenic flexure) and performing appropriate vascular ligation (i.e., high ligation of the inferior mesenteric artery and vein) for a tension-free anastomosis are paramount. Dividing the mesentery or mesocolon sharply at the time of bowel transection has been described to verify adequate blood supply to the bowel prior to anastomosis. After mesenteric division, confirming the presence of arterial blood supply can be aided by palpating a pulse or using a Doppler to confirm a signal. Newer techniques such as fluorescence angiography have been advocated to provide visual confirmation of blood supply before and after performing an anastomosis.¹⁴

The association between handsewn versus stapled anastomoses and leak rates is varied in the literature and differs by site of anastomosis. A Cochrane review of seven trials showed that handsewn ileocolic anastomoses were associated with a higher leak rate than stapled ileocolic anastomoses, for both benign and cancer diagnoses.¹⁵ For colorectal anastomoses, however, stapled and handsewn anastomoses had similar leak rates, both clinically and radiologically.¹⁶

Finally, the use of diverting ostomies has been evaluated as a means of reducing the risk of anastomotic leak. Almost all studies have demonstrated that diverting ostomy reduces the clinical impact of a leak (need for reoperation, mortality, etc.), but fewer have shown a clearly lower leak rate with a diverting ostomy. In a 2014 prospective study of 2,364 patients undergoing 2,994 anastomoses, the use of a

diverting stoma was not associated with decreased leak rate, but was associated with decreased clinical severity of leakage and decreased need for reoperative exploration.¹⁷ This finding confirmed that of a previous prospective study.¹⁸ In a meta-analysis that included four randomized trials, however, protective stoma was associated with both a lower leak rate (9.6 vs. 22.8%) and a decreased need for reoperation when a leak occurred (OR: 0.27, 95% CI: 0.17–0.59) compared with those patients without stomas.¹⁹

Patient Factors

A myriad of patient factors have been identified as risk factors for anastomotic leak, but few have been shown to be definitively or consistently associated with increased leak rates. Several large, retrospective studies have identified several modifiable and nonmodifiable patient factors possibly related to increased risk of anastomotic leak.^{20,21}

These include:

- Diabetes, perioperative hyperglycemia, and elevated hemoglobin A1c
- American Society of Anesthesiologists score ≥ 3
- Young age
- Smoking
- Serum albumin <4 , weight loss
- Anemia
- Blood transfusion
- Neoadjuvant radiation
- Perianastomotic drain placement
- Mechanical bowel preparation
- Increased operative time
- Emergency surgery.

We explore a few other specific patient-related factors below.

Male gender was found to be a risk factor for extraperitoneal anastomotic leaks.²⁰ This is presumably secondary to the technical challenges associated with operating in the narrow male pelvis.²² This supposition is supported by the findings that male gender is not associated with an increased risk of leak following intraperitoneal anastomoses.²³ A similar relationship between obesity and anastomotic leak has been identified. One retrospective study found that obesity was associated with higher risk of anastomotic leak following low colorectal anastomoses.²⁴ However, this association has not been confirmed in larger, modern, but still retrospective, studies including all anastomoses.²⁰ It may be that the same challenges that result in higher leak rates in the narrow, male pelvis also exist in the pelvis of obese patients.

Perioperative corticosteroids are often implicated as a risk factor for anastomotic leak. Individual retrospective studies have shown varying associations between steroid use and anastomotic leak. The largest systematic review, however, which included 12 studies, showed a higher rate of anastomotic leak in those patients who used corticosteroids preoperatively (6.8 vs. 3.3%).²⁵

Because of the frequent use of nonsteroidal anti-inflammatory drugs (NSAIDs) as part of multimodality, nonnarcotic pain management following colorectal surgery, their association

with postoperative complications has been scrutinized. A systematic review and meta-analysis was published in 2016 and evaluated 6 randomized controlled trials (including 473 patients) and 11 observational studies (including more than 20,184 patients). NSAID use was associated with a significantly increased risk of anastomotic leak in the observational studies (OR: 1.46, 95% CI: 1.14–1.86, $I = 54\%$). In the randomized controlled studies, however, NSAID use was not significantly associated with leaks (risk ratio: 1.96, 95% CI: 0.74–5.16, $I = 0\%$). The pooled incidence of leak was 2.5% in patients without NSAID usage, but 5.2% for NSAID users, which suggest a difference clinically, although it was nonsignificant statistically.²⁶ A NSAID of specific interest is ketorolac, which is often used intra- and postoperatively as part of enhanced recovery pathways. One recent study (55% of included patients were colorectal patients) showed that ketorolac use was associated with a higher rate of readmissions related to anastomotic complications (OR: 1.20, 95% CI: 1.06–1.36).²⁷ However, an earlier study of 731 patients with primary anastomoses, 48.6% of whom received ketorolac perioperatively, showed no difference in leak rate with the addition of ketorolac (3.2 vs. 3.4%, OR: 1.06, 95% CI: 0.43–2.62; $p = 0.886$).²⁸ Given the frequency of their use in enhanced recovery pathways in colorectal surgery, additional well-powered randomized studies are necessary to determine if NSAID use truly increases anastomotic leak rate.

Overall, there are many technical and patient factors that likely relate, in a cumulative manner, to the risk of anastomotic leak. First and foremost, in our opinion, surgeons should perform a tension-free anastomosis with no evidence of vascular compromise. The approach they choose, whether laparoscopic or open, or handsewn or stapled should be an approach that they feel most comfortable performing safely. If there are concerns about the integrity of the anastomosis, the anastomosis should be redone at the index operation. If the anastomosis or the patient is deemed to have several risk factors for a leak, use of a diverting ostomy is recommended. While it may not decrease the rate of anastomotic leak, it will minimize the clinical impact of a leak on the patient.

Operative Approach for Anastomotic Leaks

Anastomotic leaks should be treated based on their location, the stability of the patient, the degree of leakage (contained vs. free perforation), and findings at the time of surgical exploration. A modern algorithm for the treatment of intraperitoneal anastomotic leaks is presented in ►Fig. 1.

If an anastomotic leak is suspected, assessing the stability of the patient is the first priority. If the patient is hemodynamically unstable, immediate resuscitation with intravenous (IV) fluids and broad-spectrum IV antibiotics should be undertaken. Invasive monitoring and transfer to the intensive care unit may be necessary. After a period of resuscitation, if the patient stabilizes, imaging such as a CT scan with IV, oral, and, if indicated, rectal contrast can be considered to further aid management. However, if the patient remains unstable or has signs of diffuse peritonitis, continued resuscitation with emergent operative exploration is indicated.

Fig. 1 Proposed algorithm for the management of intraperitoneal anastomotic leaks. (A) Determination of patient stability should be made and resuscitation undertaken prior to diagnostic imaging. If patient remains unstable, they should follow “free perforation” portion of the algorithm and proceed to surgical exploration. If the patient is stable or stabilizes with resuscitation, diagnostic imaging can be undertaken. (B) Versus diagnostic laparoscopy, if applicable. (C) +/- Mucous fistula, where appropriate. (D) Please refer to free perforation algorithm.

Most patients with anastomotic leak do not present with fulminant sepsis or hemodynamic instability; most present with signs and symptoms such as fever, leukocytosis, increasing abdominal pain, and tachycardia without instability. In this cohort of patients, imaging should be considered to evaluate more definitively for leak before intervention is undertaken. CT scan with contrast is the most common imaging modality utilized given its almost universal availability in a hospital setting and its ability to reliably demonstrate pathology such as free air, perianastomotic air or fluid, and collections/abscesses.

If imaging reveals a contained leak with either mild surrounding inflammation/phlegmon or an associated collection that is less than 3 cm, bowel rest and broad-spectrum antibiotics can be initiated with continued serial abdominal and clinical exams to evaluate for signs of development of a free perforation. If there is an organized abscess that is more than 3 cm large or multiple abscesses, percutaneous drainage can be utilized in addition to antibiotics.²⁹

If the patient fails conservative measures, surgical exploration is warranted. Boyce et al evaluated 555 patients undergoing laparoscopic low anterior resection with anastomosis within 10 cm of the anus and described their management of the 44 patients who had an anastomotic leak. Sixteen of the patients who were diagnosed with a leak already had a diverting stoma and only four of those patients required reoperation. Twenty-four of the 28 patients, however, who were diagnosed with a leak who did not have a diverting stoma did require reoperation. Seventy-four per cent of the surgical re-explorations were performed laparoscopically and typically consisted of formation of ileostomy or colostomy. Permanent

stomas were required in 14 patients (2.5% of total cohort, 18% of those with anastomotic leaks).³⁰

Whether laparoscopic or open, safely and efficiently diagnosing and treating the leak should be the priority in surgical exploration. If there is a large phlegmon and the bowel is matted, attempts to mobilize and explore the anastomosis may potentially create more injuries. In these cases, washout, drainage, and proximal diversion are the preferred treatment modality.

If the anastomosis is safely accessible, evaluation of the bowel viability and anastomotic integrity can be performed. If a clearly delineated defect that is less than 1 cm can be identified and the surrounding bowel is otherwise healthy without gross inflammation, primary repair of the anastomosis with proximal diversion can be considered. Otherwise, the anastomosis should be taken down and re-created if the remaining bowel is healthy and nonedematous. Proximal diversion should be strongly considered even if new anastomosis looks healthy and intact, particularly with more distal leaks.

If the bowel is unhealthy or edematous, creating a new anastomosis is not indicated. An end stoma should be created with either a Hartmann's pouch or a mucous fistula of the distal bowel. The level of a colorectal anastomosis would typically preclude one from bringing up the rectum as a mucous fistula in the event of anastomotic leak. If a colorectal anastomosis has to be taken down, multiple drains should be left in the pelvis and the rectum should be drained with a rectal tube.

In the case of low colorectal, coloanal, or ileoanal anastomoses, which do not already have a diverting stoma in place, repair of an anastomotic leak is almost never possible. Proximal diversion, washout, and perianastomotic drainage are

usually adequate to control sepsis. In patients who already have been proximally diverted at the index operation, management depends on severity of leak, as discussed earlier. If a perianastomotic abscess is present, drainage can be performed via a percutaneous or transanal route. If transanal drainage is appropriate, this can be performed in the operating room under general anesthesia or sedation and the abscess can be drained via the anastomosis with a drain (Penrose drain, typically) left in place, if needed. In patients who have a subclinical leak such as those who have a leak identified only on contrast enema study, CT scan should be performed to evaluate for a collection. If a collection is present, it should be drained, if possible. If there is a contained leak without an associated collection, expectant management can be performed with repeat imaging after a period of ~3 to 6 weeks.

Ultimately, the goal of any treatment intervention for anastomotic leak is to control and treat sepsis. This goal should be kept in mind as the treatment plan is performed.

Conclusion

Anastomotic leak is an unfortunate reality in colorectal surgery. There are many risk factors described for anastomotic leak, although few have been definitively proven consistently in high-quality studies. It is likely that these risk factors are cumulative and clinical judgment by the surgeon is necessary in evaluating a patient's individual risk for leak. When modifiable factors are present, attempts should be made to optimize the patient prior to proceeding with an operation. In the end, assessment of each individual patient's risk for leak must be made at the time of the operation and decisions regarding anastomosis and use of proximal diversion should be made accordingly. Treatment of anastomotic leak should start with determination of patient stability followed by resuscitation and diagnostic imaging or operative exploration. Operative findings will dictate surgical approach with the goal of controlling sepsis and stabilizing the patient.

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